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해외진출 전략국가 ICT 마스터플랜 정책자문(Ⅰ)

ICT Master Plan for Development : Benchmarking Best Policy Practices of Korea

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서 언

개발도상국은 우리나라의 입장에서 볼 때 잠재력이 매우 큰 미래시장인 동시에 함께 공동번영을 해 나가기 위한 협력 파트너입니다. 정보통신의 급속한 발전으로 인해 국가간의 발전격차는 더욱 커지고 있으며 이는 세계적인 주요한 이슈로 떠오르고 있기도 합니다. 2003년과 2005년에 걸쳐 개최된 세계정보사회 정상회의(World Summit on Information Society: WSIS)는 정보사회와 관련된 제반 이슈를 포괄적으로 논의하는 장이었지만 이중에서 가장 중요하고 근본적인 문제가 “정보격차”였습니다. WSIS 개최를 승인한 UN의 결의 문구에서도 정보통신 기술 혁명의 혜택을 충분히 누리기 위해 모든 나라가 발전을 위한 정보통신기술에 접근하고 이용할 수 있어야 할 긴급한 요구를 달성해야 하며 이를 위한 고위 정치 지도자간의 합의와 몰입을 유도하고 나아가 정보사회 달성과 관련된 여러 가지 쟁점을 다루어야 하는 필요성을 명시하고 있기도 합니다.

반면 우리나라는 단기간내 원조 수원국에서 공여국으로 전환된 세계에서 유일한 국가입니다. 또한 우리나라는 ICT 분야에 있어서 ICT 개발지수인 IDI 지수로 상위 10위권 안에 드는 일본을 제외한 유일한 아시아 국가이며, 국민1인당 소득 2만달러 대로 ICT 개발지수 상위 20위권에 드는 유일한 나라입니다. 이렇다 보니, 한국의 IT 기반 경제성장에 대한 신흥 개도국의 관심이 매우 높으며, 관련 정책자문의 수요도 급증하는 추세입니다.

이에 개발도상국의 정보격차해소를 통하여 공동번영을 추진하기 위한 개도국 ICT 정책자문의 틀을 구축하는 것을 목적으로 본 연구를 수행하게 되었습니다. 정보통신 기반이 미흡한 개발도상국의 IT 발전과 정보화를 촉진하기 위해 한국의 ICT 발전 모범사례를 체계적으로 정리하고, 이를 통해 국제 정보격차해소에 기여하며 나아가서는 개발도상국과 공동번영의 기틀을 마련하고자 하는 것이 본 연구의 궁극적인 목적

입니다.

그러나 이러한 궁극적인 목적 이면에는 우리나라의 국제 이니셔티브를 제고하고자 하는 목적과 함께 이를 통해 우리나라 정보통신업체들의 해외진출 기반을 마련하고자 하는 목적을 갖고 있습니다. 개발도상국을 대상으로 한 ICT 정책자문사업은 국내기업의 해외진출을 위한 효과적인 수단이 될 수 있습니다. 개발도상국에 우리나라의 IT 발전경험 및 노하우 등을 소개・자문하여 우호적인 인적・물적 네트워크를 구축하고 이를 바탕으로 국내 IT기업의 해외진출기반을 마련하고자 하는 것이 본 연구의 주요 목적이라 할 수 있습니다.

본 연구는 3개년동안 수행되는 장기프로젝트의 1차년도 내용으로서 개발도상국 IT 정책자문에 필요한 마스터플랜을 수립하고 전략대상국 선정을 위한 기초조사 과정까지를 포함하고 있습니다. 2차년도에는 해외진출 전략대상국을 선정하고 1차년도의 연구를 심화시켜 주요 정책 모범사례를 모듈화시켜 전략국가별 맞춤형 IT정책 실천계획을 수립할 계획입니다. 그리고 3차년도에는 1,2차년도의 성과를 평가하고 피드백을 받아 해외진출 전략국가 ICT 마스터플랜 정책자문 연구를 완성한다는 계획입니다.

본 보고서는 본원의 고상원 연구위원, 김창완 연구위원, 김윤화 전문연구원이 주도적으로 수행하였습니다. 그리고 산업연구원의 이상규 연구위원, 이원빈 연구위원, 유현선 전문연구원이 제조업의 ICT 활용사례에 대해서 자문과 집필에 도움을 주셨고, 해외 IT 활용의 모범사례는 Ovum의 Somak Roy에 의해 작성되었습니다. 본 연구를 수행함에 있어서 도움을 주신 모든 분들과, 본 보고서를 심사하고 좋은 의견을 주신 여러 심사위원들께 감사를 드립니다. 아무쪼록 본 연구보고서가 개발도상국의 정보격차해소에 도움이 되는 자료가 되기를 바라고, 우리나라 ICT기업의 해외진출 기반 마련에 좋은 참고자료로 활용되기를 기대합니다.

2010년 12월

정보통신정책연구원

원 장 방 석 호

목 차

서 언 ····· 1

요약문 ····· 13

Chapter 1. ICT 해외진출 전략대상국가 풀(Pool) 선정 ····· 31
1. 정책자문 필요성 및 목적 ····· 31
2. 주요지역별 현황 ····· 33
3. 정책자문 대상국가 풀(Pool) 선정을 위한 요소 분석 ····· 49
4. 정책자문 대상국가 풀(Pool) 선정 ····· 60
5. 주요 대상국가 현황 ····· 66

Chapter 2. The Status of ICT in Korea ····· 84
1. Overview of ICT Policy in Korea ····· 84
2. ICT and Economic Growth in Korea ····· 89
3. Weakness of Korean IT Industry: Polarization ····· 99

Chapter 3. Telecommunications Competition Policy in Korea ····· 105
1. Characteristics of Telecommunications Service Industry and Overview of Regulations ····· 105
2. Early Stage of Korean Telecommunications Services ····· 115
3. Recent Development in Regulatory Reform ····· 127

Chapter 4. ICT Industrial Policy of Korea ····· 138
1. Government-led Electronics Industry Promotion Policies in the 1960s and 1970s 138

2. Development of Three Strategic IT Products in the 1980s ····· 142
3. Creation of MIC and Informatization Promotion Fund in the 1990s ····· 145
4. IT 839 Strategy and New IT Strategy in the 2000s ····· 153
5. Research and Development in the ICT Sector ····· 166
6. ICT Human Resource Development ····· 171

Chapter 5. Informatization Policy in Korea ····· 191
1. Implementation of Informatization Promotion Plan ····· 191
2. Establishment of Infrastructure ····· 194
3. U-Korea Master Plan ····· 211
4. Bridging the Digital Divide ····· 214

Chapter 6. Case Studies of Overseas ICT Use ····· 223
1. Germany: ICT in Construction, Retail, Consumer Goods, and Manufacturing 223
2. US: ICT in Health Care ····· 229
3. Syria: ICT in Education ····· 240
4. Zimbabwe: ICT in Agriculture ····· 246
5. India: ICT in Telemedicine ····· 253
6. Ireland: ICT in Construction ····· 258
7. France: ICT in Automotive ····· 261
8. Ethiopia: ICT in Agriculture ····· 263
9. India: ICT in Agriculture ····· 265
10. Greece: ICT in Technology-intensive SMEs ····· 268
11. Netherlands: ICT in Transprot and Logistics, Healthcare, Software Engineering, and Financial Services ····· 270
12. Canada: ICT in Logistics, Tourism, Automobile Leasing, Livestock Production, Printing, and Publishing ····· 272

13. Uganda: ICT in Education ····· 275
14. Portugal: ICT in Automotive, Retail, Pharmaceutical, Chemical, Retail, and Consumer Goods ····· 277
15. Slovenia: ICT in SMEs across Agriculture, Logistics, Financial Services, and Public Administration ····· 279

Chapter 7. The Use of IT for the Advancement of the Manufacturing Industry ···· 283
1. The Importance of IT Use in the Manufacturing Industry ····· 283
2. Case Studies of IT Use in the Manufacturing Industry ····· 291
3. Policy Measures Related to IT Use as a Means to Advance the Manufacturing Industry ····· 368

Chapter 8. Conclusion ····· 382

Reference ····· 391

표 목 차

〈Table 1－1〉 아시아태평양지역 회원국의 ICT 전략 ····· 34
〈Table 1－2〉 아시아태평양지역 국가들의 IDI (2002, 2007) ····· 36
〈Table 1－3〉 주요 중남미 국가의 글로벌경쟁력지수(GCI) 순위 ····· 40
〈Table 1－4〉 중남미 및 카리브해 국가들의 인프라 경쟁력 수준 ····· 43
〈Table 1－5〉 전세계 대비 아프리카 지역의 ICT 성장률 ····· 44
〈Table 1－6〉 아프리카지역 국가들의 IDI (2002, 2007) ····· 45
〈Table 1－7〉 아프리카 글로벌경쟁력지수(GCI) ····· 48
〈Table 1－8〉 지역별 IT 성장 전망 ····· 59
〈Table 1－9〉 한국의 국가별 정보통신 수출규모 ····· 62
〈Table 1－10〉 국가별 부문별 IT 연평균 성장률(2008-2014) ····· 64
〈Table 1－11〉 지역별 전략대상국가 풀(Pool) ····· 65
〈Table 1－12〉 ICT산업 부문별 전략대상국가 풀(Pool) ····· 65
〈Table 1－13〉 인도 IT 산업의 성장추이 ····· 68
〈Table 1－14〉 인도 IT 산업의 구성 ····· 69
〈Table 1－15〉 각국 IT 인력 인건비 비교 ····· 69
〈Table 1－16〉 인도의 유선통신 현황 ····· 71
〈Table 1－17〉 인도의 이동통신 현황 ····· 72
〈Table 1－18〉 인도의 인터넷 이용 현황 ····· 72
〈Table 1－19〉 중국의 IT 산업 부문별 성장 전망 ····· 76
〈Table 1－20〉 중국의 유선통신 현황 ····· 76
〈Table 1－21〉 2008년 중국 통신사별 서비스 사용자 규모 ····· 77

〈Table 1－22〉 중국의 무선통신 현황 ····· 77
〈Table 1－23〉 중국의 무선통신 사업자별 가입자 추이 ····· 78
〈Table 1－24〉 중국의 인터넷 이용 현황 ····· 78
〈Table 1－25〉 중국 IPTV 발전사 ····· 82
〈Table 2－1〉 Contribution of the IT Industry to Economic Growth (2001-2009) 91
〈Table 2－2〉 Previous Research Estimating the Growth of Total Factor Productivity in the IT Industry ····· 91
〈Table 2－3〉 Contributions of IT Investments to Economic Growth ····· 93
〈Table 2－4〉 Productivity of Industry Based on IT Use ····· 93
〈Table 2－5〉 Current Account Surplus of ICT Sector and Non ICT Sector ····· 94
〈Table 2－6〉 Deflationary Effects of ICT ····· 95
〈Table 2－7〉 Causes of Fluctuations in the Number of Employees in the IT Industry ····· 96
〈Table 2－8〉 Indirect Effects of the IT industry on Employment (2005) ····· 97
〈Table 2－9〉 Indirect Effects of the IT industry on Employment (2008) ····· 97
〈Table 2－10〉 Fluctuations in the Number of Employees in the IT Industry ····· 98
〈Table 2－11〉 Comparison of IT Industries in Korea and the U.S. ····· 100
〈Table 2－12〉 Import-inducing Coefficients of Key IT Components (2008) ····· 101
〈Table 2－13〉 Distribution of Manufacturing Businesses (2008) ····· 103
〈Table 3－1〉 Service Provider/Service Classification ····· 109
〈Table 3－2〉 Service Provider Classification and their Rights and Obligations 110
〈Table 3－3〉 Universal Service ····· 114
〈Table 3－4〉 History of the Market Competition in Korea ····· 123
〈Table 4－1〉 Purposes and Sources of Informatization Promotion Fund ····· 149
〈Table 4－2〉 Major Achievements of IT Research and Development Projects ·· 150
〈Table 4－3〉 The Characteristics of IT Converged Industries and Remaining Tasks 161

〈Table 4－4〉 IT-traditional Industries Convergence Milestones ····· 162
〈Table 4－5〉 Establishment of an IT Convergence System ····· 165
〈Table 4－6〉 Crowding out of Private R&D in IT industry:
Before and after Asian Financial Crisis (fixed effects model) ····· 168
〈Table 4－7〉 Estimated Spillover Effects of R&D Investment in the
ICT Sector: on all Industries ····· 171
〈Table 4－8〉 Investment Size of IT HRD Program by Year ····· 174
〈Table 4－9〉 Seoul Accord Members & Accreditation Institutions ····· 181
〈Table 4－10〉 Outcome of 10 Million People Informatization Education ····· 184
〈Table 4－11〉 Overseas Case Examples of Best-in-Class Talent Development ·· 189
〈Table 5－1〉 Different Phases of Master Plan for Informatization Promotion ··· 193
〈Table 5－2〉 Phased Objectives and Strategies for Implementation and
Advancement of High-speed Communication Infrastructure ····· 195
〈Table 5－3〉 Evolution of Comprehensive Plan for Implementation of High-speed
Communication Infrastructure ····· 196
〈Table 5－4〉 Sales of Broadband Internet Service ····· 204
〈Table 5－5〉 Budget for Informatization and Informatization Promotion Fund ·· 206
〈Table 5－6〉 Key Government's Informatization Policies ····· 212
〈Table 5－7〉 Major Details of Enactment and Revision of Laws
on Bridging the Digital Divide ····· 217
〈Table 5－8〉 Distribution of "Green PCs" by year ····· 220
〈Table 5－9〉 Online Education Programs and Courses by Year ····· 220
〈Table 5－10〉 Digital Divide Index and Comparison to Overall Population ····· 221
〈Table 6－1〉 US: Health Information Technology Potential Cost Savings ····· 238
〈Table 7－1〉 Two Different Approaches to the Convergence Phenomenon ····· 285
〈Table 7－2〉 Changes in the DNA of the Automobile Industry ····· 302

〈Table 7－3〉 Sources of Automotive-IT Convergence Technology ····· 304
〈Table 7－4〉 SWOT Analysis of Shipbuilding-IT Convergence ····· 318
〈Table 7－5〉 Stage-based Approach to the Role of IT Use in the Development of the Shipbuilding Industry ····· 320
〈Table 7－6〉 Comparison of PLM in the Shipbuilding and Non-Shipbuilding Industries ····· 328
〈Table 7－7〉 The Korean Construction Industry's Share of GDP ····· 336
〈Table 7－8〉 Production Inducement Coefficient by Industry ····· 336
〈Table 7－9〉 Employment Inducement Coefficient by Industry ····· 337
〈Table 7－10〉 The Current State of Overseas Construction Contracts ····· 337
〈Table 7－11〉 Trends in the Size of the Global Construction IT Convergence Market ····· 338
〈Table 7－12〉 SWOT Analysis of Korean Construction-IT Convergence ····· 340
〈Table 7－13〉 IT Use during Each Stage of the Development of the Construction Industry ····· 341
〈Table 7－14〉 IT 839 Strategy ····· 358
〈Table 7－15〉 The Advancement of Five Areas and Optimization of Four Engines in the u-Korea Master Plan ····· 360
〈Table 7－16〉 Three Strategic Areas Covered by the New IT Strategy ····· 361
〈Table 7－17〉 Connectivity between Construction-IT Convergence Technology and IT Policy, and the Use of IT Technology ····· 364
〈Table 7－18〉 IT Technological Areas Needed to Facilitate Manufacturing-IT Convergence ····· 369
〈Table 8－1〉 Evolution of Korea's IT Policies ····· 387

그 림 목 차

〔Figure 1－1〕 아시아태평양지역 국가들의 IDI와 GNI (2007) ····· 37
〔Figure 1－2〕 상위 소득(좌) 및 중하위 소득(우) 국가에서의
모바일브로드밴드 가입율 (2007) ····· 38
〔Figure 1－3〕 아메리카 지역의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008 39
〔Figure 1－4〕 아메리카 지역의 인구 100명 중 이동통신 가입자수 (2008) ····· 42
〔Figure 1－5〕 아프리카 지역의 ICT 발전 추이 (1998-2008) ····· 44
〔Figure 1－6〕 2009년 2분기 아프리카 인터넷 보급률 현황 ····· 47
〔Figure 1－7〕 한국의 ODA 원조상황 ····· 50
〔Figure 1－8〕 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008 ····· 51
〔Figure 1－9〕 아프리카의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008 ··· 52
〔Figure 1－10〕 아랍국가의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008 ··· 53
〔Figure 1－11〕 아시아태평양국가의 IDI(ICT 개발지수)와
GNI(인당 국민소득), 2008 ····· 54
〔Figure 1－12〕 아메리카국가의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008 55
〔Figure 1－13〕 IDI와 ICT Price Basket 상관관계 ····· 56
〔Figure 1－14〕 통신서비스별, 국가수준별 요금수준 격차 ····· 57
〔Figure 1－15〕 1단계 대상국가 선정 결과 ····· 61
〔Figure 1－16〕 2단계 대상국가 선정 결과 ····· 63
〔Figure 1－17〕 인도의 브로드밴드 가입회선 추이 ····· 73
〔Figure 1－18〕 중국 IT 시장 현황 ····· 75
〔Figure 1－19〕 중국 3G 설비 시장규모 및 시장점유율 현황 ····· 79

〔Figure 1－20〕 중국 IPTV 가입자 규모 및 성장 추이 ····· 81
〔Figure 1－21〕 중국 IPTV 설비 시장규모 및 성장 추이 ····· 81
〔Figure 3－1〕 Privatization of Korea Telecom (KT) ····· 119
〔Figure 3－2〕 Snapshot of the Telecommunication Competition Policy in Korea 126
〔Figure 3－3〕 Fixed Telephony Revenue ····· 127
〔Figure 3－4〕 Number of Mobile Telephony by Telecom Operators ····· 128
〔Figure 4－1〕 Application of SCM Model: Hanium Internship Project ····· 180
〔Figure 5－1〕 HII in the High-speed Internet Market ····· 203
〔Figure 6－1〕 Syrian Virtual University: Enrollment by Program ····· 245
〔Figure 7－1〕 IT-based Convergence Technology Fields ····· 290
〔Figure 7－2〕 Downstream Industries Linked to the Automobile Industry ····· 293
〔Figure 7－3〕 Upstream Industries Linked to the Automobile Industry ····· 294
〔Figure 7－4〕 The Status of the Korean Automobile Industry ····· 295
〔Figure 7－5〕 Market Share of Domestic Automakers ····· 297
〔Figure 7－6〕 Change in the Ratio of Shipbuilding Industry Exports to Total Exports - Comparison with Other Industries ····· 315
〔Figure 7－7〕 Trends in Export Volumes for the Shipbuilding Industry - Comparison with Other Industries ····· 316
〔Figure 7－8〕 Comparison of Market Share by Vessel Type ····· 317
〔Figure 7－9〕 Concept of Shipbuilding-IT Convergence ····· 321
〔Figure 7－10〕 Need for Construction-IT Convergence ····· 339

요 약 문

The purpose of this study is to formulate the framework to provide information and communications technology (ICT) policy advice to developing countries with the aim of co-prosperity sought by bridging an information gap. In order to promote the development of the ICT industry and informatization in the developing world, we have systematically set up the database of exemplary ICT cases in Korea. We expect that the study would lead to bridging the global information gap and paving the way for co-prosperity of developed and developing countries.

Behind this ultimate purpose, however, lies the objective to enhance Korea's initiative in the international stage and to support domestic ICT companies to go beyond Korea. Japan has taken steps to hold IT leadership in Asia under the Asia Broadband Plan; China has risen as a powerhouse in Africa with a huge amount of direct investment. For Korea, ICT policy consulting service may be an effective measure for Korean companies to go into markets overseas. By introducing and offering consulting services on Korea's experience and expertise of developing the IT industry, the nation can build human and physical networks with developing countries, which in turn will help Korean IT companies start and do business in these countries.

Korea transformed itself from an international aid recipient to a donor country within an exceptionally short period of time. Not only that, Korea is one of just two Asian countries that rank within the top 10 of the UN ICT Development Index (IDI) and the sole country whose per capita income is in the 20-30 thousand dollars range among the top 20 nations on IDI. Accordingly, developing nations have keen interest in learning

Korea's experience of IT-based economic development with increasing request for relevant policy consultation.

The anticipated huge investment in energy, logistics and mobile communications infrastructure in emerging countries is likely to result in greater efficiency when combined with information technology. Faced with the opportunity in developing countries, the infrastructure building industry is emerging as a new growth engine and IT can become a major component. Consulting projects on IT-based economic development can be offered along with infrastructure projects, which will increase the probability of winning infrastructure projects and give greater opportunities to Korean IT companies in exploring overseas markets.

To break away from the current practices, which are fragmented and limited to informatization and e-government, a study is essential on IT consultation encompassing both successful and failed national IT policy experiences, including informatization, IT industry policy, competition policy and regulation. In addition, a strategic approach that integrates the IT policy consulting with infrastructure export to developing countries is necessary by coming up with ways to increase productivity with the help of information technology in other industries, such as manufacturing and education.

Chapter 1. ICT 해외진출 전략대상국가 풀(Pool) 선정

1. 정책자문 필요성 및 목적

본 연구는 개발도상국의 정보격차해소를 통하여 공동번영을 추진하기 위한 개도국 ICT 정책자문의 틀을 구축하는 것을 목적으로 수행되었다. 정보통신 기반이 미흡한 개발도상국의 IT 발전과 정보화를 촉진하기 위해 한국의 ICT 발전 모범사례를 체계적으로 정리하였다. 이를 통해 국제 정보격차해소에 기여하며 나아가서는 개발도상

국과 공동번영의 기틀을 마련하고자 하는 것이 본 연구의 궁극적인 목적이다. 그러나 이러한 궁극적인 목적 이면에는 우리나라의 국제 이니셔티브를 제고하고자 하는 목적과 함께 이를 통해 우리나라 정보통신업체들의 해외진출 기반을 마련하고자 하는 목적을 갖고 있다. 일본은 '아시아 브로드밴드 계획'을 통해 아시아지역의 IT 주도권 확보에 나서고 있고, 중국은 이미 엄청난 규모의 직접투자를 통해 아프리카 지역의 맹주로 떠올랐다. 개발도상국을 대상으로 한 ICT 정책자문사업은 국내기업의 해외진출을 위한 효과적인 수단이 될 수 있다. 개발도상국에 우리나라의 IT 발전경험 및 노하우 등을 소개·자문하여 우호적인 인적·물적 네트워크를 구축하고 이를 바탕으로 국내 IT기업의 해외진출기반을 마련하고자 하는 것이 본 연구의 주요 목적이라 할 수 있겠다.

본 연구는 3개년동안 수행되는 장기프로젝트의 1차년도 내용으로서 개발도상국 IT 정책자문에 필요한 마스터플랜을 수립하고 전략대상국 선정을 위한 기초조사 과정까지를 포함한다. 2차년도에는 해외진출 전략대상국을 선정하고 1차년도의 연구를 심화시켜 주요 정책 모범사례를 모듈화시켜 전략국가별 맞춤형 IT정책 실천계획을 수립할 계획이다. 그리고 3차년도에는 1,2차년도의 성과를 평가하고 피드백을 받아 해외진출 전략국가 ICT 마스터플랜 정책자문 연구를 완성한다는 계획이다.

2. 정책자문 대상국가 풀(Pool) 선정

정책자문 대상국가 풀(Pool)을 선정하기 위해 대상국의 경제력, 성장잠재력, 우리나라의 정보통신 해외진출상황, 정치적 상황 등 여러 가지 요소를 고려해야 한다. 그리고 요소 분석결과에 따라 전략국가를 그룹별로 구분해서 살펴볼 수 있을 것이다. 첫째는 우선협력국으로 정부의 IT정책에 대한 인식과 기초 IT 인프라 환경을 보유하고 있으며 협력관계 구축을 통해 상호호혜의 결과를 기대할 수 있는 국가군이 있다. 둘째는 전략협력국으로 기초 IT환경이 열악하여 상호호혜 기반 협력관계는 기대하기 어려우나, 에너지, 자원 등 상호대체 협력수요를 보유하여 전략적 접근의

가치가 있는 국가군이 있다. 마지막으로 위상협력국으로 국제기구 및 국제회의 등 국제사회에서 우리의 IT 위상 강화를 위한 파트너 국가군이 있다.

본 연구에서는 위에서 살펴본 국가군 중 첫 번째 우선협력국 및 두 번째 전략협력국이 본 연구에서 추구하는 정책자문 대상국가에 포함된다고 할 수 있다. 그러나 우리나라가 IT 인프라 수출시 정책자문을 할 수 있는 전략대상국가를 선정하는 것이 본 연구과제의 목적인 바, 대상국가를 좀 더 구체적이고 효율적으로 선정하기 위하여 IT 부문에 국한하지 않고, IT를 핵심축으로 하되 다양한 요소와의 조화를 통해 시너지 효과를 제고할 수 있는 방향으로 검토하였다. 즉, ICT 개발지수(IDI), 통신요금수준(ICT Price Basket), 국제경쟁력지수(GCI) 등 여러 가지 다양한 요소를 고려하여 대상국가를 그룹화한 뒤 전략대상국가 풀(Pool)을 선정하였다.

우선 IT 선진국을 제외하고 주요 개도국을 중심으로 3단계 분석 과정을 통해 정책자문 대상국가 풀(Pool) 선정이 이루어졌다. 1단계에서는 전반적인 국가별 경제력 및 성장잠재력을 고려하기 위해 국민1인당생산지표(GDP)와 국제경쟁력지수(GCI)를 적용하여 전략대상국을 1차로 도출하였다. 2단계에서는 한국으로부터의 IT 수입규모 및 정보통신발전지수(IDI)를 지표로 활용하여 한국과의 정보통신시장 교류상황 및 국가별 정보통신산업 발전정도를 판단하여 전략대상국을 도출하였다. 마지막 단계에서는 가트너의 국가별 IT시장 전망 자료를 활용하여 IT산업 부문별로 유망한 국가군 분류를 수행하였다.

Chapter 2. The Status of ICT in Korea

Korea is well-known for its successful achievement of rapid economic development. In the space of four to five decades, Korea rose from one of the world's poorest nations to become one of the largest economies. Korea's GNI per capita stood at a mere US$87 in 1962, which was equivalent to that of Ghana at that time. The figure surged to more

than US$10,000 in 1995 and vaulted above US$20,000 in 2007. The development of the IT sector has been one of the core drivers of Korea's exceptional growth. Korea has now become the world's IT superpower. In 2010, Korea ranked top in Study on the Super High-Speed Internet Quality published by the University of Oxford, in ICT National Competitiveness Assessment for the White Paper 2010 Information and Communications released by the Japanese Ministry of Internal Affairs and Communications, and in the United Nation's e-government survey.

The information technology (IT) industry has made a significant contribution to the growth of the Korean economy since the 1990s. With the world's highest Internet penetration rate and the global first adoption of advanced telecommunication services such as DMB (Digital Multimedia Broadcasting) and WiBro (Wireless Broadband), Korea is a first-class IT country where cutting edge IT technologies have been put in place. This tech savvy nation's rapid development of the IT industry is largely attributed to the local companies that have created state-of-the-art IT products such as semiconductors, LCD panels and mobile phones. Their bold and forward-looking investments into facilities, research and development have enabled Korea's IT industry to take its current leading position in the global IT market. A report of the Organization for Economic Cooperation and Development (OECD) published in 2008 includes Samsung Electronics, LG Electronics and KT in its list of the world's top 50 IT companies. These Korean names that lead the evolution of the global IT industry are one of the main achievements of the IT industry in Korea.

The government is another important player of this outstanding progress of the IT industry. It has addressed a wide range of issues for both demand and supply sides: technology development, human resource development, modification or creation of relevant laws and regulations, investments in high-speed Internet infrastructure, implementation of e-Government,

privatization and market liberalization of telecommunication industry and execution of competition policies. Korea's IT industry is a typical example in which the government plays a leading role by continuously motivating the relevant companies to develop new technologies and organizing the relevant legal and regulatory systems. The Korean government even engaged in the direct development of major communication technologies such as TDX (Time Division Exchanger) and CDMA (Code Division Multiple Access) through one of its invested research institutes and set them as the local standards. While some critics argue that the government's adoption of the technologies, which are not the world's dominant technologies, as the standards has undermined the efficiency of the local industry, everybody agrees that the government-led technological development and standardization policies have vitalized the local IT market and thus significantly enhanced their competitiveness.

Chapter 3. Telecommunications Competition Policy in Korea

Telecommunications services began in Korea in the early 1900s. Modern telecommunications services developed along with the industrialization policy of the third Republic in the early 1960s. Initial telecommunications services began to be provided with the government actually running the service operation. This was partly because the government was the only party that could afford such astronomical costs to build a large-scale network similar to that of several other countries. Another reason lied in the fact that telecommunications services were an essential factor in the lives of the general population. Apart from the fact that telecommunications services require large-scale initial investment with the government in the lead, other effects of the network and several other characteristics exist. Consequently, the telecommunications sector has several regulatory devices under

its sleeve since it provides universal services in addition to the regulations applied in the general industries with economy of scale. The general competition law uses a post-regulatory method that asks for corrections or a fine when actions hampering competition occur, such as abuse of the market dominance, unfair group action and other actions. However, the telecommunications sector still has structural barriers such as essential facilities, network externality, limited frequency resources and other factors, proving to be much more advantageous to the first-comers rather than late-comers to the market. Taking these characteristics into consideration, a ex-ante regulation such as building a competitive environment in the market was taken and a ex-post regulation measure such as prohibiting certain actions in response to unfair actions unique to the telecommunications sector was adopted. For these reasons, Korea, like most countries, has a specific regulatory system in the telecommunications sector.

Korea took a methodical path of developing its telecommunication market by means of privatization, liberalization, and encouraging competition. The principal objective was to expand and improve the infrastructure and provide quality services at lower rates, hence increasing consumer and social welfare. This foundation turned out to be the essential market and regulatory element for building a thriving telecommunications market in Korea.

Further major issues are introduction of a new regulatory system responding to the trend of Fixed Mobile Convergence (FMC) and convergence of telecommunications and multimedia. Such convergence trend is in progress already, as witnessed in the examples of VoIP and IPTV, and eventually, diverse services are expected to be provided through all-IP-based broadband network instead of a single service provided from individual networks. The services offering the same functions may be provided through different telecommunications networks or it may be possible that several services that could not

be offered through a single communication network are offered. Services that were currently competing in different markets may be competing directly with each other. Such environmental changes require changes in the regulatory framework. In such circumstances, the overall direction to improve the regulations can be summarized briefly as the most challenging issue to how to ensure fairness in regulation of services provided among competitors.

Chapter 4. ICT Industrial Policy of Korea

The government's IT policy devoted itself to meeting the basic demand of telecommunication and preparing foundations for an information society until the mid 1980s. Since then the government made an intensive focus on growing the IT industry at the national level with the slogan 'We were late in industrialization. But we will lead the information age' until the mid 1990s. Then it established the Ministry of Information and Communication (MIC) and devised a variety of plans to promote the industry as a main engine for the national economic growth. This strategy was strengthened and more investment was made into the IT sector at the end of 1997 when Korea became subject to the supervision of the International Monetary Fund (IMF) after the country was hit hard by the global financial crisis. Major IT-oriented projects were carried out with budgets from the Information Promotion Fund: informatization, an IT technology development and a comprehensive development plan for the IT industry, and the IT industry truly became the main engine for the nation's economic growth.

Research and development in ICT has been one of the key factors contributing to the growth of the ICT sector in Korea. Keeping pace with technological change to be remained globally competitive, the Korea's ICT sector has continuously increased

investment in R&D. Although major parts of R&D in ICT have been financed and performed by private businesses, the Korean government has also taken an important part of R&D for ensuring sustainable economic growth and improvements in living standards. Recognizing economic benefit of ICT, the Korean government has actively involved in major R&D projects such as TDX and CDMA. The R&D programs funded by MIC consisted of three major ones: a leading technology development program supporting strategic R&D which requires long-term R&D efforts; an industrial competitiveness development program which promotes R&D in competitive technologies with a high potential for commercialization in the short-run; and a new technology support program which mainly focuses on the development of new information technologies in the small and medium-sized enterprises(SMEs).

Korea's IT human resources development (HRD) policy has been focused on securing the quantitative supply base of IT human resources through an increase in IT departments in college and expansion of job transitional education, for instance. As a result, college graduates with IT degrees account for 47% of the entire engineering college graduates as of 2009. The IT human resources development program undertaken from 1997 has gone through three phases: the foundation phase, the expansion phase, and the practice & job skills expansion phase, transforming the nature of the program from supply-based to demand-based, from quantitative to qualitative, and from domestic-oriented to global-oriented. Development of Korean IT human resources has been pushed forward in a virtuous circle through: i) the establishment of IT infrastructure for human resources development; ii) the increased production of IT human resources by regular educational institutions; iii) the re-education of IT workforce; iv) the offering of informatization education to the entire population of the nation; and v) the regular estimation of supply and demand prospects, the improvement of IT-relevant certificate systems, and the expansion and increase of institutional

framework, etc. Not only the IT human resources development plan, but other human resources development policies, in general, were pushed forward in harmony with industrial policy, science and technology policy etc. Equally, the IT human resources development policy will be pushed in tune with industrial policy, R&D policy etc.

Chapter 5. Informatization Policy in Korea

Since the beginning of the 1990s, the developed countries such as the U.S., Japan, the EU nations and Singapore started pushing forward informatization as a critical strategy to determine an individual nation's competitiveness and further its survival in a global competition by raising the productivity of the government and industries as well as contributing to the growth of national economy and creating jobs. In this global trend, Korea also recognized the informatization as a key element to determine the future of the national economy and the development of the society from the mid 1990s and prepared and implemented the visions and strategies at a national level.

In its first move, the government created the MIC to replace and expand the functions of the former MOC in a governmental reorganization conducted in December 1994 and consolidated the functions distributed to multiple agencies into the MIC, such as promoting of the IT industry and development of communication and broadcasting technologies. Along with this organizational change, the government enacted the Framework Act on Informatization Promotion in August 1995 and made systematic preparations to realize the informatization, including setting up a committee to govern all informatization-related activities throughout administration, legislation and jurisdiction. In accordance with the Framework Act, the government also developed the Master Plan for Informatization Promotion. This was an upgraded version of a national informatization framework

intended to further advance the existing informatization projects including the construction of the nation's core IT infrastructure. In other words, the Master Plan was a policy framework representing the government's IT policy direction in a comprehensive and systematic way and the highest level of the government's IT plan that incorporated different IT plans prepared. Unlike the 5-year Economic Development Plan in the past, the Master Plan well displays changes in the roles of the government. In fact, in developing an informatization plan at the governmental level, the government is required to provide a comprehensive and systematic long-term visions at the national level from the initial stages of the informatization so that the government itself can create the initial demand for informatization as a leading user of information technology and encourage the private sector to exert their creativity and voluntary efforts and make investment in the IT industry.

The Master Plan for Informatization Promotion developed in 1996 was the government's first broad blueprint to usher in an information-based society into Korea by 2010. The Master Plan had informatization objectives that would be conducted over three phases by 2010. The objectives of the first phase (1996 - 2000), which was designed to build foundations for a rapid implementation of the informatization, were to identify, and focus on, ten major tasks for informatization, and upgrade the level of Korea's IT industry to that of G7 countries. The first phase also included the construction of high-speed communication network to serve 30,000 government agencies and 2.6 million individual subscribers throughout the country, and the arrangement of regulatory and systematic environments. The objectives of the second phase (2001 - 2005), which was to expand the utilization of information, were to stabilize the private sector-led informatization efforts and create a sufficient demand for an advanced information society. The third phase (2006 - 2010), which was intended to further advance the utilization of information, had objectives to make information available anytime and anywhere for anyone.

Chapter 6. Case Studies of Overseas ICT Use

1. Germany: ICT in Construction, Retail, Consumer Goods, and Manufacturing

The core objective of the German's government ICT policy was focused on increasing the adoption levels of business applications. This was implemented through the establishment of specialized vehicles that would promote the adoption of business applications among SMEs. Such specialized vehicles would enable software and standards implementation projects by providing subsidies and advice, as well as by implementing assistance unbiased by commercial considerations. The intended beneficiaries of such policy initiatives were typically SMEs in the target sectors; the target beneficiaries were almost always well defined by sector, industry cluster, or region. The PROZEUS initiative was operational between 2002 and 2008 and companies that were part of the initiative report benefits such as reductions in order processing time, order processing error rate, time and costs for tracking deliveries and out-of-stock time. They also experienced increased sales, and successful launch of contemporary supply chain management strategies such as Vendor Management Inventory.

2. US: ICT in Health Care

The key policy objective guiding the US government's role in the field of Health Information Technology is to improve the quality of health care and reduce the cost of health care by reducing wasteful administrative procedures and unnecessary procedures. The long term goal of this policy is to enable results-based payment for health care services, as opposed to procedure-based payments for individual services. The evidence presented indicates that HIT policy has played a direct role in increasing HIT adoption. It also indicates that HIT usage has led to a reduction in costs and improved health

care. Projection of health care cost savings data on a national scale indicate costs savings of over US$620 billion over a 15 year period. Empirical evidence of improved health care from HIT usage includes cases of reduced morbidity from fewer adverse drug event cases. The government has used multiple policy tools, from subsidies to infrastructure development, taking HIT adoption (according to various accounts) between 10-15%; HIT policy remains a focus area for the US government.

3. Syria: ICT in Education

The Syrian government launched a number of IT policy initiatives between 2000 and 2005 with the intention of increasing the number of computer science, engineering and business education trained graduates. These initiatives also cited facilitating research-based tertiary education, and extending overall accessibility of tertiary education. Such initiatives were part of the broad-based policy objective aimed at increasing the usage of ICT tools across educational institutes at all levels. The results achieved, in terms of productivity enhancements and net job creation. The ICT policy initiatives have led to increased availability of ICT trained graduates across Syria, which in turn has enabled home grown IT companies to serve IT intensive sectors, such as banking in the domestic market. The SVU provided approximate 20% of ICT-trained graduates from state universities between 2006 and 2007.

4. Zimbabwe: ICT in Agriculture

In the years leading up to 2010, Zimbabwe embarked on a program to provide small scale, subsistence farmers with information through websites and software tools. These initiatives were part of the policy objective of leveraging ICT in agriculture to promote food security, achieve superior land management, manage production better, and

promote information sharing for better forecasting and sustainable agricultural practices. The benefits of internet access (that provided among others, meteorological information) and farming software are somewhat offset by the considerable challenges the country faced for most of the last ten years. Zimbabwe experienced GDP contraction of 40% between 2000 and 2007 and for most of the 2000-2010 decade the country has faced considerable economic and social challenges. The initiatives have led to relatively high usage of the farming applications. In addition to this, the information access infrastructure has played a role in farmers managing to maintain a subsistence level output. The benefits, while modest in absolute terms, can be considered significant when viewed in light of Zimbabwe's considerable economic and social challenges.

Chapter 7. The Use of IT Technology for the Advancement of the Manufacturing Industry

1. Automobile Industry

The development of wireless mobile communication technology, which began with the advent of CDMA, provided an opportunity for all industries to use telematics as a means to bring about the convergence of bi-directional communication services. This also provided the opportunity for the automobile industry to develop the platform technology needed to establish automotive networks such as the connection between in-vehicle systems and mobile devices, in-vehicle communication networks, and the systems which make it possible to exchange information with other vehicles and traffic facilities (Hi-Pass). Furthermore, the domestic development of the computer industry helped to create a form of platform technology which made possible the computerization of the domestic automobile industry's manufacturing process, and the production of automotive parts rooted in highly advanced

electronic control systems. The development of the semiconductor industry and the advancement of semiconductor technology have facilitated the development of the automotive semiconductors that constitute core parts within the automotive electronics system. These automotive semiconductors have also contributed to helping Korea not only consolidate its standing, but also secure a technological advantage. The development of IT and related convergence has made it possible to strengthen the competitiveness of the automobile industry and to develop new growth engines for the society of the future. The possibility of creating intelligent vehicles created by the convergence of IT and the automobile industry is expected to result in great improvements being made in automotive safety, convenience, and networking.

2. Shipbuilding Industry

The third stage in the development of the Korean shipbuilding industry, that of high value-added (1998-2007), was focused on the application of IT technologies to such processes as ship design, shipbuilding, and the implementation of onboard electronic control systems. The fourth stage, the stage of digital ships (since 2008), has been focused on applying IT technologies to the integrated management of the shipbuilding process, integrated management of ship transportation systems, integrated management of ship navigation information, IT convergence of ship equipment, and shipbuilding PLM. As such, the main trend in terms of IT technology has gone from the application of basic IT technologies to IT convergence as it relates to the integrated management of the entire shipbuilding process and ship navigation systems. In the past, basic IT technologies were used in conjunction with automation processes such as the introduction of CAD technology in ship design and of computation into the shipbuilding process. However, the development of the shipbuilding industry and growing sophistication of IT technology have resulted

in convergence between the IT and shipbuilding industries being on the rise. As such, the emphasis has been on the development of direct IT convergence technology that can be used within the shipbuilding industry. The strategy of establishing a cooperative system linking together IT research institutes, the shipbuilding industry, and the academic sector is expected to emerge as an important policy variable. This cooperative system will lead to the implementation of joint research on the development of the platform technology needed to bring about the improvement of productivity and advent of digital ships and e-navigation enabling technology.

3. Construction Industry

IT technology has traditionally been used in the construction industry as a tool with which to heighten the overall efficiency associated with various work processes. However, recent efforts have been focused on the advent of a high value-added IT convergence industry capable of improving productivity and increasing profitability within a construction industry that has traditionally been a labor intensive industry. The transformation of the construction industry into a high value-added IT convergence industry is made possible by the supporting role played by the IT technology and infrastructure developed under the auspices of national IT policies. In other words, whenever an advanced IT technology is selected and developed in a strategic manner as part of national IT policies, the construction industry can then redevelop and use the IT technology in question in a manner that brings about high value-added to the industry. The growing construction IT convergence has paved the way for the emergence of a trend towards a joint partnership between IT policy and the construction industry. It has also established the framework for the eradication of the previous supply-demand based relationship in which while IT policy assumed a leadership role in terms of the

development of technologies, the construction industry limited itself to selectively adopting IT technologies in accordance with its needs.

Chapter 8. Conclusion

The Korean government's IT policies focused on satisfying the basic demand for telecommunications, developing the industry based on the electronics industry and building a foundation for informatization until the mid-1980s. Since that point until the mid-1990s, the government made intensive efforts at the national level to boost the country to be an IT superpower. Especially, once the country was under the International Monetary Fund's supervision (IMF) in late 1997, the government injected a large-scale fund into the IT industry in its desperate move to overcome the crisis. The decision was effective. The world's best IT infrastructure was built, the nationwide level of informatization was significantly enhanced, and the IT industry became a main engine for the growth of other industries. The government's following drives of the IT839 strategy and the development of the new growth engines provided a stepping stone for Korea to move away from its old model of simply following the advanced countries' technologies to a new model to actively lead the development of new technologies. With those innovative policies, the environments where different IT industries can grow together and Korea plays a leading role in the global IT development were created.

At the same time, however, several issues were raised. As for informatization, Korea now has the highest level of Internet users throughout the globe, but it has failed to build a foundation by which different sectors effectively utilize the Internet and is actively used in many different ways. In addition, despite its quantitative growth, the

local software industry has not produced tangible results in terms of global competitiveness and ripple effect on the national economy.

Jorgenson & Vu (2005) who investigated the IT investments' contribution to the national economic growth in the 110 economies argued that Korea's low contribution rate in the IT industry was attributed to a relatively low utilization rate of IT and a slow development of the software industry. He also pointed out that Korea was very strong in terms of IT hardware, but it was a way behind the developed nations in terms of the application of IT technologies such as convergence of IT and other industries and other software-style areas. To put this analysis in a positive way, Korea still has lots of potential to realize additional economic growth through IT.

Chapter 1. ICT 해외진출 전략대상국가 풀(Pool) 선정

1. 정책자문 필요성 및 목적

개발도상국은 우리나라의 입장에서 볼 때 잠재력이 매우 큰 미래시장인 동시에 함께 공동번영을 해 나가기 위한 협력 파트너이다. 정보통신의 급속한 발전으로 인해 국가간의 발전격차는 더욱 커지고 있으며 이는 세계적인 주요한 이슈로 떠오르고 있다. 2003년과 2005년에 걸쳐 개최된 세계정보사회 정상회의(World Summit on Information Society: WSIS)[1]는 정보사회와 관련된 제반 이슈를 포괄적으로 논의하는 장이었지만 이중에서 가장 중요하고 근본적인 문제가 “정보격차”였다. WSIS 개최를 승인한 UN의 결의 문구에서도 정보통신 기술 혁명의 혜택을 충분히 누리기 위해 모든 나라가 발전을 위한 정보통신기술에 접근하고 이용할 수 있어야 할 긴급한 요구를 달성해야 하며 이를 위한 고위 정치 지도자간의 합의와 몰입을 유도하고 나아가 정보사회 달성과 관련된 여러 가지 쟁점을 다루어야 하는 필요성을 동 회의 개최의 배경으로 명시하고 있다.

현재 세계은행(World Bank), 아시아 개발은행(Asia Development Bank) 등이 추진중인 개발협력에서 IT가 주류가 되고 있으며, 2003년 12월에 개최된 정보사회 세계정상회의(WSIS)에서도 “개발을 위한 정보통신(Telecommunications for Development)”을 핵심내용으로 다루는 등 정보통신 국제협력에 있어 포괄적이고 고차원적인 협력이 요구되고 있다. 그리고 공동번영을 위한 개도국 정보통신 협력사업의 주요 대상이 되는 국가들의 경우 다른 경제지원을 필요로 하는 최빈국들에 비해 재원조달 등

1) WSIS는 World Summit on the Information Society 의 약자로 세계 정보화 문제 및 정보격차 해소를 위한 180여개국 정상들의 회의. 1차 회의는 2003년 12월 제네바에서 개최되었으며 2차 회의는 2005년 11월 튀니지에서 개최됨.

물적 지원에 대한 수요는 적으며 오히려 정보화 정책자문, IT분야 연구기관 간 기술협력을 통한 IT기술 표준 확산, 포럼을 통한 정보교류 등 고차원적인 지식협력을 필요로 하고 있다.

본 연구는 개발도상국의 정보격차해소를 통하여 공동번영을 추진하기 위한 개도국 ICT 정책자문의 틀을 구축하는 것을 목적으로 수행되었다. 정보통신 기반이 미흡한 개발도상국의 IT 발전과 정보화를 촉진하기 위해 한국의 ICT 발전 모범사례를 체계적으로 정리하였다. 이를 통해 국제 정보격차해소에 기여하며 나아가서는 개발도상국과 공동번영의 기틀을 마련하고자 하는 것이 본 연구의 궁극적인 목적이다.

그러나 이러한 궁극적인 목적 이면에는 우리나라의 국제 이니셔티브를 제고하고자 하는 목적과 함께 이를 통해 우리나라 정보통신업체들의 해외진출 기반을 마련하고자 하는 목적을 갖고 있다. 일본은 '아시아 브로드밴드 계획'을 통해 아시아지역의 IT 주도권 확보에 나서고 있고, 중국은 이미 엄청난 규모의 직접투자를 통해 아프리카 지역의 맹주로 떠올랐다. 개발도상국을 대상으로 한 ICT 정책자문사업은 국내기업의 해외진출을 위한 효과적인 수단이 될 수 있다. 개발도상국에 우리나라의 IT 발전경험 및 노하우 등을 소개・자문하여 우호적인 인적・물적 네트워크를 구축하고 이를 바탕으로 국내 IT기업의 해외진출기반을 마련하고자 하는 것이 본 연구의 주요 목적이라 할 수 있겠다.

우리나라는 단기간내 원조 수원국에서 공여국으로 전환된 세계에서 유일한 국가이다. 이러한 우리나라의 발전 경험을 벤치마킹하려는 신흥 개도국은, 특히 한국이 비교우위를 가지고 있는 ICT 분야에 대해 경험 공유 및 자문에 대한 요청이 급증하고 있다. 게다가 ICT 분야에 있어서는 ICT 개발지수인 IDI 지수로 상위 10위권 안에 드는 일본을 제외한 유일한 아시아 국가이다. 또한 국민1인당 소득으로 보면, 2만달러대의 소득으로 ICT 개발지수 상위 20위권에 드는 유일한 나라이다. 이렇다 보니, 한국의 IT 기반 경제성장에 대한 신흥 개도국의 관심이 매우 높으며, 관련 정책자문의 수요도 급증하는 추세이다.

둘째, 최근 에너지, 물류, 차세대 이동통신 등 인프라에 대한 신흥 개도국의 대규

모 투자가 예상되는데, 이러한 투자는 IT와 결합되어 효율을 높일 수 있을 것으로 보인다. 신흥국 시장을 기회로 인프라 산업은 새로운 성장동력으로 부상하고 있으며, 특히 IT는 인프라 산업 수출의 주요한 요소가 될 수 있을 것이다. 신흥국에 대한 인프라 산업 수출시 IT 기반 경제성장 정책자문사업을 동반 제공함으로써 국내 인프라 수출가능성을 높이고 이를 통해서 국내 IT기업의 세계진출 기회를 확대하는 기회를 삼을 수도 있다.

셋째, 기존의 대개도국 IT 자문사업은 정보화 및 전자정부 등 일부 영역에 한정되어 있거나 단편적인 정책 위주로 이루어져 왔다. 따라서 한국의 정보화정책, IT 산업정책, 경쟁정책 및 규제 등 IT 정책 전반에 걸쳐 한국의 모범사례 및 실패사례를 포괄하는 연구가 필요하다. 또한 제조업과 IT, 교육과 IT 등 IT를 활용한 타산업의 생산성 향상방안을 도출하여 IT정책 자문사업이 신흥국 시장에 대한 인프라 수출과 결합될 수 있도록 하는 전략적 접근이 필요하다 하겠다.

본 연구는 3개년동안 수행되는 장기프로젝트의 1차년도 내용으로서 개발도상국 IT 정책자문에 필요한 마스터플랜을 수립하고 전략대상국 선정을 위한 기초조사 과정까지를 포함한다. 2차년도에는 해외진출 전략대상국을 선정하고 1차년도의 연구를 심화시켜 주요 정책 모범사례를 모듈화시켜 전략국가별 맞춤형 IT정책 실천계획을 수립할 계획이다. 그리고 3차년도에는 1,2차년도의 성과를 평가하고 피드백을 받아 해외진출 전략국가 ICT 마스터플랜 정책자문 연구를 완성한다는 계획이다.

2. 주요지역별 현황

2.1. 아시아태평양 지역

최근 10년간 아시아태평양지역은 지속적인 정보통신 인프라 발전과 서비스 향상으로 ICT 분야에서 여타 지역의 성장을 이끌고 있는 것으로 파악된다. 2007년 말 기준, 아시아태평양지역은 전 세계 휴대폰 가입자의 42%, 유선전화의 47%, 인터넷 사용자의 39%, 유선 브로드밴드의 36%, 그리고 모바일 브로드밴드 가입자의 42%를

차지했다.

아시아태평양국가들의 경우, 한국, 일본과 같이 ICT 발전 선두국이 있는 반면 파푸아뉴기니와 같은 최후진국도 있는 등 역내 가장 ICT 발전격차가 심하여 전체적으로 보면 국제평균에 못미치는 상황이다. 이는 지역적으로 넓게 산재하는 인구밀도도 원인이 되겠지만, 가장 중요한 원인은 낮은 소득수준으로 인해 높은 ICT 비용이 형성되어 있는 점이 이 지역의 ICT 발전을 저해하는 가장 중요한 원인으로 꼽힌다. 그래서 ICT 정책적 개발이 필요한 국가들이 가장 많은 지역이기도 하다. 최근에 중국과 인도, 베트남에서의 3G망 활용으로 지역 내 ICT 발전에 대한 기대가 높아지고 있다. 그리고 이 지역에서는 정부가 주도하는 ICT 발전정책이 ICT 발전에 크게 영향을 미치고 있는 것으로 판단된다. 특히 브로드밴드 보급에 있어서는 호주의 브로드밴드 정책 등을 위시하여 개별 국가의 정책적 추진이 브로드밴드 보급률 상승에 크게 기여한 것으로 보인다.

〈Table 1－1〉 아시아태평양지역 회원국의 ICT 전략

국가명	ICT전략 내용
브루나이	• RAGAM21: 말레이시아, 싱가포르, 필리핀, 미국을 연결하는 국제망인 광대역 네트워크는 e-commerce, e-government, 원격교육 , 스마트 스쿨, 원격의료를 위한 중추이자 플랫폼을 제공 • e-government 프로젝트에 10억 브루나이 달러 예산 배분
캄보디아	• NiDA(National Information Development Authority)를 통한 정부 전산화, ICT 개발에 있어서 지역 장벽 제거, 공여국, 정부기관, 산업, 커뮤니티 간 긴밀한 협력관계 유지
인도네시아	• SISFONAS 2010(Sistem Informasi National): 국가적 ICT청사진으로 e-government를 가속화하고, 모든 주류 활동에 있어서 ICT를 촉진함과 동시에 통신 보급률이 낮은 지역들을 연결하여 광대역과 무선 통신을 확대
라오스	• 종합기본계획(2003-2015): 기본 인프라 확보, ICT개발 • LANIC(Lao National Internet Committee): 공공부분의 현대화, 민간부문 산업에 ICT 접근성 제공

국가명	ICT전략 내용
말레이시아	• MSC(Multimedia Super Corridor): 국제적 또는 지역 ICT산업체들이 멀티미디어, 커뮤니케이션 수단, 솔루션, 서비스 분야에 있어 R&D에 착수할 수 있도록 돕고, MSC를 하이테크 생산 기지, 글로벌 테스트베드(test bed), 아시아 지역 운영 허브로서 활용할 수 있도록 함
미얀마	• ICT 마스터플랜: 지역, 국제적 파트너들을 유인하여 세계적 수준의 인프라와 기술이 뒷받침된 ICT 관련 산업 클러스터(cluster)를 형성함으로써 ICT 개발을 촉진함 • 미얀마 ICT 개발조합(Myanmar ICT Development Corporation): 미얀마의 ICT 허브 조성을 위한 '정부개발 MICT Park 프로젝트' 아래 형성된 50개 지역 회사들로 구성된 컨소시엄
필리핀	• ICT21: 비전과 프레임워크 설정 • 민간부문 원격통신 거대사업자(PLDT, Globe)와 ICT 컨소시엄(TelicPhil)에 의한 ICT 개발 추진
태국	• National ICT Masterplan(2002～2006): ICT개발 촉진 및 ICT개발에 1,350억 바트 예산 배분 • ICT 2010: ICT 2000을 대체하여 e-government 프로젝트에 6천만 바트 배분
싱가포르	• SingaporeOne: 전국적 광대역 네트워크로서 호환적 멀티미디어 응용 및 서비스 제공 • Infocomm21: 예술・디자인을 포함한 새로운 성장 동력 개발 • 2006년 추가적 e-government 프로젝트에 6억2천만 SD 배분 • iN2015: 무선 광대역을 비롯한 차세대 네트워크(Next Generation networks) 마스터플랜
베트남	• 전국적 infocomm 네트워크 형성, ICT기술 개발, 민간 공공 부문에 ICT 응용을 위한 ICT 마스터플랜

자료: 강인수&서보현(2009)

국가별 ICT 개발지수(IDI)[2]를 살펴보면, 아시아태평양지역의 국가들은 대부분 2002년에 비해 2007년 IDI 지수가 상승한 것을 볼 수 있다. 특히 한국 이외에 베트

2) ICT Development Index로 2009년 ITU가 국가별 정보격차 해소 및 ICT 발전 경험 공유 등을 목적으로 국가별 ICT 개발정도를 지수화하여 제시함. 하위 항목으로 ICT 인프라와 접근(접근 항목), ICT 이용과 사용빈도(이용 항목), 효과적인 ICT 활용을 위한 수용도(기술 항목)를 측정함

남이 소득에 비해서 ICT 개발지수가 높게 나타났고, 말레이시아, 이란, 피지 등은 국가소득에 비해 ICT 개발이 저조한 것으로 나타났다. 또한 아시아태평양지역의 국가들에서는 ICT 접근(access)과 활용(use)의 차원에서는 매우 동적으로 나타난 반면 기술습득(skill)의 차원에서는 지난 5년 동안 지수의 상승폭이 높지 않아 ICT 교육 및 지식 향상에 있어서 발전이 더딘 것으로 파악된다.

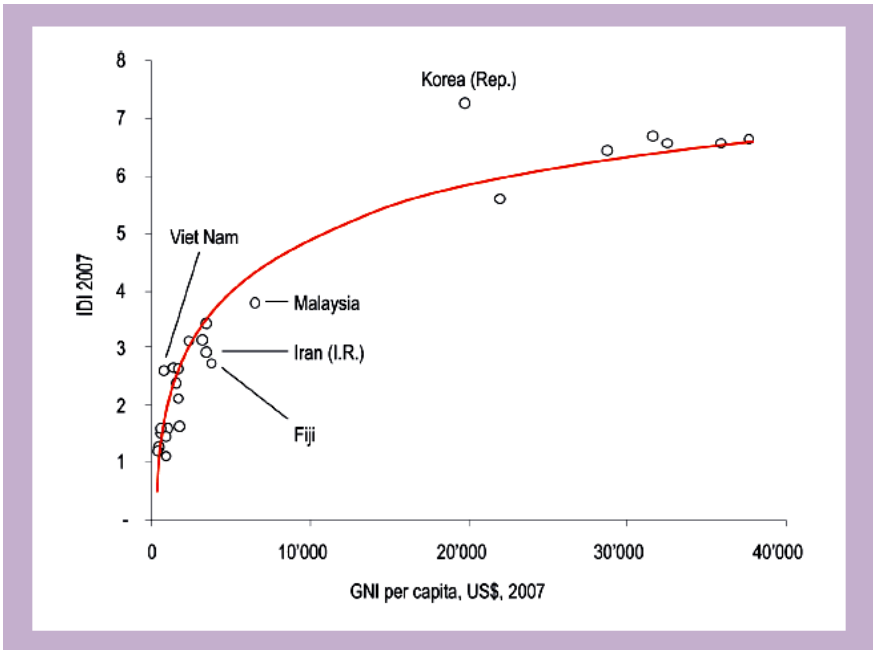
〈Table 1－2〉 아시아태평양지역 국가들의 IDI (2002, 2007)

국가	2007 랭킹	IDI 2007	2002 랭킹	IDI 2002
한국	1	7.26	1	5.83
홍콩	2	6.70	2	5.10
일본	3	6.64	5	4.82
호주	4	6.58	3	5.02
싱가폴	5	6.57	4	4.83
뉴질랜드	6	6.44	6	4.79
마카오	7	6.25	7	4.41
브루나이	8	4.80	8	3.27
말레이시아	9	3.79	9	2.74
태국	10	3.44	10	2.17
몰디브	11	3.16	14	1.96
중국	12	3.11	15	1.95
이란	13	2.94	16	1.93
피지	14	2.73	12	2.00
몽골	15	2.67	13	1.97
필리핀	16	2.63	11	2.07
베트남	17	2.61	18	1.59
스리랑카	18	2.38	17	1.75
인도네시아	19	2.13	19	1.54
부탄	20	1.63	21	1.17
라오스	21	1.60	22	1.08
인도	22	1.59	20	1.19
캄보티아	23	1.53	23	1.07
파키스탄	24	1.46	27	0.89
방글라데시	25	1.26	25	1.02
네팔	26	1.23	26	1.01
파푸아뉴기니	27	1.14	24	1.05

자료: Information Society Statistical Profiles 2009 (ITU, 2010)

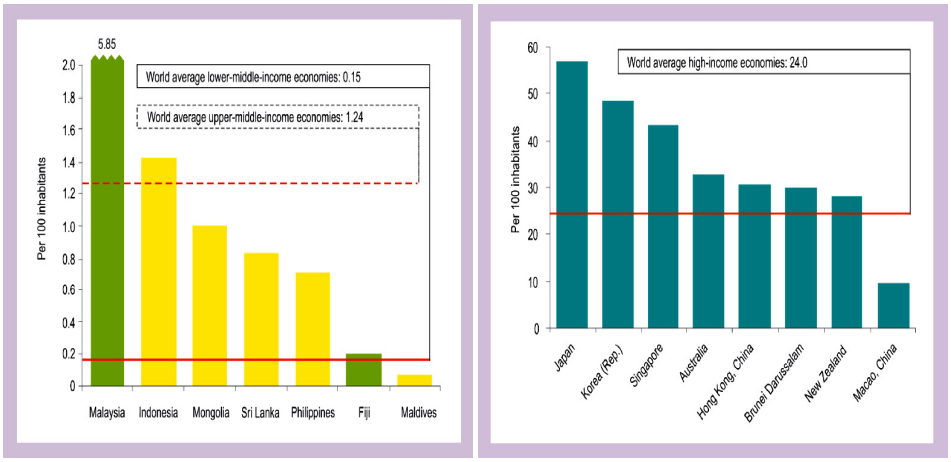
특히 지역내 국가별로 소득의 차이에 따른 ICT 발전 성과도 상이하게 나타나고 있다. 상위소득의 국가들에서는 세계 평균보다 모바일 브로드밴드 가입자 규모가 빠르게 성장하고 있는 것으로 나타난 반면, 중하위소득 국가들에서는 세계 평균보다 성장이 저조한 것으로 나타났다. ICT가 국민경제의 핵심적인 요소가 되고, 국가발전을 선도하고 있는 상황에서 정보격차의 심화는 기존의 발전격차를 더욱 구조화하고 심화시키게 되며 국민생활의 질에 있어서도 큰 격차를 야기할 것으로 우려된다.

〔Figure 1－1〕 아시아태평양지역 국가들의 IDI와 GNI (2007)



자료: Information Society Statistical Profiles 2009 (ITU, 2010)

〔Figure 1－2〕 상위 소득(좌) 및 중하위 소득(우) 국가에서의 모바일브로드밴드 가입율 (2007)



자료: Information Society Statistical Profiles 2009 (ITU, 2010)

아시아태평양지역 국가들의 정보통신 인프라의 경우, 유선부문에 있어서도 급속한 성장을 보여주고 있는 베트남과 정치적인 이유로 무선전화 보급이 제한되고 있는 미얀마의 경우를 제외하고는 유선보다 무선을 중심으로 발전하고 있다. 전체 전화보급률에 있어 무선이 차지하는 비중도 캄보디아, 라오스, 필리핀의 경우 90%이상이며, 태국과 인도네시아, 말레이시아도 85% 안팎의 높은 비중을 나타내고 있다. (강인수&서보현, 2009)

새로운 기술 및 서비스로 개도국의 정보통신발전에 있어서 대안으로 간주되었던 유선 브로드밴드의 경우도 역시 지역내 소득격차에 따라 발전양상이 갈리고 있다. 상위소득 국가에서는 약 20%의 보급률을 보이는 반면, 저소득 국가 대부분은 0%의 브로드밴드 보급률을 보이고 있다. 2006년 대비 2007년 몽골(1.1%), 베트남(1.4%), 스리랑카(2.0%), 태국(2.0%) 등 4개의 저소득 국가만이 유선브로드밴드에서 성장을 보이고 있을 뿐이다.

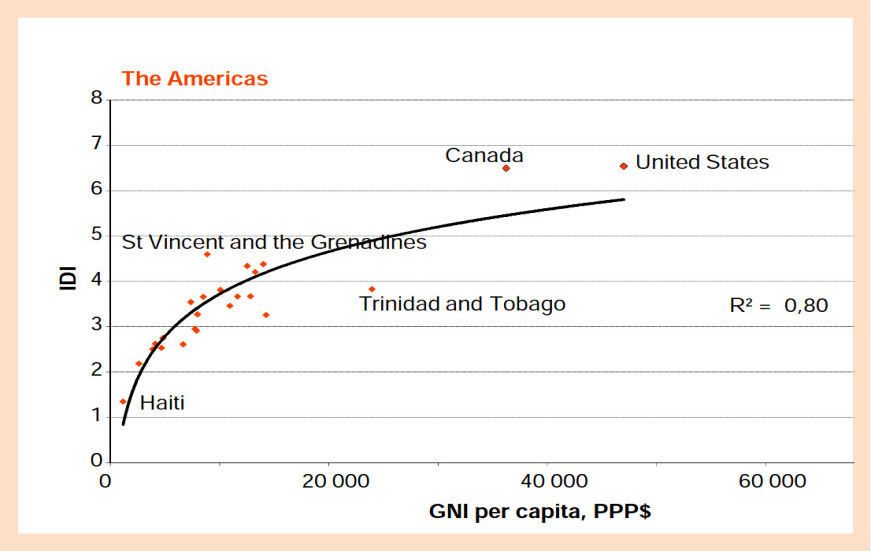
아시아태평양 지역은 최근 10년간 정보통신기술의 월드리더로 부상했다. 아시아태평양 지역은 세계에서 가장 많은 유선망과 모바일가입자, 인터넷사용자, 유·무선 브로드밴드 가입자를 보유하고 있다. 그러나 이러한 가입자수와 증가추세에도 불구하고

지역내 소득격차 및 지형적 곤란 등을 이유로 ICT 보급 수준은 세계 평균에 미치지 못하고 있다. 그러나 여전히 ICT 개발 수준(IDI)에 있어서는 ICT 활용 수준이 크게 향상되고 있고 역동적으로 발전하고 있는 양상을 보여준다는 점에서 ICT 환경개선에 큰 잠재성을 가진 지역으로 평가할 수 있겠다.

2.2. 중남미 지역

중남미는 최근 지속적으로 ICT 발전이 이루어지고 있다. 특히 이동통신서비스의 확산이 두드러진다. 반면 브로드밴드 침투율이 저조하여 전체적인 발전을 더디게 하고 있다. 그러나 이 지역은 주요언어(영어, 스페인어 등) 사용으로 언어의 장벽이 크지 않아 인터넷 사용이 비교적 용이하고, 관련 분야의 발전이 빠를 것으로 보인다. 단 각종 규제가 이 지역 ICT 발전을 저해하고 있는 것으로 평가되고 있다. 따라서 망 고도화를 위한 인센티브 활용 및 규제프레임워크의 조화, 경쟁촉진, ICT 교육에의 투자 등이 필요할 것으로 보인다.

〔Figure 1－3〕 아메리카 지역의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008



자료: Measuring the Information Society, ITU, 2010

중남미 국가들은 아시아태평양지역의 국가들처럼 경제 수준이나 ICT 수준에 있어서는 국가별로 많은 차이를 보이고 있지만, 대부분 스페인・포르투갈의 식민 지배를 오랜 기간 동안 받았으며 가톨릭 문화가 기저에 자리 잡고 메스티소와 같은 혼혈족이 인구의 많은 부분을 구성하고 있다는 점에서 서로 유사함을 지닌다. 이때문에 중남미 국가들이 서로 협력하여 발전을 도모한다면 그 잠재성이 매우 클 것으로 전망된다. 특히, 한국 방송통신 발전 경험의 확산은 한국 업체들이 중남미에 진출하는데 많은 도움이 될 것이다.(강인수&서보현, 2009)

〈Table 1－3〉 주요 중남미 국가의 글로벌경쟁력지수(GCI) 순위

국가	’10～’11년	’09～’10년	’08～’09년
칠레	30	30	28
코스타리카	56	55	59
브라질	58	56	64
파나마	53	59	58
멕시코	66	60	60
우루과이	64	65	75
콜롬비아	68	69	74
엘살바도르	82	77	79
페루	73	78	83
과테말라	78	80	84
아르헨티나	87	85	88
온두라스	91	89	82
도미니카공화국	101	95	98
에콰도르	105	105	104
베네수엘라	122	113	105
니카라과	112	115	120
볼리비아	108	120	118
파라과이	120	124	

자료: 세계경제포럼(World Economic Forum, 2010)

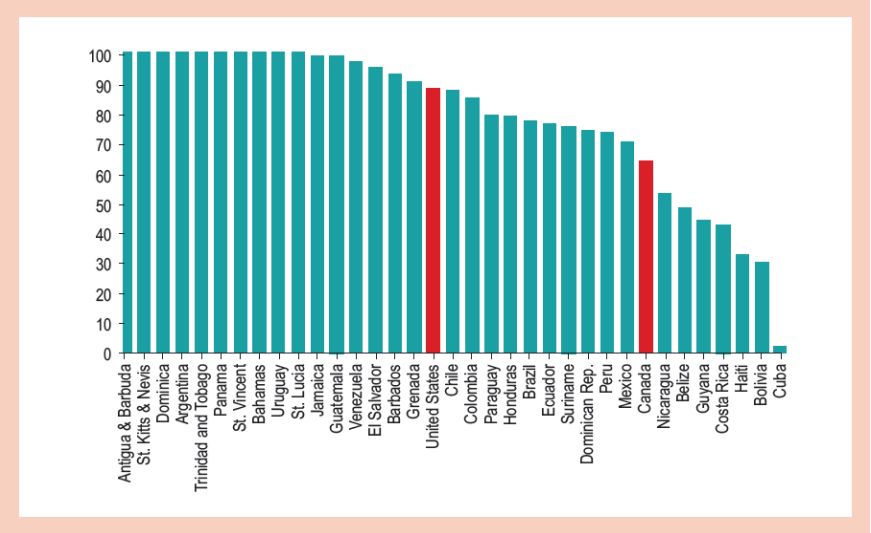
중남미 국가들의 2010-2011 글로벌경쟁력지수(Global Competitiveness Index: GCI)[3]는 최근의 글로벌 경제 위기에도 불구하고 강한 회복력을 보여주며 전반적으로 개선되고 공고해진 것으로 나타났다. 특히, 볼리비아, 파나마, 파라과이의 경쟁력지수가 크게 상승했고, 브라질, 칠레, 코스타리카, 우루과이 등 여타 다른 중남미 국가들은 소폭 상승하거나 전년도 수준을 유지하는 수준을 보였다. 이같은 결과는 이 지역 국가들의 재정안정성, 시장효율성, 시장개방성, 수출다변화 등이 안정적으로 구현되고 있음을 방증함과 동시에 2008년 시작된 글로벌 경제위기를 잘 극복해온 결과로 받아들여질 수 있겠다. 이 지역 2009년 GDP는 1.8% 하락하였으나, 2010년에는 국내 소비증가 및 대외환경개선 등으로 인해 4% 성장이 전망되고 있다. 하지만 아직도 이 지역의 잠재적 경쟁력까지 끌어올리기까지는 상당한 노력이 필요할 것으로 보인다. 글로벌경쟁력지수 50위권 안에 랭킹된 국가는 칠레(30위)가 유일하고, 파나마(53위), 코스타리카(56위), 브라질(58위), 우루과이(64위), 콜롬비아(68위), 페루(73위) 등이 중위권에 랭크되었고, 기타국들은 하위권에 머물러있는 실정이다.

전반적인 중남미 국가들의 이동전화 및 인터넷 이용 현황은 크게 개선되고 있다. 특히, 중남미 국가들의 휴대폰 가입자 추이를 보면 카리브 국가를 포함시키고도 2008년 이동통신 가입자 수치가 80%를 상회하고 있다. 아르헨티나, 트리니다드토바고, 파나마 등은 북미의 선진국인 미국, 캐나다를 추월하는 이동통신 서비스 가입률을 나타내며 급속한 발전양상을 보여주고 있다. 중남미 지역 국가들은 컴퓨터 구입 및 인터넷 접속 비용이 수입에 비해 상당히 높게 형성되어 있어서 가정에서 인터넷 사용보다 공공인터넷센터(Public Internet Centers)를 이용하여 인터넷을 사용하는 비율이 매우 높다. 멕시코는 2007년 e-멕시코 프로젝트를 통해 2천여 곳에 8천개가 넘는 디지털커뮤니티센터(Digital Community Center)를 설치했고, 콜롬비아는 통신부가 컴파텔(Compartel) 프로젝트를 통해 1만5천여개의 공공기관을 인터넷으로 연결했다. 이같은 공공인터넷 시설의 확산은

3) 세계경제포럼(WEF)에서 매년 각국의 노동시장 효율성, 거시경제의 건전성 등 12개 부문을 평가해 해당 국가 안에서 기업들이 얼마나 효율적으로 경제활동을 할 수 있는지를 보여주는 지수.

ICT 접근성을 높인다는 차원에서 긍정적이긴 하지만, 인터넷 접근성 및 활용도를 더욱 높이고 서비스를 확산시키기 위해서는 가정내 인터넷 접속비율을 높일 필요가 있을 것이다.

〔Figure 1－4〕 아메리카 지역의 인구 100명 중 이동통신 가입자수 (2008)



자료: Information Society Statistical Profiles 2009 (ITU, 2010)

반면, 중남미 지역의 인프라 수준은 아시아태평양 지역에 비해 크게 뒤떨어져 있다. Calderon&Servenㅡ은 이 지역의 인프라 수준을 한국 수준으로 향상시킬 경우 이 지역의 연간 GDP를 1.4%에서 1.8% 가량 증가시킬 것으로 전망했다. 아래 표는 중남미 지역 및 카리브해 지역 국가들의 2010-2011 GCI 중 인프라 부분의 경쟁력지수를 한국, 중국, 인도 등과 비교하여 보여준다. 중남미 지역 국가들의 국제 평균 수준으로의 인프라 수준 향상을 위해서는 공공부문의 재정지원 뿐만 아니라 민간부문의 재정적 지원이 크게 필요할 것으로 판단된다. 따라서 향후 중남미 지역에서는 ICT 인프라 및 이동통신을 이용한 방송통신융합서비스 분야의 발전이 크게 일어날 것으로 전망되는 바, 이 분야 수출시장에 집중하는 것이 바람직할 것이다.

〈Table 1－4〉 중남미 및 카리브해 국가들의 인프라 경쟁력 수준

	Infrastructure 2010–2011		A. Transport infrastructure 2010–2011		B. Electricity and telephony infrastructure 2010–2011	
Country/Economy	Rank	Score	Rank	Score	Rank	Score
Hong Kong SAR	1	6.77	1	6.69	1	6.85
Korea, Rep.	**18**	**5.59**	**12**	**5.73**	**30**	**5.44**
Barbados	23	5.37	29	4.82	15	5.93
Chile	40	4.69	37	4.56	48	4.83
Panama	44	4.53	46	4.15	44	4.92
Trinidad and Tobago	45	4.53	58	3.94	38	5.12
Puerto Rico	49	4.44	30	4.76	70	4.12
China	**50**	**4.44**	**31**	**4.73**	**69**	**4.14**
Uruguay	53	4.29	75	3.54	42	5.03
El Salvador	59	4.13	66	3.78	56	4.49
BRIC average	**n/a**	**4.10**	**n/a**	**4.27**	**n/a**	**3.93**
Brazil	**62**	**4.02**	**67**	**3.76**	**65**	**4.28**
Jamaica	65	3.91	51	4.05	86	3.76
Guatemala	66	3.9	76	3.48	64	4.31
Latin America & Caribbean average	**n/a**	**3.75**	**n/a**	**3.48**	**n/a**	**4.01**
Mexico	75	3.74	57	3.96	92	3.51
Argentina	77	3.63	89	3.17	73	4.08
Costa Rica	78	3.62	111	2.78	59	4.45
Colombia	79	3.59	101	2.94	68	4.24
Honduras	85	3.51	82	3.30	88	3.73
India	**86**	**3.49**	**39**	**4.50**	**115**	**2.49**
Peru	88	3.47	94	3.08	84	3.86
Ecuador	96	3.18	99	2.96	95	3.39
Bolivia	100	3.04	122	2.59	94	3.49
Guyana	103	2.92	100	2.95	102	2.90
Dominican Republic	107	2.83	79	3.38	121	2.28
Venezuela	108	2.82	123	2.58	98	3.06
Nicaragua	111	2.73	102	2.90	112	2.55
Paraguay	125	2.46	138	2.10	104	2.82

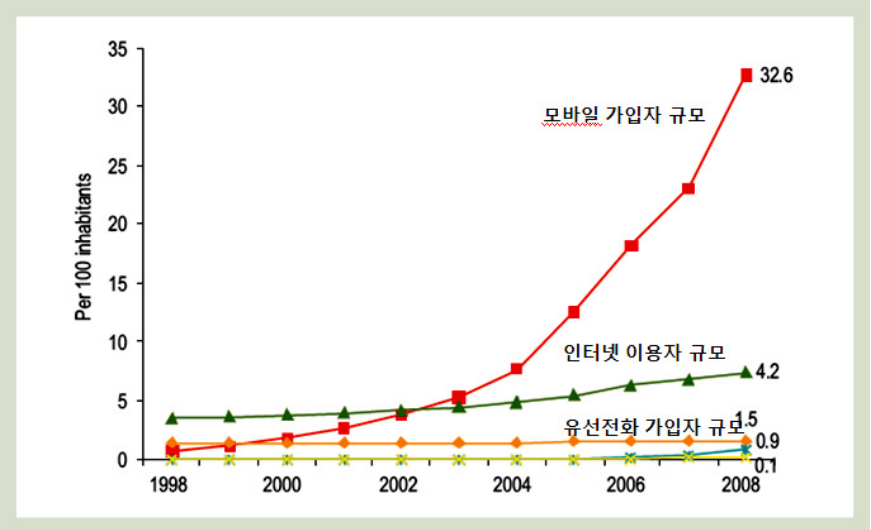
자료: 세계경제포럼(World Economic Forum, 2010)

2.3. 아프리카 지역

아프리카는 여전히 ICT 개발이 저조한 것으로 나타났고, 특히 ICT 사용에 있어서 거의 발전의 양상이 나타나지 않는다. 대신 모바일 브로드밴드 활용이 그 초기단계이지만 유선보다는 상당히 빠르게 성장하고 있어 향후 이 분야에서의 성과가 기대되고 있다. 지난 10년간 아프리카의 정보통신기술 발전에 따른 가장 두드러진 점은 휴대전화 가입자의 지속적인 성장이다. 보급률은 상대적으로 낮지만 휴대폰 및 인터넷 사용자 증가추세는 빠르다. 2000년 휴대폰 가입자 1,100만명, 인터넷 사용자는 300만명이 2008년 말, 휴대폰 가입자 2억 4,600만명, 인터넷 사용자 3,200만명으로 성장함으로써, 동기간동안 세계 성장률의 2배에 달하는 성장을 이루었다. 이와 같이 여타 지역에 비해 가장 역동적인 성장을 했지만, 20년 전 1% 보급률로 시작한 아프

리카는 여전히 ICT 보급률이 선진국 및 개도국의 수준에 크게 못미치고 있다.

〔Figure 1－5〕 아프리카 지역의 ICT 발전 추이 (1998-2008)



자료: Information Society Statistical Profiles 2009 (ITU, 2010)

〈Table 1－5〉 전세계 대비 아프리카 지역의 ICT 성장률 (단위: CAGR, %)

	유선전화	이동전화	인터넷
아프리카	2.4	47.0	30.6
전세계	2.5	23.0	17.0

자료: Information Society Statistical Profiles 2009 (ITU, 2010)

국가별 ICT 개발지수(IDI)를 살펴보면, 아프리카지역의 국가들에서는 2002년에 비해 2007년 IDI 지수가 대체적으로 상승한 것으로 나타났다. 특히 세이셸은 인구 10만명 미만의 국가로 2002년부터 줄곧 이 지역에서 가장 높은 IDI 지수를 보여주고 있다. 세이셸의 이동통신 보급률은 2002년 57%에서 2007년 89%로 급증한 것이 주목할만 한데, 이는 적은 인구를 가진 국가여서 단기간의 급성장이 가능한 것으로

도 볼 수도 있다. 그 밖에 가나와 케냐가 지역내 저소득국가로서 IDI 지수 상위 10개국 안에 포함되어 있다. 아프리카 지역은 무선망 확충(2000년 25%에서 2008년 58.5%) 및 휴대전화 가입율 성장(2005년 12.5%에서 2008년 31%) 등 무선통신 부문에서 성장이 속도가 빠른 편이다. 그러나 ICT 접근(access)면에서 성장이 큰 반면 활용(use)의 측면은 성장이 더딘 편인데, 이는 ICT 서비스의 비싼 요금수준에 기인한다. 특히 유선브로드밴드의 요금이 지역내 대부분의 국가(32개국 중 22개국)에서 월 GNI보다 높은 것으로 나타났다. 따라서 아프리카 지역에서는 저렴한 통신서비스 요금수준 확보가 가장 시급한 문제로 대두되고 있으며, 급속한 성장이 예상되는 무선브로드밴드 서비스와 이동전화서비스의 활성화가 ICT 발전을 위한 주요한 정책이 될 것으로 보인다.

〈Table 1－6〉 아프리카지역 국가들의 IDI (2002, 2007)

국가	2007 랭킹	IDI 2007	2002 랭킹	IDI 2002
Seychelles	1	3.60	1	2.59
Mauritius	2	3.45	2	2.45
South Africa	3	2.70	3	2.11
Cape Verde	4	2.18	5	1.67
Gabon	5	2.14	7	1.48
Botswana	6	2.10	4	1.70
Namibia	7	1.92	6	1.58
Swaziland	8	1.73	8	1.32
Ghana	9	1.63	14	1.10
Kenya	10	1.62	10	1.21
Gambia	11	1.49	22	0.96
Lesotho	12	1.48	11	1.15
Cameroon	13	1.46	12	1.12
Zimbabwe	14	1.46	9	1.29
Cote d'Ivoire	15	1.41	18	1.01
Zambia	16	1.39	16	1.08
Nigeria	17	1.39	15	1.09
Senegal	18	1.38	25	0.95
Congo	19	1.37	13	1.10
Madagascar	20	1.36	23	0.96
Benin	21	1.28	30	0.76

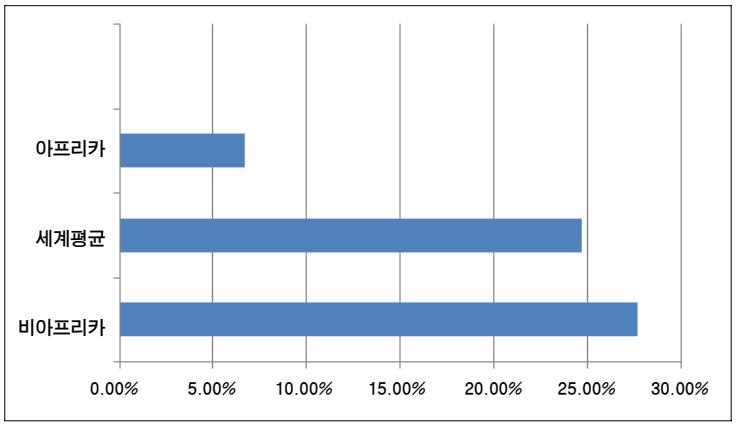
국가	2007 랭킹	IDI 2007	2002 랭킹	IDI 2002
Togo	22	1.26	17	1.03
Uganda	23	1.21	26	0.92
Malawi	24	1.17	24	0.95
Rwanda	25	1.17	19	0.99
Tanzania	26	1.13	21	0.96
Mali	27	1.12	31	0.75
Ethiopia	28	1.03	28	0.78
Mozambique	29	1.02	29	0.77
Eritrea	30	1.00	20	0.96
Burkina Faso	31	0.97	32	0.68
D.R.Congo	32	0.95	27	0.92
Guinea-Bissau	33	0.90	34	0.56
Chad	34	0.83	33	0.65
Niger	35	0.82	35	0.51

자료: Information Society Statistical Profiles 2009 (ITU, 2010)

ITU의 시장 조사결과에 따르면 2008년 한 해 아프리카의 정보통신 개발에 80억 달러가 투자된 것으로 추산된다. 아프리카의 텔레콤 시장 투자액은 2013년에 411억 달러까지 치솟을 것으로 예측되고 있다. 특히 아프리카의 모바일서비스 가입자 수는 2013년 7억 8천만 명에 달할 것으로 전망된다. 이처럼 아프리카에서 모바일이 급성장하는 까닭은 전력 공급 인프라와 유선 전화 네트워크의 미비 및 높은 서비스요금 등이 장애요인으로 작용하고 있기 때문인 것으로 보인다. UN 보고서에 따르면 부르키나파소, 중앙아프리카 공화국, 스와질란드의 경우 한 달 인터넷 사용료가 무려 1,300달러에 달한다. 그리고 알제리, 이집트, 모로코, 남아프리카 공화국, 튀니지 5개 국가가 아프리카 전체의 브로드밴드 가입자의 90%를 점유하고 있는 것으로 밝혀져 아프리카 내의 인터넷 접근성의 지역 간 격차가 극심한 것으로 나타났다. 이 때문에 국가 차원의 대대적인 인프라 구축이 필요한 인터넷 분야의 경우, 아프리카는 오히려 위성이나 무선 브로드밴드 등과 같은 가장 최신의 기술을 적용할 필요가 있다는 주장이 제기되고 있다. 비슷한 관점에서 모바일의 웹 브라우징 기술을 활용하여 인터넷 접근 기회를 증대하려는 구상이 있으나 현재 아프리카 모바일 시장의 ARPU(Average revenue per user)가 계속 감소추세에 있다는 점에서 즉각적인 효과는

기대하기 힘들 것으로 보인다.[4] 반면 이동통신사업 연합체인 GSMA은 모바일 녹색 파워 프로그램(Green Power for Mobile-GPM)을 상용화하는 데 노력을 기울이고 있다. GSMA는 휴대폰 네트워크 기구(Worldwide organization of mobile phone networks)로서 현재 전기 그리드(Grid) 없이 모바일을 사용할 수 있는 방안을 연구 중에 있다. 이 기구는 전 세계의 15억 인구 중 1/3에 해당하는 인구가 전기 공급을 통하지 않고서도 휴대폰을 사용하기를 원하며, 이와 관련한 사업적 기회가 23억 달러에 달한다고 예상했다. 아프리카와 같이 전력 공급 상황이 열악한 곳에서는 태양열로 충전하는 휴대폰과 같이 공짜로 충전이 가능한 솔루션들이 필요한 상황이다. 이 시장의 잠재적 소비자 수는 현재 4억 8천만 명에 달하며 매년 10%의 성장률이 예상된다. 만약 이 솔루션이 상용화될 경우 아프리카의 정보 접근성에 매우 긍정적인 영향을 미칠 것으로 기대된다. (강인수&서보현, 2009)

〔Figure 1－6〕 2009년 2분기 아프리카 인터넷 보급률 현황



자료: Internet World Stats(2009), 강인수&서보현(2009)에서 재인용

4) 아프리카의 가장 큰 모바일 사업자인 MTN에 따르면, 아프리카 전반의 ARPU는 매우 낮으며, 더 낮아지고 있는 추세이다. MTN은 현재 아프리카 16개 시장에 진출해 있으며, 2009년 1분기에 가장 높은 ARPU를 기록한 곳은 17$인 남아프리카 공화국이었다. 가장 낮은 곳은 $5의 수단이었으며, 대부분의 나라들은 수단과 비슷한 수준을 보이고 있다. 통신서비스의 신규가입자들의 경우 대부분은 기본적인 음성서비스만 사용하고 있는 것으로 판단된다.

아프리카 국가들의 2010-2011 글로벌경쟁력지수(Global Competitiveness Index: GCI)를 보면, 세계금융시장과의 상호의존성이 적은 관계로 최근의 글로벌 경제 위기로 인한 여파를 크게 받지 않은 것을 알 수 있다. 이 지역 국가들은 꾸준히 견고한 성장세를 보이고 있으나 이러한 성장세가 얼마나 지속적일것인가에 대해서는 의문의 여지가 있다. 그럼에도 불구하고 튀니지, 남아프리카공화국, 모리셔스 등이 아프리카 지역에서 견고한 성장을 보이며 꾸준히 높은 국가경쟁력 순위를 지키고 있다. 튀니지는 효율적인 정부, 견고한 국가안전망, 질높은 교육시스템 등의 영향으로 전체 순위에서 8단계 상승하여 32위에 랭크되었다. IMF는 아프리카 지역이 2010년 4.7%, 2010년 이후에는 5% 이상의 GDP 성장이 가능할 것으로 낙관하고 있다.

〈Table 1－7〉 아프리카 글로벌경쟁력지수(GCI)

국 가	2010-2011		2009-2010	
	순위	점수	순위	점수
Tunisia	1	4.65	1	4.50
South Africa	2	4.32	2	4.34
Mauritius	3	4.32	3	4.22
Botswana	5	4.05	4	4.08
Namibia	4	4.09	5	4.03
Kenya	8	3.65	6	3.67
Nigeria	15	3.38	7	3.65
Gambia	6	3.90	8	3.96
Tanzania	10	3.56	9	3.59
Benin	7	3.69	10	3.56
Cameroon	9	3.58	11	3.50
Madagascar	15	3.46	12	3.42
Lesotho	17	3.36	13	3.54
Uganda	12	3.51	14	3.53
Mauritania	22	3.14	15	3.25
Zambia	11	3.55	16	3.50
Burkina Faso	21	3.20	17	3.23
Malawi	14	3.45	18	3.42
Mali	20	3.28	19	3.22
Zimbabwe	19	3.30	20	2.77
Ethiopia	13	3.51	21	4.43
Mozambique	18	3.32	22	3.22
Chad	25	2.73	23	2.87
Burundi	23	2.96	24	2.58
Angola	24	2.93	25	

자료: Global Competitive Index 2009, 2010 (WEF)

3. 정책자문 대상국가 풀(Pool) 선정을 위한 요소 분석

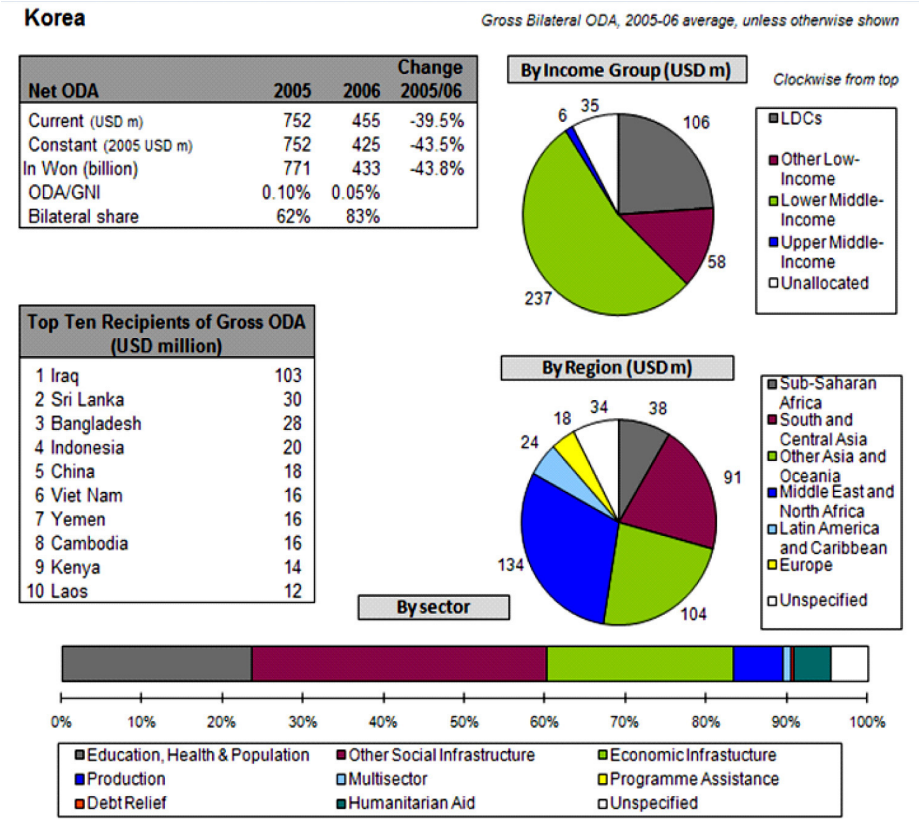
정책자문 대상국가 풀(Pool)을 선정하기 위해 대상국의 경제력, 성장잠재력, 우리나라의 정보통신 해외진출상황, 정치적 상황 등 여러 가지 요소를 고려해야 한다. 그리고 요소 분석결과에 따라 전략국가를 그룹별로 구분해서 살펴볼 수 있을 것이다. 첫째는 우선협력국으로 정부의 IT정책에 대한 인식과 기초 IT 인프라 환경을 보유하고 있으며 협력관계 구축을 통해 상호호혜의 결과를 기대할 수 있는 국가군이 있다. 둘째는 전략협력국으로 기초 IT환경이 열악하여 상호호혜 기반 협력관계는 기대하기 어려우나, 에너지, 자원 등 상호대체 협력수요를 보유하여 전략적 접근의 가치가 있는 국가군이 있다. 마지막으로 위상협력국으로 국제기구 및 국제회의 등 국제사회에서 우리의 IT 위상 강화를 위한 파트너 국가군이 있다.

참고로 OECD에서 발표한 우리나라의 ODA[5] 원조상황을 살펴보면, 소득별로는 중하위소득국, 최빈국, 하위소득국 등의 순으로 원조가 이루어지고 있고, 지역별로는 아시아태평양지역이 1억 9,500만 달러로 지원규모가 가장 크고, 중동·아프리카 지역이 1억 7,200만 달러로 지원규모가 두 번째로 크며, 중남미의 경우 2,400만 달러로 지원규모가 작은 것으로 나타났다. 한국 ODA의 top10 수혜국으로는 이라크, 스리랑카, 방글라데시, 인도네시아, 중국, 베트남, 예멘, 캄보디아, 케냐, 라오스 순이다. 그 밖에 한국은 원조대상국에 사회간접자본, 경제인프라, 교육·복지 분야 등의 순으로 원조를 수행하고 있는 것으로 나타났다. 한국의 ODA 원조상황으로 미루어 볼 때, 한국은 주로 아시아태평양, 중동·아프리카, 중남미 지역의 빈곤국을 대상으로 사회·경제 인프라에 원조를 하고 있는 것으로 보인다. 따라서 본 보고서의 전략대상국 풀 선정에 있어서 ODA 대상 지역 및 국가를 참고할 수 있을 것이다.

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5) ODA는 Official Development Assistant의 약자로, 공적개발원조 혹은 정부개발원조라고 불리는 것으로, 선진국의 정부 또는 공공기관이 개발도상국의 경제사회발전과 복지증진을 위해 개발도상국에 공여하는 증여(grant) 및 양허성차관을 말함

〔Figure 1－7〕 한국의 ODA 원조상황



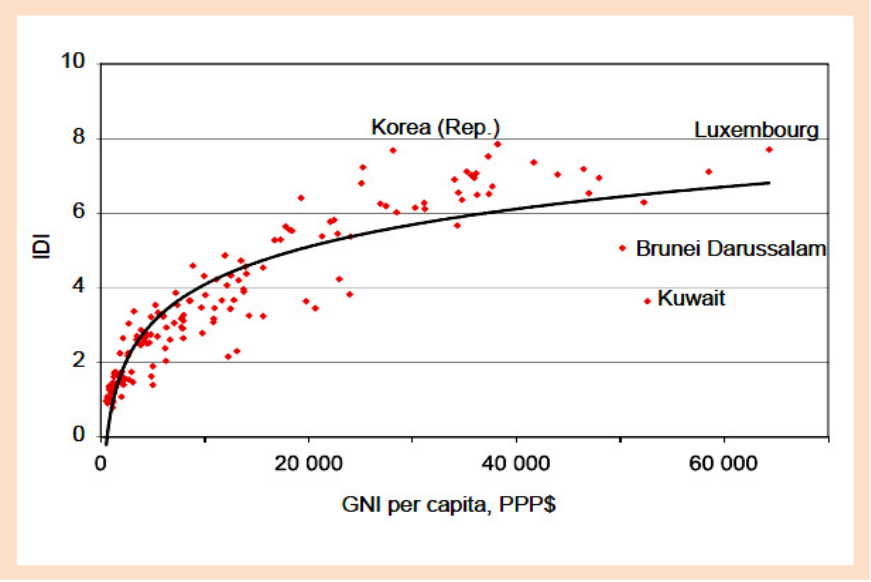
자료: OECD(2008.9)

본 연구에서는 위에서 살펴본 국가군 중 첫 번째 우선협력국 및 두 번째 전략협력국이 본 연구에서 추구하는 정책자문 대상국가에 포함된다고 할 수 있다. 그러나 우리나라가 IT 인프라 수출시 정책자문을 할 수 있는 전략대상국가를 선정하는 것이 본 연구과제의 목적인 바, 대상국가를 좀 더 구체적이고 효율적으로 선정하기 위하여 IT 부문에 국한하지 않고, IT를 핵심축으로 하되 다양한 요소와의 조화를 통해 시너지 효과를 제고할 수 있는 방향으로 검토하였다. 즉, ICT 개발지수(IDI), 통신요금수준(ICT Price Basket), 국제경쟁력지수(GCI) 등 여러 가지 다양한 요소를 고려하여 대상국가를 그룹화한 뒤 전략대상국가 풀(Pool)을 선정하기로 한다.

3.1. 국민소득 대비 ICT 개발수준(IDI)

국민소득과 ICT 개발지수는 명확한 정의 상관관계를 보여준다. 이는 특히 저소득국가들의 경우 더욱 명확하게 나타난다. 소득이 높은 국가들의 경우 대부분 상관관계 추세선의 위쪽에 위치하고, 저소득국가들의 경우 대부분 추세선 아래쪽에 위치하는 것을 볼 수 있다. 그 중에서 가장 특이성을 보이는 국가가 바로 한국이다. 한국은 국민소득이 2만 1천불 남짓으로 상대적으로 소득이 높지 않은 국가이지만 IDI 지수는 2008년 기준 3위로 추세선의 위쪽에서도 높은 곳에 위치한다. 이를 두고 ITU는 한국정부가 정책적으로 ICT 개발을 추진해왔기 때문으로 분석하고, 한국의 경험을 모범으로 삼아 여타 저소득국가에서도 유사한 개발경험을 재현할 수 있을 것으로 기대하고 있다.

〔Figure 1－8〕 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008



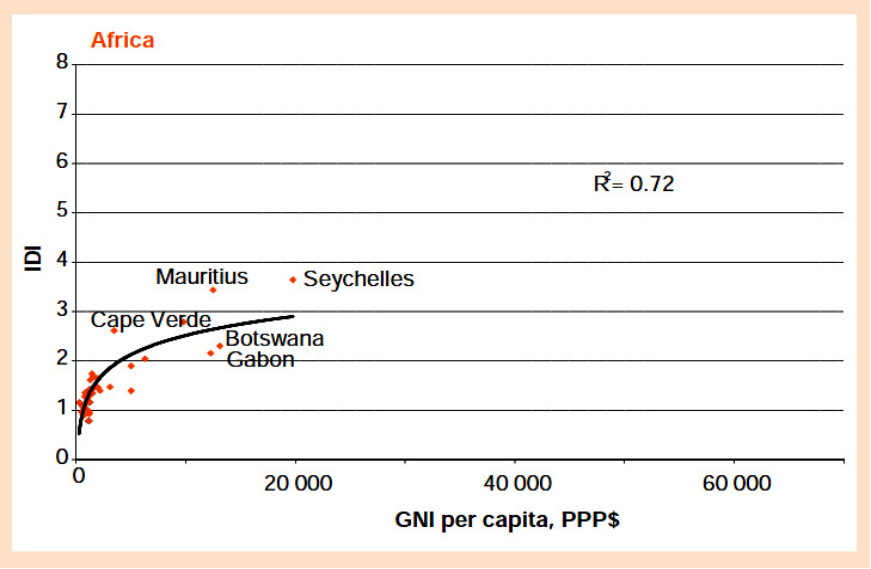
자료: Measuring the Information Society (ITU, 2010)

추세선 아래쪽에 위치한 국가들 중 중동의 원유수출국인 쿠웨이트, 브루나이, 사우디아라비아 등은 경제발전을 천연자원 개발을 중심으로 진행해온 국가들로 향후

ICT 발전에 잠재력이 큰 국가들로 분석할 수 있다.

지역별로 살펴보면, 아프리카는 여전히 ICT 개발이 저조한 것으로 나타났고, 특히 ICT 사용에 있어서 거의 발전의 양상이 나타나지 않는다. 대신 모바일 브로드밴드 활용이 그 초기단계이지만 유선보다는 상당히 빠르게 성장하고 있어 향후 이 분야에서의 성과가 기대된다. 따라서 ITU는 아프리카 지역에 대해서 이동통신 및 인터넷 성장 촉진 및 저소득층의 접근률 향상과 브로드밴드 억세스 확산을 위한 방안 마련 등을 정책이슈로 꼽은 바 있다. 이를 위해서 개방 및 민영화, 인프라 공유, 통신비용 인하, 이동전화의 보편적서비스화, 보편적접근및서비스기금(UASFs) 활용 촉진, 공공인터넷억세스 확대 등을 제안한바 있다.

〔Figure 1－9〕 아프리카의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008

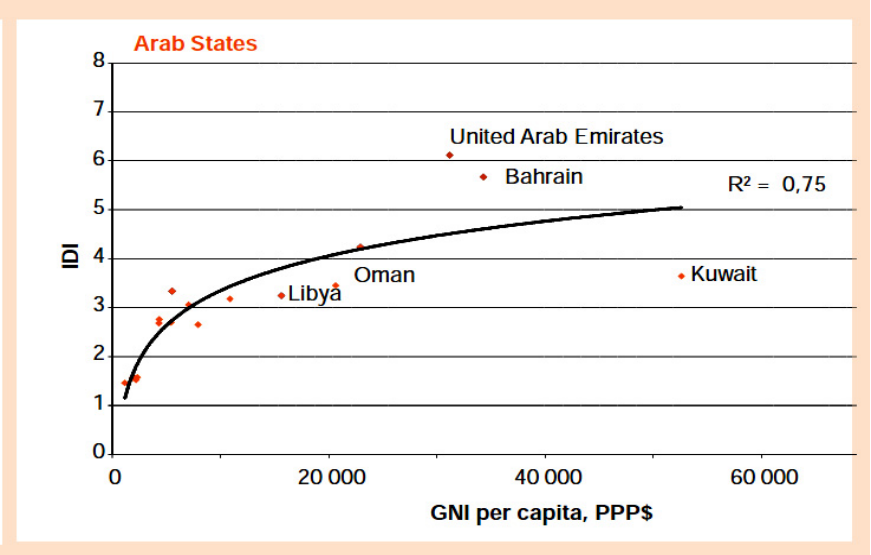


자료: Measuring the Information Society (ITU, 2010)

다음으로 아랍국가를 살펴보면, 이 지역은 지역내 소득격차가 커서 IDI 지수 격차도 크게 나타난다. UAE의 경우는 2008년 IDI지수 6.11로 29위를 차지할 정도로 정

보화 지수가 높은 반면, Comoros 같은 국가는 IDI지수 1.46으로 134위를 차지할 정도다. 또한 이지역은 인구밀도가 낮아 ICT 발전이 더딘 것으로 분석되고 있다. 그럼에도 불구하고, 걸프만지역국가(GCC)들을 중심으로 정보화 발전이 진행되면서 2007년에서 2008년 기간동안 상당한 ICT 발전을 보이고 있다. 또한 이 지역에서는 지난 10년간 이동통신서비스가 크게 발전해왔는데, 연간 55% 성장을 통해 2008년 기준 이동통신 포화율이 62%에 이른다. 이는 이 지역 높은 소득 뿐만 아니라, 이 지역에 거주하는 전문가, 관광객 등의 이동통신 이용이 상당히 영향을 미쳤다고 분석된다. 이동통신과는 다르게 유선통신, 인터넷 사용 등은 여전히 낮은 수준에 머물러 있기 때문이다. 따라서 ITU는 아랍국가들의 정책의 중요성을 역설하고 있다. 애초에 아랍국가에서 ICT 발전이 늦어진 이유가 아랍내 산업의 외자유치를 제한한 정책의 영향이었으므로, 향후 초고속브로드밴드망 확대, ICT 기술 확보, 차세대 통신망으로의 이행 등을 위해서 정부정책이 중요하다고 판단하고 있다.

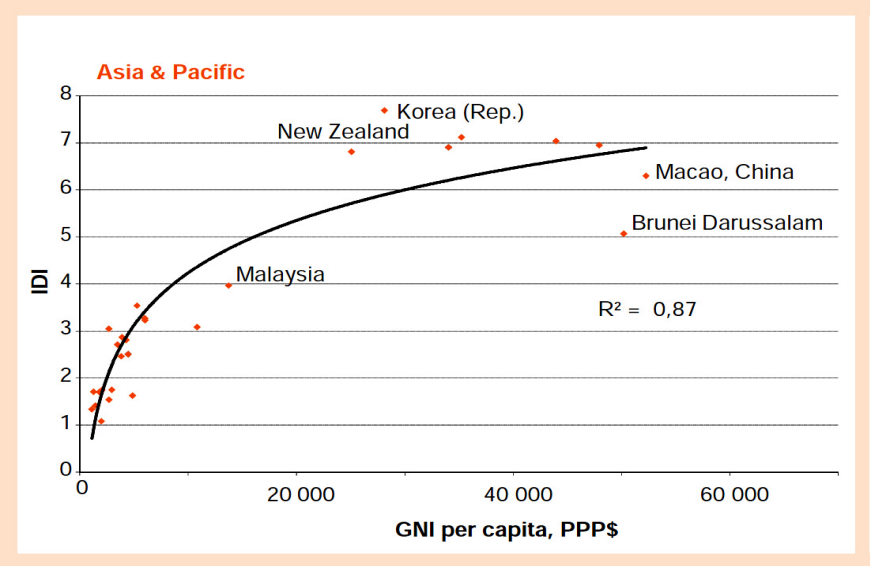
〔Figure 1－10〕 아랍국가의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008



자료: Measuring the Information Society (ITU, 2010)

아시아태평양국가들의 경우, 한국, 일본과 같이 ICT 발전 선두국이 있는 반면 파푸아뉴기니와 같은 최후진국도 있는 등 역내 가장 ICT 발전격차가 심하여 전체적으로 보면 국제평균에 못미치는 상황이다. 이는 지역적으로 넓게 산재하는 인구밀도도 원인이 되겠지만, 가장 중요한 원인은 낮은 소득수준으로 인해 높은 ICT 비용이 형성되어 있는 점이 이 지역의 ICT 발전을 저해하는 가장 중요한 원인으로 꼽힌다. 그래서 ICT 정책적 개발이 필요한 국가들이 가장 많은 지역이기도 하다. 최근에 중국과 인도, 베트남에서의 3G망 활용으로 지역 내 ICT 발전에 대한 기대가 높아지고 있다. ITU는 보편적서비스기금을 활용한 정보취약지역 개발, 통신산업 투자유인책 활용, 경쟁촉진, e-gov't 등 공공 인프라 확대 등을 제안하고 있다.

〔Figure 1－11〕 아시아태평양국가의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008

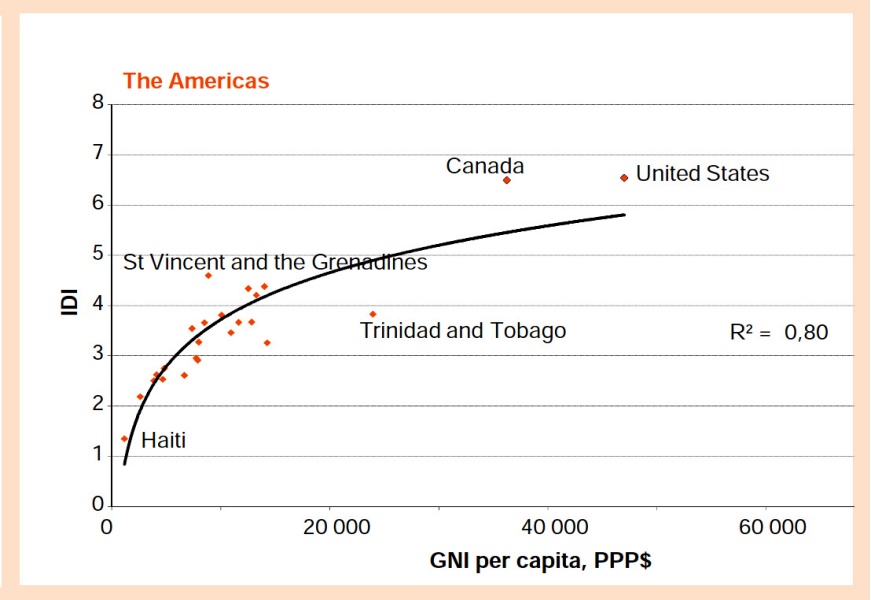


자료: Measuring the Information Society (ITU, 2010)

중남미는 최근 지속적으로 ICT 발전이 이루어지고 있다. 특히 이동통신서비스의 확산이 두드러진다. 반면 브로드밴드 침투율이 저조하여 전체적인 발전을 더디게

하고 있다. 그러나 이 지역은 주요언어(영어, 스페인어 등) 사용으로 언어의 장벽이 크지 않아 인터넷 사용이 비교적 용이하고, 관련 분야의 발전이 빠를 것으로 보인다. 단 각종 규제가 이 지역 ICT 발전을 저해하고 있는 것으로 평가되고 있는데, 따라서 망 고도화를 위한 인센티브 활용 및 규제프레임워크의 조화, 경쟁촉진, ICT 교육에의 투자 등이 필요할 것으로 판단된다.

〔Figure 1－12〕 아메리카국가의 IDI(ICT 개발지수)와 GNI(인당 국민소득), 2008



자료: Measuring the Information Society (ITU, 2010)

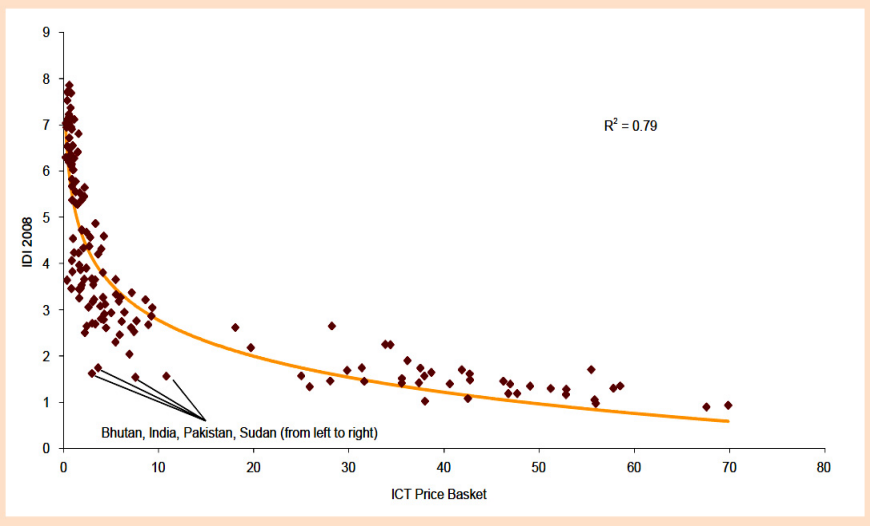
3.2. 국민소득 대비 통신요금수준(ICT Price Basket)

ITU는 2009년부터 국민소득 대비 ICT 비용수준을 보여주는 ICT Price Basket 지표를 도입했다. ICT Price Basket은 국가간 통신요금 수준 비교를 위해 구매력평가(PPP) 기준 국민총소득(GNI) 대비 통신서비스의 요금수준을 보여주는 지표이다. 각국의 정부는 이 지표를 통해 다른 나라와의 통신요금 수준 비교를 통해 경쟁도입, 관세정책 수정 등의 정책적 수단을 동원하여 통신요금 수준을 낮추는데 활용할 수

있을 것이다.

통신요금 수준이 낮아지면 자연스럽게 ICT 발전이 가속화될 것을 예상할 수 있다. 따라서 ICT Price Basket과 IDI 간에는 밀접한 관계가 성립된다. 통신요금 수준이 낮으면 ICT 활용정도가 높아지고, 마찬가지로 ICT 활용수준이 높으면 규모의 경제로 인해 통신요금이 하락하는 것이다. 그러나 인도, 부탄, 파키스탄, 수단 등은 상대적으로 ICT Price Basket 지수가 낮은 반면 IDI 지수도 낮게 나타났는데, 이들 국가들에서는 ICT 비용 이외에도 ICT의 발전을 저해하는 장애가 따로 존재함을 미루어 짐작할 수 있다.

〔Figure 1－13〕 IDI와 ICT Price Basket 상관관계

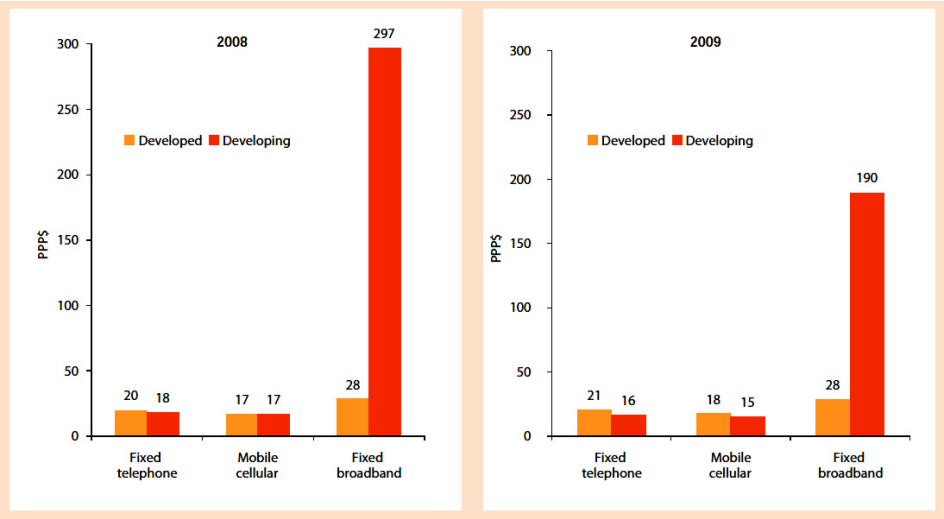


자료: Measuring the Information Society (ITU, 2010)

2008-2009 기간에는 거의 대부분의 국가에서 ICT Price Basket 지표, 즉 통신요금 수준이 하락한 것으로 나타났다. 전체적으로 선진국의 국민들은 소득의 1.5%를 통신비용으로 지출하는 반면, 개도국의 국민들은 소득의 17.5%를 지출하는 것으로 나타났다. 유선통신, 이동통신, 유선브로드밴드 등의 서비스로 나누어 살펴보면, 유선

통신 및 이동통신은 대체로 요금 수준이 낮은 것으로 나타났고 국가별로 보았을 때도 전체적인 트렌드에서 벗어나지 않을 만큼 선진국보다 개도국에서의 소득 대비 요금수준이 높았다. 유선브로드밴드의 경우는 선진국과 개도국간 요금수준 차이가 매우 크게 나타났다. 아프리카에서는 초고속인터넷 이용요금이 인당 평균 월 국민총소득의 500%에 육박함으로써 아프리카의 대부분의 국민들은 유선브로드밴드 서비스를 이용하지 못하고 있는 것으로 보인다. 반면 아시아태평양 지역은 71%, 유럽은 2% 미만으로 나타났다. 선진국과 개도국으로 나누어 보면 이러한 요금수준의 불균형이 더욱 확연해지는데, 유선브로드밴드 요금이 선진국에서는 28불, 개도국은 190불이다. 그리고 2009년 기준 유선브로드밴드 요금이 월 국민소득을 초과하는 국가는 161개국 중 28개국이나 된다.

〔Figure 1－14〕 통신서비스별, 국가수준별 요금수준 격차



자료: Measuring the Information Society (ITU, 2010)

3.3. 경제성장가능성과 국제경쟁력지수(Global Competitiveness Index)

정책자문의 대상국가를 선정함에 있어 대상국의 경제성장가능성, 특히 IT분야 성장성을 염두하고 분석하는 것이 중요하다. 또한 국제경쟁력지수를 고려함으로써 전체적인 대상국의 성장잠재력을 가늠해볼 수 있을 것이다.

우리나라는 IT 성장을 바탕으로 한 경제성장을 이룬 나라로서, IT 성장 경험을 가지고 아시아, 동유럽, 서유럽, 중남미, 아프리카, 중앙아시아 등 총 50여개 국가와 IT 협력관계를 구축하여 왔으며, 지역적 경제통합의 확산으로 아시아 역내 국가와의 협력에 상대적으로 많은 역량을 집중해 왔다. 따라서 지역별 성장성, IT산업의 발전성을 고려하여 기존에 협력관계 구축이 활발히 추진되어온 서유럽・아시아 지역과의 협력관계를 심화하는 한편, 아프리카・동유럽・중앙아시아・중남미 등 미래 전략 지역과는 신규 협력기반 조성과 같은 전략이 필요한 시점이라고 할 수 있다.

개발도상국은 우리나라의 입장에서 볼 때 잠재력이 매우 큰 미래시장인 동시에 IT 강국으로서 공동번영을 해나가야 할 파트너이기도 하다. 우리나라는 국제사회의 책임있는 구성원으로 국제정보격차해소를 위한 공여국으로서 임무완수, IT강국으로서의 입지강화를 위한 IT외교 강화와 IT부문의 해외진출을 위한 기반 구축이라는 면에서 개도국과의 IT협력 및 외교 전략을 수립하고 수행할 필요가 있다.

국내 정보화의 성공적 경험을 바탕으로 IT 글로벌 진출의 양적 확대가 급속히 전개되어 왔으나, 질적인 면에서 볼 때 IT협력이 MOU 체결에 머무르는 경우가 많고, 지속적 협력 활동으로의 연계를 통한 실질적인 협력관계로 나아가지 못하며, 개도국으로부터의 높은 협력 수요에도 적절히 대응하지 못하고 있다고 할 수 있다. 현재까지 추진되어 온 국가 간 협력을 협력 단계별로 구분할 때, 협력기반조성 40%, 협력신뢰구축 26%, 협력심화 34%의 비중으로 구성되어 있는데, 아프리카, 동유럽, 중앙아시아, 중남미 지역과는 협력기반조성 및 협력확대 단계, 아시아 지역과는 협력심화 단계의 비중이 크다.

〈Table 1－8〉 지역별 IT 성장 전망(Billion US$)

	2008	2009	2010	2011	2012	2013	2014	CAGR
Worldwide	3,374	3,223	3,394	3,538	3,696	3,858	4,021	
		-4.8%	5.6%	4.2%	4.5%	4.4%	4.2%	4.5%
북미	1,035	1,003	1,036	1,086	1,140	1,195	1,251	
		-4.8%	5.6%	4.8%	4.7%	4.5%	8.6%	4.8%
서유럽	905	820	865	890	915	943	971	
		-9.4%	5.4%	2.9%	2.9%	3.0%	3.0%	3.4%
중・동유럽	170	138	139	144	151	160	170	
		-18.7%	0.1%	3.6%	5.2%	6.1%	6.1%	4.2%
아시아 태평양	506	505	549	580	615	651	686	
		-0.2%	8.7%	5.6%	6.1%	5.8%	5.4%	**6.3%**
중남미	251	238	265	282	299	315	330	
		-5.1%	11.3%	6.5%	6.0%	5.3%	4.7%	**6.7%**
중동・아프리카	204	204	219	232	247	263	280	
		-0.3%	7.4%	6.2%	6.1%	6.6%	6.4%	**6.5%**

자료: Gartner(2010.3)
주: 1. 북미는 미국과 캐나다를 포함
2. 아시아 태평양은 일본을 제외한 수치임

본 연구에서는 우리나라의 IT 성장 경험을 전수하고 상호호혜의 결과를 얻을 수 있는 국가를 선정함에 있어서, IT 저개발국이 많은 중동·아프리카, 중남미, 아시아태평양 지역의 국가들을 대상으로 지역별 'IT시장 전망(성장성)' 및 국가별 '글로벌 경쟁력 지수(GCI)'를 고려하고자 한다. 특히 향후 5년간 북미, 서유럽 등은 3%-4%대의 성장률이 예상되는 반면 아시아, 중남미, 중동·아프리카 지역의 IT시장 성장률이 6% 이상의 수준으로 증가할 것으로 전망됨에 따라 이들 지역에 대한 우선적인 검토를 할 필요가 있다.

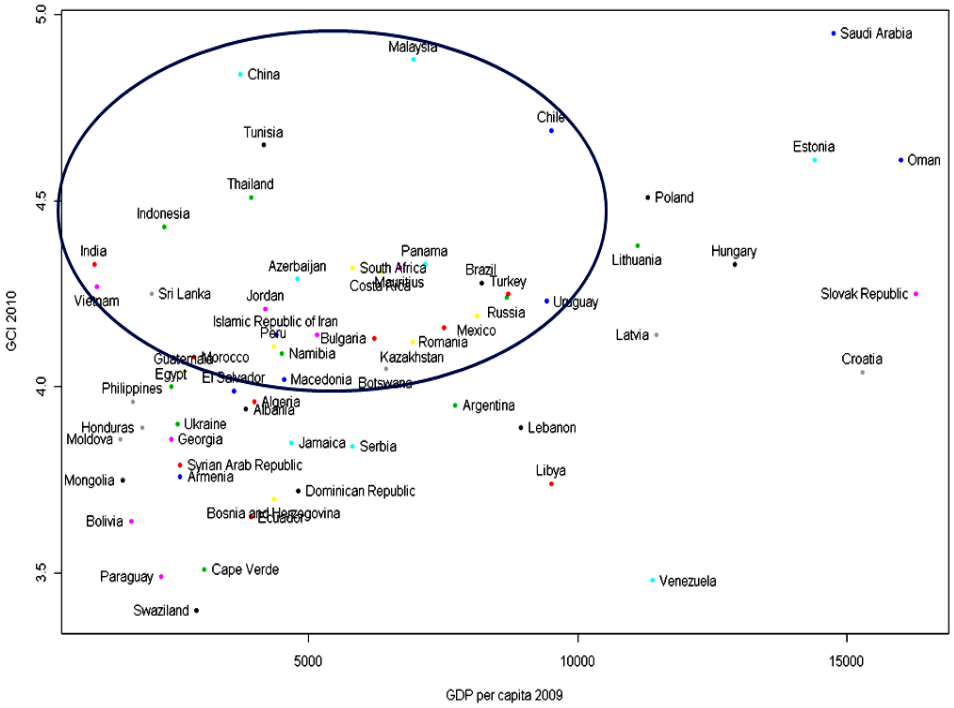
4. 정책자문 대상국가 풀(Pool) 선정

우선 IT 선진국을 제외하고 주요 개도국을 중심으로 3단계 분석 과정을 통해 정책자문 대상국가 풀(Pool) 선정이 이루어졌다. 1단계에서는 전반적인 국가별 경제력 및 성장잠재력을 고려하기 위해 국민1인당생산지표(GDP)와 국제경쟁력지수(GCI)를 적용하여 전략대상국을 1차로 도출하였다. 2단계에서는 한국으로부터의 IT 수입규모 및 정보통신발전지수(IDI)를 지표로 활용하여 한국과의 정보통신시장 교류상황 및 국가별 정보통신산업 발전정도를 판단하여 전략대상국을 도출하였다. 마지막 단계에서는 가트너의 국가별 IT시장 전망 자료를 활용하여 IT산업 부문별로 유망한 국가군 분류를 시도해 보았다.

4.1. 1단계: 국가별 경제력 및 성장잠재력 고려

국민1인당 GDP와 국제경쟁력지수(GCI; Global Competitiveness Index)를 고려했을 때, 저소득국가이나 성장잠재력은 일정수준 이상인 국가를 1차적으로 정책자문의 전략대상국으로 아래의 도표와 같이 도출해냈다. 도출된 국가들로는 아시아태평양 지역의 말레이시아, 중국, 태국, 러시아, 인도네시아, 인도, 베트남, 카자흐스탄, 스리랑카, 아제르바이잔 등과, 중동·아프리카 지역의 남아공, 튀니지, 이란, 나미비아, 요르단, 보스와나, 이집트, 모로코 등과, 중남미의 칠레, 우루과이, 브라질, 멕시코, 페루, 코스타리카, 파나마 등이 있다. 1단계에서 도출된 국가들은 1인당 GDP가 10,000불 이하이고 국제경쟁력지수 4.0 이상인 국가들로 현재의 경제상황은 좋지 않으나 국가경쟁력 평가가 좋은 국가들로 향후 경제성장가능성이 큰 국가들이라고 할 수 있다.

〔Figure 1－15〕 1단계 대상국가 선정 결과



4.2. 2단계: 한국과의 정보통신부문 통상관계 및 ICT개발정도 고려

2단계에서는 대한국 IT 수입규모가 일정수준 이상이면서 ICT 개발수준이 일정수준 이상인 국가들을 그림과 같이 도출했다. 제한된 국가별 데이터의 한계로 많은 국가를 포괄적으로 비교할 수는 없었으나, 한국의 일정규모 이상의 수출대상국은 대부분 포함하고 있는 것으로 판단된다. 그리고 ICT 개발정도가 미약하더라도 한국과의 교역관계를 고려하여 정보통신 부문의 교역관계가 있는 국가들은 대부분 포함시키고자 했다. 2009년 말 기준 한국으로부터 IT 분야 수입실적과 ICT 개발지수 정도를 고려하여 2단계에서 도출된 국가는 아시아태평양지역의 중국, 말레이시아, 러시아, 필리핀, 태국, 베트남, 캄보디아, 인도네시아, 인도 등과 중동·아프리카 지역의 사우디아라비아, 이란, 남아공, 이집트, 모로코 등과, 중남미 지역의 멕시코, 브라질, 칠

레, 콜롬비아 등이다.

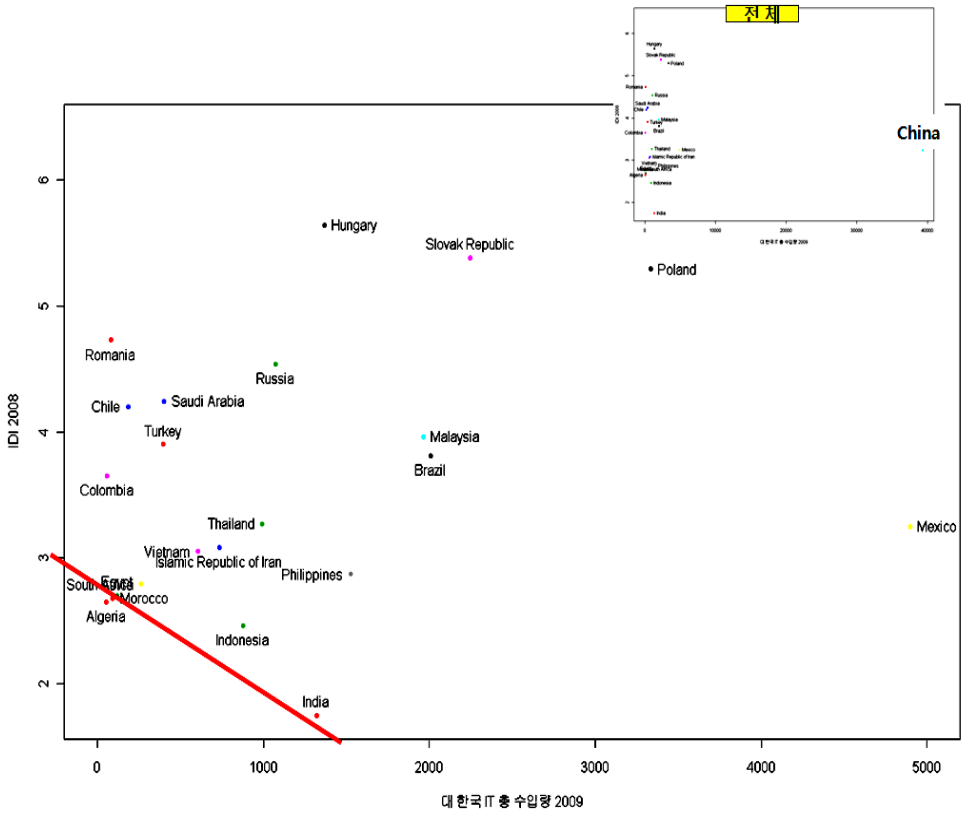
〈Table 1－9〉 한국의 국가별 정보통신 수출규모

(단위: 백만 달러)

국가	2007	2008	2009	증감율 07~09
China	35,879	38,222	39,343	9.65%
Mexico	5,158	6,035	4,896	-5.06%
Malaysia	3,211	2,985	1,962	-38.89%
Poland	2,453	2,932	3,333	35.85%
Brazil	1,883	2,300	2,008	6.60%
Philippines	1,669	1,669	1,526	-8.60%
Slovak Republic	1,413	2,191	2,244	58.77%
Hungary	1,391	1,049	1,367	-1.72%
Russia	1,336	1,476	1,071	-19.85%
Thailand	1,059	1,060	992	-6.35%
Turkey	962	457	395	-58.90%
India	885	1,341	1,320	49.08%
Indonesia	828	830	876	5.78%
Iran	481	634	735	52.83%
Vietnam	425	352	602	41.83%
South Africa	392	301	263	-32.90%
Saudi Arabia	283	317	402	41.86%
Chile	179	180	185	2.96%
Morocco	131	110	91	-30.38%
Romania	124	125	78	-37.16%
Colombia	115	85	56	-51.19%
Egypt	93	94	116	25.08%
Algeria	33	52	53	60.66%

자료: itstat.go.kr

〔Figure 1－16〕 2단계 대상국가 선정 결과



4.3. 3단계: IT 시장 성장 전망 고려

3단계에서는 가트너의 “Forcast: Enterprise IT Spending by Vertifal Industry Market, Worldwide, 2008-2014" 전망보고서를 토대로 국가별 IT 시장 성장가능성을 살펴보았다. 그리고 IT산업을 하드웨어, 소프트웨어, IT서비스, 통신서비스 등 4개의 부문으로 나누어 시장 성장가능성을 보고 지역별 부문별 전략대상국가군을 분류했다.

〈Table 1－10〉 국가별 부문별 IT 연평균 성장률(2008-2014)

국가명	HW	SW	IT서비스	통신서비스
인도	14.2%	12.3%	17.6%	8.1%
중국	7.1%	13.7%	16.6%	8.6%
브라질	7.0%	12.3%	10.4%	8.5%
칠레	1.1%	10.8%	10.3%	5.6%
콜롬비아	4.7%	9.3%	9.4%	5.7%
헝가리	2.3%	5.8%	3.5%	4.4%
말레이시아	2.6%	10.1%	9.7%	3.9%
멕시코	4.3%	9.8%	9.1%	2.9%
페루	3.1%	11.5%	11.1%	6.4%
폴란드	4.2%	6.8%	5.0%	4.1%
러시아	8.0%	7.1%	5.1%	5.4%
남아공	3.3%	6.6%	5.3%	8.5%
대만	4.1%	10.1%	4.2%	1.5%
태국	6.7%	8.0%	6.3%	3.9%
터키	3.2%	6.1%	4.8%	3.1%
베네수엘라	-1.9%	9.0%	7.8%	2.2%

국가별 부문별 2008년-2014년 기간동안의 IT 성장 전망을 분석한 결과, 하드웨어 부문은 아시아태평양 지역에서는 인도, 중국, 태국, 대만, 말레이시아 순으로, 중남미 지역에서는 브라질, 콜롬비아, 멕시코 순으로, 아프리카에서는 남아공이 각각 성장가능성이 큰 국가들로 나타났다. 소프트웨어 부문은 아시아태평양 지역에서는 중국, 인도, 말레이시아, 대만의 순으로, 중남미 지역에서는 브라질, 페루, 칠레, 멕시코, 콜롬비아, 베네수엘라의 순으로 성장가능성이 큰 국가들로 나타났다. IT 서비스 부문에 있어서는 아시아태평양 지역의 인도, 중국, 말레이시아와 중남미 지역의 페루, 브라질, 칠레, 콜롬비아, 멕시코가 가장 성장가능성이 큰 것으로 나타났다. 마지막으로 통신서비스 부문에서는 아시아태평양 지역의 중국과 인도, 중남미 지역의 브라질, 페루, 콜롬비아, 칠레, 아프리카 지역의 남아공이 각각 성장가능성을 크게 보여주었다.

4.4. 선정결과 종합

총 3년에 걸쳐 수행되는 해외진출 전략국가 ICT 마스터플랜 정책자문 연구 중 제1차년도 연구로 수행되는 본 연구는 정책자문 전략국가 선정에 앞서 전략대상국가 풀(Pool)을 도출하는 것을 목표로 하고 있다. 따라서 앞서 이루어진 1단계에서 3단계까지의 도출과정에서 국가들을 단계별로 걸러내고 대상국가를 선정하는 것이 아니라, 단계별로 도출된 국가들를 모두 망라하여 가능한 대상국을 모두 후보군으로 분류하는 방식을 통해 다음과 같이 지역별, 부문별 전략대상국가 풀(Pool)을 도출하였다.

〈Table 1－11〉 지역별 전략대상국가 풀(Pool)

아시아태평양	중동·아프리카	중남미
말레이시아 중국 태국 러시아 필리핀 인도네시아 인도 베트남 캄보디아 카자흐스탄 스리랑카 아제르바이잔	남아프리카공화국 튀니지 이란 사우디아라비아 나미비아 요르단 보스와나 이집트 모로코	칠레 우루과이 브라질 멕시코 콜롬비아 페루 코스타리카 파나마

〈Table 1－12〉 ICT산업 부문별 전략대상국가 풀(Pool)

	아시아태평양	아프리카	중남미
HW	인도 중국 태국 대만 말레이시아	남아공	브라질 콜롬비아 멕시코

	아시아태평양	아프리카	중남미
SW	중국 인도 말레이시아 대만	-	브라질 페루 칠레 멕시코 콜롬비아 베네수엘라
IT서비스	인도 중국 말레이시아	-	페루 브라질 칠레 콜롬비아 멕시코
통신서비스	중국 인도	남아공	브라질 페루 콜롬비아 칠레

2차년도 연구에서 전략대상국가 선정시에는 본 연구에서 도출된 국가군 중에서 한국과의 정부간 교류협력관계 및 민간기업간 협력관계 등을 고려하여 진출 유망국가를 선정할 수 있을 것으로 기대한다.

5. 주요 대상국가 현황

5.1. 인도

가. 개관

인도의 인구는 세계 총 인구의 17.1%에 달하는 11억 3,000만 명으로 중국에 이어 세계 2위의 인구대국으로 여타 투자 대상국에 비할 수 없는 방대한 내수시장을 보유하고 있다. 또한 인도는 최근 경제가 안정되고 고도성장이 몇 년째 지속되면서 세계적으로 큰 주목을 받고 있는 국가이다. 먼저 IT, BT 등 지식산업분야의 아웃소싱 기지로 부상하였고 4년 연속 7~9%의 성장을 거듭해 오면서 제조업과 서비스업이

급성장해 인도시장에 대한 세계적인 기업들의 투자가 이어지고 있다. 하지만 인도는 대부분 수입 품목에 대해 30% 상당의 고관세 규제를 하고 있어 수출을 통한 시장진출 경로가 제한되어 있다는 점에서 직접 투자진출이 필요하다고 볼 수 있다.

인도의 최종 소비자들의 IT 소비는 2009년 대비 14.1% 상승하여 2010년에는 6백 7십억 달러에 달할 것으로 전망된다. 인도의 경제는 최근 세계적인 경제 위기 동안에도 6% 이상의 GDP 상승을 기록하였다. 이러한 인도의 IT산업의 성장은 대부분 국내 소비에 의하여 이루어졌기 때문에 인도는 상대적으로 외부 수요 급변으로 인한 영향이 작다고 할 수 있다. 따라서 인도는 글로벌 경제 사이클 속에 있는 다른 많은 신생 시장들보다 안정적인 경제를 형성하고 있는 것으로 평가된다.

IT 산업은 인도의 주요 산업의 하나로 인도 정부도 IT 산업 육성을 위한 다양한 정책을 추진하고 있다. 이미 1980년대부터 소프트웨어를 중심으로 IT 산업 육성정책을 시행하여 왔으며, 지속적으로 관련 규제를 철폐해 왔다. 1990년대 들어서는 소프트웨어 수출 기업에 한해 법인세를 면제해주는 등 파격적인 지원책을 도입하였으며 소프트웨어 제품의 수입관세를 114%에서 무관세로 인하하였다. 또한 인도정부는 1998년 5월 'IT 및 소프트웨어 개발에 관한 국가 태스크포스'를 구성해 장기 IT 산업 정책을 입안하고, 이 분야의 장애를 해결하고자 했다. 또한 수출기반기업(EOU), 특별경제구역(SEZ), 소프트웨어 테크놀로지 파크(STPI) 등의 제도를 통해 관련 상업을 집중 육성하고 있으며, 세제지원 등의 인센티브 제공, IT 인프라 강화 등 다양한 정책을 추진하고 있다.

나. IT 산업 현황

1) 개요

인도 IT 산업은 GDP의 약 5%를 차지하는 핵심 산업이며 인도 경제성장의 견인차라 할 수 있다. 아래 표를 보면, 인도의 IT 산업은 2007년 기준 GDP의 5.4%를 차지하고, 산업규모가 478억 달러에 이르며, 직접 고용인원이 163만 명에 달한다. 또한 2000년 40억 달러에 불과하던 인도의 IT 총수출액은 2006년 234억 달러로 급격히 성장하고 있다.

〈Table 1－13〉 인도 IT 산업의 성장추이

(단위: %, 천명, 억 달러)

	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07
GDP 대비(%)	1.8	2.6	2.8	3.2	3.6	4.1	4.7	5.4
직접 고용인원	284	430	522	670	830	1,060	1,290	1,630
산업규모	82	121	135	161	216	285	374	478

자료: NASSCOM

주: 1. 직접고용인원은 하드웨어 부문 종사자들을 제외한 수치임
2. GDP 대비(%)와 산업규모는 하드웨어 부문을 포함한 수치임

인도는 소프트웨어 중심의 산업 특성을 보인다. 인도의 IT 산업은 IT 서비스[6], BPO[7], 엔지니어링 서비스 및 소프트웨어[8], 하드웨어 등 4개의 범주로 구분할 수 있는데, 이 중 1990년대 소프트웨어 산업의 발전은 인도 경제의 가장 놀라운 성과 중 하나로 평가되고 있다. 총수출액 중 하드웨어는 5억 달러 수준으로 매우 미미한 반면, IT 서비스 및 소프트웨어가 대부분의 수출규모를 형성하고 있다. 부문별로는 IT 서비스 부분의 수출이 2006년 132억 달러에 달해 전체 수출 234억 달러의 56.4%를 차지한 것으로 집계되었다. 이와 같이 인도의 IT 산업은 소프트웨어 및 IT 서비스 부문이 성장을 주도하고 있다.

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6) IT 서비스는 소프트웨어 주문생산을 일컫는 용어로 소프트웨어 하청 생산, IT 컨설팅, 응용프로그램 관리, 서비스통합, 네트워크 컨설팅 및 네트워크 통합, 기술지원, 소프트웨어 테스트 등을 포함

7) BPO(Business Process Outsourcing)는 인사, 총무, 급여, 고객관리, 고객응대 및 지원 등을 주 대상으로 하며, 인도의 경우에는 콜센터 등 고객응대 및 지원서비스가 전체 BPO 수출의 46%를 차지함

8) 엔지니어링 서비스 및 소프트웨어는 건축, 건설, 플랜트 등의 엔지니어링과 관련된 IT 서비스 및 소프트웨어 제품을 의미함. 최근 이 부문은 급속도로 성장하고 있는 고급기술 분야로 일반 IT 서비스 부문과 별도로 구분하여 집계되고 있음

〈Table 1－14〉 인도 IT 산업의 구성

(단위: 백만 달러)

	2005/2006		2006/2007		2007/2008	
	수출액	내수매출	수출액	내수매출	수출액	내수매출
IT 서비스	9,70	3,508	12,305	4,477	18,090	5,560
BPO	4,600	600	6,300	914	8,300	1,185
엔지니어링 서비스 및 소프트웨어	3,140	722	4,000	1,329	4,890	1,500
하드웨어	547	5,189	584	6,500	600	7,550
Total	18,257	10,018	24,189	13,220	31,880	15,885

자료: NASSCOM

인도의 IT 산업의 경쟁력은 저임금의 영어사용이 가능한 우수 인력이 풍부하다는 데 있다. 공학 및 기술 분야에서만 매년 49만여 명의 인력이 배출되고 있다. 최근 인도 IT 산업의 급성장으로 인력의 퀄리티는 저하되고 인건비는 상승하는 부정적인 현상도 발생하고 있지만, 여전히 IT 서비스를 포함한 전 세계 해외 아웃소싱 분야 저임 노동력의 28%를 인도가 제공하고 있으며 지속적으로 비중은 확대될 전망이다. 인도의 아웃소싱 업무는 가격경쟁력으로 정평이 나있다. 미국은 IT 개발, 콜센터, R&D 등 인도에서의 IT 아웃소싱을 통해 연간 30~50% 가량의 비용을 절감하는 것으로 분석되고 있다. 최근 인도 IT 산업 종사자들의 급여가 수년간 지속적으로 상승했음에도 불구하고, 인도는 여전히 선진국 및 경쟁국에 비해 인건비 경쟁력을 보유하고 있다. 또한 인도의 IT 서비스 인력은 전체 고용 인력의 22%이지만 그 부가가치는 전체의 50% 이상을 담당하고 있을 정도로 국가경쟁력 향상에 중요한 요소가 되고 있다.

〈Table 1－15〉 각국 IT 인력 인건비 비교 (응용프로그램 개발자 기준, 미국=100 기준)

국가	일본	미국	독일	프랑스	영국	인도	중국	폴란드	멕시코	체코
인건비 수준	141	100	89	85	84	16	17	35	37	37

자료: Mckinsey Global Institute, 2006

2) 소프트웨어 부문

소프트웨어 강국인 인도는 소프트웨어 및 IT 서비스 부문의 매출규모가 303억 달러로 전체 IT 매출액의 약 80%를 차지하고 있으며, 이중 수출 비중은 78%에 달한다. 전체 IT 산업에서 소프트웨어 수출이 차지하는 비중은 64.4% 수준이며 인도는 미국에 이어 세계 2위의 소프트웨어 수출국이다.

특히 인도는 국제표준 또는 국제 소프트웨어 기술인증을 통해 기술력의 객관화를 도모한 결과 인도의 소프트웨어 기업 상위 300개사 중 ISO9000이나 소프트웨어 분야 능력평가로 잘 알려진 SEI-CMM의 인증을 받은 기업이 2000년 5월 기준으로 148개사에 달한다. 특히 소프트웨어 분야의 최고수준을 의미하는 SEI-CMM Level 5를 획득한 기업이 전 세계의 65%에 달해 세계적인 기술을 보유하고 있다고 평가된다.

3) 하드웨어 부문

인도는 소프트웨어 및 관련 서비스는 발전했으나 하드웨어 부분은 발전이 더딘 심각한 불균형 상태를 보였으며 하드웨어의 수요 급증을 뒷받침할만한 생산체제를 갖추지 못한 것으로 분석되고 있다. 그러나 최근 휴대폰, 컴퓨터, 반도체 제조업체들이 인도에 점차 관심을 보이고 있는 추세다. 2007년 2월 기준, 지난 18개월 동안 주요 글로벌 기업들이 인도의 하드웨어 제조, 칩 설계, 연구개발, 소프트웨어 제품 개발 등의 전자·IT·통신 분야에 180억 달러의 투자를 해오고 있다.

인도 하드웨어 시장규모는 2005~2006년 기준 65억 달러 수준으로 전년대비 25.3% 성장을 기록하였다. 소프트웨어 산업과는 달리 내수 중심의 산업으로서 서버, 워크스테이션, PC, 주변기기, 네트워크장비, 저장장비 등으로 구성되어 있다. 전체 하드웨어 시장에서 PC 시장이 50%를 차지하고 있는데 특히 노트북 분야의 판매가 급증하는 추세다.

다. 방송통신 시장 현황

1) 개요

인도는 11억이 넘는 인구를 가지고 있음에도 불구하고 산업 인프라의 기본이라 할 수 있는 통신서비스 보급은 세계 최저 수준으로 평가되고 있다. 하지만, 인도 통

신 시장은 최근 수년 동안 전 세계에서 가장 빠른 성장속도를 보이고 있으며, 대형 통신사업자와 중소형 통신사업자를 포함한 다수의 사업자들이 치열한 경쟁을 벌이고 있다. 이들 통신사업자들은 대부분 유선/이동통신을 결합하여 제공하고 있으며, 최근 통신사업자들이 시장에서의 경쟁이 치열해지면서 사업자 주도의 시장에서 가입자 중심의 시장으로 옮겨가고 있다.

최근 인도정부는 통신산업을 경제발전에 있어 핵심 산업이라는 인식과 현재 세계적 경쟁력을 갖추고 있는 소프트웨어 산업의 도약에 필수조건이라는 판단 하에 관련법 정비 및 민간 참여를 통해 산업 육성에 적극 나서고 있다.

2) 유선통신

최근 수년 동안 유선전화 가입자 규모는 이동통신에 비해 매우 느린 증가세를 나타내고 있으며, 최근 통계에서는 오히려 완만한 감소세를 보이고 있는 것으로 조사되었다. 이는 인도 통신시장이 유선에서 무선으로의 전환이 급속도로 진행되고 있다는 사실을 나타낸다고 볼 수 있다. 인도의 유선시장은 2003년부터 2005년까지 완만한 성장세를 보이다가 2006년 이후 가입자 수가 다시 하락하고 있다. 2009년 10월 기준 인도 유선통신 가입자 수는 3,725만명, 보급률 7.1%로 무선통신 서비스에 비해 가입자 증가가 크게 더디다.

〈Table 1－16〉 인도의 유선통신 현황

(단위: 천명, %)

구분	2004	2005	2006	2007	2008	2009.10
유선통신가입자	46,198	50,177	40,770	39,413	37,900	37,250
보급률	4.2	4.4	3.6	3.4	3.2	7.1

자료: KOTRA-NIPA, 2010

3) 이동통신

인도는 세계에서 가장 뜨거운 신흥 무선시장으로 2009년 이동통신 가입자는 4억 8,840만명, 보급률 37.7%를 달성했다. 1997년 이후 인도 무선통신시장에 WLL 서비

스와 신규 사업자의 등장으로 괄목할만한 성장세를 보이며 세계적인 무선통신시장으로 부상하고 있다. 인도는 세계에서 가장 폭발적인 무선통신시장으로 매월 800-900만 명의 신규 가입자가 발생하고 있으며, 가트너에 따르면 2010년 가입자 수는 5억명을 넘어서 60.7%의 보급률을 보일 것으로 전망하고 있다.

〈Table 1－17〉 인도의 이동통신 현황

(단위: 천명, %)

구분	2004	2005	2006	2007	2008	2009.10
이동통신가입자	52,220	90,140	166,050	233,620	346,890	488,400
보급률	4.7	8.0	14.5	20.1	29.4	37.7

자료: KOTRA-NIPA, 2010

2008년 기준 인도의 GSM 가입자는 전체 가입자 중 83.2%, CDMA 가입자는 16.8%로 나타났다. 인도 무선통신 시장은 도시 위주의 성장을 해왔기 때문에 주요 수도권 지역의 이동통신 보급률이 80%대로 거의 포화상태에 이른 것으로 나타났다. 인도의 3G 서비스는 난항 끝에 2010년 4월 3G 주파수 경매를 실시할 예정이며, 인도의 3G 서비스는 2013년 가입자가 9천만명에 달해 전체 무선시장의 12%를 차지할 것으로 전망된다.

4) 인터넷

인도의 인터넷 이용률은 저조하다. 2008년 인도의 인터넷 이용자 수는 5,175만 명으로 이용률이 4.4% 수준이며, 이중 2Mbps 이상의 초고속인터넷 가입자수는 40만 명에 불과하다.

〈Table 1－18〉 인도의 인터넷 이용 현황

(단위: 천명, %)

구분	2003	2004	2005	2006	2007	2008
인터넷이용자	18,480	22,000	27,000	32,200	46,000	51,750
인터넷이용률	1.7	2.0	2.4	2.8	4.0	4.4

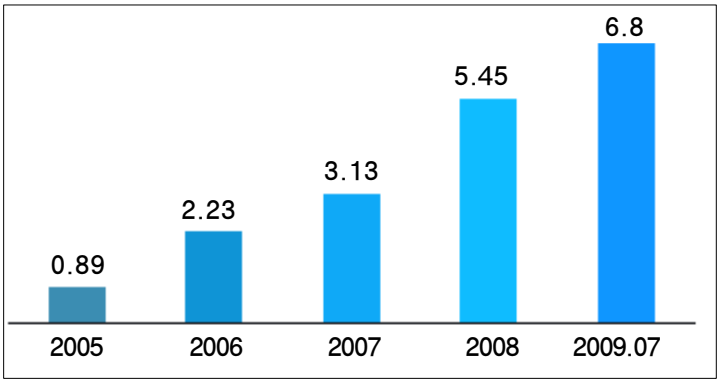
자료: KOTRA-NIPA, 2010

인도의 고속인터넷 접속은 도심 위주로 성장하고 있으며, 높은 요금과 느린 인터넷 회선 등이 인터넷 성장을 저해하고 있는 것으로 분석된다. 넓은 국토로 인한 유선인터넷 인프라의 한계를 극복하기 위해 최근 Wi-Fi, WiMax 등 무선인터넷 인프라가 대안으로 부상하고 있으나 주파수 할당 관련 논란으로 상용화가 지연되고 있다.

인도의 브로드밴드 시장은 여전히 초기 단계이나 매우 빠른 속도로 성장하고 있다. 2009년 7월 기준으로 브로드밴드 가입회선 수는 680만이며, 이는 전년 동기 대비 약 49% 증가했으나 보급률은 1% 미만이다. 기술방식의 경우, 2008년 말 기준 DSL 방식이 85%를 차지하고 있으며, 케이블 모뎀이나 LAN, 광섬유, 무선은 한 자리수의 점유율을 기록한다.

〔Figure 1－17〕 인도의 브로드밴드 가입회선 추이

(단위: 백만 회선)



자료: TRAI

5) 방송

인도 IPTV 시장은 주요 통신사업자인 Bharti Airtel, BSNL, MTNL, Reliance 등의 상용화에도 불구하고 낙후된 인터넷 인프라로 인해 서비스 확산이 제한되고 있는 상황이다. 2009년 6월 기준 인도 IPTV 가입자는 1만~1만 5천 가구 수준으로, 시장 초기 단계라고 볼 수 있다. 인도 정부의 브로드밴드 구축 사업으로 브로드밴드 속도가 개선됨과

동시에 IPTV 서비스 커버리지가 확대됨에 따라 가입 가구도 증가폭이 크게 개선될 전망이다. 2011년경에는 IPTV 가입자가 97만 명 수준으로 증가할 것으로 전망된다.

인도는 1999년 모바일 TV 표준으로 DVB-H를 선정했으나, 아직 상용 서비스는 개시되지 않았다. 공영 방송국 Doordarshan(DD)은 2007년 DVB-H 기반의 모바일 TV 시범 서비스를 실시한 바 있으나, 지원 단말의 부족으로 서비스 확산에 실패하였다. 그러나 DD는 2009년 4월 DVB-T와 함께 DVB-H에 대한 PPP(Public Private Partner) 모델 추진을 위해 컨설턴트/컨소시엄을 공모한다는 의향서를 발표했으며, 2009년 8월 서비스를 재개한다고 공식적으로 밝혔다. 지금까지 인도에서는 모바일 네트워크 기반의 스트리밍 방식 모바일 TV가 주로 이용됐으나, 적극적으로 DVB-H 기반 모바일 TV를 추진함에 따라 2010년부터 시장이 본격 개화할 것으로 전망된다.

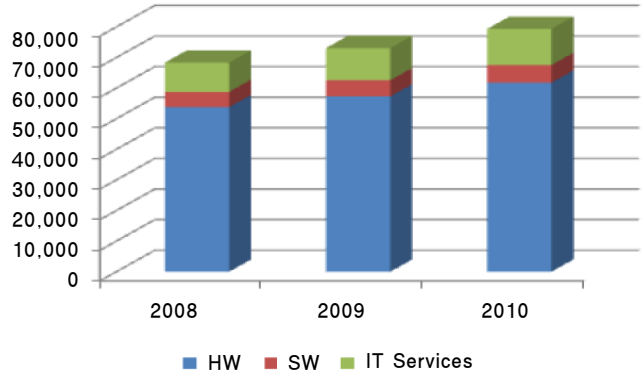
5.2. 중국

가. 개관

중국 IT시장 규모는 2009년 전년 대비 7.0% 성장한 731억 달러를 기록하였다. 중국은 2009년 아시아 태평양 IT 시장의 24.0%를, 전 세계 IT 시장의 5.1%를 차지하고 있는 세계 최대 규모의 IT 시장으로 2013년까지 연평균 12.6%의 고성장을 거듭, 1,131억 달러 규모의 시장으로 발전할 전망이다.

중국의 IT 시장은 하드웨어 부문이 78.4%를 차지하는 하드웨어 위주의 시장이 형성되어 있으며, IT 서비스는 14.4%, 소프트웨어는 7.2%를 차지하고 있다.

〔Figure 1－18〕 중국 IT 시장 현황



자료: IDC(2009)

중국정부는 중국을 세계적 수준의 경제 대국으로 성장시키기 위하여, '11.5 계획'을 실행하고 있다. 2006년 발효하여 2010년까지 실행하고 있는 이 계획을 통해 2010년까지 IT 산업을 중국 최대 기간산업으로 육성하고, 2020년까지 GDP를 4배 이상 성장시킨다는 계획이다. 중국정부는 IT 산업을 고도성장의 동력으로 생각하고, 민영기업 발전을 촉진하기 위한 정책과 도시화 제고를 통한 소비 촉진, 서비스 산업 육성을 위한 정책 등의 전략을 통해 정보화를 매개로 한 첨단산업 육성 및 기존 산업의 정보화를 이루려는 목표를 가지고 있다.

또한 중국정부는 IT 업체들에 대하여 5년 동안 IT 산업 촉진을 위한 투자를 실시하였는데, 2010년에 가장 큰 규모의 투자가 이루어질 것으로 보인다. IT에 대한 투자는 건설, 교통, 헬쓰케어, 전자 기기 등에서 가장 많이 발생하며, 이 사업들은 IT에 많이 의존하고 있기 때문에 공격적으로 투자하고 있는 것으로 보인다. 중국정부의 IT 산업 촉진 정책으로 미루어 볼 때, 중국이 얼마나 하드웨어에 큰 비중을 두고 산업 발전에 힘쓰고 있는지를 알 수 있다.

〈Table 1－19〉 중국의 IT 산업 부문별 성장 전망

(단위: 백만 달러)

	2009	2010	2011	2012	2013	Total
Hardware	3,327	4,082	2,265	1,676	1,660	13,010
Software	1,273	1,659	629	519	523	4,602
Telecom	3,656	4,456	2,330	1,874	1,903	14,220
IT Services	2,143	2,904	771	666	668	7,152
Total	**10,400**	**13,101**	**5,995**	**4,735**	**4,754**	**38,984**

자료: Gartner (2009)

나. 방송통신 시장 현황

1) 유선통신

2009년 중국의 유선통신 가입자는 3억 1,379만 명으로 보급률은 25.5%이다. 유선통신 인구로는 세계 최대 시장이나 보급률에서는 저조한 편이며 유선가입자의 대부분이 도시 가입자로 농촌 보급률이 저조하다. 도시의 유선전화 보급률은 40.3%인 반면 농촌 지역의 보급률은 21.6%로 농촌지역의 유선전화 보급률은 도시지역의 절반 정도의 수준이다.

〈Table 1－20〉 중국의 유선통신 현황

(단위: 천명, %)

구분	2004	2005	2006	2007	2008	2009
유선통신가입자	311,756	350,445	367,786	365,637	340,810	313,700
보급률	23.9	26.7	27.8	27.5	25.5	25.5

자료: ITU(2009.12), The Ministry of Industry and Information Technology(2010.2)

중국의 유선통신 업계는 3대 통신사업자가 점유하고 있다. 중국의 3대 통신사업자는 전체 유선통신 시장의 97% 이상을 차지하고 있으며, 2005년 이후 유선 통신업은 3대 통신업체 위주로 주도되고 있다. 이 중 이동통신사의 매출 성장속도가 상대적으로 빠르고 이동통신사와 유선통신사의 매출 격차는 더욱 확대되고 있어 심각한 불균형을 이루고 있는 실정이다.

차이나모바일(China Mobile)이 시장을 주도하고 있는데, 2007년 차이나 모바일이 전체 통신업에서 차지하는 매출액 비중은 47.95%로 업계 독점우위가 한층 더 강화되고 있다. 차이나 모바일은 주로 무선통신 사업에 치중하고 있는데 최근 유선통신과 브로드밴드 가입자 추가 확보를 위해 유선통신망 확장을 계획하고 있다.

〈Table 1－21〉 2008년 중국 통신사별 서비스 사용자 규모

(단위: 만명, %)

구분	China Mobile	China Telecom	China Unicom	합계
유선통신	2,062 (5.9)	21,900 (62.6)	11,000 (31.5)	64,962 (100)
무선통신	45,018 (73.7)	2,797 (4.6)	13,294 (21.8)	61,109 (100)
브로드밴드	500 (6.8)	2,797 (4.6)	13,294 (34.4)	7,400 (100)

자료: 2008년 중국 내 주요 통신사 통계데이터

2) 무선통신

중국의 2009년 무선통신 가입자는 7억 2,100만 명으로, 보급률이 54.0%에 이르고 있다. 폭발적인 성장세를 이어가고 있으며 신규가입자 규모, 기존가입자 규모에서 세계최대 수준이다. 도시지역은 포화상태이나 농촌지역은 아직 큰 잠재시장이라고 볼 수 있다. 대도시 위주로 보급이 이루어져왔기 때문에 북경, 상해, 광주 등 대도시는 보급률이 75~100%로 선진국 수준인데 반해 안휘(安徽), 귀주(貴州), 호남(湖南) 등 중서부 지역은 평균 20% 내외이다.

〈Table 1－22〉 중국의 무선통신 현황

(단위: 천명, %)

구분	2004	2005	2006	2007	2008	2009
무선통신가입자	334,824	393,406	461,058	547,306	616,477	721,001
보급률	25.7	30.0	34.9	41.2	48.0	54.0

자료: ITU(2009.12), 가트너(2010.2)

무선통신 사업자별 가입자 현황을 살펴보면 China Mobile의 시장 독점 현상이 뚜렷하다. 2009년 무선통신 시장은 최대 통신 사업자인 China Mobile이 전체 시장의

72.1%를 점유하고 있으며 그 뒤를 이어 China Unicom이 20.1%를 점유하고 있다.

〈Table 1－23〉 중국의 무선통신 사업자별 가입자 추이

무선사업자	서비스행태	시장점유율	2009년	2008년
China Mobile	GSM900/1800	72.1%	520,066	455,202
China Unicom	GSM900/1800	20.1%	144,845	133,365
China Telecom	CDMA	7.8%	56,090	27,910
Chiha Total			721,001	616,477

자료: 가트너 (2009.3)

3) 인터넷

중국의 인터넷 이용자는 약 2억 1,258명 정도이다. 중국 인터넷은 1994년 처음 도입되었고, 1996년 이후 중국 유학생들이 대거 귀국하면서 인터넷 기업들이 등장하기 시작하여 각종 인터넷 기업들이 설립되며 급격히 증가하였다. 중국의 인터넷 이용자는 세계 최대 규모이나 보급률에서는 세계 평균을 밑도는 수준이다. 최근에는 휴대폰을 통한 인터넷 접속자 수가 증가하고 있으며 2008년 휴대폰으로 인터넷에 접속한 사용자가 7,305만 명에 이르러 전체 네티즌의 29%를 차지, 향후 휴대폰을 이용한 모바일 인터넷 접속자는 급속도로 증가할 전망이다. 인터넷은 브로드밴드화가 가속화되고 있다. 인터넷가입자는 점차 광대역접속방식으로 전환하고 있으며 Dual-up 방식의 인터넷 접속은 점차 감소하고 있다.

〈Table 1－24〉 중국의 인터넷 이용 현황

(단위: 천명, %)

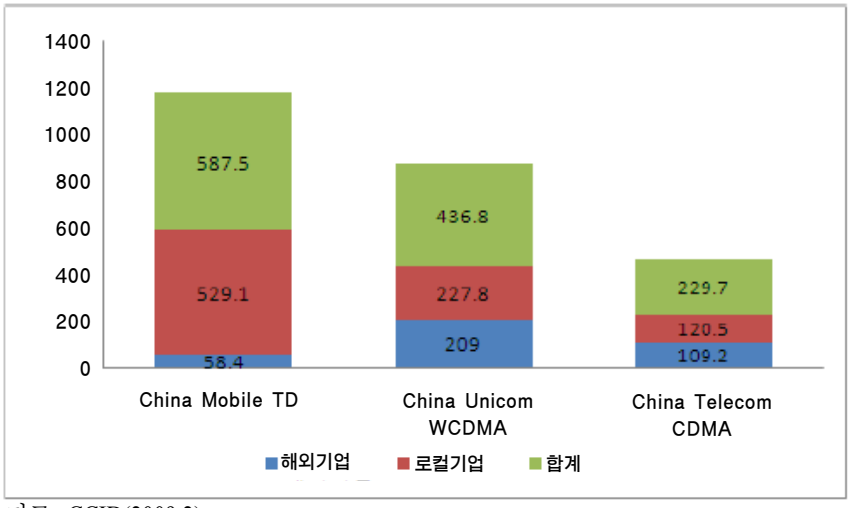
구분	2003	2004	2005	2006	2007	2008
인터넷이용자	79,500	94,000	111,847	138,982	212,581	298,000
인터넷이용률	6.1	7.2	8.5	10.5	16.0	22.3

자료: ITU(2009.12)

2009년 1월 중국 공업신식화부가 통신 3사에 3G 면허를 발급하면서 향후 세계에서 가장 큰 시장으로 성장할 중국 3G 시장의 시작을 알렸다. 중국 공업신식화부에 따르면 향후 5년 간 3G 시장의 부가가치 규모는 약 10조 위안이 될 것으로 전망하고 있으며 관련 투자규모는 1.5조 위안 규모이다. 3G 시대 개막에 앞서 중국의 무선통신 3사는 활발한 인수 합병을 통해 3G 서비스를 위한 기술 및 가입자 확보에 총력을 기울이고 있는데, 차이나유니콤은 차이나넷콤을 인수하며 WCDMA에 대한 라이센스를 확보하였으며 차이나 텔레콤은 차이나 유니콤의 CDMA 부문을 인수하며 차이나유니콤의 CDMA 가입자 2,791만 명을 보유하게 되었다. 차이나 모바일은 TD-SCDMA 기지국을 확충하는데 588억 위안을 쏟아 부으며 2011년까지 3G 커버리지를 현재의 2G 규모로 확충할 계획이다. 중국 공업과정보화부에 따르면 2009년 10월까지 중국 3G 사용자 수는 약 977만명이며 그 중 China Mobile TD 사용자 수는 394만 명이다. 또한 CCID에 따르면 2009년 1월까지 중국 3G 시장 규모는 약 1,254억 위안에 달하였으며 그 중, TD-SCDMA의 시장 규모는 587.5억 위안에 달한다.

〔Figure 1－19〕 중국 3G 설비 시장규모 및 시장점유율 현황

(단위: 억 위안)



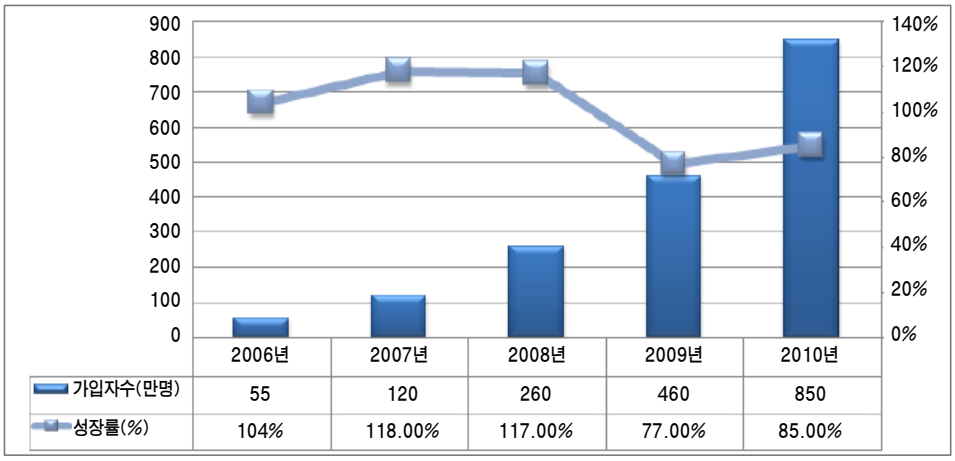
자료: CCID(2009.2)

중국의 통신사업자들은 각지에서 와이맥스 테스트 및 네트워크 구축을 추진하는 동시에 주요 지방정부들도 와이맥스 기반의 Wireless City 구축을 주도하고 있다. 2005년 대련과 성도시 정부는 Intel과 손잡고 WiMAX망을 깔기 시작하였으며 2007년 북경, 상해, 천진, 무한, 항주, 심천 등 6개 도시들은 Wireless City 구축계획을 확정하고 모바일 와이맥스망 구축작업을 진행하는 과정에 있다. 2008년 6월 베이징시는 Wireless city 프로젝트의 1단계로 신호 커버리지 면적이 100평방킬로미터에 달하는 네트워크 시범운영에 돌입했으며, 2단계 프로젝트는 2009년 말 완료를 목표로 제 5 순환도로 내에 무선 브로드밴드망 보급이 이루어질 예정이다. 3 단계 프로젝트는 2010년 말까지 전체 베이징시민과 지역의 토탈 커버리지를 실현한다는 계획이다. 중국 와이맥스 관련 투자 규모는 67억 위안, 관련 시장은 259억 위안의 규모이다. 중국 국가무선 전파 주파수 관리연구소는 2007~2010년까지 중국의 와이맥스 기지국 시스템에 대한 투자는 65억 9,600만 위안, 와이맥스 고정 단말과 무선 랜카드 시장규모는 258억 7,500만 위안에 이를 것으로 전망하고 있다. 중국내 3G 국가표준인 TD-SCDMA와의 주파수 할당 충돌이 중국내에서 무선 WiMAX 발전의 최대 장해물이 될 것으로 전망된다.

4) 방송

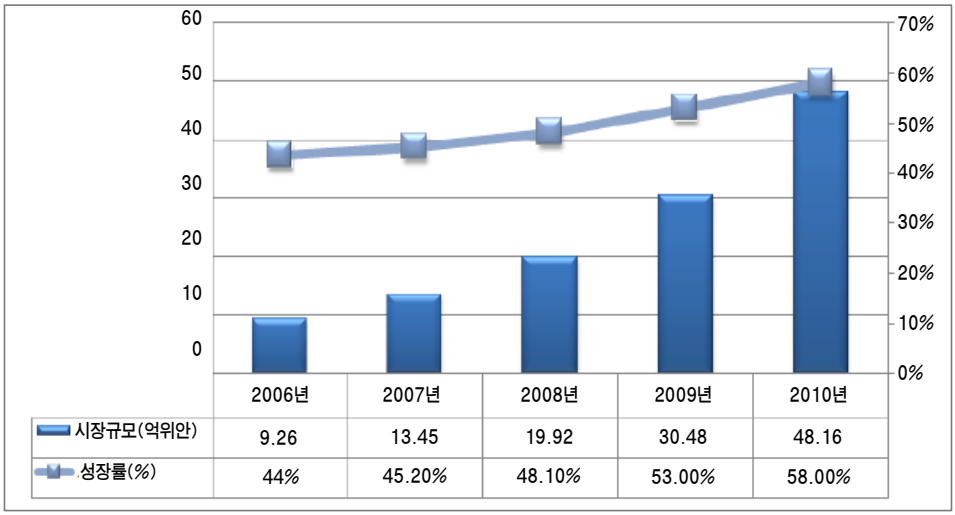
2007년 3분기 중국 IPTV 가입자 수는 2006년 말에 비해 46만 명 증가하여 백만 명을 돌파하였다. IPTV 상용화 지역 규모가 확대됨에 따라 상해, 하남, 흑룡강, 절강 등 지역은 IPTV에 대한 소비자들의 인지도도 점차 높아지고 있다. 주요 인터넷 매체 정보에 따르면 중국 IPTV 가입자 규모는 2007년 120만 명에서 2008년 260만 명으로 두 배 이상 증가하였으며 2009년은 460만 명으로 전년 대비 77% 증가될 것으로 전망된다. 2008년 중국 IPTV 관련 설비 시장규모는 전년대비 48.1% 증가한 19.92억 위안이다. 2008년 중국 내 IPTV 가입자 수의 대폭 증가로 IPTV 관련 설비의 시장규모도 큰 폭으로 성장하였다.

〔Figure 1－20〕 중국 IPTV 가입자 규모 및 성장 추이



자료: IDC (2009.2)

〔Figure 1－21〕 중국 IPTV 설비 시장규모 및 성장 추이



자료: CCID (2009.2)

중국의 IPTV산업은 2003년에 첫 출발을 하였으나 방송, 통신 주무부처 간의 주도권 다툼으로 인해 부진을 면치 못하다가 2008년 규제정책 완화, 베이징올림픽 특수,

사업자들의 노력으로 IPTV 가입자 수가 급증하기 시작했다. 2008년 초 발표된 '국가발전개혁위원회 등 부처의 디지털TV산업발전 독려정책 전달에 관한 국무원 판공청의 통지'는 IPTV 규제 완화의 신호탄이 되었다. 방송기관이 국가 공중통신망과 방송망 등의 정보망을 이용해 디지털TV 서비스와 부가서비스를 제공하는 것을 독려하기 시작했기 때문이다.

〈Table 1－25〉 중국 IPTV 발전사

시 기	동 향
2006년 3월	중국 국가표준화관리위원회(Standardization Administration of the People's Republic of China, SAC)에서 AVS를 비디오 코덱 국가표준으로 확정 차이나넷콤은 2006년부터 IPTV 시스템장비와 셋톱박스 공급업체들에 AVS 지원 요청
2007년 5월	AVS가 ITU-T FG IPTV WG6에서 선택 항목으로 채택
2007년 8월	Spreadtrum(展訊)이 AVS 칩 발표
2007년 9월	상하이텔레콤은 AVS와 H.26 비교 테스트 후 AVS를 IPTV 비디오 코덱 표준으로 사용하기로 결정
2007년 12월	차이나텔레콤, 차이나넷콤 등 18개 기업이 AVS-IPTV를 핵심으로 하는 양방향 미디어 산업연맹을 출범시킴
2008년 3월	다롄넷콤이 AVS-IPTV 양방향TV 시스템의 상용화 실현
2008년 말	AVS2 표준(영상 모니터링 코덱 표준) 제정 시작

자료: 건홍리서치(2009. 4)

중국에서는 광전총국으로부터 IPTV 라이선스를 취득한 사업자만이 IPTV 서비스 제공이 가능하다. 지금까지 IPTV 라이센스를 취득한 사업자는 전부 방송사업자들로, 이들은 통신사업자와 협력하여 지역별로 IPTV 서비스를 제공하고 있다. 지역시장에 진출하는 과정에서 현지 방송사업자와 마찰이 발생하는 경우도 많이 있다. 통신사업자는 주로 브로드밴드망을 제공하는 역할을 하고 있다.

그 동안 중국의 IPTV산업은 규제정책, 수익모델의 부재, 콘텐츠 차별화 실패 등의 원인으로 성장이 다소 부진하였으나 2008년 베이징 올림픽을 계기로 인지도가 크게 향상되었다고 평가된다. 중국에서는 IPTV가 대표적인 TPS(Triple Play Service)서비스가 될 것으로 예상하고 있으며 TPS 관련 정책이 가시화되고 정보화, 인프라, 고도화 작업이 가속화되면서 IPTV 산업에 유리한 환경이 조성되고 있다. 중국 또한 한국 IPTV시장 활성화에 장애요소로 작용하는 문제점에 동일하게 직면한 상태로, IPTV의 케이블TV와 디지털TV간의 경쟁환경하에서 Market Win할 수 있느냐가 중국 IPTV 서비스의 성패를 좌우할 것으로 보인다.

이상으로 주요 지역별 ICT 산업 현황 분석 및 전략대상국가 선정에 필요한 다양한 요소 분석을 통하여 정책자문 전략대상국가풀(pool)을 선정하였다. 그리고 주요 대상국이라 할 수 있는 중국과 인도에 대한 현황을 살펴보았다. 본 보고서의 2장부터는 전략대상국의 정책자문시 기초자료로 활용할 수 있는 한국의 ICT 산업에 대해 살펴보고자 한다. 한국의 ICT 산업현황, 통신경쟁정책, 산업정책, 정보화정책을 소개하고 한국 정보통신산업의 급속한 성장에 있어서 이러한 정책이 어떠한 역할을 수행했는지에 대해 논하고자 한다. 다음으로 해외 ICT 활용사례를 조사분석하고, 한국의 ICT를 활용한 제조업의 산업고도화 사례 및 정책 분석을 통해 타산업과 IT 기술의 융합 트렌드에 대해 짚어보고자 한다.

Chapter 2. The Status of ICT in Korea

1. Overview of ICT Policy in Korea

Korea is well-known for its successful achievement of rapid economic development. In the space of four to five decades, Korea rose from one of the world's poorest nations to become one of the largest economies. Korea's GNI per capita stood at a mere US$87 in 1962, which was equivalent to that of Ghana at that time. The figure surged to more than US$10,000 in 1995 and vaulted above US$20,000 in 2007. The development of the IT sector has been one of the core drivers of Korea's exceptional growth. Korea has now become the world's IT superpower. In 2010, Korea ranked top in Study on the Super High-Speed Internet Quality published by the University of Oxford, in ICT National Competitiveness Assessment for the White Paper 2010 Information and Communications released by the Japanese Ministry of Internal Affairs and Communications, and in the United Nation's e-government survey.

The information technology (IT) industry has made a significant contribution to the growth of the Korean economy since the 1990s. With the world's highest Internet penetration rate and the global first adoption of advanced telecommunication services such as DMB (Digital Multimedia Broadcasting) and WiBro (Wireless Broadband), Korea is a first-class IT country where cutting edge IT technologies have been put in place. This tech savvy nation's rapid development of the IT industry is largely attributed to the local companies that have created state-of-the-art IT products such as semiconductors, LCD panels and mobile phones. Their bold and forward-looking

investments into facilities, research and development have enabled Korea's IT industry to take its current leading position in the global IT market. A report of the Organization for Economic Cooperation and Development (OECD) published in 2008 includes Samsung Electronics, LG Electronics and KT in its list of the world's top 50 IT companies. These Korean names that lead the evolution of the global IT industry are one of the main achievements of the IT industry in Korea.

The government is another important player of this outstanding progress of the IT industry. It has addressed a wide range of issues for both demand and supply sides: technology development, human resource development, modification or creation of relevant laws and regulations, investments in high-speed Internet infrastructure, implementation of e-Government, privatization and market liberalization of telecommunication industry and execution of competition policies. Korea's IT industry is a typical example in which the government plays a leading role by continuously motivating the relevant companies to develop new technologies and organizing the relevant legal and regulatory systems. The Korean government even engaged in the direct development of major communication technologies such as TDX (Time Division Exchanger) and CDMA (Code Division Multiple Access) through one of its affiliated research institutes and set them as the local standards. While some critics argue that the government's adoption of the technologies, which are not the world's dominant ones, as the standards has undermined the efficiency of the local industry, everybody agrees that the government-led technological development and standardization policies have vitalized the local IT market and thus significantly enhanced their competitiveness.

While the full-fledged growth of the IT industry and Korea's emergence as an IT superpower on the global stage began only after 1994 when the Ministry of Information and Communication (MIC) was established, both the corporate sector and the government had already proactively adapted to changing IT environments and

successfully released new products and services. With its forecast of the growth of the personal computer industry, the acceleration of digitalization and the growth of wireless telecommunication services, the Korean government intensively fostered the semiconductor, display and mobile phone industries. While Apple released its personal computer, also called Apple, in 1978, and IBM brought out its personal computer, which ran on MS-DOS, an operating system, in 1981, Korea borrowed $29 million from the World Bank and started developing semiconductor in 1979, which was led by the Korea Institute of Electronic Technology (KIET), and Samsung Electronics finally announced its capability to produce, assemble and inspect 64K DRAM in December 1983. Then in 1994, when Samsung became the first company in the world to successfully develop 256M DRAM, it had truly become a leader in the global semiconductor market with proactive research and development efforts and investments. For the telecommunication service sector, in 1982, just one year after IBM launched its personal computers, the Korean government created Data Communications Corp. of Korea (DACOM), which well represented the Korean government's strong will to adopt new IT technologies and utilize them to create more opportunities.

It is believed that the government took carefully-calibrated approaches in the privatization of telecommunications operators, market liberalization and competition policies, which were proved to be effective. Even though the issue of privatizing Korea Telecom (KT) was first discussed in 1987, the public telecommunication company's privatization did not happen until 2002, 15 years later. The government took reasonable actions to respond to changes in the telecommunication market environment. It ran a public company for the telecommunication industry, which was supposed to be a natural monopoly in the initial stage, and privatized it to ease regulations and promote competition as the development of new technologies significantly reduced the degree of the natural monopoly. The liberalization of the telecommunication market was

performed, also with enough prudence, in a way to fairly accommodate diverse interests of different stakeholders such as developed countries, international trade organizations, foreign multinational companies and local conglomerates. The global financial crisis, which erupted in 1997, provided the government with an opportunity to push forward the market liberalization without creating any significant conflict.

The Ministry of Information and Communication (MIC), established in 1994, was responsible for a wide range of IT policies: the promotion of the IT industry, the advancement of infrastructure and technology, which included the projects to build high-speed Internet infrastructure and e-Government, and the introduction of competition to maximize the benefits of consumers through proper regulations on telecommunication service providers. All these diverse activities of the Ministry were possible largely thanks to a public fund designed to promote the IT industry, which was set up with contributions from the government and telecommunication operators. The fund served as a financial foundation with which the government made large-scale investments into the IT industry with a long-term vision.

The industry promotion policies focused on the development of skilled IT resources and technologies. Along with them, the policies to standardize technologies and support small- and medium-sized firms and venture companies were carried out. However, the government's IT policies, which were mainly implemented through government affiliated research organizations, have recently faced the criticism that they are unduly supplier-oriented. Since the development of TDX (Time Division Exchange) and CDMA (Code Division Multiple Access) technologies, there have been no breakthrough technologies developed to meet consumer needs. Another initiative, titled IT 839 policy, was designed to build a virtuous circle of the IT ecosystem by connecting new services, advanced infrastructures and growth engine products, but failed to fully produce intended results. More specifically, the WiBro service, a major new service, is

struggling to attract local subscribers and for the DMB (Digital Multimedia Broadcasting) service, no proper business model has been developed and service providers are suffering losses. As for these projects, some experts argue that the level of the government's involvement in the launch of the new services was too much. Given that Korea has had a number of world class IT companies, it has become more important to properly define the roles of private companies, government-sponsored research institutes and universities.

The infrastructure and technology development policies, combined with the competition-introducing policies, led to the establishment of the world's fastest high-speed Internet infrastructure. The government directly funded the construction of high-speed Internet network for the public sector, but encouraged companies to compete in facility investment for the private sector. While unlike the case of service investment, the competition of facility investment could lead to duplicate investment into the same infrastructure and lower the economic efficiency, it has the main advantage of accelerating the availability of infrastructure. In this race to build infrastructure fast, newcomers' aggressive investments advanced the level of IT infrastructure in a short period of time, which significantly increased the number of subscribers and allowed businesses to reduce costs and attract more subscribers once they achieve economies of scale.

With the beginning of the Lee Myung-bak government, the MIC was disbanded and the policies to promote the IT industry, to advance IT infrastructure and technologies and to bring in competition to the IT market were commissioned to the Ministry of Knowledge Economy (MKE), the Ministry of Public Administration and Security (MOPAS) and the Korea Communications Commission (KCC), respectively. This reorganization of government functions was intended to more flexibly respond to the new changes in IT environments: accelerated convergence of IT and other industries, increasing union between broadcasting and telecommunication industries and adverse

effects of IT advancement. The effectiveness of this decentralization of the IT policies can be evaluated later. The government's top priority of the IT industry is to define a policy direction to improve the productivity of the national economy and support the IT industry to fully realize its growth potential by facilitating the current convergence efforts between IT and other industries and between the broadcasting and the telecommunication sectors.

In this chapter, the status of ICT in Korea will be described. The telecommunications competition policy, the ICT industrial policy, and the informatization policy in Korea will be discussed subsequently in the following chapters. The case studies of overseas ICT use and the use of IT technology for the advancement of the manufacturing industry will be presented in later chapters, followed by conclusion.

2. ICT and Economic Growth in Korea

2.1. ICT Industry Overview

There are at least three complementary approaches for assessing the role of ICT in output growth. One way to grasp the economic importance of ICT is to look at the importance of ICT production in the economy. Although the share of value added of ICT industries is relatively modest when measured in current prices, the contribution to real output growth can be significant if ICT industries grow faster than other parts of the economy. A second avenue by which ICT can affect output and labour productivity growth is its role as a capital good. ICT investment occurs throughout the economy and thereby provides capital services. These are part of the overall contribution of ICT to output and labour productivity growth. Studies which assess the importance of ICT as a capital input include Jorgenson and Stiroh (2000), Oliner and Sichel (2000), Whelan (2000) and Schreyer (2000). These

studies treat ICT capital goods like other types of capital goods; in particular, it is assumed that firms owning ICT assets can reap most or all benefits accruing from using new technologies. Only then is it possible to observe market income accruing to ICT capital and make inferences about its overall contribution to growth. If there are other, unobserved benefits or income, this contribution would be underestimated. This leads to the point about ICT as a special input. A final avenue for tracing effects of ICT involves the claim that ICT produces benefits which go beyond those accruing to investors and owners, for example through network externalities. Where such spillovers exist, they raise overall MFP growth. As such, they are similar to advances in knowledge and new blueprints and formulae or organizational innovations that potentially benefit all market participants. Studies at firm level (for example, Brynjolfsson and Kemerer, 1996; Gandal et al., 1999) do indeed point to spillovers from ICT capital, but it is difficult to transpose these results to the aggregate level.[9)]

Korea's IT industry has rapidly grown since the 1990s, helped by the enhancement of technology competitiveness in memory chips and mobile handsets, whose share in the overall economy has continuously expanded. IT industry production skyrocketed from 21.7 trillion won in 1992 to about 288.2 trillion won in 2008, whose share in GDP also soared to 11% in 2008.

The consistent growth in the IT industry has made a remarkable contribution to the Korean economic growth that has slowed following the financial turmoil. About 0.3%p ~ 1.4p% of GDP growth was attributed to the IT industry from 2001 to 2009. In particular, from 2003 to 2004 when the Korean economy slowed due to falling consumption and investments, the IT industry accounted for almost half of GDP growth, confirming its importance in the Korean economy. Moreover, IT industry is making relatively fast recovery from

9) The whole paragraph is taken from “OECD(2000) A New Economy? The Changing Role of Innovation and Information Technology in Growth”

the global financial crisis caused by Lehman Brothers' bankruptcy in 2008.

〈Table 2－1〉 Contribution of the IT Industry to Economic Growth (2001-2009)

(in %)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
GDP Growth	4.0	7.2	2.8	4.6	4.0	5.2	5.1	2.3	0.2
IT Industry Growth	8.7	15.9	13.7	17.1	11.7	12.6	8.7	6.8	5.3
Contribution		0.3	1.1	1.4	1.0	1.1	0.7	0.6	0.4
Proportion in GDP (%)	6.7	7.2	8.0	8.9	9.6	10.2	10.6	11.0	11.6

Note: 1. ICT industry includes the manufacturing of ICT apparatuses (office appliances, semiconductors and other ICT appliances) and ICT services (broadcasting, software, and computer-related services).
2. Reference year is 2005

Source: BOK, National Income Account(provisional), April 2010

The main driver of the rapid growth of the IT industry was the enhancement of productivity by continuous technology development. Total Factor Productivity (TFP) has been widely used as a measure of productivity in economics. Growth in TFP represents output growth not accounted for by the growth in input.

〈Table 2－2〉 Previous Research Estimating the Growth of Total Factor Productivity in the IT Industry

(in %)

Dong-pyo Hong et al. (2003)	1991-1997	1997-2000	1991-2000
Manufacturing Industry	2.8	1.5	2.3
IT Manufacturing Industry	11.5	7.0	10.0
Gwan-ho Shin et al. (2004)	1991-1996	1997-1999	1991-1999
The Whole Industry	3.2	-0.7	1.9
IT Industry	12.4	8.7	11.2
Jeong-gyu Park et al. (2005)	1993-1997	1998-2001	1993-2001
The Whole Industry	2.2	-1.1	0.7
IT Industry	12.7	19.3	15.6

According to many research on TFP, the growth of TFP in Korea's IT industry exceeds those of other industries by a great margin. Unlike other industries, Korea's IT industry has grown more than 10% per year in TFP, since the 1990s. In particular, taking into account changes in productivity before and after the Asian financial crisis, the difference between IT and other industries is very clear. TFP in non-IT industries has relatively fallen since the economic turmoil while that of the IT industry has continuously risen. The enhancement in the productivity of the IT industry has made great contributions to the growth of the Korean economy as a whole by increasing the overall productivity.

IT capital goods are distinguished from others in terms of two characteristics. First, the enhancement of quality has been quickly achieved due to the rapid technological development. Second, IT capital goods have a characteristic of general purpose technologies that can be widely applied. Such features helped encourage the whole industry more actively to invest in IT capital goods. Informatization-related investments including computers, peripherals, networking, and software increased their share in the overall facility investments sharply from 24% in 1995 to 39.7% in 2001.

An increase in IT investments across the whole industry can have effects on economic growth through two channels. First, the rise in IT investments, as one of the factors of production, means an increase in capital, directly linked to economic growth. Second, the IT investment can lead to economic growth by enhancing business or industry productivity. Changes in production, management, and organization accompanied by IT investment further improve productivity. According to several research on the relationship between Korea's IT investments and economic growth, there exist the effects of IT investments on economic growth through increasing capital accumulation. The IT investment, however, does not have a significant effect on the growth of TFP in the Korean economy as a whole.

〈Table 2－3〉 Contributions of IT Investments to Economic Growth

(in %)

	1990-1995	1995-2000
GDP Growth	7.450	5.310
Labor Contribution	1.193	-0.004
Capital Contribution	2.203	2.782
Non-IT Capital Contribution	1.945	1.841
IT Capital Contribution	0.258	0.941
Growth of Total Factor Productivity	4.054	2.532

Source: Dong-pyo Hong et al. (2003 b)

According to Dong-pyo Hong et al. (2003) that analyzed the contribution of IT investments to economic growth around 1995, the contribution has soared since 1995. The contribution of IT investments to the overall GDP growth was about 3.5% (=0.258/7.450) from 1990 to 1995, which rose to 17.7% (=0.941/5.310) from 1995 to 2000. By increasing capital accumulation, the IT investment made great contributions to economic growth. Furthermore, the contribution in Korea can be regarded as not lower than in the U.S. Canada, and Australia.

However, the effects of IT investments on productivity growth couldn't be easily identified across the industry. When we categorized industries by intensity of IT use, the growth rate of productivity in the industries using IT much was higher than that of the industries using IT less.

〈Table 2－4〉 Productivity of Industry Based on IT Use

(in %)

Labor Productivity Growth				
KISDI (2004)	1994-1998	1998-2001	1994-2001	
IT High-Use Industries	9.1	5.6	8.0	
IT Low-Use Industries	4.0	-2.6	0.9	
Total Factor Productivity Growth				
Jeong-gyu Park, etc (2005)	1993-1997	1998-2001	2002-2004	1993-2004
IT High-Use Industries	2.0	-1.2	3.1	1.2
IT Low-Use Industries	0.6	-0.9	0.8	0.1

Bresnahan, Brynjolfsson and Hitt(2002) show that the effects of IT investments on productivity may differ among firms, because complementary changes in organizational structure and job process are incurred in a different manner. In other words, as well as the IT investment, complementary changes such as HR investment, incentive, and decentralization play a pivotal role in enhancing productivity. Dong-pyo Hong (2004) pointed out that the IT investment could have only limited effects on productivity due to the weak correlation between IT investments and changes in job process and internal organization in Korea. Therefore, an innovative job operation system is required across business activities in order to help the IT investment increase productivity.

The ICT sector also played a big role in maintaining a balanced current account. The data shows that, without the ICT sector, Korea would have recorded current account deficits during the period 2005-2008.

〈Table 2－5〉 Current Account Surplus of ICT Sector and Non ICT Sector

(Unit: $100Million)

Current Account Surplus	2005	2006	2007	2008	2009
ICT Sector	492	543	593	564	188
Non ICT Sector	-260	-382	-447	-696	216

Furthermore, the ICT sector significantly contributed to stabilizing prices. Between 2003 and 2007, overall prices continued to rise, but ICT prices continued to fall by -7.9% in 2003, -3.7% in 2005 and -4.3% in 2007.

〈Table 2－6〉 Deflationary Effects of ICT

(Unit: %)

	'03	'04	'05	'06	'07	'03-'07 average
CPI	3.5	3.6	2.8	2.2	2.5	2.9
CPI(IT)	-7.9	-3.2	-3.7	-3.4	-3.3	-4.3
Deflationary Effect(%p)	-0.75	-0.27	-0.32	-0.27	-0.25	-0.4

Source: BOK, KISDI

2.2. ICT Employment

Fluctuations in the number of workers in a specific industry are influenced by the growth and productivity of the industry. Generally, the number of workers is in proportion to the output and in inverse proportion to labor productivity. It was recently pointed out that job creation in the IT industry would be limited because of productivity enhancement. However, the direct impact of the IT industry on job creation and the indirect job creation in other areas caused by rising demand for IT should be considered at the same time. Employment coefficients in the IT industry[10] (’90 : 21.1 → ’95 : 10.1 → ‘00 : 4.0 → ‘05 : 2.4 → ‘08 : 2.4) decreased faster than those in the non-IT industry (’90 : 24.6 → ’95 : 17.4 → ‘00 : 13.4 → ‘05 : 7.9 → ‘08 : 7.0). Despite falling employment coefficients, the number of workers in the IT industry increased (refer to Table 2－7). The increase in the final demand for the IT industry created more jobs in other industries, rather than

10) The employment coefficient refers the number of employees per output worth 1 billion won (= the employed + the self-employed & unpaid household employees), the reciprocal of labor productivity. Employment coefficients in the IT equipment industry: '90: 21.1 → '95:9.4 → '00: 3.7 → '05: 2.5 → '08: 2.0. Employment coefficients in the semiconductor industry: '90: 42.9 → '95:10.0 → '00: 2.6 → '05: 1.7 → '08: 2.7. Employment coefficients in the telecommunications service industry: '90: 21.4 → '95: 11.2 → '00: 4.9 → '05: 3.0 → '08: 2.5

in the IT industry (Table 2－8, Table 2－9). With job creation, job quality should also be discussed. Even when manufacturing the same product, two jobs, rather than one, can be created by lowering labor productivity and wages by 50%. Creating jobs in areas where productivity is low is more efficient in quantity. However, the feasibility of creating many low-paying jobs should be reviewed more carefully. The recent argument that the smokestack industry should be promoted for job creation cannot be regarded as desirable in terms of employment quality. Increasing long-term growth potential has a significant meaning in job creation. The role of IT in job creation cannot be overemphasized. According to a series of OECD reports regarding “technology, productivity, and job creation,” technological changes in IT seem to reduce the number of jobs on a short-term basis by improving productivity but more jobs are created in countries rapidly adapting to such changes.

〈Table 2－7〉 Causes of Fluctuations in the Number of Employees in the IT Industry

(in %)

	Fluctuations in the number of employees			by Labor Productivity			by Output		
	’90～95	’95～00	’00~08	’90～95	’95～00	’00~08	’90～95	’95～00	’00~08
IT	16.7	6.6	9.6	-52.3	-60.1	-32.0	68.9	66.7	61.1
IT manufacturing	6.0	4.3	-1.3	-55.4	-60.4	-44.9	61.4	64.7	79.2
Semiconductor	47.4	4.5	17.4	-76.8	-73.9	2.2	124.2	78.4	14.9
Telecommunications	53.4	12.0	29.3	-42.8	-59.9	-22.2	96.2	71.8	66.2
The Whole Industry	8.2	-3.0	15.2	-30.7	-27.8	-41.5	38.9	24.8	96.7

Source: BOK

〈Table 2－8〉 Indirect Effects of the IT industry on Employment (2005)

(in person/1 billion won)

	Number of Jobs Induced1) (A)	Number of Jobs Actually Created 2) (B)	Number of Jobs Indirectly Induced (C=A-B)	Percentage of indirectly induced jobs in the number of jobs actually created (C/B, %)
IT	6.9	2.4	4.5	187.5
IT manufacturing	7.3	2.5	4.8	192.0
Semiconductor	4.3	1.7	2.6	152.9
telecommunications	9.2	3	6.2	206.7
Non-IT	14.5	7.3	7.2	98.6
The Whole Industry	14.4	7.9	6.5	82.3

〈Table 2－9〉 Indirect Effects of the IT industry on Employment (2008)

(in person/1 billion won)

	Number of Jobs Induced1) (A)	Number of Jobs Actually Created 2) (B)	Number of Jobs Indirectly Induced (C=A-B)	Percentage of indirectly induced jobs in the number of jobs actually created (C/B, %)
IT	7.6	2.4	5.2	220.4
IT manufacturing	6.4	2.1	4.4	211.5
Semiconductor	5.5	2.7	2.8	107.4
telecommunications	10.4	2.9	7.5	256.8
Non-IT	13.5	7.4	6.1	82.4
The Whole Industry	14.0	7.0	7.0	99.7

Table 2－10 shows changes in the number of employees in the IT industry. From 1998 to 2007, the annual average growth of employment in the IT industry was almost four times as high as that in the whole industry. From the financial turmoil in 1997 to 2000, employment in the IT industry rose rapidly. However, in 2001, employment growth rate in the IT industry plummeted. In 2004, it fell further, compared to that of 2003. The falling employment in 2004 is closely linked to the fact that the number of jobs in the IT industry dropped by 658,000. Since then, employment in the telecommunications service industry

had remained stationary at the level of 120,000~140,000. In particular, in 1999 and 2003, it plummeted in the process of massive business restructuring. After 2004, employment increased at a relatively higher pace, helped by the expectation of the introduction of new services such as DMB and WiBro. The S/W and computer service industry created 68,000 jobs from 1998 to 2001 but have shown sluggish employment performance since then. Employment in the industry rose again in 2004. The percentage of employees in the S/W and computer service industry reached the highest level in 2002, thereafter decreasing continuously.

〈Table 2－10〉 Fluctuations in the Number of Employees in the IT Industry

	Whole Employment (in 1,000 persons):A	IT Employment (in persons): B	IT Equipment	Telecommun ications	S/W & Computer-related service	B/A
1998	19,938	399,767	243,910	105,370	50,487	2.01%
1999	20,291	442,629	280,601	99,348	62,680	2.18%
2000	21,156	552,612	351,746	104,574	96,292	2.61%
2001	21,572	609,187	383,971	106,721	118,495	2.82%
2002	22,169	641,182	396,586	113,668	130,928	2.89%
2003	22,139	667,889	418,964	118,093	130,832	3.02%
2004	22,557	658,117	416,869	124,963	116,285	2.92%
2005	22,856	717,946	462,289	127,053	128,604	3.14%
2006	23,151	753,136	481,055	139,838	132,243	3.25%
2007	23,433	734,262	457,429	137,939	138,894	3.13%
Average Growth (‘98-'07)	1.8%	7.0%	7.2%	3.0%	11.9%	

Source: whole employment - KNSO, IT - KAIT(Yearbook of IT Industry Statistics

IT human resources can be identified not only by the industry but by occupation. For example, HRs in computing who work in a bank are not IT industry employees but included in the IT profession. According to data between 1999 and 2002, employment in the IT industry can be characterized by Skill-Biased Technological Change (SBTC), where demand for jobs requiring a high level of education and technology rises at a relatively faster pace. However, 2003 data showed different perspectives. Technological changes in IT seem to incur labor demand polarization in quality where demand for jobs requiring a low or high level of education and technology rise at the same time, with demand for mid-level engineers falling.

3. Weakness of Korean IT Industry: Polarization

"Polarization" was originally used to describe imbalance in income distribution (Duclos, Esteban, and Ray 2004), but is recently being mentioned in Korea in order to explain the widening gap in the overall economy between advanced and underdeveloped sectors. IT-related polarization has mainly focused on differences between IT and non-IT. As Hee-chul Min (2005) pointed out, research on polarization can produce different conclusions, depending on indices applied. This chapter is designed to emphasize the imbalance within the IT industry, rather than the imbalance between IT and non-IT.

3.1. Manufacturing-based Industrial Structure

Table 2－11 compares IT industries in Korea with the U.S. in terms of added-value and employment. The added-value created by the S/W and the computer service industry accounted for about 6.9% of the total in Korea's IT industry while it took up 38.9% of the total added-value in the U.S. IT industry. The share of the telecommunications service

industry in added-value was 19.5% in Korea and 32.7% in the U.S., showing little difference between the two. However, in the IT equipment industry, Korea and the U.S. produced a wider gap, recording 73.6% and 28.4%, respectively. For the S/W and computer-related service industry, differences between the two nations in employment were smaller than those in added-value, reflecting that many low-paying jobs were created in Korea due to relatively low labor productivity. Only when S/W, contents and computer-related service industries grow, balanced with the manufacturing sector, will Korea's IT industry move to a higher level.

〈Table 2－11〉 Comparison of IT Industries in Korea and the U.S.

	Korea (2007)				The U.S. (2002)			
	Added-value (billion won)		Employment (persons)		Added-value (billion dollars)		Employment (100 persons):	
IT Equipment	91,209	73.6%	457,429	62.3%	235.9	28.4%	16,248	34%
Telecommunications Service	24,192	19.5%	137,939	18.8%	272.1	32.7%	11,931	25%
S/W & Computer-related service	8,508	6.9%	138,894	18.9%	323.7	38.9%	19,610	41%
Total	123,909	100.0%	734,262	100.0%	831.6	100%	47,790	100%

Source: KAIT, Department of Commerce

Korea's S/W and computer service industry is far behind those of advanced nations in terms of size and labor productivity, so that the size and added-value are required to be expanded. Such transformation is very important in reinforcing the job creation potential of the IT industry. The reason is that the S/W industry is relatively more labor-intensive than the IT manufacturing industry, creating higher-paying jobs.

3.2. Weaknesses in the IT Component/Material Industry

As the percentage of the IT industry in production rises, the high import-inducing effects of the IT industry is raised as an issue. Such high import-inducing effects are attributed to the high reliance of the IT component/material industry on imports. As described in Table 2－12, the import-inducing coefficients of key IT components range from 0.46 to 0.70, about four times larger than that of Japan's electric & electronics industry (0.13). About 70 to 80% of the trade deficits with Japan are from the component/material imports, 40% of which are occurring in the IT industry. (Hyun-chang Kim, 2004).

〈Table 2－12〉 Import-inducing Coefficients of Key IT Components (2008)

Item	Semiconductor	digital display	Other Electronic Components	Wired Communications	Wireless Communications	Computer
Import-inducing Coefficients	0.553	0.458	0.453	0.494	0.553	0.695

Source: BOK

In 2009, IT component exports decline by 1.6% from the previous year to 62.7 billion dollars while imports decline by 14.2% to 37.3 billion dollars. The share of IT components in the total exports of the IT manufacturing industry was 53.3%, comparable to the percentage (47.0%) of the component industry in the total exports of the whole manufacturing sector. However, IT components accounted for 69.6% of the total imports in the IT manufacturing industry, much higher than the percentage (37.1%) of the overall component industry in the total exports of the entire manufacturing industry.

The immature component industry may not only limit the impact of the IT industry on the domestic economy but weaken the competitiveness of the finished goods industry, hampering economic growth. Economists such as Dani Rodrik emphasized the role of the

intermediate goods industry (components and materials) in economic growth and technology development. In particular, due to a strong mutual dependence between the finished & intermediate goods industries, the specialty and diversity of the component/material industry will lead to the enhancement in the productivity of the finished goods industry, increasing demand for components and materials and ultimately strengthening the component/material industry. Therefore, the failure to form a virtuous cycle incurs lack of mutual reliance, leading to the low-growth economy. Such a low growth prospect can be based on external factors like costs for the early entry into the component/material industry and coordination failure. For example, if specialized experiences, technology, and knowledge required for component/material production are not fully accumulated, the costs for the early entry into the intermediate goods industry can be larger. Furthermore, if cooperation between component producers and finished goods manufacturers for investment, research, and development is not properly guaranteed due to lack of information, the resulting failure in adjustment can incur insufficient entry into the component industry. In this case, the government's active intervention in promoting the component/material industry may be justified in order to reduce the negative externality (Hee-chul Min, 2005).

3.3. Polarization by Firm Size

Polarization by firm size is one of the most distinctive characteristics in the Korean economy. Table 2－13 describes employment, added-value, and labor productivity in the whole manufacturing industry, the IT manufacturing industry and the IT component/material industry. The percentage of large businesses in the IT manufacturing industry is more than 3 times as high as the average of the manufacturing industry as a whole. The share of large conglomerates in the entire manufacturing industry is just 1.1% while their shares in the IT manufacturing industry and in the IT component/material industry are 3.7% and

5.1%, respectively. As a result, the percentage of large businesses in employment and sales is much higher in the IT and component/material manufacturing industries than in the manufacturing industry as a whole. The percentage of large enterprises in added-value is 53.2% in the manufacturing industry while the figures are 84.5% and 88.4% in the IT manufacturing industry and IT component/material industry, respectively. Large companies and SMEs can also be compared in labor productivity. Labor productivity in large enterprises is 3.07 times, 3.20 times, and 2.79 times larger than the SMEs, in the manufacturing, IT manufacturing, and IT component/material industries, respectively. In the IT manufacturing and IT component/material industries, the absolute value in labor productivity is lower than the average in the manufacturing industry. Futhermore, labor productivity in large IT businesses and IT component/material companies is lower than the average in the large manufacturing businesses. In other words, large and SME IT companies under-perform against large and SME non-IT enterprises

〈Table 2－13〉 Distribution of Manufacturing Businesses (2008)

(in item, person, million won)

Classification	Classification	Number of Companies	Employment	Added-value	Labor Productivity
Manufacturing	Large Business	622(1.1)	662,563(27.0)	195,691,914(53.2)	295.4
	SME	57,837(98.9)	1,791,70073.0)	171,938,357(46.8)	96.0
	Total	58,459	2,454,263	367,630,271	149.8
IT Manufacturing	Large Business	62(3.7)	297,239(62.9)	83,164,070(84.5)	279.8
	SME	1,628(96.3)	175,009(37.1)	15,309,997(15.5)	87.5
	Total	1,690	472,248	98,474,067	208.5
IT Component · Material Manufacturing	Large Business	30(5.1)	211,361(73.2)	55,324,275(88.4)	261.8
	SME	561(94.9)	77,373(26.8)	7,266,764(11.6)	93.9
	Total	591	288,734	62,591,039	216.8

Source: KNSO, Mining & Manufacturing Industries Statistics Report, 2004

If polarization by business size can be attributed to relatively high productivity in large IT enterprises, it may not be a serious issue. However, relatively low productivity in SMEs deepened polarization. Unless the growth of the domestic IT SMEs are guaranteed, the growth of Korea's large IT businesses may be hampered. In particular, if polarization is partly incurred by unfair trade practices such as the unilateral request of large conglomerates to lower unit prices or closed management (such as the prevention of contracts with competitors), it may limit technology innovation in SMEs and consequently exacerbate polarization. Comprehensive IT SMEs promotion policies such as technology development, financial assistance, the prevention of unfair trade practices, and cultivation of technology-intensive IT SMEs should be developed in order to correct such problems.

In the following chapters, the telecommunications competition policy, the ICT industrial policy, and the informatization policy in Korea will be discussed in terms of introduction and policy implication. In addition, the case studies of overseas ICT use and the use of IT technology for the advancement of the manufacturing industry will be presented by subsequent chapters.

Chapter 3. Telecommunications Competition Policy in Korea

1. Characteristics of Telecommunications Service Industry and Overview of Regulations

Telecommunications services began in Korea in the early 1900s. Modern telecommunications services developed along with the industrialization policy of the third Republic in the early 1960s. Initial Telecommunications services began to be provided with the government. This was partly because the government was the only party that could afford such astronomical costs to build a large-scale network. Another reason lied in the fact that telecommunications services were an essential factor in the lives of the general population. Apart from the fact that telecommunications services require large-scale initial investment with the government in the lead, other effects of the network and several other characteristics exist. Consequently, the telecommunications sector has several regulatory devices under its sleeve since it provides universal services in addition to the regulations applied in the general industries with economy of scale. The general competition law uses a post-regulatory method that asks for corrections or a fine when actions hampering competition occur, such as abuse of the market dominance, unfair group action and other actions. However, the telecommunications sector still has structural barriers such as essential facilities, network externality, limited frequency resources and other factors, proving to be much more advantageous to the first-comers rather than late-comers to the market. Taking these characteristics into consideration, a ex-ante regulation such as building a competitive environment in the market was taken and a ex-post regulation such as prohibiting certain

actions in response to unfair actions unique to the telecommunications sector was adopted. For these reasons, Korea, like most countries, has a specific regulatory system in the telecommunications sector. The following examines the uniqueness of telecom service sector and the need for regulations, and the current status of the regulatory system in Korea.

1.1. Industrial Characteristics of Telecommunications Service Sector

In this section, the industrial characteristics of the telecommunications sector will be described followed by the regulations that were stipulated in response to them and the status of the regulations in Korea. Examples of major industrial characteristics are essential facilities, network effect, and the size of common cost.

A. Essential Facilities

Essential facilities mean facilities that need to be used to provide a certain service[11]. In the Korean telecommunication sector, the essential facilities include physical telecommunication devices such as cables and networks as well as resources such as conduit lines on which the cables are laid.

Telecommunications service is characterized by the fact that it cannot be directly consumed by its customers, but has to be linked for remote consumers to use. Most services require the installation of a nationwide network because these services are essential in our daily lives. Accordingly, a great amount of initial investment is required to be equipped with the facilities to provide telecommunications services independently. However, with the increasing number of subscribers, the variable cost is significantly

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11) According to the WTO, essential facilities mean facilities of a public telecommunications transport network or services that i) are exclusively or predominantly provided by a single or limited number of suppliers; and ii) cannot feasibly be economically or technically substituted in order to provide a service.

low. As a result, service providers owning essential facilities enjoy economy of scale, and this acts as an entry barrier to other potential competitors. This may lead to the dominance of incumbent service providers of the market. To solve such problems, regulations on providing essential facilities have been stipulated to allow other competitors to use those essential telecom facilities.

B. Network effect

Network effect of the telecom service refers to the effect[12] of increasing value of the telecommunication network with the increasing number of users of a specific network. If the network effect is net reflected in the charges properly, it is possible that the size of the telecommunication network may not be socially optimal. If interconnection between the networks is not done, in particular, the subscribers may tend to lean toward a certain telecommunication service network. To prevent such a denouement, regulatory policies on call prices, policies on interconnection between different types of networks, and number mobility must be introduced.

C. High Common Cost

One of the special features of telecommunications service is the common usage of a single facility to provide several services, increasing the ratio of common cost. In other words, because several services can be provided through the same network, it is possible to provide assistance between services based on how common cost is allocated in service sectors in the actual accounting procedure. If this becomes possible, several unfair actions can be taken. For example, if a telecom operator changes the accounting procedure to

12) For example, let us assume that interconnection to different types of telecommunications networks is not possible therefore consumers can only make calls to subscribers to the same service provider. If such cases occur, consumers will prefer telecommunications networks with the large number of subscribers.

calculate service cost arbitrarily, it can have an impact on determining the calling rate of a specific service. Such action eventually leads to hindering market entry of potential competitors or charging users with unreasonable amounts to pay. To prevent these side effects, several regulatory actions have been set up such as establishment of accounting standards of telecommunications service, regulation on call rates, and prohibition of unfair actions.

D. Daily Necessities

Telecommunication services, such as making local telephone calls, are essential to the everyday life of Koreans. Taking the public interest aspect of telecommunications into consideration, the purpose of offering a universal service is to designate specific services as universal services so that all Koreans can make use of the service at a reasonable price. Also, because universal service cannot be maintained with the call rates paid by the users, a loss replenishment system is in operation to raise money spent to provide such universal service.

1.2. Major Telecommunications Policy Measures

A. Service/Service Provider Classification and Regulations on Market Entry

The telecommunications business classification system itself is not regulatory, but it defines the rights and responsibilities of the service providers, so it is the basic framework of regulations in the telecommunications sector, applying to both the telecommunications service and service providers. Current service classification is divided into facility-service and value-added service. Services not recognized as based services (key telecommunications service) are classified as value-added services. The service providers are divided into facility-based service provider, value-added service provider and special service provider

based on the ownership of telecommunications facilities and the type of service provided. Facility-based service provider refers to the providers that own telecommunications facilities and provide key telecommunications services, whereas, special service provider use the facility owned by facility-based service provider to provide key telecommunications services to its customers.

Entry to the market is slightly different based on the status of the service provider. In the past, entry as a facility-based service provider required approval for the services the operator wants to offer. The approval system by service usually was conditional where the installation of telecommunications network was required for relevant services, so it was an adequate way under circumstances. However, changes have been made recently for operators to obtain a single approval for all services. Such changes can be understood as a lower entry barrier to the telecommunications business. In the cases of special service provider and value-added service provider, entry to the market is relatively easy as they just have to follow the registration and reporting procedures. However, in the case of wireless telecommunications that uses frequency, separate approval procedures are in place to obtain the right to use frequencies. The following table describes the procedures required.

〈Table 3－1〉 Service Provider/Service Classification

Category	Facility-based Service Provider	Special Service Provider			Value Added Service Provider
		#1	#2	#3	
Definition	Carrier installing telecommunications circuit line and providing key telecommunications services	Operators providing key telecom service using telecom lines of facility-based service provider		Operator providing telecom service within zone	Carrier providing value added telecom service by renting telecom lines from facility-based service provider

Category	Facility-based Service Provider	Special Service Provider			Value Added Service Provider
		#1	#2	#3	
Service Type	Key communications service	Voice resale, Internet phone, call-back service	Switchless rebiller, subscriber recruitment, wireless resale, Internet phone	In-zone communi cations	Key services (Internet contents, etc.)
Entry Regulation	Permission	Registration			Reporting

Source: Telecommunications Business Law

The objective of this classification system is to assign different rights and obligations depending on their status as telecommunications service providers. The clarification of rights and obligations can be called an approval system. The following table is an overview of different rights and obligations by service providers. Details of rights and obligations shall be explained in the next section.

〈Table 3－2〉 Service Provider Classification and their Rights and Obligations

Category	Facility-based Service Provider	Special Service Provider	Value Added Service Provider
Additional service	-	Change registration	Change reporting
Merger & Acquisition	Authorization	Reporting	Reporting
Collective use of communications devices	Approval	-	-
Restriction on foreign ownership of shares	49%	-	-
Contribution (Approval condition · registration condition)	Levied	Levied	-

Category	Facility-based Service Provider	Special Service Provider	Value Added Service Provider
Business suspension and discontinuance	Approval	Reporting	Reporting
Facility provision	Provision (agreement or duty) request (possible)	-	-
Common use of subscriber network	Provision (agreement or duty) request (possible)	-	-
Roaming	Provision (agreement) request (possible)	-	-
Interconnection	Interconnection request, connection fee applied, report (authorization) interconnection agreement	Request interconnection	Usage terms applied
Universal Service	Service provision or loss division	Exempt	Exempt
Accounting Separation	Separation by service, submission of annual sales report	-	-
Provision (call rate) regulations	Report by service Dominant carrier in local calls and mobile phones (authorization)	-	-
Pre-selection system	Apply to long-distance calls	-	-
Number System	Local, out-of-city, international, mobile telephone number	Separate numbers for out-of-city and international calls	Apply data network number
International settlement	Approval	-	-
Land use	Applied	-	-
Wholesale provision	MVNO provision (agreement or duty)	Request	

Source: Telecommunications Business Law

B. Provision of Essential Facilities

Facilities that fall under the category of essential facilities were mostly subscriber network in the local call sector, but the scope is expanding nowadays. In the past, the essential facilities were related to the facilities linking directly with the subscribers in the local call network. It is attributable to the fact that it is nearly impossible to add a new telecommunications network without using the already built subscriber network or

incoming line especially in areas where multiple households live together, one of the special traits of Korean housing structure. In addition to the telecom facility connecting houses, it is essential for the operator to secure telecom conduit lines and telegraph poles so as to connect to the network near houses. However, the special traits of Korean housing structure results in a considerable cost to secure such facilities. This fact was a strong drawback to late-comers to the market. Major policies to help the late-comers in overcoming such difficulties include the Local Loop Unbundling (LLU) policy, which allows collective use of local telephone subscriber network, provision of facilities such as incoming line to the house and telegraph poles, and interconnection with other telecom networks. Recently, the MVNO policy related to the opening of mobile telecom network is becoming an important measure in the service-based competition policy.

Local Loop Unbundling (LLU) policy, which allows sharing of subscriber network, refers to the separation of the subscriber line of the incumbent local telephone operator from the local telephone network to enable competing operator to use it under the same conditions. KT, the largest landline operator, is now obligated to provide its copper subscriber line for local calls to allow competing local telephone operators to use the lines.

Korea's mandatory provision of essential facility is stipulated to provide essential facilities of a large-scale common carrier meeting certain criteria to other telecom operators through an agreement. Currently, KT, the owner of the largest landline network, is obligated to provide its idle telegraph poles and incoming lines to other operators and the payment for using the facilities are to be calculated according to the long run incremental cost method, a bottom-up cost calculation method.

The interconnection system, in short, is physically connecting telecom facilities to enable communications between subscribers of different networks. For example, when

an SK subscriber is on the phone with a KT subscriber, the interconnection is essential. In Korea, with Dacom joining the international call market in 1991, interconnection was introduced and it has been introduced in all telecom networks including mobile telephone network and Internet network. Main content of the interconnection is the different regulations applied to operator depending on its status and the facility-based service provider is guaranteed with the right to request connection with other facility-based service provider. Also, during interconnection, the payment needs to be calculated between operators and detailed calculation criteria have been drawn up in detail by service.

MVNOs provide mobile telecom services by borrowing other operators network. The introduction of this system is expected to induce competition in the mobile telecom market and it is the most discussed issue in recent days. Currently, SKT, the largest mobile telephone operator, has the obligation to provide its wireless telecom network to newcomers if they request it.

C. Price Regulation

One of the main objectives of price regulation is to prevent operators, large-scale network owners, from setting unreasonable prices and to promote user convenience at the same time. The current price regulation mechanism is, in principle, a reporting system, but for service providers that have more than a certain market share, an exceptional price approval system is carried out. Services that are subject to price approval used to include Internet services in the past, but a price approval system is conducted for the dominant operators in the mobile and local call sectors only. In the past, whenever the price structure for the relevant service changed, it was subject to approval from the government, but recently, regulations have been eased to allow price reduction to be done without any special approval procedure.

D. Universal Service

The current universal service consists of call rate reduction for landlines, urgent calls and for the vulnerable class. KT is obligated to provide the landline and wireless telephone service on the ship. For other services, all operators providing concerned services are designated. The loss replenishment is to be calculated directly between the universal service provider and the operator sharing the cost. The operator sharing the cost is a key telecom operator exceeding a certain amount of revenue.

〈Table 3－3〉 Universal Service

<table>
<tr><th colspan="2">Category</th><th>Loss replenishment</th><th>Category</th><th>Loss Replenishment</th><th>Loss Replenishment</th></tr>
<tr><td rowspan="3">landline service</td><td>Local call service</td><td rowspan="4">Loss replenishment</td><td rowspan="5">Call rate reduction service for the disabled and low-income class</td><td>Local call service</td><td rowspan="5">To be borne by operator</td></tr>
<tr><td>Local public phone booth service</td><td>Long-distance service</td></tr>
<tr><td>Island telecom service</td><td>Mobile telephone service</td></tr>
<tr><td rowspan="2">Urgent call service</td><td>Wireless telephone service on the ship</td><td>Internet subscriber access service</td></tr>
<tr><td>Special number call service</td><td>To be borne by operator</td><td>Number informing service</td></tr>
</table>

Source: Telecommunications Business Law

E. Number Portability

Number portability allows consumers to keep their existing number even if they change the service provider. This system is essential in removing the lock-up of consumers due to the number. The current number portability system is applied to local telephone and mobile telephone telecom service providers that need a telecom number. Moreover, the number portability is guaranteed between PSTN-based service and VoIP.

To set up local telephones, the telecommunication operator employee has to do the wiring job on-site, so number portability actually takes a few days. However, this is not true of mobile telephones. The system is operated to allow number portability within a couple of minutes through simple procedures in the case of mobile telephones.

F. Actions Prohibited

Various actions are prohibited under the ex-post requlation in the telecom sector. Prohibited actions are defined in many regulations, but the overall classification is as follows: unfair refusal/delay of the key telecom operator to provide access facility, unreasonable use of information obtained doing business, unreasonable calculation of the consumer call rate/access charges, and other actions harming the interest of the user.

2. Early Stage of Korean Telecommunications Services

"Korea took a methodical path of developing its telecommunication market by means of privatization, liberalization, and encouraging competition. The principal objective was to expand and improve the infrastructure and provide quality services at lower rates, hence increasing consumer and social welfare. This foundation turned out to be the essential market and regulatory element for building a thriving telecommunications market in Korea."[13)]

"During the 1970s, the Korean telecommunication sector struggled to keep pace with the rapid economic growth, which revolved around industrial sectors. The existing telecommunication infrastructure and capacity were well short of meeting the increasing demand for subscriber lines and call traffic. The result was serious congestion in voice telephony services. Users had to wait for months for connection and the tariffs were

13) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

very high. The government set new policy objectives that included developing and expanding telecommunication infrastructure and capacity to relieve the congestion, improving the efficiency of telecommunication services, and accumulating technology for equipment and terminal manufacturing."[14)]

"Telecommunication service is a natural monopoly that exhibits economies of scale. Another non-economic consideration, such as safeguarding national security, was also a factor. As such, it was natural that the government provided telecommunication services directly to the public. However, as with many government operations, it was inefficient, and so the government established the government-owned Korea Telecommunication Authority (KTA) in December 1981 to separate the policy and operational functions. The establishment of KTA marks the beginning of changing the market environment toward liberalization and increased competition. Prior to this act, the Ministry of Post and Telecommunication carried out the integrated functions. The separation aimed at improving the efficiency of the services provided by allowing flexibility in business decisions and by cutting the red tape. It allowed more freedom in the compilation and execution of the budget and in human resource management. The government, on the other hand, concentrated on the role of regulating the monopoly operator and began implementing promotion policies."[15)]

The Korean telecommunications sector achieved significant progress during this period. Since 1982, new telephone facilities were built with over 1 million lines per year, exceeding 10 million lines by 1987, opening up "one telephone per household" era. About 9.818 million landline were newly supplied from 1992 to 1999, sufficiently satisfying the demand for the number of subscribers per 100 people, increasing the number of regular telephones from 33.7 people in 1991 to 43.8 people in 1999. The advancement in wireless telecom

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14) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

15) Ibid.

sector, however, was not as active as that of the landlines. Main reasons for the slow growth of wireless telecommunications lie in the high cost of equipment production, lack of technology, high cost burden for initial subscribers, and limitations of its utility in the beginning of the 1990s. Due to such circumstances, the number of mobile telephone facility was just 135 thousand lines. The percentage of mobile and additional telecommunications services took up a mere 10% of the total population, displaying a low percentage of the general public using information.

However, wireless telecommunications technology made gradual developments and the demand for it throughout the world also greatly increased. Such atmosphere expanded to the domestic market with the Korean government making efforts in adopting various policies in a way to seek growth in the wireless telecommunications market. As a result, by the end of 1999, the number of mobile telephone lines reached 30.4 million, an 86 times of increase compared to 1991 along with a 12 times of increase in the number of wireless beeper lines compared to 1991. The number of subscribers to mobile telephone services also increased and a new era with half of the population owning a mobile telephone opened up. In 1998, the Code Division Multiple Access (CDMA) and Personal Communication System (PCS) mobile phones were introduced. At the end of 1999, the total number of subscribers of mobile communication services stood at 26.66 million people, 21.88 million subscribers of fixed telecommunications service, with the number of subscribers to the wireless communication service exceeding by far the number of subscribers to the fixed telecommunications service. The successful launching of the Mugungwha satellite opened up an active satellite telecommunications and broadcasting era.

2.1. Privatization

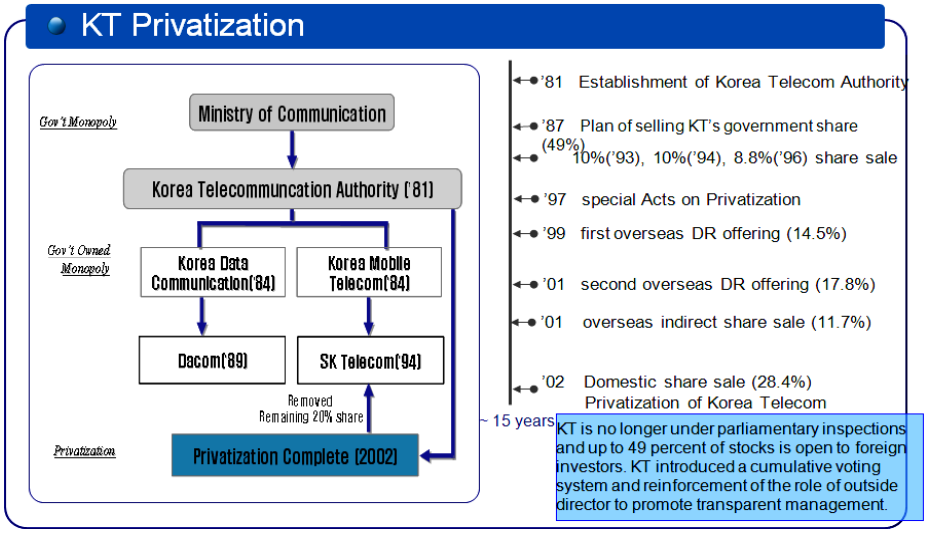
"Korea was one of the early movers to fully privatize an incumbent monopoly operator.

At the time of establishing KTA, it actually stood at a monopolistic position in all sectors of telecommunications. Such a position began to change through separation of the business sectors in early 1980s. Changes were separation of business sectors into landline service, data service and mobile telephone service to set up an independent company. Prior to 1990, three monopoly firms served each telecom subsector: Korea Telecom (KT) for fixed-line services, Korea Data Communication Corporation (Dacom) for data services, and Korea Mobile Telecom (KMT) for wireless services."[16)]

The next step was privatizing each company and this was done by selling the government's shares of these companies. Dacom and KMT (which became SK Telecom), were fully privatized in 1993 and 1997, respectively. KMT, in particular, has transformed into SKT, the largest mobile telephone service provider. The sale of KT, the largest government-invested company, went on for a significantly long period of time starting from the 1980s. The government set up a Committee for Privatization of Public Corporations in 1987, confirming the privatization plan of KT and took actions. The Korean government continuously sold KT's shares. In the course of privatization, the sale of stocks led to issuance of several overseas DRs and sale of shares to the Korean stock market. In 1990, the government's share of KT was reduced to 49 percent; KT became a fully privatized company in 2002. Currently, the government has no direct share ownership in KT and about 49% of its shares are owned by foreign investors.

16) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

〔Figure 3－1〕 Privatization of Korea Telecom (KT)



The privatization has received positive evaluations so far. Just like in several other countries, privatization provides profit incentive for the stockholders and the management, which in return, increases productive efficiency. Also, the concerns at the time of privatization such as low quality of communication and weakened universal role of telecommunications service have not been witnessed in particular. Meanwhile, since the privatization of KT, the largest fixed service provider at the time, Korea's high speed Internet service produced many achievements such as the highest penetration rate and quality. Privatization also makes the regulatory process more transparent and unbiased because the regulatory body becomes independent from the operators.

2.2. Liberalization

"Korea took a sequential but rapid path to liberalization of the ICT services sector. During the Basic Telecom Negotiation of the Uruguay Round World Trade Organization

negotiations in 1994, Korea committed to the full liberalization of the resale-based sector and partially committed to the schedule of step-by-step reduction of the limit of foreign ownership of facility-based operators. In addition, the Reference Paper of the WTO Basic Telecommunication Agreement was also adopted by the Korean government. The paper guided governments in the implementation of various regulatory measures concerned with competitive safeguards, ensured interconnection, allocation of scarce resources, provision of universal services, and transparent licensing. Korea's policies and regulatory framework were notable in their pursuit of this textbook method of the global standard. The well-designed liberalization policies resulted in the transfer of technology, innovation and investment funding from foreign operators, resulting in faster growth of the market, while providing proper incubation of competitive domestic operators."[17] Currently, in cases of specific and additional telecommunications service providers, no limitations exist in the ownership of stocks by foreigners. In the case of common carriers, the limits on the share ownership by foreigners were expanded to 49%. Hanaro (currently SKB), the second-ranking fixed service provider, even had a foreign investor exercise its management rights as the largest shareholder.

2.3. Introduction of Market Competition

A. Evolvement of Telecommunications Market

"The government's next task in the telecommunication sector was to improve efficiency by introducing competition and market mechanisms. World trends also suggested this course. In the United States, AT&T had been structurally separated. In the United Kingdom and in Japan, BT and NTT had been privatized. In a number of countries, competition

17) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

was being introduced and markets were being liberalized."[18)]

"Step-by-step entry of new telecommunication operators and gradual fomenting of a more competitive market environment constituted the basic framework of Korea's competition policy. Another objective was the diversification of services, which included fixed-line voice telephony, data communication, and mobile communication."[19)]

"The first phase of the market structure reform began in 1990. During this period, several newcomers entered the service market that used to be monopolized in the past. Dacom's entry into the international call market in 1990 was the first form of competition in telecommunications services. Shinsegi Telecom's entry into the mobile market in 1994 and Dacom's entry into the long-distance market in 1995 opened those markets for competition. Multiple licenses were granted for trunked radio and paging services. After this first phase, except for the local telephony, every subsector of telecommunications services had at least a duopoly market structure."[20)] Such changes were possible through the adoption of service provider classification system. The new classification system allowed the telecommunications service business to be divided into "key telecommunications business" and "value-added telecommunications business", which used to be classified into a single business called "public telecom business." The "key telecommunications business" is then divided into a smaller category and different entry and share ownership conditions were assigned and the "value-added telecommunications service" allowed the introduction of a full competition system.

"The second phase in inducing competition began in 1996, when 27 new licenses in seven subsectors were granted, including three personal communication services licenses. In 1997, the entry of Hanaro Telecom finally provided competition in the local telephony market.

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18) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

19) Ibid.

20) Ibid.

Also in the same year, resale-based operation in the fixed-line voice market was allowed."[21]

To back up measures to promote market competition, several regulatory policies were devised. The most outstanding feature is the completion of the classification system for telecommunications service providers. As described above, the service providers are classified into facility-based service provider, value-added service provider, and special service provider. The most special factor is the positioning of the specific telecom service provider. As a result, an operator can provide telecom services by registering after fulfilling certain requirements without securing telecom facilities through large-scale investment. Also, even foreign service operators can now provide their services in Korea once they conclude a contract with a Korean telecom operator.

The effect of introducing competition policy in two phases was shown in a significantly diverse way. The biggest effect was the envigorated market from mulitple competitors in many markets, which used to be monopolistic and the call rate drop as a result. Dacom, one year after entering the international telephony business market recorded a market share of 20.7% at the end of 1992 and Onse Telecom also obtained about 1% market share at the end of 1999, three years after market entry. Hanaro Telecom, which began local telephony service, secured about 400 thousand subscribers in early 2000 through high speed Internet service, while Onse Telecom secured 323 thousand subscribers in December 1999 after starting long-distance call service, strengthening its foothold as the third largest long-distance call service provider in the market. In the case of mobile telephone market where SKT monopolized, three additional PCS operators joined the market in 1997, increasing sales along with call rate competition. In the period from 1993 to 1999, the sale of mobile telephones increased about 42.5 times. At the same time, the call rates of mobile telephones took a big dip. Numerous call plans have been introduced into the

21) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

market considering the mobile phone usage patterns of callers, resulting in a positive effect of a wider selection for callers. In the case of the high speed Internet market, it is more meaningful because a new service market was created by a new service provider. Hanaro Telecom, the second local telephone competitor, started to provide xDSL-based high speed Internet service in 1999. The start of the high-speed Internet service by Hanaro Telecom led KT, the largest landline operator, to enter the high-speed Internet market and this market has grown at a very fast rate.

〈Table 3－4〉 History of the Market Competition in Korea

before 1982	Telecom services provided by MPT
1982	KT founded as a public corporate
1984	KDT(present Dacom) founded KT launched analogue mobile services
1988	KMT was spun off from KT
1991	Competition introduced in value-added services Entry of Dacom to international market
1992	Competition introduced in paging services (10 new operators)
1994	Second cellular license issued (Shinsegi Telecom) Accounting separation order
1995	Competition introduced in long-distance market (Dacom) Cable TV service launched, KEPCO and KT as network operators
1996	27 new licenses granted: three personal communication services (PCSs), six trunked radio systems (TRS), 11 CT-2 (cordless telephone, second generation), two dedicated line, one paging, third international operator (Onse), and three wireless data transmission
1997	10 new licenses granted: one local operator (Hanaro), one long-distance (Onse), six TRS, one paging, WTO agreement into effect Resale-based competition introduced
1999/ 2000	-Hanaro(SKB) started bundling service of local telephone and broadband internet -KT lauched boradband internet service -Universal service order (local telephone and payphone)
2001/ 2002	-Local loop unbundling order -Rebalancing KT's local tariff -DBS (skylife) launched
2003/	-LRIC applied in interconnection rule

2004	-Revision of facility sharing order making KT mandatory provider -Number portability (local and mobile phone) introduced -Broadband internet service redefined as a basic
2005/ 2006	-Banning mobile handset subsidy for 2 years -WiBro and HSDPA service launched
2007/ 2010	-KCC(Korea Communications Commission) launched -Bundling services by dominant carriers permitted -Sunset on banning mobile handset subsidy -Number portability order on VoIP -MVNO order making SK mandatory provider

B. Institutional Measure for competition policy

The government also implemented institutional measures. The government oversees the market to monitor any anti-competitive practices. “Other regulatory functions included resolution of disputes among operators, consumer protection, and interconnection. To achieve a healthy competitive environment in telecommunications, an interconnection scheme must be fair and transparent. In particular, switching the tariff scheme from a rate-of-return method to a cost-based method was a significant step. Also, unbundling network components in the interconnection contract was another measure to ensure fair competition.”[22)]

“The efforts of the Korean government in developing the telecommunications sector and making more efficient telecom services resulted in a significant decrease in the cost of telephone calls. In particular, the cost of a three-minute phone call to the United Sates dropped by 84 percent from $4.88 in 1996 to $0.76 in 2004.”[23)]

C. Facility Based Competition Policy[24)]

The key feature that distinguishes Korea’s deregulation and competition policy in the

22) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

23) Ibid.

24) Ibid.

telecommunications services sector from other countries was its reliance on facility-based competition. Facility-based competition between telecom service providers results when new entrants into the sector build their own facilities in order to provide services, as opposed to service-based competition where the entrant uses the facilities of the incumbent. In contrast to Korea, the United States and Europe employed service-based competition to encourage competition and were successful only in the long-distance and international markets, but not local markets.

Korea is one of the few countries that use multiple operators in all markets of the telecom service sector. In mobile services, five network-based operators were licensed, of which three remain in competition: SK Telecom, KTF, and LG Telecom. The astonishing success in broadband Internet service market was also credited to facility-based competition, where KT's and Hanaro's xDSL and Thrunet's cable modem services provided fierce competition. The government's laissez-faire approach, with minimal regulation, also contributed to the sector's growth.

Facility-based competition has proven to be viable even though there was a concern that the large fixed costs of constructing multiple broadband networks would incur high social cost and reduce profitability. The economic value created from the competition far exceeds the cost of network construction when effective network competition fosters successful competition in the content sector as well. Indeed, facility-based competition has many advantages.

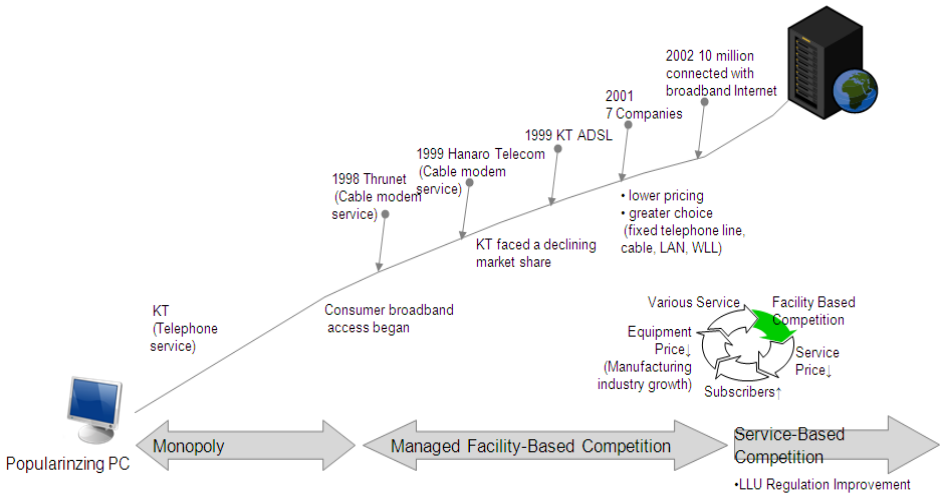
First, regulations that encourage network competition are more effective in inducing true competition, and network competition will accelerate network enhancements for each end user's full satisfaction in the delivery of the content and applications.

Second, facility-based competition provides incentives for the profit-maximizing operators. It helps achieve the optimal level of investment, because each operator chooses its own optimal network size and appropriates the return from the investment in the

additional facilities.

Third, the network and service in telecommunications form a "virtuous cycle," in which the network competition promotes the service and content industries, which in return would attract more network subscribers. As a result, such industries as e-commerce, online gaming, and Internet broadcasting have flourished in Korea. This "virtuous cycle" becomes a key driver and the objective of telecom policy in the information age.

〔Figure 3－2〕 Snapshot of the Telecommunication Competition Policy in Korea



In the absence of facility-based competition, the vertical structure would allow the incumbent monopoly network operator to extract the downstream rent. It could be prohibitive for content providers to have proper incentives under such an environment. Korea's experience indicates that, for effective competition in both the network and content sectors to be realized, facility-based competition should be in place, along with proper regulatory safeguards against market failure. Also, as the source of economic value shifts from network to content and application, a competitive environment in the content and application sectors becomes pivotal and should attract more regulatory attention.

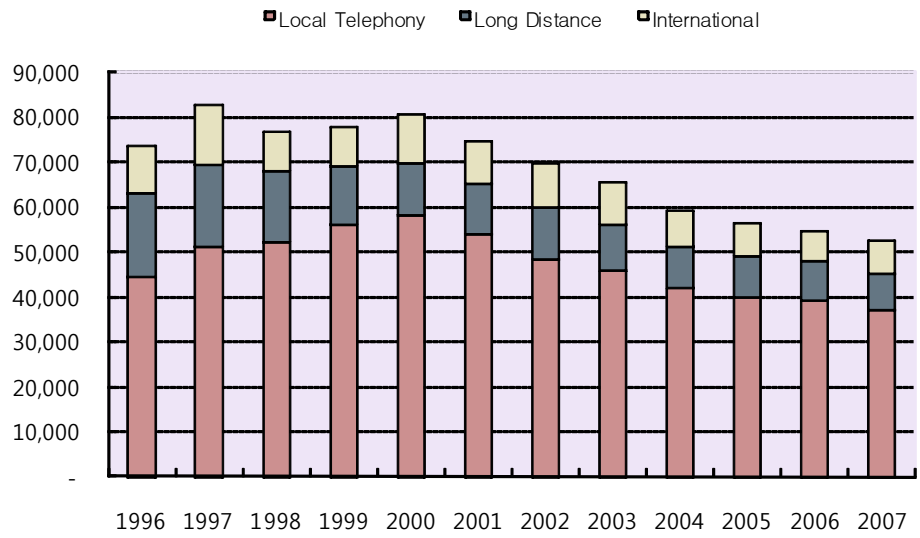
3. Recent Development in Regulatory Reform

3.1. Maturity of Market and Valid Competition Policy

The Korean telecommunications market became mature in 2000, showing slow growth rate of the market. The number of telephone lines recorded a steady growth in the 2000s, but began to decrease from 2003. The number of local telephone subscribers started to decline from the end of 2004. Meanwhile, the number of mobile telephone services subscribers have continued to grow after year 2000. The reduced number of subscribers to landlines and lines led to less revenue. This may be attributable to the reduced use of landlines arising from the expanded supply of mobile telephones.

〔Figure 3－3〕 Fixed Telephony Revenue

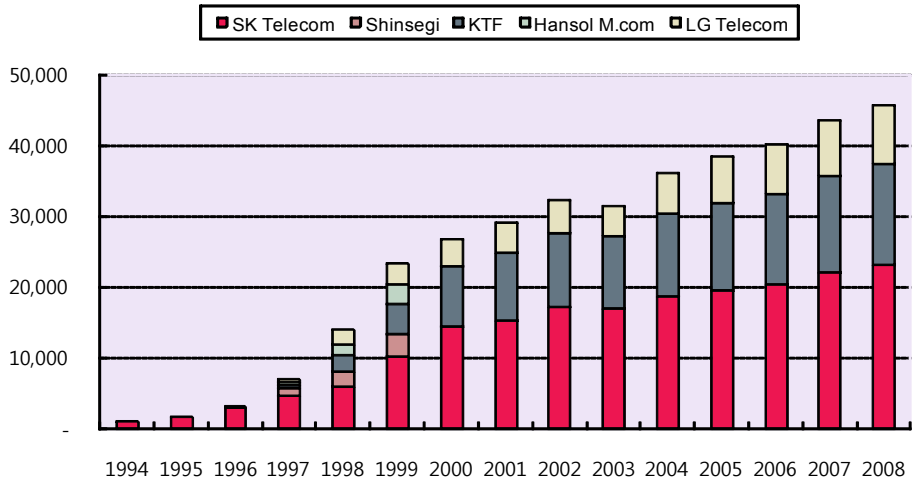
(unit: 100 million Won)



In the case of mobile telephones, SK Telecom began the world-first commercial service of CDMA2000 1X since October 2000 and provided the CDMA2000 1X EV-DO service

in 2002 supporting with a 2.4Mbps transmission speed. The terminal supporting these services led to the beginning of the wireless Internet service with mutimedia functions from 2003. The revenue from the data sector including wireless Internet at the time recorded a continuing increase reaching 17.2749 trillion won in 2004. With the start of the year 2000, the landline market shriveled and the mobile telephone market entered its maturity with the high-speed Internet market showing rapid growth. The demand for high-speed Internet services grew exponentially, exceeding 10 million subscribers in 2002. However, the growth rate rapidly slowed down after 2002 and the high-speed Internet market is also becoming saturated at a very fast speed. The per household penetration rate of high-speed Internet reached 78% by the end of 2004, showing slower growth rate in the number of subscribers, but revenue recorded a stable growth at 3.8988 trillion won in 2004. The service provided during this period was mainly done through xDSL method and cable modem methods with xDSL in the lead at 57.4%, cable modem method 34.3%, A-LAN 8.2%, and satellite method 0.04%. Despite the saturation in the market, the technological development has been made in the high-speed Internet sector.

〔Figure 3－4〕 Number of Mobile Telephony by Telecom Operators



Meanwhile, the competition structure by service market has not changed much. The reduced revenue did not change the fact that KT has the largest market share and the competition structure of the market remains with three major mobile telecom operators. KT still maintained its absolute leader status with 96% of market share in the local telephony business in terms of revenue in 2000. In the mobile telephone market, SKT still held a market share of 50% with no changes in the market share for KTF and LGT, both latecomers.

Amid the maturing market and unchanging positions of major operators in the market, the government policies began to change gradually from focusing on the entry of new players ready to invest in facilities to revitalize competition among incumbents. Such valid competition policy emphasized eliminating the gap between operators mainly in the landline market and mobile telephone market.

Major telecommunications policies devised during this period concentrated on eliminating the several advantages of being the first mover. In other words, drawing attention to the fact that dominant operators in major markets are all early-comers, the policies focused on providing equal business environment for early-comers and late-comers.

One of the best examples of giving preferential treatment to late-comers by suppressing the dominant position of the early-comer is the number portability policy for both fixed and mobile telephones. The biggest obstacle in the process of shifting from the service provided by early-comers to that latecomers was the number change resulting from the shift. The number portability system to correct the issue began to take effect in 2004. In the case of wireless telephone number change, in particular, the number portability system was carried out sequentially. In other words, the number change occurred in the sequence of SKT subscriber, KTF subscriber and LGT subscriber considering the market power of three mobile telecom operators. It was a unique method of allowing number portability to allow number transfer to SKT subscribers first, and then, allowing the same to subscribers of other operators.

Such differential number portability system showed significant effect leading to about 3.1% decrease in SKT's market share in 2004 alone. KTF and LGT increased their market shares by 0.9% and 2.2% respectively. Examples of other policies devised to control the dominance of early-comers are the completion of revised enforcement decree of Radio Act (July 2004) aiming at imposing different charges for using radio waves for cellular phones and PCS, prohibition of the subsidy support for handsets was prohibited, and policy to choose the calculation of connection tariff considering factors such as frequency efficiency, call volume size, and market competition status.

As described before, the essential facility in the telecom market is a very important element in forming market dominance. One of the major policies include the introduction of Local Loop Unbundling (LLU) for subscriber tracks required for landline service from 2003. This system was developed to prevent investment overlap by opening up essential facility, one of the core elements for early-comers to dominate the market and to strengthen latecomers' competitiveness by allowing them to use the essential facility. Also, in November 2003, improvements have been made in relevant policies to allow joint use of subscriber tracks for local telephones and high-speed Internet starting from November 2003. At the same time, the provision of the essential telecom facility owned by KT such as telegraph poles, conduit lines, cables in the subscriber zone has become mandatory. According to this regulation, KT has an obligation to provide such facilities. Other major policies include prohibition of providing combination commodities. The main point of the discussion is to prevent the market power from shifting from one market to another through combination commodity. The target subject to regulation is the dominant operator in the landline and mobile telephone markets. They were regulated to sell combination commodity under certain conditions.

In addition, the service rates of dominant operators in major service markets, an approval system has been carried out. To support this system, the accounting separation

standards have also been strengthened so that the shift of market power of operator is separately in a transparent manner in accounting.

3.2. In pursuit of service-based competition policy

"Regulatory reform helped Korea make impressive progress in developing its telecommunication service markets, resulting in better services, lower prices and rapid innovation. The telecommunication sector generated nearly 5% of GDP in 2005, well above the OECD average of 3%. In addition to the rapid diffusion of broadband penetration, Korea is a technological leader in other areas such as wireless broadband and digital multimedia broadcasting. There is a need, though, for further reform to stimulate competition, which would encourage the private sector to choose the appropriate technology and services. It is important that the objective of technological leadership in ICT manufacturing does not lead to distortions in the telecommunication services market."[25)]

Facility-based vs. service-based competition

One of the most important decisions to be made by the authorities is to determine the direction of the operation of many regulations. The main direction is divided into facility-based competition policy vs. service-based competition policy.

Facility-based competition refers to all operators building their own facilities and entering the market, whereas, service-based competition allows potential competitors to use the facility of incumbents when entering the market.

In general, facility-based policies are useful in the early stages of telecommunications services that require investment in networks, but there is a drawback with the possibility

25) OECD(2008b)

of producing loss from duplicated investment to a certain extent. Service-based policies, on the other hand, enables potential competitors to join the competition rapidly, but uncertainties in using the network of competitor and difficulty in calculating the payment for using the network. The operator providing the telecommunications network, in turn, may experience reduced motivation to invest in the facilities if the payment for using the networks is not efficiently calculated.

Under the facility-based system, most regulations require market entrants to be equipped with a certain level of facilities at the time of entering the telecommunications sector. The rights and obligations are also defined differently depending on the ownership of telecommunications network via operator classification system. Examples of service-based competition policies are fixed telecom service resale, LLU, facility provision in the fixed telecom service and wireless telecom service resale, MVNO, mandatory roaming service, and opening of wireless Internet network in the wireless telecom service.

"Korea's regulatory framework, based on detailed service categories, had become increasingly outdated as communication networks became integrated. Such an approach has limited competition between services by dividing the market."[26] The approach to determine the regulation by specified service made it difficult to respond to the convergence of telecommunications networks and the converged services. For instance, VoIP may be called landline in its service type, but it is quite different from local calls from the past in the sense that the call is made through Internet networks. It is difficult, therefore, to classify such converged services using the service classification method of the past. Another example is IPTV. IPTV is not different from the existing cable broadcasting service in

26) OECD(2008b)

its service properties, but it became difficult to classify it as a specific service within the existing regulation framework because it uses the Internet network to transmit the service. The insufficient regulatory framework caused the delay in introducing the relevant service into the market and eventually led to a factor that hampered the service-based competition. "In addition, regulations on price and bundling have slowed the development of innovative services."[27)]

"The government's 2007 "Roadmap for Telecommunication Policy and Regulation" aims at encouraging the development of new services through deregulation, competition and greater predictability of regulation. In addition, the Roadmap will promote the integration of service categories by: i) allowing bundling by major operators; ii) permitting number portability from PSTN to VoIP and improving the numbering policy; iii) introducing MVNO wireless services and USIM; iv) relaxing price regulation; v) phasing out regulation of handset subsidies; and vi) reducing entry barriers and facilitating M&As."[28)]

These policies have been realized consecutively through the legislative process. The biggest change is concerning the regulations on entering the telecommunications market. "Previously, facility-based operators were required to get an individual license for each type of service. In 2007, services were reclassified into the categories of transmission, services that require spectrum allocation, and facility leasing, thereby easing the entry of new operators in more than one type of service. Easing entry requirements is especially important in the fixed-line market, where KT's market share for local telephone calls exceeds 90%, reflecting the small number of participants and the lack of effective competition."[29)] Currently, the regulations concerning entry into the telecommunications sector is much more relaxed. The three classifications of services in 2007 has now been integrated into

27) OECD(2008b)

28) Ibid.

29) Ibid.

a single service, which means if a licensed telecommunications operator wants to introduce a new service, it can do so without any entry procedures.

"The problem of weak competition in the mobile market should be addressed directly by providing spectrum to and licensing more market players and by requiring existing mobile operators to support MVNOs, rather than regulating prices."[30] Unlike landlines, mobile telephones require a limited resource called wavelength. To allow better access to limited resources, the MVNO system has become a legislation. This system is receiving attention as it is expected to attract new mobile telecommunications operators into the market. The current market leader, SKT in the mobile telephone sector is designated as the mandatory provider and discussions on the guideline for determining the payment for using the resources is in progress.

"The management system on obtaining the right to use wavelength is also changing into a market-oriented direction. Korea has used a fee-based system since 2000 for the allocation of spectrum, rather than the auction approach recommended by the OECD. The government sets a higher and lower limit for spectrum fees. The applicants that offer to pay the higher price receive more points in the "beauty contest" procedure, but this is only one criterion in choosing which firm obtains the spectrum. The winners of the contest are allowed exclusive rights for spectrum use, including the right to transfer or lease the spectrum, thus creating a type of secondary market. However, in principle, the transfer or lease is not possible until three years after the licensing, with some exceptions specified by the law, and requires approval by the regulatory authority."[31] Currently, revisions to the relevant laws to allow auctions for frequency range with high economic value have been completed. Discussions on expanding the right to use such

30) OECD(2008b)

31) Ibid.

ranges are under discussion.

The mobile number portability of PSTN and VoIP has been introduced in 2008. Regulations on the sale of bundled telecom services have been eased around the same time. In the past, sale of bundled services were permitted with restrictions. Although operators are allowed to set service prices through notification, those that are considered to have market power in terms of business size and market share are subject to authorization. According to the eased regulations, if the price of the bundled services is less than the individual service to a certain extent, the bundling sale is allowed after a relatively simple procedure. As the bundling sale of services by the dominant operator is permitted, nearly all services are provided in the bundled form.

The M&A of key telecom operators is basically subject to approval from the policy authorities, but the operational procedures for the M&A are being simplified. Also, in the past, concerns for the dominance shift with the M&A were reflected a great deal during the approval procedure, but numerous mergers of fixed telecom operators and wireless telecom operators were carried out recently. The remaining issue concerning share ownership is the restriction of foreign ownership of shares. “Korea limits foreign investment to 49% in the two facility-based operators (KT and SKT). In addition, the authorities can prevent an investor, regardless of nationality, from becoming KT’s largest shareholder, although currently the largest shareholder in KT is a foreign investor. More generally, when more than half of a company is owned by a foreigner, and the company is investing through acquisition, it is required to report to the authorities. It should be noted, however, that this is a general requirement, applying to all sectors, not just telecommunications. The government argues that such investment restrictions are justified by national security considerations. However, most countries have the capacity to protect national security and public interest through the general legal framework rather than by foreign investment restrictions. Accordingly, such

ownership restrictions should be eased, particularly as new entrants are often short of capital."[32)]

3.3. Further issues

Further major issues are introduction of a new regulatory system responding to the trend of Fixed Mobile Convergence (FMC) and convergence of telecommunications and multimedia. Such convergence trend is in progress already, as witnessed in the examples of VoIP and IPTV, and eventually, diverse services are expected to be provided through all-IP-based broadband network instead of a single service provided from individual networks. The services offering the same functions may be provided through different telecommunications networks or it may be possible that several services that could not be offered through a single communication network are offered. Services that were currently competing in different markets may be competing directly with each other. Such environmental changes require changes in the regulatory framework. In such circumstances, the overall direction to improve the regulations can be summarized briefly as the most challenging issue to how to ensure fairness in regulation of services provided among competitors. To do this, the scope of services should be defined in a broad manner so as to accelerate the combination of various services, ultimately promoting revitalization of competition. Next challenging issue is alluring investors to expand their investment in networks. To do this, the network opening policy needs to be more flexible to attract more investment in the new services so as to maintain consistency and transparency in the regulations. Lastly, it is important to secure a fair competition environment. With the bundled sales of services becoming more active, the market dominance may shift to some service providers. Because the dominance of

32) OECD(2008b)

network owners may be shifted to other service sectors, it is necessary to devise measures to respond in a flexible manner.

Chapter 4. ICT Industrial Policy of Korea

1. Government-led Electronics Industry Promotion Policies in the 1960s and 1970s

"The remarkable development of Korea's IT industry can find its origin in the electronics industry which emerged during the 1960s. During that period, the local electronics market had two groups of players: local manufacturers assembling black-and-white television sets and radios, and American semiconductor producers. While the local players concentrated on meeting domestic demand, the U.S. semiconductor producers such as Fairchild and Motorola, focused on export, taking advantage of low-wage workers of Korea. With the U.S. companies' investment, Korea's export of semiconductors experienced a rapid growth to account for 5.6% of the nation's total export in 1969. However, we have to notice that this growth was mainly led by foreign players. In 1972, foreign companies made up of 55% of the Korea's total production of electronics goods."[33)]

The Ministry of Commerce and Industry (MCI) created an electric industry department in 1964 and divided the telecommunication industry team under the department into two functions – telecommunication and electronic appliances – and upgraded the latter function to the team level in early 1966. This action allowed the electronics industry to be one of the government's policy focuses and relevant businesses to be handled through administrative processes.

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33) OECD(2008a)

The government also announced the 5-year Electronics Industry Promotion Plan in 1966, which would be the basis for the 8-year Electronics Products Export Plan later. The key elements of the Plan are as follows: replacing foreign parts of electronics products with domestic ones; dividing and specializing functions of parts supplying and assembling factories; reducing exports costs; nurturing skilled resources; and diversifying export markets. The Plan also enacted the Electronics Industry Promotion Act, which took effect in January 1969, to actively boost the growth of the industry. The Act provided a legal ground for the MCIE to designate a list of items to actively promote and officially to be a central government agency to comprehensively support the growth of the industry.

Along with the enactment and promulgation of the Act, the Korean government announced the 8-year Electronics Products Export Plan, a mid- and long-term master plan. The Plan was incepted originally as a 5-year plan, but the timeline was extended to 8 years to be in line with the third 5-year plan for economic development. The Plan was mainly to inject a promotion fund worth 14 billion KRW into the electronics industry during the 8-year timeline to enable the industry to achieve the export goal of $400 million by 1976, the closing year of the Plan. It had three objectives: selecting a list of items to actively develop (localization); achieving the export goals; and gradually expanding the level of localization. Some concrete measures were proposed: establishing an industry-wide development structure through the integration of the production processes of different materials, parts and machines; promoting the industry as a national strategic industry for export; and setting up a promotion fund.

According to the Plan, the MCIE designated a total of 95 promotion target items – 12 materials, 29 parts and 54 types of equipment – and they would be developed into two phases: the first phase during 1969 to 1971 and the second phase during 1972 to 1976. This 8-year plan produced a huge success and the electronics industry recorded $1.036 billion in export in 1976, which was 260% bigger than the original target of

$400 million. As Korea's total export for the same year amounted to $7.715 billion, the electronics industry accounted for 17.6% of the total export.

The government also decided to actively attract foreign investment to provide the industry with a strong financial backing. It enacted the Foreign Capital Inducement Law, which stimulated the entry of a large number of multinational corporations into the local market. The Law, enacted in 1967, greatly simplified the export and import procedures for the electronics companies that acquired the government's permission of a single or joint investment. For this preferential treatment of foreign investors, the government attached a condition that they should export the entire quantity of electronics parts and goods produced in Korea.

As of the end of 1969, a total of 22 multinational companies opened in Korea, which consisted of 10 companies with 100% sole investment and 12 joint ventures with local partners. As we can suppose from the fact that only 1 sole-invested firm and 2 joint ventures were established before the enactment of the Law, the Law made a great contribution to attracting foreign investments into Korea.

The production items of the multinational firms showed that whether they were sole investment or joint investment. American companies mainly produced semiconductor and computer-related products, including integrated circuit (IC) and transistors, and Japanese companies mostly manufactured electronic goods such as resistors, electric condensers, transistors and speakers. Those multinational corporations played a critical role in laying a foundation for the local electronics industry to grow on and addressing our lack of technological capabilities. The products that multinational companies manufactured in the local market during the 1960s were radios, televisions, refrigerators, automatic exchangers and cables, all of which could be easily assembled without knowledge of source technologies.

Along with the technology transfer from foreign companies, the Korean government

realized the urgent need for dedicated science and technology research institutes and started large-scale investments into this area beginning in the late 1960s. The Korea Institute of Science and Technology (KIST), Korea's first comprehensive research organization, was established in 1966 and formed the groundwork for the development of the nation's science and technology. With the understanding of the need for more diverse and specialized research units, the government created area-specific research institutes under the KIST and let them lead the nation's technological advancement. With the strong support of then president Park Chung-hee who had special interest in export expansion and technology localization, a total of 16 government-invested research organizations were established from the opening of the KIST in February 1966 through 1979 and they actively performed diverse research activities.

In 1976, the Korea Electronic Communication Research Institute (KECRI) was founded. The KECRI introduced electronic exchangers to expand the local telecommunication infrastructure. The higher level agency to supervise the KECRI changed to the Ministry of Communications (MOC) in 1977 and the institute's name also changed to the Korea Telecommunications Research Institute (KTRI). The institute merged with the Korean Electric Research and Testing Institute (KERTI), which belonged to the Ministry of Commerce and Industry (MCI), in 1981 and its name changed again to the Korea Electro-technology and Telecommunications Research Institute (KETRI), which served as a main research wing of the local telecommunication industry, leading the localization of exchangers. The KIET launched projects to convert the UNIX operating system to adapt to 16-bit and 32-bit mini computers and develop 8-bit and 16-bit mini computers. Another critical task of the institute was to develop the local design and production processes and mass production technology for different types of semiconductors.

2. Development of Three Strategic IT Products in the 1980s

The Korean government started earnestly to find ways to raise the value-added of the electronics industry from 1980s. While the presidential secretary office for economic policy led the efforts to prepare a plan to promote the electronics industry, the implementation of the plan was the responsibility of a task force comprised of 20 working level officers from economy-related government agencies: the Ministry of Commerce and Industry, the Economic Planning Board, the Ministry of Finance, the Ministry of Communications and the Ministry of Science and Technology, the corporate sector and research organizations. The electronics industry promotion plan, which was released after a 3-month project, made an innovative proposal to shift the industry's focus from the existing household electronics appliances to industrial products and related parts, and identified three products to strategically develop: semiconductor, computer and electronic switching system. Especially for those three target products, the government encouraged the relevant companies to conduct joint projects to prevent any competitive, excessive research and development efforts.

The most actively discussed ideas were to ease a number of regulations imposed on the industry and provide more support in terms of diverse systems including financing and tax. Thus, the project to minimize administrative regulations on the electronics industry was launched to facilitate the growth of the relevant companies and realize the free enterprise system that allows companies the right to seek the interest of consumers in its own way. In summary, the government's policy for the electronics industry during the 1980s put more focus on deregulation than on strengthening of support.

Since then, according to the proposed Electronics Industry Promotion Plan, the government pursued to fully remove restrictions on the entry of new players to the

market, liberalize the electronics companies' selection of production items, allow the introduction of new technologies, require public agencies to purchase locally-produced electronic goods, impose provisional tax rates for special excise taxes and provide support for securing plant sites. With this comprehensive, strong support of the government, Korea's electronics industry recorded $10 billion in export in 1986 and even doubled this number to post $20 million in 1988, which naturally realized economies of scale in the materials and parts sectors.

Now, we will guide the reader through how the three strategic products were developed. First, the development of semiconductors was led by the Korea Institute of Electronic Technology (KIET) with a fund worth $29 million the government borrowed from the World Bank in 1979. In 1983, however, Samsung Group announced investment in semiconductor production and it successfully completed the production, assembly and inspection of 64K DRAM only six months later, in December of the same year. It led the KIET to merge with the Korea Electro-technology and Telecommunications Research Institute (KETRI) in 1985 to form a new agency, the Electronics and Telecommunications Research Institute (ETRI). Following the success of 64K DRAM development, Samsung successively produced 256K DRAM and 1M DRAM in 1984 and 1986, respectively, promoting Korea as a fast rising semiconductor producer in the world. Along with the development of 1M DRAM in 1986, the Korean government and the private sector jointly started to develop 4M DRAM, displaying technological capabilities that match those of the developed countries. The successful production of 4M DRAM in 1988 was followed by that of 16M DRAM and 64M DRAM. In 1994, Korea finally became the world's first country to produce 256M DRAM.

Second, the development of local computers, from the initial stage, had many challenges of development capability itself and an expected lack of domestic demand. However, the Oil Shock and futurists' forecast of the advent of an information society during the 1970s

made Korea realize the need for preparing against the upcoming new era of information society and pushed the government to build the national backbone computer network. The project to build an administrative IT infrastructure, performed as a part of the above initiative, created the demand for mainframe computers and propelled the development local mainframes. In 1987, the Korean government signed a contract with Tolerant, a U.S. mainframe manufacturer, to introduce the latter's technology of mainframe computers and in 1988, the four local electronics companies – Gold Star, Daewoo Telecom, Samsung Semiconductor Telecommunications and Hyundai Electronics – started producing medium size computers. These series of events resulted in the local design and production of mini computers called TICOM in 1991 and further led to the development of Mainframe III and IV.

Lastly, TDX (Time Division Exchange) system, an electronic telephone exchange system, began to be brought into Korea from the end of the 1970s and was believed to be the best solution to the chronic issues of phone line backlog and poor speech quality, but several issues including different mechanical properties from the old technology delayed the full-scale introduction of the new technology. Only from the early 1980s, some proactive actions were taken: introducing the second generation of TDX and designating local partners. In 1981, a domestic TDX development project was launched with 24 billion KRW worth of research and development fund, which was an exceptionally large amount for a single project budget. This ambitious project was initiated not only to localize electronic phone exchangers, but also spark off the development of the whole electronics industry and this intention was also well displayed in the government's Electronics Industry Promotion Plan, developed a little bit earlier, specifying the electronic phone exchange system along with semiconductor and computer as the three strategic products. The TDX project produced a tangible result by enabling four local producers to open a total of 24,000 phone lines in March 1986, in the following four areas: Ga-pyeong, Jeon-gok, Mu-ju and

Go-ryeong. The telephone exchanger called TDX-1 was upgraded to TDX-1A or TDX-1B later. In 1991, TDX-10 was developed to cover 100,000 lines and was followed by TDX-100. In conclusion, the TDX development greatly contributed to the expanded supply of telephones and the advancement of the entire IT industry.

The local development of TDX was regarded as a critical achievement in upgrading Korea's technological capabilities, which were a relatively low level at that time. While there is some criticism about the need for local development of the electronic telephone exchangers itself, and the failure to export the relevant technology due to excessive protection of the technology, the TDX project is highly praised for the proper selection of technology and local efforts made during the process of acquiring and internalizing the technology.

"The TDX electronic switching project played a crucial role in allowing Korea to build a modern telecommunications network and extend phone and other service to citizens nationwide. It fulfilled the twin objectives of coping with the dramatically increasing demand for telephone service and developing an indigenous digital exchange technology. TDX was not only the largest development project ever undertaken in Korea to that date. Also, because switching technology required sophistication in communications, computers and semiconductors, the project had a profound and synergistic effect on the entire electronics industry in Korea."[34)]

3. Creation of MIC and Informatization Promotion Fund in the 1990s

3.1 Creation of MIC

In accordance with the government reorganization act passed by the National Assembly

34) Oh, Myung and James Larson(forthcoming 2011)

on December 23, 1994, the Ministry of Communications that governed the national telecommunication policies was changed and expanded into the Ministry of Information and Communication (MIC). The reorganization was made to allow a single agency to be responsible for separately-handled IT functions and policies and build a more systematic foundation for the IT industry to grow as one of the nation's strategic industries.

The development of the IT sector requires the consistent and consolidated development of different areas: equipment, software and communication network. Up to that point, however, different government agencies had supervised the different areas: equipment by the Ministry of Commerce, Industry and Energy (MCIE), software by the Ministry of Science and Technology (MST) and communication network by the Ministry of Communications (MOC). This resulted in many duplicate and wasteful tasks and policies. Hence, when the government's reshuffling was implemented in December 1994, many IT functions of different agencies were transferred to a single agency, the MIC: the MCIE's functions to foster and support the IT industry, telecommunication equipment industries, multi-media and computers and peripherals industries; the MST's functions to develop and nurture the system development industry, develop and distribute computer systems and protect and develop computer programs; and the Ministry of Information's cable broadcasting-related tasks and permission issuance for cable television operators. As a result, the MIC was positioned to make an accurate analysis of the level of the nation's informatization and the status of the IT industry and better support different IT industries in a more comprehensive and consistent way so that they were able to more flexibly respond to changes at home and abroad.

The Ministry's successful implementation of those challenging functions was largely attributed to the Informatization Promotion Fund. The Fund was set up with the idea that the fund collected from IT operators through different governmental processes, including a new telecommunication operator selection process, needed to be invested into

the IT industry again, and served as the valuable financial source for the government's active investment in IT research and development projects. The Fund enabled the MIC to successfully launch the CDMA and IMT-2000 services and build the world's top class IT infrastructure and make enormous contributions to expediting the IT industry's advancement and enhancing the benefits citizens enjoyed in their daily lives.

3.2. Establishment of Comprehensive Plan for IT Industry Development and 5-year Plan for IT Technology Development

After the MIC was created, the government prepared the Comprehensive Plan for the IT Industry Development in early 1995 to present a vision for the IT industry's future, which was believed to be a highly promising and growing industry for the 21 century, and to make the industry a catalyst for the growth of the national economy, and to build a foundation for the IT industry's advancement so that it would lead production, export and employment in the 21 century. This comprehensive plan included area-specific propositions: expanding the demand base for the IT industry; developing strategic IT technologies; supporting training of professional IT resources; developing small- and medium-sized IT companies; focusing on developing the software industry; building an environment of competition in order to prepare for the upcoming market opening; promoting the satellite communication industry and preparing for the convergence between communication and broadcasting; and expanding the IT industry overseas. The encompassing plan was a meaningful approach in that it presented a mid- and long-term vision for the period from 1996 and 2000 and provided a variety of policy tools for the IT industry to serve as a main engine for the nation to overcome the aftereffect of the 1997 financial crisis.

The 5-year IT Technology Development Plan (2000 - 2004) was designed to prepare a foundation for the implementation of informatization to allow the country to transform

into a creative knowledge nation, and to support the innovation of the industrial structure to prepare for the intended migration to a digital economy. The objective of the plan was to make Korea a winner in the fierce global competition by carrying out comprehensive and strategic technology development throughout the private sector as well as the public sector. Under the plan, policy objectives and visions were identified through an analysis of IT environments and benchmarking of developed nations' IT plans, and 30 task forces were set up, including network, terminal, software contents, parts, source technology, to select promising detailed technologies and projects to help achieve the proposed visions. Through this process, the 6 core business areas were identified: next-generation Internet, optical communication, digital broadcasting, wireless communication, software and computers. Strategic key technologies of each area were also selected. In addition, the key components of IMT-2000, optical devices and display technology, and the basic fields such as photoelectric elements and human interface were designated as the equally important fields.

3.3. Informatization Promotion Fund

The Korean government, with the slogan "We were late in industrialization. But we will lead the information age," built the public consensus on the need for informatization since the 1990s and enacted the Basic Law of Informatization Promotion to pursue an informatization strategy at the national level. It also expanded the Information and Communication Promotion Fund (1993-1995), financed by contributions of tele-communication operators, and changed its name to the Informatization Promotion Fund to financially cover the government's IT initiatives.

The Informatization Promotion Fund consisted of General Account and Research and Development Account, and was used for investments and financing for informatization

and IT-related projects. As large-scale IT projects such as the construction of high-speed Internet networks and the 1st phase of e-Government were completed, which were the objectives of the General Account of the Fund, the title of the Fund was returned to the Information and Communication Promotion Fund to focus on investments into IT research and development initiatives.

〈Table 4－1〉 Purposes and Sources of Informatization Promotion Fund

	Purpose	Source
General Account	- Build high-speed Internet network and promote its utilization - Facilitate informatization in different areas: public, regional and industrial areas - Build a foundation for the growth of the IT industry	- The government's contribution - Profit from the operation of the Fund - Borrowings and other revenue
Research and Development Account	- Develop IT technologies - Nurture skilled IT resources - Develop and distribute IT standards - Build a foundation for IT research	- The government's contribution or loans - Mandatory contribution collected from telecommunication operators - Profit from the operation of the Fund - Borrowings and other revenue

The Fund allowed the government a significant financial flexibility to perform large-scale projects at the national level. As the Fund was designed to support the government's implementation of informatization projects in a comprehensive way, it freed the government from restrictions of budget, timeline and human resources so that it could rapidly reflect changes in technology and environment into its IT projects. The execution of the Fund also led to the development of other related technologies and created new demand for business activities, accelerating the speed of the informatization through society.

More specifically, the Fund, combined with the know-how of developing TDX, ATM and CDMA, and broadband networks, allowed service, infrastructure and manufacturing sectors to jointly develop cutting-edge technologies such as mobile Internet service, called WiBro, and DMB (Digital Media Broadcasting) first in the world, and make them international standards. With this success, Korea gained the upper hand in the global IT market.

The Fund also contributed to a balanced development of different IT industries as it was used to renovate the old performance-oriented research and development system, foster demand-oriented personnel, build an environment for small- and medium-sized IT companies to grow in, and intensively boost IT parts and materials industries and high value-added software industry. It also helped Korea reduce its technological gap with the U.S. from 2.6 years in 2003 to 1.6 years in 2006 with continued investment in research and development of new IT areas of growth. Lastly, the Fund-enabled development of IT technologies made mobile phone and Internet access a part of people's daily lives, enhancing the convenience of their lives.

〈Table 4－2〉 Major Achievements of IT Research and Development Projects

Year	Description of Technology Development	Remark
1994	- Developed medium-sized computers (mainframe computers III) - Developed 256M DRAM	The world's first
1995	- Developed TDX-10, electronic telephone exchanger	
1996	- Developed CDMA digital mobile communication system	The world's first
1998	- Had CDMA technology adopted as international standards - Developed mainframe computers IV	Europe and the U.S.
2000	- Launched synchronous CDMA-1x service	The world's first
2002	- Launched synchronous CDMA-1x EV service	The world's first

Year	Description of Technology Development	Remark
2003	- Developed a terrestrial DMB system	The world's first
2004	- Developed a pilot product of mobile Internet device (WiBro)	The world's first
2005	- WiBro adapted by the Institute of Electrical and Electronics Engineers (IEEE) as global standards - Terrestrial DMB adopted by the European Telecommunications Standards Institute (ETSI) as European standards	IEEE 802.16e
2006	- Developed a server system for a network robot (Ubiquitous Robotic Companion)	The world's first

3.4 Successful Development of CDMA Technology

In 1989, the Ministry of Communications designated the Development of Digital Mobile Communication System as a national project and started to develop CDMA (Code Division Multiple Access) technology. According to this plan, the ETRI signed a contract for technical cooperation with Qualcomm, an American wireless telecommunications research and development company, which had the source technology of CDMA, and launched the development project.

In September 1993, a task force was set up within the Korea Mobile Telecommunications (KMT, now SK Telecom) to accelerate the CDMA development. The equipment manufacturers such as LG, Samsung and Hyundai also joined the project. While those manufacturers were responsible for enhancing the performance of the system, the KMT began to design the telecommunication networks. The CDMA networks were organized based on the forecast statistics of subscribers of different time points and geographical locations. Research was also made to define how to connect this new network to the existing analogue communication networks.

The CDMA service opened on January 3, 1996 in Incheon and Bucheon, first in

Korea. The digital mobile phone service began in all areas of Seoul in April of the same year. Only 9 months after the commercialization of the technology, its nationwide service was provided. Since October 1, 1997, the three mobile communication operators: Korea Telecom Freetel (now KT), LG Telecom and Hansol PCS (now KTF) launched the Personal Communication Service (PCS) with three-digit mobile phone codes of 016, 019 and 018, respectively, ushering in the CDMA era. From this point, the number of mobile phone subscribers began to explosively grow. The number, which amounted to 3.189 million in 1996, almost doubled every year and surpassed 10 million in 1998. Since then the number kept growing to 20 million in 1999 and 30 million in 2002. It recorded 40 million in 2006. As of February 2009, the number was 45.988 million.

The CDMA project is widely regarded as a success. The development of CDMA digital mobile communication system served to protect the local mobile communication market in preparation for the market opening to the world and helped raise the market shares of the local mobile communication systems and terminals in the global markets. The Korean mobile phone producers equipped with the excellent speech quality enabled by the CDMA technology took a fairly large portion of the mobile phone market, which was dominated by American companies, within one year after the CDMA development. According to an ETRI report published in 2002, the local CDMA mobile communication industry maintained a robust average annual growth of 37.2% between 1996 and 2001 and recorded the accumulated production volume of 42 trillion KRW: 28.3 trillion KRW for domestic consumption and $ 11 billion or 13.7 trillion KRW for exports, which made the industry the nation's core IT business. The industry also significantly improved the local technological foundations of the mobile communication business and also strengthened industrial foundations by increasing the localization rate of parts to 70%. The CDMA technology's contribution to the national economy was 125 trillion KRW in triggering the related productions and the creation of 1.42 million jobs during 1996 and 2001. The

economic ripple effect of the CDMA technology helped the nation rapidly recover from the aftermath of the 1997 financial crisis and make a sustainable economic growth again.

There are several success factors behind the CDMA project. Firstly, Korea acquired the technical capabilities to build a large-scale system through the development of TDX exchangers, then identified valuable cutting-edge source technologies and implemented government-led, large-scale projects jointly with foreign partners. Secondly, Korea correctly understood the change in the market environment shifting from analogue mobile communication to digital communication and reflected the change into new policies of technology development, standardization and license issuance in a consistent way. The other factors include the corporate sector's efforts to innovate products, new technology development policy of parts and mobile service operators' subsidy of mobile phones. In summary, the government's accurate assessment of the changing market environment and strong will of implementation translated into consistent and systematic policies of technology development, standardization and issuance of business license.

4. IT 839 Strategy and New IT Strategy in the 2000s

4.1. IT 839 Strategy and Supplementary Measures

The Korean government's national level IT 839 Strategy was designed to foster the evolution of IT technology and to help the nation be reborn as a global leader in future IT technology. The IT 839 strategy is an IT industrial development plan which organically connects together eight services, three infrastructures, and nine new growth engines. By providing Korea with an opportunity to become a leader in the global IT market, this strategy helped to make possible the scrapping of the catch-up development model that had been in place up until that point.

The eight new services consist of DMB and DTV, WiBro, HSDPA, telematics and location based services (LBS) considered to be core services in terms of the recently commercialized convergence of communications and broadcasting, as well as the broadband convergence, u-Home, RFID/USN, and IT services classified as related services. The three infrastructures consist of the BcN (Broadband Convergence Networks) and USN (u-sensor networks) that have become the basis of the ubiquitous environment, and soft infraware (IPv6, Internet Protocol Version 6), the nine new growth engines, which became the technological basis for the eight new services and three infrastructures, were mobile communications/ telematics devices, broadband/home network devices, digital TV/ broadcasting devices, next generation computing/ assistive devices, intelligent robots, RFID/ USN devices, IT SoC/ convergence parts, embedded SW, and digital contents / SW solutions.

While the IT 839 Strategy was rooted in the concept of the IT industry's value chains, it was also a joint development strategy that revolved around nine new growth engines related to IT devices, three infrastructures related to networks, and eight new services related to contents. As such, the IT 839 Strategy can be evaluated as a wide ranging policy strategy that encompassed all the value chains within the IT industry, and as an integrated policy which mutually influenced supply and demand.

The period spanning from the establishment of the IT 839 Strategy in 2004 to the formation of the supplementary strategy called the u-IT 839 Strategy rooted in the u-Korea Policy in 2006 saw Korea achieve outstanding results. These included the development of WiBro and DMB technology, the securing of a leadership role in terms of cutting-edge IT technology through the advent of international standardization, and the establishment of the foundation for the take-off of ubiquitous IT Hubs based on the expansion of the RFID market.

The technological and industrial effects of the IT 839 Strategy included the preemptive

capture of a share of the future technology market, the securing of international technological competitiveness based on the securing of core original technologies, and the discovery of solutions, based on the advent of international standardization, to technological problems that had to be resolved in order to pave the way for the onset of a digital knowledge information society. In addition, Korea secured the capacity to develop the core infrastructure needed to foster new IT growth engines and strategic national industries, and was able to secure global competitiveness through the embedment of IT in traditional industries and the collaborative development of related industrial technologies.

4.2. Dismantling of MIC and New IT Strategy

The Ministry of Information and Communication (MIC) was established in 1994 in order to consolidate the government's IT functions, which were distributed to different agencies such as the Ministry of Science and Technology (MST), the Ministry of Information (MI) and the Ministry of Commerce, Industry and Energy (MCIE), to centrally and intensively support the IT industry to lead the national development, and it played a critical role in making Korea a global IT superpower. However, since IT affected many other industries and the boundary was blurred between IT and non-IT areas, the government's IT-centered policies were no longer effective in supporting the newly emerging convergence trends between different technologies and between different industries, and the creation of new industries. In addition, some of the Ministry's policies were overlapped with those of other agencies, lowering the administrative efficiency. For example, the robot, home network and Telematics businesses of the IT839 strategy were duplicated with the functions of the MCIE, and its digital contents function was overlapped with the Ministry of Culture. Thus, the government decided to close the MIC and assigned its functions into the new organizations created under a reorganization to remove duplicate functions and build a

knowledge-based economy through consolidating Information and Communication Technologies (ICT) and other industrial technologies to bring in new energies to the nation's economy. As a result, the functions to coordinate and supervise informatization efforts, including e-Government project, was assigned to the Ministry of Public Administration and Safety (MOPAS), the implementation of IT infrastructure and related policies to the Korea Communications Commission (KCC), the contents development function to the KCC and the Ministry of Culture and Sports (MCS) and the overall development of the IT industry to the Ministry of Knowledge Economy (MKE).

The fourth stage of Korea's IT policy, which started in 2008 and continues to the present, focuses on three strategies: the convergence of IT with all industries (Convergence IT), the resolution of economic and social problems using IT (Problem Solver IT), and the advancement of core IT industries (Advanced IT).

Inaugurated in accordance with the reorganization of the government structure that took place in February 2008, the Ministry of Knowledge and Economy announced its New IT Strategy in July of that same year. This new policy, which is essentially a new growth strategy for an IT industry whose growth rate has slowed in recent years, is aimed at expanding the scope of national growth engines from the IT sector to all industries. The New IT Strategy was designed to facilitate the implementation of three strategies, namely the Convergence IT, Problem Solver IT, and Advanced IT strategies as part of efforts to achieve the vision of "advancing the industrial structure and resolving social problems through the spread of IT," and create an IT convergence market.

The differences between the New IT Strategy and previous IT policies can be traced back to the fact that while previous IT policies were concentrated on developing the IT industry, the New IT Strategy has as its basic direction the further strengthening of competitiveness through the convergence of the IT industry and traditional industries.

Furthermore, as part of efforts to ensure the sustainable growth of the IT industry, the plan emphasizes the search for sources of growth outside of IT, such as through ties with the manufacturing and services industries, and on the role of IT in resolving socioeconomic problems such as high oil prices and the advent of an aging society.

The New IT Strategy focuses on developing demand for Korea's IT industry in new areas before other countries do so, thereby helping the nation to secure new markets in the future. It also pursues the advancement of the IT industry by strengthening collaboration between private sector corporations, and creating demand as part of efforts to move beyond government-led R&D and the focus on the external spread of the IT industry.

A. Convergence IT

In keeping with the trend towards IT convergence, a trend that has included convergence within the IT industry and convergence between the IT and other industries, the Ministry of Knowledge and Economy has set out to create new markets and bring innovation in terms of the overall productivity of the economy by converging IT with all other industries. The growing focus on integration and convergence has served as the backdrop for the Ministry's decision to implement convergence within the IT industry, and to draw up strategies to foster convergence with the overall manufacturing industry.

The policy measures to facilitate IT convergence with all industries have taken the form of the convergence of IT with Korea's five main industrial sectors (automobile, shipbuilding, defense, medical and construction), the improvement of the working process based on the use of RFID, the introduction of IT in the service industry, and the advent of intelligence in existing industries through the development of embedded software.

B. Problem Solver IT

As part of its efforts to develop IT-based policy measures which can be used to resolve the economic and social problems such as high oil prices and advent of an aging society which Korea finds itself challenged, the Ministry of Knowledge and Economy has promoted the development of the IT industry as a highly energy efficient and environment-friendly industry. To this end, it has improved the energy efficiency of IT products and facilitated the development of the LED industry which has emerged as a new source of lighting in the 21st industry. Second, it has promoted the advancement of the health care and medical fields by introducing IT. Third, it has facilitated IT use in various areas, including intelligent home networks, remote monitoring, and information security.

C. Advanced IT

As part of its efforts to advance Korea's IT industry, the Ministry of Knowledge and Economy plans to, on the one hand, strengthen the competitiveness of the parts and software industries that are widely regarded as some of the weaker sectors, while on the other also doing its utmost to ensure the continued competitiveness of semiconductor and display industries which have exhibited a clear competitive advantage. In addition, there are also plans to bring about the advancement of the IT industry by establishing a virtuous circle of service-terminal-equipment where the broadcasting & communication industry is concerned. The government has established detailed implementation plans to achieve the 200 billion dollars worth of export mark within the IT industry by 2012, and to increase the number of IT industrial sectors earning in excess of 1 billion dollars in exports from 13 to 20.

4.3. New Growth Engine Project

In August 2008, the New Economic Growth Engine Planning Team established under

the auspices of the Ministry of Knowledge and Economy introduced a strategy to bring about the development of traditional industries based on IT convergence.[35] The development strategy has been designed to concentrate on areas for which a clear market demand can be created, that have a great ripple effect, and in which independent investment by the private sector is considered to be difficult.

The end goal is to facilitate industrialization and accelerate the creation of markets through the provision of a total solution that encompasses the development of the core technologies of nine traditional-IT convergence industries and of related industries; the advent of improvements to the institutional structure; the education of human resources; and the ensuring of standardization and certification.

The main focal points of IT-traditional industry convergence (five areas) are as follows:

① IT + Automobile: a new industry which through the creation of cutting edge IT technology-based vehicles helps to improve driving safety and the safety of passengers and pedestrians alike

② IT + Shipbuilding: a new industry that revolves around navigation systems boasting domestically produced equipment and the creation of management services, and

35) The New Economic Growth Engine Planning Team was launched in March 2008 by the incoming government. It has as its main objectives the expansion of the potential for new growth and the search for means to facilitate the rapid transfer to a high value-added industrial structure as part of Korea's attempts to join the group of advanced nations. This entity designed to facilitate the development of the high value added industries that will lead Korea 5-10 years down the road was formed with the private sector as its focal point, a move that was designed to maximize market vitality. Based on a comprehensive consideration of factors such as support for R&D, human resources, and commercialization, the planning team seeks to not only achieve short-term results, but also to in the long-run improve the overall economic structure.

another new industry capable of creating high value-added in the form of the ship electronic equipment system industry

③ IT + Construction: a new integrated management systems industry related to the construction-IT converged technology-based intelligent building lifecycle

④ IT + Textiles: a new IT-converged next generation everyday life textile industry capable of fostering a ubiquitous digital lifestyle

⑤ IT + Home appliances: a future new home appliance industry that incorporates new technologies such as those related to sensibility, real-sense, well-being, and intelligence.

The other strategically important areas in terms of IT-traditional industry convergence that are regarded as having a bright future are (4 areas):

⑥ IT + Defense: a national strategic industry which introduces cutting edge IT technologies to the emerging market for items pertaining to security such as those related to unmanned surveillance and the war on terror.

⑦ IT + Aircraft: a key national industry which makes it possible to establish highly advanced safety navigation management systems and Global Top Air hubs

⑧ IT + Medical: a medical-IT convergence industry that will encompass everything from new bio-convergence chips to optimized medical services

⑨ IT + Education: real-sense media converged learning system industry that is based on innovative user interface

〈Table 4－3〉 The Characteristics of IT Converged Industries and Remaining Tasks

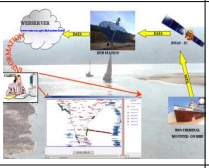
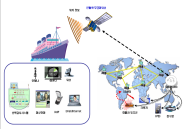
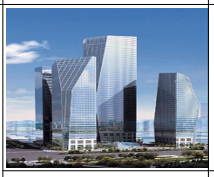
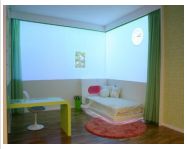
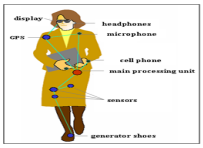
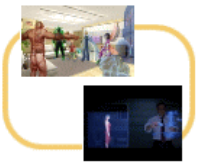
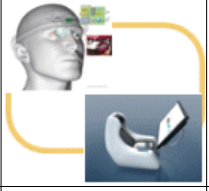
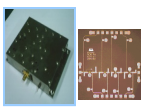
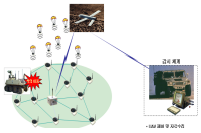
Industry	Characteristics of current industry	Remaining tasks	Concept of convergence
IT + automobile	- Ranked 7th in the world in terms of the production of vehicles in 2006 (3.88 million). However, the high proportion of low-priced automobiles meant that Korea actually ranked 9th in the world in terms of sales	-Need to produce original technologies required to develop high value-added vehicles, such as those related to improving environment-friendly fuel efficiency, core parts, and automotive electronic SW	Safe and convenient vehicle
IT + shipbuilding	- Despite presently being the top shipbuilding country in the world, steps must be taken to prepare for rapid pursuit by other countries such as China	- Localization of shipbuilding and navigation systems and securing of global remote ship maintenance/management systems	Ship navigation management services
IT + construction	- Despite boasting highly-advanced building construction, the country remains weak in terms of its cutting-edge construction design capacity	- Need to secure construction design, energy reduction, environment-friendly, and intelligent construction technology needed to create high value-added and to bring about market expansion	Intelligent Green construction
IT + textiles	- Despite being 5th in the world in textile production, high value-added areas such as design and fashion remain underdeveloped	- Develop responses to the ubiquitous lifestyle such as wearable computers and smart everyday products	IT-Wearable based u-services
IT + home appliances	- Although Korea is tops in terms of its share of the global digital TV market, its dependence on imports from abroad remains very high in terms of core parts and China is rapidly making up ground	- Need to enhance competitiveness in terms of core parts, original technology, and international standardization in order to preemptively occupy the future market for the home appliance convergence industry	Future home appliance convergence based on sensibility, real-sense, and well being

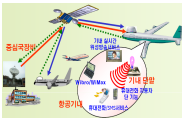
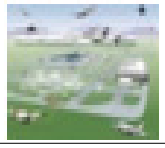
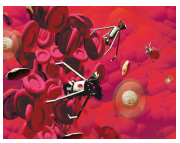
Industry	Characteristics of current industry	Remaining tasks	Concept of convergence
IT + defense	- Industrialization of defense remains rather limited despite huge outlays for defense	- Develop responses to the network-oriented electric management that will prevail in the future electronic environment and bring about robotization	Digital military
IT + aircraft	- The domestic aircraft industry imports the majority of its core parts and original technologies from abroad	- Need to establish production facility, radar, controlled flight, and flight management systems	Safe and convenient aircraft flight
IT + medical	- Medical industry remains at the initial development level in terms of such endeavors as clinic informatization and u-health	- Develop responses to the changing paradigm characterized by the advent of an aging society, reduction of medical expenses, and early diagnosis of diseases	u-health care
IT + education	- Lack of structured development in terms of resolving the issues related to the reducing of private educational expenditures and increasing the online educational market	- Need to create markets through the development of learning systems based on the explosive demand for u-learning	Real-sense convergence learning system

Source: New Economic Growth Engine Planning Team (2008)

〈Table 4－4〉 IT-traditional Industries Convergence Milestones

Industry	2010	2013	2015	2018
IT + automobiles				
	Individual sensor based adaptive IT vehicles	Multifunctional/ communication based adaptive IT vehicles	Environment-friendly autonomous IT vehicles	Situation awareness based autonomous IT vehicles

Industry	2010	2013	2015	2018
IT + shipbuilding				
	Maritime mobile/satellite communication	Real-time navigation monitoring	Ship communication network system	Intelligent remote maintenance/ management system
IT + construction				
	Intelligent construction	Smart city	Smart homeland	Human-oriented sensibility based home environment
IT + textiles				
	Digital-based mobile electronic agent system	Electronic textile-based wearable electronic assistant system	SoT(System-on-Textile) computers	SoT based u-health, u-life service platform
IT + home appliances				
	User-aware converged home appliances	User-aware real-sense home appliances	User-aware sensibility based home appliances	Human-oriented sensibility based home appliance integrated services
IT + defense				

Industry	2010	2013	2015	2018
T/R module core element	Small-sized sensor nodes, autonomous sensor networks	Mobile-equipped satellite transmission systems, vehicle-equipped broadband active antenna	Unmanned aerial platform wireless communication / wireless application based payload and terminal devices	
IT + aircraft			 	
Urban information generation/ recognition system	In-aircraft real-time communication/broadcasting transmission system	Air traffic monitoring/ air traffic control system	Next generation free flight system	
Visual design system	Real-time THz quality management system	Compound parts assembly control system	tracking/genealogy management technology	
IT + medical				
Cutting edge u-Health wear	Well-being smart house	Converged /therapy System	Surgery nano bio robotic system	
IT + education				
	on/offline learning contents integrated platform	on/offline learning contents integrated learning system	Real-sense media converged learning contents platform	Real-sense media converged learning system

Source: New Economic Growth Engine Planning Team (2008b)

In September 2008, the New Economic Growth Engine Planning Team introduced visions and development strategies for 22 new growth engines in six industrial areas. These areas included energy, the environment, converged new industries, and the knowledge services field that includes cultural contents.

The New Economic Growth Engine Planning Team introduced IT convergence systems as a representative field of the "New IT" that can be used to heighten the value-added of traditional industries through the advent of convergence between such traditional industries and the IT industry. While the ratio of IT use within the main traditional industries such as automobiles, shipbuilding, and construction has gradually increased and the importance of IT as a tool with which to heighten the value-added of an industry has increasingly been recognized, Korea's IT convergence technology remains at the initial stage, a situation that is symbolized by the fact that its cutting edge technologies have been estimated to be only at about 50-80% of the level of those of the advanced countries.

To rectify this situation, the government plans to invest about 1.3 trillion won over the next five years in three areas (institutional improvement, R&D, and market creation), with the end goal being that of transforming Korea into the No. 1 power in terms of IT convergence technology by 2018.

〈Table 4－5〉 Establishment of an IT Convergence System

Policy tool	Tasks
Institutional improvement	Establishment of vehicle safety related frequency technology standards, Strengthening of energy reduction/environment-friendly green construction-IT convergence legal institutions, Amendment of the Medical Act to pave the way for the advent of a remote medical system
R&D	Development of convergence technology
Market creation	Introduction and activation of 'traditional industries + IT innovation center'
	Employ the traditional industries + IT convergence technology and implement pilot projects

Source: New Economic Growth Engine Planning Team (2008a)

5. Research and Development in the ICT Sector

5.1. ICT R&D Support Programs in Korea[36)]

Research and development in ICT has been one of the key factors contributing to the growth of the ICT sector in Korea. Keeping pace with technological change to remain globally competitive, the Korea's ICT sector has continuously increased investment in R&D.

Although major parts of R&D in ICT have been financed and performed by private businesses, the Korean government has also taken an important part of R&D for ensuring sustainable economic growth and improvements in living standards. Recognizing economic benefit of ICT, the Korean government has actively involved in major R&D projects such as TDX and CDMA.

Creating job opportunities and securing the long-term economic growth, the Korean government has promoted R&D activities in ICT. In particular, the Korean government has strategically designed and implemented various R&D programs since the Informatization Promotion Fund was established in 1997.

The R&D programs funded by MIC consisted of three major ones: a leading technology development program supporting strategic R&D which requires long-term R&D efforts; an industrial competitiveness development program which promotes R&D in competitive technologies with a high potential for commercialization in the short-run; and a new technology support program which mainly focuses on the development of new information technologies in the small and medium-sized enterprises (SMEs).

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36) Hong, Dongpyo, Sangwon Ko, and Alexey Volynets(2007).

A. The Leading Technology Development Program

The leading technology development program is designed to carry out the development of advanced information technologies in a mid- and long-term perspective. Based on market surveys and analyses of recent technological changes, the Korean government identified core research areas such as next generation mobile communications, digital TV/broad-casting, optical subscriber networking, and embedded software. In general, most of R&D resources for the leading technology development are given to government research institutes.

B. The Industrial Competitiveness Development Program

The industrial competitiveness development program provides financial assistance to private ICT firms focused on the development of applied technologies which can be commercialized within a short period of time. Based on the careful evaluation of proposals submitted by applicant firms, the government supports 50 percent of the total R&D cost up to 2billion won. The government also utilized the industrial competitive development program in order to promote joint R&D project performed by both public research institutes and private companies. If technology being developed at public research institutes is highly demanded on the market, the government assists private firms to participated in the R&D project.

C. The new technology support program

The new technology support program intended to help new and young SMEs in the ICT sector. Equipped with innovative ideas and patents, the firms less than three years old may participate in the program. If the technology development supported by the program is successful, the new technology support prgram also provides management assistance as well as seeks for investors to help bring the products or services to its full market potential.

5.2 Evaluation of Korea ICT R&D Program

By using firm-level panel data, Ko and Kwon(2005) empirically tested whether government R&D subsidies crowd out private R&D or not. By using a fixed effect model and a difference-in-differences (DID) model, we found that government R&D subsidies have crowded out private R&D. The research estimated the extent of "crowding out" by period, firm size and industry. The result showed that the crowding-out effect is greater since the financial crisis, in small- and medium-sized enterprises, and in the IT sector. 〈Table 4－6〉 shows the empirical results that supports the crowding out of public R&D subsidy.

The research suggested that it is not desirable that public subsidies for R&D are concentrated on certain periods or industries because it would result in greater crowding out of private R&D investments.

〈Table 4－6〉 Crowding out of Private R&D in IT industry: Before and after Asian Financial Crisis (fixed effects model)

	1995~1997		1999~2002	
	(1)	(2)	(3)	(4)
constant	3.161*** (0.508)	3.031*** (0.510)	4.909*** (0.174)	4.762*** (0.017)
D	－0.155*** (0.039)		－0.205*** (0.029)	
log(GOS)		－0.008*** (0.002)		－0.0107*** (0.0015)
log(Sales)	0.125*** (0.038)	0.126*** (0.038)	0.0064 (0.010)	0.0063 (0.001)
log(# of employees)	0.386*** (0.070)	0.388*** (0.070)	0.329*** (0.031)	0.329*** (0.031)
EBITDA	0.00007 (0.00017)	0.00008 (0.00017)	-0.00006 (0.00011)	-0.00007 (0.00011)
R2	0.49	0.49	0.32	0.31
# of firms observed	1,604	1,604	3,536	3,536
# of observation	3,610	3,610	7,489	7,489

***: P<0.01, **:P<0.05, *:P<0.1

Source: Ko Sangwon and Namhoon Kwon(2005)

Kim Jeong-Eon et al.(2007) investigated to what extent R&D investment in the ICT sector has contributed to the productivity improvement in other industries. Time series data for a period 1990-2005 of Mining and Manufacturing Statistics published by Statistics Korea were used.

To understand whether R&D investment in the ICT sector gave rise to productivity growth in individual industries, Kim Jeong-Eon et al. (2007) used a production function that regard technological progress as an exogenous process[37].

$$Y_{it} = F(L_{it}, K_{it})A^{spillover}$$

In this equation, Y_{it} represents measured value-added for industry i for year t, and L_{it}, K_{it} are both production elements, respectively representing total employment and capital stock. F(•) reflects the production function, representing the level of technologies of an industry. $A^{spillover}$ is an indicator of spillover effects of R&D investment in the ICT sector[38].

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37) Specifically, this production function is derived as follows. First, a generally used production function is defined as $Y_{it} = F(L_{it}, K_{it})A^{spillover}$ and converted using a log transformation to get the estimation equation as shown below.

38) The backward linkage effect variable can be represented as,

$$A_{it} = \frac{\alpha_{it}^{j}}{\sum \alpha_{it}} RD_{jt}$$

Here, α_{it}^{j} represents inputs flown in from the ICT sector j to industry i, and $\sum \alpha_{it}$ represents gross output in industry I. Therefore, $\frac{\alpha_{it}^{j}}{\sum \alpha_{it}}$ is the input coefficient representing the share of the input in the ICT sector to gross input in industry i. Such cross-sectoral spillovers are defined as backward linkage effects. Therefore, the more $\frac{\alpha_{it}^{j}}{\sum \alpha_{it}}$ value, the higher use of ICTs in the respective industry. RD_{jt} represents investment in R&D in the ICT sector.

The table here shows the estimation of spillovers of R&D investment in the ICT sector. To begin with, the spillovers are estimated across all industries and for the whole period analyzed. [1] and [2] of the table show that R&D investment in the ICT sector has positive effects on productivity growth in other industries. Both random effects and fixed effects show similar results, confirming the robustness of the estimation result. The estimated coefficent α_4 that estimates effects of R&D investment in the ICT sector on productivity in other industries is found as being positive and statistically significant. When R&D investment in the ICT sector increases by 1%, other industries are found to grow by 0.07 to 0.08%.

Effects of R&D investment in the ICT sector on productivity in individual industries may vary depending on the measured period, which is especially the case in Korea where the effects are likely to differ significantly before and after the currency crisis. For this reason, two estimations were made for two periods: one before the currency crisis and another one after the currency crisis. [3] and [4] in the table show estimation results for a period 1990-1997, before the currency crisis, and [5] and [6] are estimation results for a period 1998-2005, after the currency crisis.

Both estimation results showed statistically significant spillover effects with positive values. For a period 1990-1997, when R&D investment in the ICT sector increased by 1%, other industries grew by about 0.13 to 0.22%. However, for a period 1998-2005, when R&D investment in the ICT sector increased by 1%, other industries grew by about 0.05%. This indicates that the spillover effects declined after the currency crisis.

〈Table 4－7〉 Estimated Spillover Effects of R&D Investment in the ICT Sector: on all Industries

	1	2	3	4	5	6
Labor	0.570 (0.041)*	0.673 (0.042)*	0.361 (0.067)*	0.621 (0.078)*	0.506 (0.081)*	0.905 (0.105)*
Capital stock	0.369 (0.044)*	0.377 (0.045)*	0.473 (0.068)*	0.367 (0.079)*	0.255 (0.084)*	0.028 (0.107)
Spillover effects of R&D investment	0.068 (0.012)*	0.076 (0.012)*	0.128 (0.038)*	0.220 (0.046)*	0.054 (0.017)*	0.052 (0.016)*
Number of data	252	252	108	108	144	144
R^2	0.66	0.64	0.67	0.58	0.67	0.50

Note: 1) 1 is the estimation result using the random effect model for a period 1990-2005
2 is the estimation result using the fixed effect model for a period 1990-2005
3 is the estimation result using the random effect model for a period 1990-1997
4 is the estimation result using the fixed effect model for a period 1990-1997
5 is the estimation result using the random effect model for a period 1998-2005
6 is the estimation result using the fixed effect model for a period 1998-2005
2) Coefficient statistically significant at the 5% level of significance are marked *
3) Numbers in parentheses are standard errors of each estimated coefficient

6. ICT Human Resource Development

In a knowledge-based economy, where a country's competitiveness depends on its ability to create, utilize and distribute knowledge, more emphasis is put on the accumulation of knowledge or information rather than on the growth led by input of production factors. Inparticular, it is increasingly necessary to acquire knowledge by prior occupation since the law of increasing returns is applicable: the more knowledge accumulates, the easier the creation of new knowledge. For this reason, the Organization of Economic Development and Cooperation (OECD) recognizes human resources development as one of the four main

elements for a knowledge-based economy together with economic & institutional system, information technology (IT), and national innovation system (NIS). The OECD, in particular, in its analysis, recognizes that education and training play a crucial role in developing human resources and building a national innovation system.

Human resources is one of the most crucial production factors that determine abilities to create and utilize knowledge, and bring about innovation. As the nurturing and acquiring of qualitative human resources emerge in a list of priorities to gain competitiveness, major countries reinforce human resources development plans. In this context, the EU set up an increase in human resources investment through more rigorous education and technology training as one of the ten action plans in the Renewed Lisbon Strategy 2005. Similarly, the US suggested investment in human resources as one of the three main policy tasks in Innovative America, 2004.

The Korean government also puts the development of human resources on the top of list of policy agenda. In addition to that, Korean economy has pushed the nurturing of IT industry and the utilization of IT as main strategies for economic growth. Against this backdrop, the Korean government has executed policies in a systematic manner that secures IT talents and efficiently utilizes them to bring about continuous technological innovations and encourage a wide utilization of IT.

6.1 Evolution of Korean IT human resources development policy

Korea's IT human resources development (HRD) policy has been focused on securing the quantitative supply base of IT human resources through an increase in IT departments in college and expansion of job transitional education, for instance. As a result, college graduates with IT degrees account for 47% of the entire engineering college graduates as of 2009. The IT human resources development program undertaken from 1997 has gone through three phases: the foundation phase, the expansion phase, and the practice & job

skills expansion phase, transforming the nature of the program from supply-based to demand-based, from quantitative to qualitative, and from domestic-oriented to global-oriented.

In the period of expansion of base from 1997 to 2000, efforts were focused on quantitative expansion of IT workforce, for example, the establishment of ICT-relevant facilities and infrastructure in conformity with the growth of IT industry.

Examples of main policies, then, include the development of subjects, dissemination of main computers, assistance to information and communication-relevant academic researches, informatization education by field, etc., and the establishment of information and communication universities and graduate schools in 1998 etc. With rapid growth of IT industry thereafter budgets were mainly allocated on expanding the foundation for quantitative expansion of IT workforce and for fostering high-qualify IT brains from 2001 to 2003, with a goal of continuous improvement of IC education environment. For example, the increase of prescribed number of students at IT departments at universities, the establishment of ICU departments, fostering and supporting IT research centers at universities, increased assistance to IT technology specialist education, and supports to short-term education for new technologies, such as information protection etc. With the adoption of the SCM model beginning from 2004, efforts were focused on I) continuous assistance to IT research centers at universities striving to foster IT specialist resources to meet the demand-oriented industrial needs; 2) attracting greater numbers of foreign students; and 3) expansion of continuous education for industrial human forces, etc. In short, the undertaking of IT human resources development has evolved and kept abreast of internal and external, economic and policy environments such as changes of industrial labor demand and technological advancement, etc.

As illustrated in the table below, significant budget has been allocated to the IT HRD policy, especially in the early 2000s when the scale of the program significantly increased with the sudden expansion of the ICT Promotion Fund, the funding source for the IT

HRD program. Assistance to workers and the people of neglected classes remained at high-level in the period between foreign exchange crisis and 2002, and fell sharply after 2003. However, in recent times, as technology life-span shortens on a continuous basis workers prefer to take continuous education or re-training. For this reason, a recent trend is to expand the re-training of new IT technology and field-oriented re-training to meet the demand of IT technology. To be specific, in terms of re-training demands, workers at large corporations prefer continuous training revolving around a degree and comparatively, those at small and medium-sized companies rather prefer to take short-term courses. Therefore, short-term and mid- and long-term courses are being appropriately adjusted.

〈Table 4－8〉 Investment Size of IT HRD Program by Year

(Unit: KRW100 million)

Description	97	98	99	00	01	02	03	04	05	06	07	08	09
Support for colleges	464	547	400	379	2,026	805	856	460	439	402	361	313	339
Support for graduate schools	-	65	198	130	437	410	772	723	565	564	517	496	441
Support for workers	88	294	115	52	630	617	131	107	74	169	180	169	44
Support for the underprivileged	-	105	117	129	1,218	724	50	15	-	-	-	-	-
Total	552	1,010	830	690	4,311	2,556	1,809	1,305	1,078	1,145	1,063	978	824

It is true that the IT HRD policy has produced some positive outcomes with continued quality improvement. According to the survey conducted by the Ministry of Knowledge Economy, currently in charge of the IT HRD policy, the job performance ability of IT workforce is about 10 scores higher than that of the general workforce, with the period required for adaptation to work shorter by 3-4 months. The policy also

significantly contributed to reducing the shortage of highly-educated/skilled resources for SMEs to some degree. For instance, 28% of IT personnel were employed by SMEs during 2005-2008. Furthermore, as part of the HRD program, an international convention (the Seoul Accord) on ICT engineering education certification was launched in December 2008, led by Korea, and joined by the US, the UK, Japan, Canada, and Australia, among others. This accord has greatly contributed to raising the status of Korea as IT Korea and introducing advanced curriculums to satisfy demand.

6.2 Basic direction of Korean IT human resources development

Development of Korean IT human resources has been pushed forward in a virtuous circle through: i) the establishment of IT infrastructure for human resources development; ii) the increased production of IT human resources by regular educational institutions; iii) the re-education of IT workforce; iv) the offering of informatization education to the entire population of the nation; and v) the regular estimation of supply and demand prospects, the improvement of IT-relevant certificate systems, and the expansion and increase of institutional framework, etc.

A. Establishment of IT infrastructure for human resources development

Korea pushed policies putting a priority on enabling seamless utilization of computers and internet at all schools. The first Comprehensive Plan for Education Informatization, embarked upon from 1997, with a goal of establishing basic infrastructure that enables every student at elementary and secondary schools to smoothly utilize computers and internet, was completed two years earlier than planned at the end of 2000. Thanks to the Level 1 Plan, for the first time in the world, in-school computer networks were constructed and connected to the internet at all elementary and secondary schools, totaling 10,000 schools in number across the nation, and a total of 13,000 computer skill practice rooms were established and equipped. Moreover, multimedia equipment including PCs are

provided to general classrooms numbering 214,000 and the entire population of schoolteachers, all of 340,000, are provided with individual PCs, one PC per head, completing the build-up of basic infrastructure for education informatization. As a result, it became a breakthrough project where schoolteachers can utilize the internet in teaching in a proactive manner and students can develop, in their own initiatives, learning abilities and exploratory learning attitudes.[39)]

Thereafter, the second Comprehensive Plan for Education Informatization was developed and pushed in the period from 2001 to 2005. The Plan had three-fold goals: i) the establishment of ICT environment with a goal of 1 PC per 5 students; ii) achieving diversity, such as “computer practice rooms,” “classrooms exclusively reserve by subject,” and “classrooms for small group-based learning,”; iii) providing assistance to ensure internet communication speed of at least two mbps or faster; and iv) creating an informatization environment to maximize ICT utilization education under the 7th Education Curriculum. Since then, the undertaking of education informatization focused its supporting efforts to software-dependent capabilities, especially, in elementary and secondary education areas, assisting schoolteachers and students in developing ICT utilization capabilities, assisting the development of ICT-based education content, assisting schoolteachers in developing information utilization capabilities, and providing support to ICT-based education etc.

The Korean government, in its effort to improve public officials' information utilization capabilities and to raise awareness thereof, has implemented informatization education for public officials beginning from the 1980s. In particular, the government formulated and implemented “the 5-year plan for rigorous informatization education” from 2000 and as a result, public officials totalling 2.11 million were trained and equipped with basic

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39) The Ministry of Education and Human Resources (2003), The White Paper on Education Informatization

informatization capabilities up until 2005. In addition, the government developed and launched "the informatization human resources development plan for the government innovation and for the closer linkage to e-government" beginning from 2005 in order to run a mature e-government and to attain higher utilization rates of e-government. This plan systematized education courses in eight areas such as IT planning, EA, quality & standardization, security technology & management, network, database, project management, application & system, etc. in liaison with core competencies required for performing informatization duties, currently running systematic education courses tailored to the level of trainees by dividing education courses into three levels, ie., general, core, advanced levels, and by closely integrating preceding and ensuing education courses, in order to provide differentiated programs by the level of public officials.[40)]

With regard to informatization education for public officials, intensive education courses led by the Ministry of Public Administration and Security are conducted for the Level 4 or higher ranking public officials exposed to difficulties in participating in education courses due to the characteristics of their duties and also, for other types of public officials in charge of informatization duties, requiring advanced education of specialist skills. With regard to working-level public officials with Level 5 or lower, those officials are offered with in-house education and informatization education courses at various educational institutions in consideration of the characteristics of their duties as government workers.

B. Increased production of IT human resources by regular educational institutions

The Korean government has made continuous efforts to meet the labor demand in line with the development in IT industry and to secure core human resources leading IT industry.

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40) The Ministry of Public Administration and Security, The 2005 White Paper on Public Administration and Security, The 2008 White Paper on Public Administration and Security

With regard to the IT specialist resources development plan, assisting efforts to regular educational institutions' IT human resources development is divided into the basic IT human resources development plan and the high quality/high skilled human resources development plan. First, the basic IT human resources development plan is further divided into: 1) supports to secure more ICT professors, which facilitates the employment as professors of IT specialists with ample field experiences in industries and research fields; 2) overhauling curriculums at IT-relevant departments by reflecting industrial needs; and 3) supports for expanding education facilities and equipment, which enables the introduction of IT-linked programs at non-IT departments. In the course of selecting regular educational institutions benefiting from such plans explained above, select and focus strategies were adopted under which an exemplary or model schools were designated as such and provided with intensive supports. Note that omni-directional supports were provided to university, junior college, vocational high school at the initial stage of informatization. However, as the demand for ITC human resources became more sophisticated, supporting efforts, through reorganization, were focused mainly to higher educational institutions.

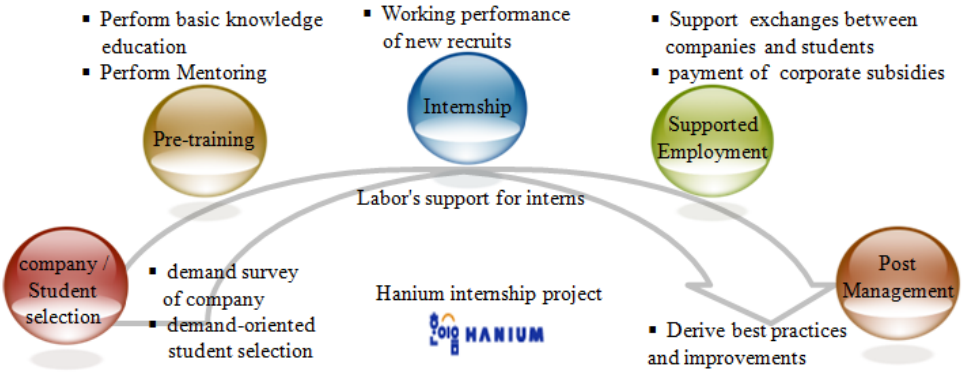
In comparison with the basic IT human resources development plan, the high quality/high skilled human resources development plan is categorized into: 1) the research-specific human resources development plan, which mainly produces high-quality workforce capable of organizing research competences concentrated at universities, developing leading IT technologies and performing projects; and 2) the global IT specialist resources development plan, which includes supporting the training of university (or graduate school) students at outstanding IT educational institutions abroad, and supporting the overseas training after acquiring a domestic doctorate degree. Furthermore, the research-specific human resources development plan was pushed forward through the IT Research Center (ITRC) project. Once selected for ITRC project, it enables a long-term research with the provision of an annual 8 billion won in research expenses for eight years. The number of ITRC grew

to 50 in 2007 from 32 in 2002 and especially, the focused supports to IT839 and convergence technology-relevant areas linked the research & development in growth driving areas with the human resources development thereof.

Moreover, the global IT specialist resources development plan is a scholarship project assisting domestic talents to acquire IT-relevant master's degree or doctorate degree at outstanding educational institutions abroad. Annually, 300 quality human resources, approximately, benefitted from this plan in 2000. After then, however, after then, this plan was converted to assist domestic graduate schools to attract outstanding foreign human resources studying in Korea for masters' and doctorate courses, thus, raising global competitiveness of domestic education environment and to build Korea-friendly IT human resources network with understanding of and in favor of Korea.

The Supply Chain Management (SCM) model was adopted in 2003 to the undertaking of IT human resources development plan and the policy direction of the IT human resources development undertaking became quality-oriented and demand-oriented, moving toward the establishment of efficient IT workforce supply and demand structure. The adoption of SCM model to the IT human resources development plan signifies the resolution of qualitative mismatches between education and labor market by integrating, organically, industry-academia linkage regarding the supply and demand of IT human resources. In short, the essence of the SCM model is the creation of a systematic mechanism in which, industries, as user of labor, provide the technology requirements required on human resources to regular educational institutions, supplier of human resources, and in turn, such technology requirements are properly reflected to educational curriculums. Subsequently, industries hire, on a priority basis, human resources produced in conformity with those requirements. Recently, the Hanium website is connecting corporations with educational scenes at individual and institutional levels through and in combination with mentoring and internship.

〔Figure 4－1〕 Application of SCM Model: Hanium Internship Project



The SCM human resources development project was reformed and reinforced to the Nurturing Excellent Engineers in Information Technology (NEXT) in 2006. NEXT is designed to help universities analyze its competitiveness on its own initiative, formulate improvement plans, reform curriculums and expand internships and the size of professors, thus, improving educational conditions. In a nutshell, NEXT is an advanced form of governmental support, since universities are granted with autonomy to select fields as needed to receive governmental assistance.

In addition to NEXT, Korea guided universities to attain an accreditation on engineering education in an attempt to strengthen its global competitiveness in university education on IT fields. With a goal to facilitate the development of engineering education and produce international technical/engineering human resources, the accreditation system on engineering education offers criteria and guidelines for engineering education programs, and provides the evaluation, certification and advice regarding the fulfillment of educational goals by subject and the academic achievements by graduates. Korea became a member of the Washington Accord running to ensure international equivalence of engineering education and currently, the US, the UK, Japan etc. are members of the Washington Accord.

However, the existing accreditation system for engineering education, ie. Washington Accord, was not appropriate for IT fields considering the relatively short academic history of computer science as an origin of IT fields, and the classification of IT fields as natural science. For that reason, there was an increasing need for a new accreditation system. Against this backdrop, Korea took an initiative in creating an international standardization in engineering education on IT fields and brought up the need to promote the exchanges of IT human resources between countries. Korea, officially, announced the Seoul Accord in December 2008.

〈Table 4－9〉 Seoul Accord Members & Accreditation Institutions

Members	Certificate Institutions
Korea	ABEEK (Accreditation Board for Engineering Education of Korea)
the US	ABET (Accreditation Board for Engineering and Technology)
Japan	JABEE (Japan Accreditation Board for Engineering Education)
the UK	BCS (the British Computer Society)
Canada	CIPS (Canadian Information Processing Society)
Australia	ACS (Australian Computer Society)

With the Seoul Accord becoming effective, it established an international standard for engineering education in IT fields, running an international agreement framework. Consequently, the Seoul Accord will ensure the equivalence of IT educations among countries and encourage the IT human resources development in conformity with industrial demands, by reflecting the industrial needs to educational curriculums of IT-relevant studies at Korean universities.

C. Re-education of IT human resources

IT technologies change swiftly and require different skills sector by sector. For this reason, it seems difficult in many occasions to replace one IT technology with another by skill or academic level. With such technological changes, the cycle of rise and fall of occupations

have shortened, working as a factor that disintegrates the concept of lifetime employment and even lifetime occupation. Moreover, as the amount of knowledge and information grows explosively even in the same technology, continuous re-education and life-long learning become increasingly more important. Therefore, it is increasingly necessary to provide IT human resources with the incentives for self ability development across a person's entire life cycle, to tide over technological innovation cycles and secure core professional resources. Support for re-education programs can be a main method to attract human resources into IT field.

The Korean government's support to re-education of IT human resources was in the form of specialized education with regard to certain IT fields with rising labor demand, or in the form of conversion education that retrains the unemployed or non-IT workers. In particular, relatively larger amount of budgets was allocated to re-education in the period between 1998 and 2002 when the IMF crisis shook the Korean economy. A prime example of the government efforts to reinforce the re-training is the designation of an outstanding private educational institution as MIC IT Academy, assisting the purchasing of facilities and equipment. The government also induced the unemployed youth with high academic achievements to employment at ICT fields, by using designated institutions and by supporting the expenses of ICT specialist education. A voucher system is another form of assistance to private education consumers. Under the system, a private institution offers a voucher to the unemployed who desire to take a course and in turn, the employed select education courses as desired. This system has a purpose of raising competition among private institutions and thus, improving the quality of education. In addition to the voucher system, Information & Communications Cyber University was established, offering, through the internet, education courses regarding information protection and e-commerce, etc. which are in sharp demand. To this end, assistance was provided to the development of a number of cyber education programs.

Specialized Professional Education Program with regard to hot skills, in sharp demand, was run on a continuous basis. By contrast, the content of Specialized Professional Education Program concerning ASIC, JAVA, RF design, IT SoC, etc. have changed in conformity with demand. Assistance to education for hot skills was run through a subsidy of education and training expenses, in particular, in a way that minimizes expenses incurred on a worker under training in liaison with unemployment insurance. Moreover, re-training programs were operated to foster industrial human resources in digital content and game industry and other types of education to specialist resources were offered with regard to E-Book, intelligence property right in internet, wireless content, etc.

D. Providing informatization education to the entire nation.

Internet PC was first disseminated in 1999 and the population of internet users has exceeded 10 million people. Since then, as the population of internet super-highway users grew exponentially, the interest about digital divide came up at the front of national policy-making. According to the 1999 survey on informatization by social stratum, those in farming and fisheries, housewives and the disabled showed comparatively low informatization levels in most surveys, such as in the utilization rates of computer & internet, completion rates of informatization education, etc. The gap between these people and those in other social strata such as students, public officials etc. seemed widening. Noticeably, the lower the level of informatization, the lower the desire to take informatization education, and as a result, the digital divide, was, presumably, expected to become wider. In response thereto, the Korean government formulated “the Informatization Education Plan for 10 Million People” at a cabinet meeting in June 2000 and intensively conducted the informatization education for the entire nation including strata of neglected people from information.

Informatizatoin education was conducted in collaboration with ten government Ministries

and Agencies, including the Ministry of Information and Communications, and as a result of joint efforts, a total of 13.8 million people benefitted in the period between 2000 and June 2002 from opportunities of informaitization education, specifically, ranging from classes of people neglected from information due to social and economic conditions, for example, the disabled, the elderly, housewives, etc. even to classes of students, public officials, servicemen, etc. who are leading the informatization trend, with great ripple effects on informatization. The Informatization Education Plan for 10 Million People is evaluated as having substantially contributed to the expansion of information infrastructure, for example, the construction of information super-highway network etc., with an aim of eliminating the computer-illiterate and promoting the people's abilities to utilize information, and the creation of foundational informatization demand, for example, the sharp increase of internet users, growth of IT-relevant industries, etc., facilitating the national and social informatization.

〈Table 4－10〉 Outcome of 10 Million People Informatization Education

(unit: thousand)

Trainee	Goal	Actual	Trainee	Goal	Actual
disabled	207	101	workers	1,500	1,435
farmers	171	129	servicemen	740	623
fishermen	20	16	public officials	510	510
the elderly	171	443	schoolteachers	615	1,109
housewives	2,000	434	students	3,364	3,373
juvenile offenders & inmates	32	120	employees at public companies	200	153
local residents	1,600	5,359	total	11,130	13,850

Source: Information & Culture Center (2002)

E. Establishment of Institutional framework for IT human resources development

To formulate the policy for the IT human resources development, it is crucial to have

statistics concerning supply and demand of IT human resources. In particular, considering that a substantial amount of time is required to foster an IT workforce, the future outlook is more important than current supply and demand numbers. In addition, various information with regard to labor and education markets on IT workforce has to be provided, accurately and promptly, to education consumers and to companies as a hiring party, in order to facilitate smooth mobility and utilization of IT workforce. It is a prerequisite to have reliable surveys on labor supply and demand and future outlook thereof, before the government formulates the IT human resources development policy to meet the industrial needs and before universities, with autonomy, adjust the fixed number of students. While surveying the supply and demand prospects of IT workforce, and realties of utilization thereof, the Korean government has continuously provided support to foundational researches and surveys, necessary for pushing the IT human resources development policy, for example, systematic career paths management for the workforce turned out from the human resources development plan, the establishment of university IT competitiveness evaluation system, etc.

6.3. Korean IT human resources development policy in the future

The objective of Korea's IT professional resources development policy is to resolve the quantitative and qualitative mismatch of demand and supply in IT professional resources and bring about the knowledge-based economy. The IT professional human resources development policy has been changing with shifts in the relevant policy environments. From 1997 to 1999, the focus of the policy was on expanding the infrastructure to improve the IT educational environment. From 2000 to 2002, increasing the size of human resources was pushed for to ease the supply shortage of IT human resources. After 2003, the policy focused on improving the quality of IT human resources. Investment in developing human resources has been increasing according to the policy since 2003, which will lead to the next generation new growth engine businesses. Introduction of the SCM (Supply Chain Management) to

the education curriculum was also done, with the implementation of the global talent development program since 2003 to nurture practical job capabilities and global capabilities.

That is, since 2003, the IT human resources development policy has changed from quantitative expansion to qualitative improvement, from supply-centered to demand-centered, from domestic market-oriented to global market-oriented, and from the metropolitan area to balanced regional development. The policy focuses on developing the human resources in key IT areas while increasing the support for high quality human resources in order to move from quantitative expansion to qualitative improvement. To migrate from supply-oriented to demand-oriented, it introduced the supply chain management concept to the human resources development and revised the curriculum of the education courses in consideration of the industry demand, systemizing the collaborative efforts and resource utilization between the industry, academia and research institutes. The policy also continues to support overseas exchange programs with the expansion of exchanging and using the IT human resources from other nations to develop globalized IT professional resources equipped with foreign language skills and international perspectives as well as IT competencies. The policy focuses on developing high quality IT resources for seamless implementation of new growth engine businesses in the mid- and long-term, with intensive investment made in developing the IT human resources to meet the industry demand through the SCM. In addition, the government is preparing a policy to improve and expand the IT statistical infrastructure to resolve the qualitative IT human resources imbalance based on the improved data linkage between the labor market and education, in cooperation with the users by making them participate in education and training.

The direction of the IT human resources development policy was changed in 2009 to respond to the future demand more aggressively. Under the new direction, the government has plans to develop 35,000 basic human resources customized for corporate needs, 4,000 high-quality IT human resources and 2,000 high-quality convergence human resources by

investing a total of KRW401.1 billion from 2009 to 2013. The new plan aims to ease the imbalance in the IT labor market by expanding the support to graduate schools, and establishing creative software research courses, and so on. In implementing the plan, support for graduate schools will be expanded from 49% in 2009 to 67% by 2013. Considering the reality of the IT labor market where college graduates are in surplus while the Masters and Ph.Ds are in shortage, support for colleges will be significantly reduced from 38% to 5%. In terms of amount, the government's support for the IT human resources development will be reduced from KRW34.35 billion for colleges, and KRW40.45 billion for graduate schools in 2009, to KRW4.3 billion for colleges and KRW56.7 billion for graduate schools by 2013. Also, to increase the supply of Master and Ph.D resources in the software sector, a new project, called “SW Creative Research Course,” will be created. When a graduate school student proposes a small-scale research project, and a company decides to select it for execution, the student and the company will jointly work on the project. That is, the selection and execution of a research project is now left to the companies and the students themselves. Several domestic and foreign companies show interest in this project. For example, Microsoft will support certain amount to this project as research expenses with plans to provide overseas education and training in its US headquarters for high-performing students.

Second, the industry-academia collaboration extra point system will be introduced to encourage the incumbent professors to participate in the human resources development effort, with the expansion of the youth internship program to increase the practical and substantial industry-academia collaboration. If the “industry-academia collaboration extra point system” is introduced, additional points will be given to the colleges that give preferential scores to those professors cooperating with the industry in the performance evaluation of professors. College students will be given more opportunities to experience internship in companies, and the number of beneficiaries of the “IT mentoring” project

where both companies and students show high level of satisfaction will be increased from 3,000 to 9,000. To promote employment, if an SME hires a student, KRW1 million in subsidy will be provided to the company for maximum six months. The following figure illustrates the IT mentoring project diagram. As described in the figure, professors work as a bridge between the mentee, the student, and the mentor, the company, to help them perform a project together, and provide online mentoring to both the mentee and the mentor. The mentee receives offline mentoring through the field experience at an industrial site for two to six months, and if he or she is hired by an SME, the SME is given KRW1 million in subsidy for maximum six months.

The government also plans to provide subsidies for IT education and training for new hires of SMEs. If they provide 20% of the education expenses, they can provide customized field education to their new hires at private education centers including the BIT Academy. A project called “private education center utilization” containing aforementioned details will be launched starting from 2011. Provision of information on the employers and job seekers will also be enhanced. The government plans to deliver accurate reality of the labor market by surveying the labor market indices including wages and work hours. In addition, the government will also build a system to survey recruiting plans of large companies and inform SMEs of the plans in advance to help SMEs manage human resources more effectively.

Third, in order to secure global IT leadership, the government plans to make intensive efforts to develop best-in-class talents as well as “convergence” human resources. First of all, the “best-in-class talent development” project will be launched in 2010, in which a huge amount of research expenses will be granted to top talents as in the case of the “US MIT Media Lab.” Selected colleges or universities will receive KRW2.5 billion p.a. in pure research expenses for 10 years. Two universities will be selected, one in 2010 and another in 2011. The government is considering linking the project with the

Korea Science Academy to attract talents.

〈Table 4－11〉 Overseas Case Examples of Best-in-Class Talent Development

US MIT Media Lab	US CMU ETC	National Univ. of Singapore, IDMI
Founded in 1985	Founded in 1998	Founded in 2007
- Runs about 30 study groups on science and media arts	- Research focuses on content, such as games and entertainment	- Runs 8 research labs on art & creative, and mixed reality, etc.
- About 40 research professors - About 120 masters and Ph.Ds	- About 40 research professors - About 140 masters and Ph.Ds	- About 100-200 research staffs

Furthermore, the “IT convergence high-quality resources” course will be created this year to resolve the shortage problem in terms of both quantity and quality of IT convergence human resources. In line with the future strategy of IT Korea announced in 2009, human resources with master and doctoral degrees will be developed in the top 10 convergence areas. The “IT convergence human resources development” course, currently run as a college course, will be reorganized and expanded as the “IT convergence advanced human resources development course” for graduate schools. These human resources development programs are aligned with the future strategy of IT Korea that targets convergence in 10 key areas, including IT+Automobiles, IT+Shipbuilding, IT+Construction, IT+Textile, IT+Machinery, IT+Medicine, and IT+Aviation. In developing convergence human resources, the government seeks to accelerate SME human resources supply by making SME participation in the programs mandatory, and encourage active industry-academia collaboration by offering companies with subsidies (10%) in accordance with their business costs. Furthermore, the government also plans to increase the supply of IT convergence resources to companies by creating new courses such as the “SW Convergence Course” and the “SW Convergence Training Course for Recruitment”. The SW Convergence Course is a

consolidated and updated course of the existing “Customized human resources development project”, in an effort to catch up with the software technology changes and the software convergence trend.

In conclusion, the undertaking of IT human resources development has evolved in keeping abreast of internal and external economic and policy environments such as the changes in industrial labor demand, technological advancement, etc. IT human resources development plan is expected to continue to evolve in the future. It is because the demand for IT human resources is derived demand and evolves in tune with the changes in market environment and technological advancement. Not only the IT human resources development plan, but other human resources development policies, in general, were pushed forward in harmony with industrial policy, science and technology policy etc. Equally, the IT human resources development policy will be pushed in tune with industrial policy, R&D policy etc.

Chapter 5. Informatization Policy in Korea

1. Implementation of Informatization Promotion Plan

Since the beginning of the 1990s, the developed countries such as the U.S., Japan, the EU nations and Singapore started pushing forward informatization as a critical strategy to determine an individual nation's competitiveness and further its survival in a global competition by raising the productivity of the government and industries as well as contributing to the growth of national economy and creating jobs. In this global trend, Korea also recognized the informatization as a key element to determine the future of the national economy and the development of society from the mid 1990s and prepared and implemented the visions and strategies at a national level.

In its first move, the government created the MIC to replace and expand the functions of the former MOC in a governmental reorganization conducted in December 1994 and consolidated the functions distributed to multiple agencies into the MIC, such as promoting of the IT industry and development of communication and broadcasting technologies. Along with this organizational change, the government enacted the Framework Act on Informatization Promotion in August 1995 and made systematic preparations to realize the informatization, including setting up a committee to govern all informatization-related activities throughout administration, legislation and jurisdiction. In accordance with the Framework Act, the government also developed the Master Plan for Informatization Promotion. This was an upgraded version of a national informatization framework intended to further advance the existing informatization projects including the construction of the

nation's core IT infrastructure. In other words, the Master Plan was a policy framework representing the government's IT policy direction in a comprehensive and systematic way and the highest level of the government's IT plan that incorporated different IT plans prepared. Unlike the 5-year Economic Development Plan in the past, the Master Plan well displays changes in the roles of the government. In fact, in developing an informatization plan at the governmental level, the government is required to provide a comprehensive and systematic long-term visions at the national level from the initial stages of the informatization so that the government itself can create the initial demand for informatization as a leading user of information technology and encourage the private sector to exert their creativity and voluntary efforts and make investment in the IT industry[41]. The contents of the Master Plan, which were announced over different timeframes, are as follows.

The Master Plan for Informatization Promotion developed in 1996 was the government's first broad blueprint to usher in an information-based society into Korea by 2010. The Master Plan had informatization objectives that would be conducted over three phases by 2010. The objectives of the first phase (1996-2000), which was designed to build foundations for a rapid implementation of the informatization, were to identify, and focus on, ten major tasks for informatization, and upgrade the level of Korea's IT industry to that of G7 countries. The first phase also included the construction of high-speed communication network to serve 30,000 government agencies and 2.6 million individual subscribers throughout the country, and the arrangement of regulatory and systematic environments. The objectives of the second phase (2001-2005), which was to expand the

41) The Article 10 of the Framework Act on Informatization Promotion specifies the expansion of private investments and the promotion of fair competition as a part of the ground rules of the government's IT policies to facilitate informatization efforts, build a foundation for the IT industry and advance the IT infrastructure.

utilization of information, were to stabilize the private sector-led informatization efforts and create a sufficient demand for an advanced information society. The third phase (2006 - 2010), which was intended to further advance the utilization of information, had objectives to make information available anytime and anywhere for anyone.

〈Table 5－1〉 Different Phases of Master Plan for Informatization Promotion

	June 1996	March 1999	April 2002	December 2003
Plan	Master Plan for Informatization Promotion	Cyber Korea 21	e-Korea Vision 2006	Broadband IT Korea Vision 2007
Period	1996 - 2000	1999 - 2002	2002 - 2006	2003 - 2007
Vision	Realize the world top class information society by 2010	Build a creative knowledge-based nation	Build a global leader of e-Korea	Build a broadband-linked IT Korea
Objective	Identify and perform the 10 core and urgent tasks with the most far-reaching effects to build a foundation for an advanced information society	Utilize informatization efforts to create jobs and boost the national economy so that the nation can recover from the aftereffects of the 1997 financial crisis	As the key objectives of the Cyber Korea 21 initiative were accomplished earlier than scheduled, define new visions and objectives of the national level informatization efforts	Incorporate the key plans of different areas: e-Government Roadmap, BcN Master Plan and Mid- and Long-term Master Plan for Information Protection

Article 10 of the Framework Act on Informatization Promotion specifies the expansion of private investments and the promotion of fair competition as a part of the ground rules of the government's IT policies to facilitate informatization efforts, build a foundation for the IT industry and advance the IT infrastructure.

2. Establishment of Infrastructure

By the 1990s, the leading industrialized countries began to focus on building the high-speed ICT network as it was regarded as an essential component of the infrastructure for economic growth in the age of the information society. In sync with this global trend, Korea developed the Comprehensive Plan for Implementation of High-speed ICT Infrastructure in 1994 to become a leader in ICT and executed the plan for building and upgrading the high-speed ICT network in three stages from 1995 to 2005.

In the first phase of establishing the telecommunications network infrastructure (1995~1997), 80 optical transmission networks were deployed at 80 locations around the country and a test ATM exchange was set up. In the second phase, when the telecommunications network was completed (1998~2000), the ATM commercial network was deployed and construction of optical transmission networks was completed for all call coverage zones (144 locations). This was originally planned to be completed in 2002, but due to the explosive growth in the number of Internet users and as an effort to secure a core base for national competitiveness at the earliest stage possible, the schedule was accelerated by two years to have a nationwide backbone network as soon as possible.

Hence, the third phase timeline (originally set for 2003 to 2010) was advanced to 2001 to 2005, and committed efforts were undertaken to create the world best class ICT environment. The third phase focused on advancing the high-speed ICT network and with completion of the high-speed ICT network in 2005, anyone could enjoy a full range multimedia service ranging from voice, data, to video anytime and anywhere around the country through high-speed connection.

Korea's efforts to build the high-speed ICT infrastructure can be largely divided into efforts for building the national high-speed network (KII-G), the high-speed public network (KII-P), and the high-speed research network (KOREN).

〈Table 5－2〉 Phased Objectives and Strategies for Implementation and Advancement of High-speed Communication Infrastructure

	Build a foundation for high-speed communication infrastructure: Phase 1 (1995-1997)	Highly develop telecommunication infrastructure: Phase 2 (1998-2000)	Highly develop high-speed communication infrastructure: Phase 3 (2001-2005)
Objective	- Build the Information Superhighway by 2015 to deliver different forms of information such as voice, data and video in order to proactively expand the national infrastructure in preparation for the 21stcentury - Implement a universal IT service by building high-speed, large-sized data delivery network throughout the nation - Develop the multi-media information industry based on the high-speed communication infrastructure to create more jobs and strengthen the IT industry's international competitiveness	- Expand and further develop the IT infrastructure that plays key roles in efficiently managing the mechanism by which a society is operated, and facilitating the construction of network and the consolidation of different components of a society - For the above objectives, build high-speed communication backbone networks, and further enhance subscriber network, international network and mobile communication network	- Establish a universal service system to make multi-media services available anytime and anywhere for anybody - Provide about 84% of the whole households with 20M bps high-speed communication network service - Provide mobile communication service subscribers with maximum 2Mbps mobile communication service - Build the world top class high-speed communication infrastructure
Strategy	- Build the High-speed Governmental Communication Network with a public fund first in order to make it available for public agencies, research institutes and universities that are critical players for the national competitiveness at low prices - Based on the operation results and technological capability of the above national infrastructure, telecommunication operators build the High-speed Public Communication Network for citizens - The corporate, academic and research sectors jointly develop 'application services' and 'core technologies' according to the implementation phases of the high-speed communication infrastructure - Carry out a variety of pilot projects and continuously	- Advance the due date of the project of the high-speed communication infrastructure from 2015 to 2010 - Conduct separate projects of backbone transmission networks and subscriber networks, and connect them - Enhance the subscriber networks based on priority - Align and expand the existing facilities according to the second phase plan to maximize the utilization of the infrastructure - Perform a phased integration of the existing basic communication network and new high-speed network - Encourage the private sector's leading role and	- Strengthen the government's support of policies to enable the implementation and continued advancement of the world top class high-speed communication infrastructure - Perform separate projects of different areas and effectively connect them for a more efficient implementation of the high-speed infrastructure - Collect opinions from professionals of different areas and develop a system to actively respond to changes in IT environments

	Build a foundation for high-speed communication infrastructure: Phase 1 (1995-1997)	Highly develop telecommunication infrastructure: Phase 2 (1998-2000)	Highly develop high-speed communication infrastructure: Phase 3 (2001-2005)
	modify or enact relevant legal systems to raise public awareness of information society and encourage the use of related services - Engage the private sector to exert its creativity and energy in the implementation of high-speed communication infrastructure, and efficiently utilize national telecommunication resources such as cable television networks and idle private communication facilities - Functional teams develop and perform plans to support and utilize the implementation of high-speed communication networks.	make the plans flexible to implement	

Source: NCA (National Computerization Agency) (2005a)

〈Table 5－3〉 Evolution of Comprehensive Plan for Implementation of High-speed Communication Infrastructure

	Background	Project Timeline	Remark
Comprehensive plan for building high-speed communication infrastructure (March 1995)	·Build the Information Superhighway by 2015	·Phase 1: 1995-1997 ·Phase 2: 1998-2002 ·Phase 3: 2003-2015	-
Plan to advance IT infrastructure (September 1997)	·Advance the due date of the plan by 5 years to catch up with the trend of the advanced countries and prepare for the unlimited competition of the information society	·Phase 1: Completed ·Phase 2: 1998-2002 ·Phase 3: 2003-2010	·Phase 1 of the high-speed communication infrastructure project was completed in December 1997. ·A plan was prepared to conduct phase 2 of the high-speed communication infrastructure project in May 1998. ·Phase 2 was finished in December 2002.

	Background	Project Timeline	Remark
Master plan to enhance the high-speed communication infrastructure (May 2001)	·Completed the build-up of a nationwide, optical cable-based high-speed communication infrastructure by the end of 2000 ·Announced an earlier completion of the high-speed network in January 2000 (the President's New Year's address)	·Phase 1: Completed ·Phase 2: 1998-2000 ·Phase 3: 2001-2005	·A plan was developed to further enhance the high-speed communication infrastructure in January 2002 ※ The earlier completion of phase 2 also advanced and shortened the timeline of phase 3.

Source: NCA (2005a)

The national high-speed network or KII-G is the backbone network built with public investment. It aimed to connect major cities and small to medium-sized cities around the country via ATM switching based optical cable to deliver high-speed connection to public institutions including central and local government agencies, schools, and research centers at affordable prices. The high-speed public network or KII-P can transmit a high volume of information at high-speed around the country and was built with funding by the private operators. It aimed to deliver universal high-speed connection in the private sector to both businesses and homes. The high-speed research network or KOREN aimed to verify the validity and appropriateness of high-speed ICT prior to commercial deployment to be used as the testbed for the latest advanced telecommunications services.

First, the national high-speed network project (KII-G) entailed using public funding to build the high-speed broadband ICT network around a backbone network that can transmit high-speed, high volume data and information. The project focused on offering Internet and multimedia service at affordable prices to central and local government agencies, educational institutions, research centers, libraries, museums, and other public

entities to facilitate efficient information exchange and joint usage across public entities. It also aimed to promote informatization of the public sector to enable better public civic service and higher administrative productivity. For the private sector, the network would create new demand and new investment needs and accelerate technological development efforts to enable early adoption of the nationwide high-speed ICT network.

As for the high-speed public network or KII-P, in recognition of the need for expanded high-speed Internet connection, the government began to make concerted efforts in 1998 to develop policies that were the most economic and most appropriate for the domestic conditions of the time. In line with the policy direction of the government, common carriers started in late 1999 and 2000 to aggressively invest in expansion of the broadband Internet subscriber network to create one of the world's best broadband Internet infrastructures. Thanks to such efforts, the number of broadband Internet subscribers reached 10.4 million households as of the end of December 2002, making Korea the world's leader in terms of broadband penetration. Infrastructure for broadband Internet service became available to all small towns and villages (including rural districts named "eup" and "myon") around the country. Korea's broadband subscriber penetration reached 17.2 per 100 population, the highest in the entire OECD.

The high-speed research network or KOREN entailed setting up 2.5Gbps KOREN in five major cities including Seoul to be available for network services like next generation Internet, which was not yet offered through commercial Internet service. Its coverage for research was continually expanded through interconnection with domestic as well as international research networks. In the beginning, focus was on development and validation of ATM-related networking technologies and applications. In phase 2, focus was switched toward research on IP based next generation Internet technologies in line with the growth in global next generation Internet based research.

2.1. Phase 1: Foundation (1995 ~ 1997)

Phase 1 of the national high-speed network was undertaken in accordance with the Implementation Plan for High-speed ICT Infrastructure established in March 1995. The goal of this umbrella plan was to expand the basic infrastructure for national ICT by proactively building the high-speed, high-capacity broadband ICT network around the nation that could transmit voice, data, video, and other types of information for the coming 21st century. Further, to realize the set objective, detailed action plans were developed to establish the high-speed ICT infrastructure for the national high-speed network, the public network, and the research network.

The ultimate goal of phase 1 of the national high-speed network project was to build and run a broadband ICT network that connected public entities of the central and local governments via optical cables. To this end, during phase 1 from 1995 to 1997, a detailed action plan was developed and the country was divided into 144 call zones for phased deployment of communications networks.

For phase 1, government funds of 172.6 billion won were allocated in constructing the high-speed high-capacity backbone transmission network that connected over 80 locations around the country. To test and validate ATM switch performance before deployment of commercial switches, an ATM switch testbed was set up in the five major cities of Seoul, Busan, Daegu, Gwangju, and Daejon. Furthermore, activation of PUBNet(Korea National Network for Internet) offered the basic framework for delivering nationwide high-speed ICT network service to public agencies.

2.2. Phase 2: Completion of the Foundation (1998 ~ 2000)

Calls for a more realistic implementation plan as a way of accurately reflecting rapid advancement in ICT and changes in user's service demands became louder after phase

1 of the national high-speed network (KII-G) project. A more realistic approach was also seen as the right course of action given the efforts mounted by advanced countries in building the ICT infrastructure. In September 1997, the status of domestically available ICT facilities resources was reexamined and international policy trends and implementation examples were investigated. The result was the ICT Network Advancement Plan, a revision and refinement of the Implementation Plan for High-speed ICT Infrastructure established in 1995.

Pursuant to the new ICT Network Advancement Plan, the deadline for the plan was advanced by five years from 2015 to 2010 for earlier implementation. The objectives were also clarified by project, and phase 2 of Implementation Plan for High-speed ICT Infrastructure was unveiled in May 1998.

The key objectives of phase 2 of the national high-speed network or KII-G to be carried out from 1998 to 2000 were:

1) Phased expansion of the backbone network to 144 local call zones around the country;
2) Optimized integration of switches, which were disparate by network;
3) Building an ATM switch network to enable affordable and efficient provisioning of a full range of ICT services; and
4) Building an ATM switch based Internet network to satisfy demand for Internet service in the public sector.

During phase 2, deployment of optical transmission network went according to schedule, but deployment of ATM switches proved difficult. As the plan was to introduce the first ATM switch developed in Korea, there were problems in network deployment such as delays in equipment development and demands for better network performance and new features. The challenges were overcome and phase 2 of the KII-G project delivered high-speed, high-capacity optical cable transmission networks and

ATM switches to all 144 locations. The foundation of the high-speed ICT was now complete, and ATM based high-quality Internet service was available not only in big cities, but also in small rural villages. In addition, with KII-G, more than 10,000 elementary, middle, and high schools around the country could now enjoy broadband Internet service free of charge at up to 256Kbps and at heavily discounted rates for higher speeds. The ICT environment for schools and educational service was markedly improved to create a solid foundation for digital education in the future. Phase 2, in other words, enhanced usage of the national high-speed network and opened a new chapter in service deployment.

2.3. Phase 3: Advancement (2001 ~ 2005)

Thanks to the phased implementation of the high-speed national network, Korea was able to successfully complete deployment of optical cable nationwide based the high-speed national network, KII-G, at the end of 2000. It was also able to realize the world's highest broadband penetration rate. Encouraged by the success of phases 1 and 2 of high-speed national network implementation, the Korean government unveiled the Basic Plan for High-speed ICT Network Advancement in June 2001 to make Korea the world's leading ICT player in the 21st century. The plan was devised based on comprehensive review of demand for high-speed Internet in different sectors as well as the trends in development of high-speed information communications technology. The government also formed the Consultative Body for Advancement of the High-speed ICT Network in August 2001 to ensure effective implementation of the plan. The final Basic Plan for High-speed ICT Network Advancement including detailed action plans was announced in January 2002.

The goal of the Basic Plan for High-speed ICT Network Advancement was to create

a basic universal framework to make multimedia service available to anyone, anywhere, anytime by 2005. The deadline was actually advanced from 2010 to 2005 owing to explosive growth in the number of Internet users and increased need for early advancement of the ICT network as a result of the rapid development in ICT technology.

A detailed action plan was developed to continue upgrading and expanding the network in line with the expected increase in demand in the public sector. As a result of three-phases of efforts, ATM switches were laid in all 144 call zones around the country to enable nationwide high-speed ICT service. The backbone transmission network was expanded to accommodate high-speed, high-capacity bandwidth required for expansion of ATM switches and Internet facilities. The backbone network was also made broadband to enable ALL-IP based high-speed high-quality Internet service through a nationwide network built with existing ATM switches as well as newly developed high-capacity ATM-MPLS switches. In other words, phase 3 of the high-speed national network was about infrastructure upgrading where advancement of the Internet and backbone transmission networks were simultaneously carried out with focus on ATM switches.

2.4. Competition Driven Advancement of the High-speed Public Network

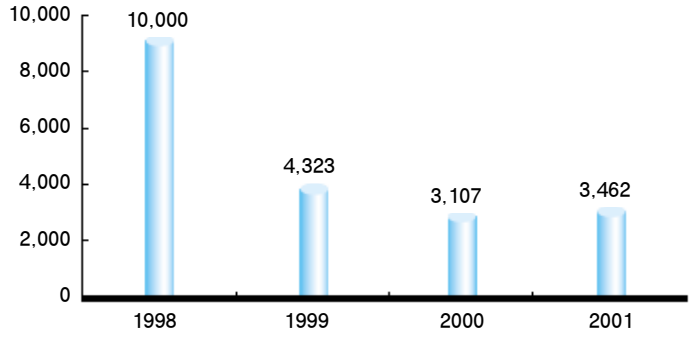
Advancement and penetration of the high-speed public network was achieved by promoting competition among operators. When service was launched, the government deemed that policy would be most effective if it promoted competition by minimizing regulation. Hence, new high-speed public network services were classified as value added services. This allowed free market access for operators with no restrictions on sales activities and charges, including tariffs. This also ensured that the competition in the telecommunications market would focus on facilities rather than services to encourage investment by operators.

The U. S., U.K., and other countries opted for local loop unbundling so that facilities of existing local carriers could be leased at cost to new entrants for high-speed Internet service. However, incumbent operators resisted leasing to stifle competition among operators. These countries are now taking note of Korea's success and are revising their policies with a view toward relaxing regulation to allow for joint usage of subscriber networks.

After increasing service penetration by promoting competition in facility installation, Korea introduced local loop unbundling in 2002 to further bolster competition.

The Herfindahl-Hirschman Index (HHI), a gauge of competition in the market, showed the index falling sharply for the first two years after its launch in 1998— meaning that competition shot up in a very short period of time. However, KT had its own local network and a competitive edge. This allowed it to carve out a larger market share in 2001, resulting in a higher HHI level. In other words, competitive conditions in the market were worsening, but the main reason for this was mostly likely lower competitiveness of new entrants, who had less in investment funds and fewer stable alternative profit streams. Their situation was exacerbated by the fierce competition for subscribers among the operators, which drove marketing expenditures upward and the tariff rate downward.

〔Figure 5－1〕 HII in the High-speed Internet Market



Note: Based on number of subscribers
Source: Korea Communications Commission

The competitive landscape for broadband Internet was still better compared to other key voice services like local, long distance, and mobile telephony. It was a success story in terms of promoting competition, and the heavier competition encouraged a wider subscriber base, lower tariff rate, more rapid technology development, and introduction of more new services.

The number of subscribers multiplied 33 times in just 30 months, from 265,000 at the end of 1999 to 8,938,000 by June 2002. This translated into an impressive 74% of total households and was the highest household penetration rate in the world. The data of June 2001 shows that Korea's broadband Internet penetration rate was two times higher than that of Canada, which had the second highest rate. This made Korea a country to benchmark for broadband Internet penetration.

The wider subscriber base also served to expand the broadband Internet market. Looking at quarterly sales, it multiplied 23 times from 37 billion won in Q1 2000 to 850 billion won by Q2 2002.

〈Table 5－4〉 Sales of Broadband Internet Service

(in 100M won, %)

1Q 2000	2Q	3Q	4Q	1Q 2001	2Q	3Q	4Q	1Q 2002	2Q
37,003	85,904	200,203	319,226	460,227	540,756	594,024	647,168	779,683	850,352
-	132%	133%	59%	44%	17%	10%	9%	20%	9%

Source: NIA, 2003

The fierce competition among operators naturally exerted downward pressure on the broadband Internet tariff rate. The high-speed Internet service tariff was charged as a monthly fixed fee regardless of usage volume. The tariff was the sum of the subscription fee, installation cost, down payment, warranty insurance, monthly usage charge, and terminal rent. Initially, the terminal was expensive, so the charge for it was divided into

the down payment and warranty insurance. These charges disappeared as competition became more heated and the prices for terminal fell. In the early days of service, only premium service with a high transmission speed was offered, but soon "Lite" services with a lower tariff and lower speed were introduced to widen the choices for consumers. The tariff rate was deemed to be the lowest among OECD countries by the PPP exchange rate.

Competition among operators also encouraged technology development for the high-speed public network. The CATV network was initially the stronger player with Thrunet offering CATV network based connection service. After KT entered the market, however, ADSL gradually gained the upper hand and became the most popular by May 2000 to reign as the dominant force since then. By June 2002, ADSL service subscribers totaled 5.53 million, and cable modem subscribers totaled only 3.15 million. There were also attempts to offer different technologies like B-WLL, satellite Internet, and Home LAN.

2.5. Informatization Promotion Fund

The promotion of informatization requires large scale investment, calls for cooperation of various organizations, and takes several years at least. It is therefore difficult to carry out the projects with the general budget. The Informatization Promotion Fund was established in 1996 as a special vehicle to overcome the budgetary restrictions in order to promote the informatization project. The goals of the Fund is to promote e-Government, roll-out broadband network, support R&D and Standardization and educating human resources in ICT. Thanks for the Informatization Promotion Fund, necessary funds to realize these goals could be adjusted flexibly, allowing skills/market environment changes to be swiftly reflected in ICT industry. The Fund, based on government budgetary and private sector contribution, created the system for letting the profits from ICT fields be reallocated into ICT sector. The Fund was managed by the

Ministry of Information and Communication (overall management), Institute of Information Technology Assessment (specific project management) and Fund Management Council (Evaluation). The chair of the Council was vice minister of MIC and members are director generals of related ministries.

〈Table 5－5〉 Budget for Informatization and Informatization Promotion Fund

(in 100M won, %)

	1996	1997	1998	2999	2000	2001	2002	2003
Budget for Informatization	4,993	7,083	8,500	12,346	13,587	15,029	16,114	16,702
Share vis-a-vis general accounts	0.79	0.99	1.05	0.40	1.43	1.42	1.47	1.50
Informatization Promotion Fund	3,587	5,539	7,735	8,500	7,480	9,810	11,893	10,698
Total	8,580	12,622	16,235	20,846	21,067	24,839	28,007	27,403

Source: Ministry of Planning and Budget, 2003

Unlike Korea, which had a comprehensive fund covering all areas of informatization, most other countries including the U.S. set up a supplementary temporary fund specific to set objectives like closing the digital divide or developing e-government. The government established the Informatization Promotion Fund to extend funds to all areas of endeavors in national informatization so that many informatization projects could be carried out flexibly instead of being constrained by strict timelines and budget limits. This allowed technical and market changes to be quickly incorporated into projects. Initiatives such as informatization of municipal and district administration and financial information system implementation especially required flexibility in funding as they involved different ministries or aimed to achieve grand strategic goals. In other words, by making investment funds more readily available as needed, the Informatization Promotion Fund allowed Korea to establish a solid foundation for the knowledge information society in a very short period

of time.

Although the Fund allowed the government to continually expand its investment in informatization, lax management of the Fund sometimes gave rise to criticism. However, there can be no denying that the Fund helped create demand for ICT technology development and service, thereby accelerating informatization across different sectors of society. In particular, during the 1997 financial crisis, when the public sector had to lead investment as part of the economic recovery efforts to create jobs and revive the economy, active investment in upgrading the ICT network spurred active participation by the private sector as sufficient future demand could be expected with confidence. It also helped Korea make another leap ahead in ICT adoption.

From 1993 to 2002, the Fund reached total of 7.78 billion USD. About 40% of the Fund (3.06 billion USD) came from government budget, 46% from private firms and 14% (1.13 billion USD) from miscellaneous profits and interests. Total of 5.33 billion USD is invested from 1994 to 2003. 37.5% is invested into IT R&D, 20% into informatization promotion, 17.8% into ICT human resource development, 15.1% into broadband infrastructure and promotion, 7% into infrastructure for IT industry and 2.6% into Standardization.

It is evaluated that the Informatization Promotion Fund played a key role in the balanced promotion of informatization policy for the creation of demand and the ICT industry policy for the expansion of supply base.

The Informatization Promotion Fund was an important means of facilitating a virtuous cycle of ICT development in Korea. It played the critical role of ensuring that IT industry policy was carried out according to a comprehensive and balanced perspective between creating demand for ICT and expanding public infrastructure.

The Fund allowed various informatization projects and IT research efforts to be carried out more flexibility without being shackled by rigid budget constraints. Informatization

projects not only require heavy investment but need different organizations to work together for many years for common usage of information and interface of disparate information systems. Receiving support from the government budget, which is normally planned and executed by each administrative body on an annual basis, was therefore an issue. The Informatization Promotion Fund meant that each project could have a different timeline and that the required budget could also be flexibly adjusted. This allowed any changes in technology and the market to be quickly reflected in the projects.

The Fund also offered a mechanism where public investment in the ICT sector could be managed efficiently as a single fund. The Fund pooled and managed all funding for informatization including government grants, telecommunications service providers' investments, and loans into one single fund for easy tracking of investment coming from the public sector toward informatization and the IT industry.

Pursuant to the Framework Act for Informatization Promotion—the law that created the Fund—investment coming from telecommunications service providers could only be spent for R&D in the IT sector so that the benefits realized by the IT industry would not be leaked to other industries. It established an official mechanism whereby gains from ICT investment were reinvested in ICT. The Fund, in other words, was a solid financial sponsor, and it allowed the Korean IT industry to grow steadily without being vulnerable to any internal or external changes.

Lastly, the Fund offered political means to comprehensively review national informatization projects like building the high-speed information infrastructure, e-government, and ICT adoption for businesses to be considered together with promotion of IT industry growth from planning to resource allocation. As informatization projects were handled through the Fund's general accounts while supporting R&D tasks through R&D accounts, the government could allocate resources with consideration to both supply and demand in achieving set goals for ICT policies.

2.6. Policy Implication

The full-scale commercial service of high-speed Internet opened in Korea in June 1998 when Durunet, a local telecommunication company, started its cable modem service, and the ADSL (Asymmetric Digital Subscriber Line) service was launched by Hanaro Telecom in April 1999. Then Korea Telecom began to provide a large-scale public service of high-speed Internet from December 1999, which kept growing rapidly mainly with ADSL and cable modem services. Korea even became a benchmark case of high-speed Internet service for many foreign countries.

According to an OECD report released in 2001, Korea ranked frist with the number of subscribers for every 100 people of 13.9 as of June 2001, which was more than two times that of Canada, which ranked second. The report forecasted that the performance of each country's high-speed Internet service development would be continuously compared to that of Korea for the following many years.

A number of analyses were released about what led to this explosive growth of the high-speed Internet users. The International Telecommunication Union (ITU, 2001b) identified Korea's dwelling patterns as one factor. The ITU report pointed out that about 90% of Korean houses were located within a 4-km radius of the exchangers of telephone offices, and a large percentage of residents lived in apartment complexes, which enabled Korea to address the delivery distance limitation of the ADSL technology and realize economies of scale. An OECD report published in 2001 explained that the competition between Internet service operators armed with different infrastructure and technology resulted in this rapid expansion of the service. This OECD report also brought our attention to the fact that apartment-oriented dwelling types and high population densities were important factors, but the same development did not happen in other countries with similar conditions as Korea.

In the case of Korea, Hanaro Telecom joined the fixed line market, which was the government's monopoly, and actively provided the high-speed Internet service rather than targeting gray markets as usually newcomers to the market did. Hanaro launched the ADSL service first in Korea and fiercely competed with cable modem operators, which had already entered the market. Even though it was a latecomer to the market, it successfully caught up with Durunet, a major cable modem operator, and made a rapid progress. The high-speed Internet market experienced another surge of exponential growth once Korea Telecom, which had the largest number of fixed lines, joined the race. The OECD analyzed in its 2001 report that the competition between cable operators and telecommunication service providers and the government's less restrictive regulatory policies, which directly affected the competition, were the main drivers of the speedy expansion of the high-speed Internet service.

The Economist also reported in 2001 that Korea's high-speed Internet service more rapidly expanded than that of other countries with a higher number of Internet users and it was enabled by the Korean government's policy to encourage the construction of cable networks, which would compete with the high-speed network and promoted the competition between different infrastructures, the ADSL service and cable modem service. The British magazine also pointed out that the high population density of Korea allowed the construction of IT infrastructures at lower costs and in an easier manner. These two factors, a high level of competition and Korea's unique dwelling pattern, are widely regarded as the major points to explain the nation's successful progress of the high-speed Internet service.

Other factors identified are the expansion of Internet telephone service (ITU, 2001a; OECE, 2001), the development of technical personnel required to undertake the installation and maintenance of a sufficient scale of infrastructures (Economist, 2001), the Korean government's strong policy drive (ITU, 2001b) and the level of people's

exposure to the service following the expansion of PC bangs, businesses that provide customers with PCs and Internet access.

Relatively low entry barriers and less restrictive regulations on rates caused an intensive competition among high-speed Internet service providers.

3. U-Korea Master Plan

The Korean government produced revolutionary outcomes such as the world's top class IT infrastructures and the greatly expanded utilization of information technologies through its continued initiatives such as Cyber Korea 21, e-Korea Vision 2006 and Broadband Korea Vision 2007. However, as the global IT environment evolved to digital convergence and further to ubiquitous environments, the government faced new challenges such as aggravated regional imbalance of economic development, increased scale of disasters, and low birth rate and aging societies, which forced the government to change its policy direction.

The Master Plan for u-Korea was designed to contribute to building an advanced Korea by realizing a ubiquitous society (u-society) on the global best ubiquitous infrastructure (u-infrastructure). To accomplish this objective, the government defined the following five targets: building a more friendly government, conducting an advanced intelligent land development, vitalizing economy and enhancing its growth potential, realizing a clean and safe society and ensuring convenient and enriched personal life, along four with the engines: a balanced global leadership, the ecological industrial foundation that can grow on its own, efficient and flexible social systems and technological development that would make convergence and connection between different areas easy and flexible.

The u-Korea Master Plan is special in that, unlike the old informatization promotion

policies such as Cyber-Korea or e-Korea, discussion was being made at the level of advancing the nation for the next generation. Therefore, a much wider range of government roles were proposed: striking a balance between demand and supply sides, modifying or creating required laws and systems, building a reliable and safe infrastructure, resolving the digital divide and creating a strategy to make IT services and technologies more accessible to everyone.

More specifically, the Master Plan for u-Korea was different from the old infomartization policies as follows: i) shifting its e-Government approach from supplier-oriented to consumer-oriented and to be more practical; ii) giving a right to control over Social Overhead Capital (SOC) to its direct operators; iii) creating synergy between different businesses and also between different industries by narrowing their gaps; iv) for social issues, changing the policy focus from a rapid response to prevention; and v) for personal services, moving from portal services targeting a mass group of customers to customized services.

〈Table 5－6〉 Key Government's Informatization Policies

	The government's support of informatization efforts			
	Cyber Korea 21	e-Korea Vision 2006	Broadband IT Korea Vision 2007	U-Korea
Assigned government agency	The MIC			
Timeline	1999 - 2002	2002 - 2006	2003 - 2007	2006～
Project objective	Build a creative, knowledge-based nation	Build a global leader e-Korea	Build an IT Korea	Build a Ubiquitous Korea
Key idea	·Build a more advanced information superhighway ·Enhance the nationwide	·Promote the realization of an information society ·Continuously improve the information	·Fully implement an information society ·Build conditions required for an information society ·Develop a	·The 5 tasks for national advancement -Build a network for government businesses -Set up a central management center

	The government's support of informatization efforts			
	Cyber Korea 21	e-Korea Vision 2006	Broadband IT Korea Vision 2007	U-Korea
	productivity based on the accumulated knowledge base ·Create jobs based on the information infrastructure	infrastructure ·Strengthen international cooperation to implement a global information society	foundation to create new IT growth engines ·Strengthen a global cooperation to realize a global information society	for a u-City -Promote u-Payment -Build an intelligent emergency network -Distribute u-ID cards ·Maximization of the 4 growth engines -Attract international organizations to lead u-IT technology -Develop u-core strategic industries -Put in place relevant laws and systems -Build the world's best infrastructure
Strategy	·Focus energy on an early implementation of information infrastructure and technology development ·Globalize operational systems using the Internet ·Create an environment where education on informatization is available for citizens ·Modify or create necessary laws and systems	·Informatization: quantitative expansion → qualitative enhancement (expansion of Internet access, improvement of systems and renovation of ways of business operation) ·Facilitation of industry: government-led approach → building a base for the IT industry including the identification of new growth engines ·Catching-up approach → Leading approach	·Implement an e-Government designed to innovate public services and management of information resources ·Introduce a performance-based assessment system and utilize e-Government to grow the IT industry	·Build a safe and reliable IT environment ·Make everybody enjoy the benefits of the IT development without any discrimination. ·Provide a variety of services by building a user-centered IT environment ·Stimulate the national economy and innovate social systems
Remark	·Simultaneously pursue informatization polices and IT industry promotion plans ·Carry out capital investment-based informatization policies - The direction of informatization policies is moving from a hardware approach, which includes the construction of IT infrastructure, to a software approach, which includes the promotion of utilization of information. ·Carry out a government-led informatizaion - The government rather than the private sector leads the nationwide informatization.			

Source: Gang Hong-ryeol and others (2008)

The “ubiquitous” was first introduced by Mr. M. Weiser of Xerox (U.S.), in 1988. He proposed the concept of an environment where users can get easy access to information they need anytime and anywhere from networks. In Korea, since 2002, “ubiquitous” was discussed as the area where new values can be created, and the corporate, academic and public sectors worked together to conduct necessary research and preparations for a new era and developed the U-Korea Master Plan, the national vision of the new era.

4. Bridging the Digital Divide

4.1. Overview

With the society becoming more open, horizontal and decentralized through informatization, the government has established strategies to bridge the digital divide, based on the understanding that different levels of informatization resulting from physical, social and other factors should not lead to differences in the exercise of basic rights. These strategies have gained considerable success.

First of all, to provide conditions that allow access to information regardless of regional and physical situations, the government set up high-speed Internet for 99.8% of rural households and built public information facilities in underserved areas such as farming and fishing villages. Also, it distributed 194,771 used PCs, raising the PC ownership rate among deprived households by 16.4% from 48.7% in 2004 to 65.1% in 2008. In addition, it facilitated information use of the disabled by providing a Telecommunications Relay Service (TRS), development and dissemination of various related peripheral equipment, establishment of a text information database and comprehensive inventory database for the visually impaired, etc. and worked on Web accessibility standardization as well as the development of accessibility compliance guidelines to improve the efficiency of Web

information delivery and Web accessibility. As a result of these efforts, Web accessibility for the information-alienated class improved to 89.7% of overall Korean population as of 2008.

Meanwhile, information use is not just a matter of access, but it differs according to personal competency. The government, therefore, has continuously held education programs on information, covering 3,087,340 people from the information-alienated class, including the disabled, the elderly, the illiterate, migrant women married to Koreans, children from multicultural families and prison inmates, through visits, gatherings at education centers as well as online education. These programs are assumed to have contributed to increasing the Internet usage rate of the information-alienated class by 16.8% from 24.9% in 2004 to 41.7% in 2008. However, there remains a lot of room for improvement concerning the gap between information usage and information access, which is demonstrated by an information literacy rate of 45.7% among the information-alienated class compared to the overall Korean population in 2008.

4.2. Legal measures to bridge the digital divide

Development of information and telecommunications technology, which began in the late 20th century, brought rapid changes to mankind's thinking and living and created an information society based on a paradigm qualitatively different from that of an industrial society. An ideal information society is achieved when there is harmony between the changes in perception, attitude, values and behavior of individuals and the changes in a new information environment. However, as distribution and usage of information and telecommunications technology including the Internet expanded, the digital divide, one of the adverse effects, emerged as a new social problem. This created a new policy area concerned with bridging the digital divide that is important for both the improvement of

national competence and social welfare.

Led by its government, Korea has carried out a strategy to promote informatization over the last decade, with emphasis on information and telecommunications as new business areas in which to facilitate growth and employment. However, the progress of the information society has been accompanied by the increase in the number of information-alienated people due to socioeconomic, regional and physical reasons, as well as an increase in the digital divide based on different age, income and academic backgrounds. To address these problems, the government introduced a policy to bridge the digital divide, and actual policy measures were implemented beginning with the organization of the 4th Meeting for Information Strategy Planning held on April 6, 2000.

Along with the introduction of the policy to bridge the digital divide, a movement was generated to prepare a comprehensive legal mechanism to help build a remedial and preventive pan-governmental response system to problems arising from the digital divide. At the time, legal provisions related to bridging the digital divide were scattered in various laws, including Clause 2, Article 16 of the Basic Act on Informatization Promotion, provisions on the universal services of the Telecommunications Business Act, and provisions on information access of the Act on the Welfare of the Disabled. However, these provisions were more like declarations; thus, the plan to establish a pan-governmental implementation system was drawn up, and the Act on Bridging the Digital Divide was enacted in January 2001 to prepare a legal basis for continuity of the strategy, later to be amended to build an effective policy implementation system to deal with changes in the digital divide environment.

The Act on Bridging the Digital Divide changed the new concept of “digital divide” into one aimed at realizing the constitutional demands for the right to live like a human being (Article 34 of the Constitution) and the principles or rights to equality (Article 11 of the Constitution) by expanding the concept to include not only guarantee of access

to the existing physical environment, but also promotion of competency in information usage. Also, it has provided the norm for national actions to guarantee the rights to access and use information for the low-income bracket, residents of rural areas, the disabled, the elderly, women, etc.

〈Table 5－7〉 Major Details of Enactment and Revision of Laws on Bridging the Digital Divide

Enactment (Jan.16, 2001)	First partial amendment (Dec.18, 2002)	Second partial amendment (Dec.30, 2005)	Basic Act on Informatization Promotion (May 22, 2009)
・Comprehensive Plan to Bridge the Digital Divide and the action plans established ・Committee on Bridging the Digital Divide founded ・Guarantee for IT service usage of the disabled/elderly and development of related technologies ・Provision of IT equipments for information-alienated people ・Establishment and operation of information facilities ・Education programs on information	・Promotion of conditions that enable usage of high-speed IT service ・Research designed to develop policy to bridge the digital divide ・A survey on the status of reduction of the digital divide ・Establishment of the National Information Society Agency	・Title changed to "Act on Bridging the Digital Divide" ・Definition of terminology related to bridging the digital divide ・Imposition on IT-related manufacturers of the duty to make efforts to design, manufacture and process IT products that consider the information access and user convenience of the information-alienated people ・A taskforce formed to take charge of execution of operations for bridging the digital divide ・A survey on the status of the digital divide	・Key provisions of "Act on Bridging the Digital Divide" moved to Clause 1, Chapter 4 of "Basic Act on Informatization Promotion" ・The Basic Act on Informatization Promotion, its action plans and the priority list of programs for bridging the digital divide reviewed and finalized by the Informatization Promotion Committee under the President ・Guarantee of Web accessibility at public institutions strengthened ・Imposition of the duty of preferential purchase of IT products that guarantee information access and user convenience

With the start of the new administration in 2008, extensive changes were made that included dispersion of the national informatization function to various ministries following the government reorganization and a large-scale reform of laws on informatization. Key provisions of the Act on Bridging the Digital Divide were transferred to the Basic Act on Informatization Promotion that deals with the guarantee of the soundness and universality of information use to prevent the adverse effects of national informatization. It stipulates the enhancement of Web accessibility at public institutions to allow the disabled and the elderly to access Websites without any discrimination and use desired services more conveniently; imposition on IT-related manufacturers of the duty to make efforts to improve the accessibility and convenience of the disabled and the elderly in using IT equipments and services; and imposition on public institutions of the duty to preferentially purchase IT products that guarantee information access and user convenience of the disabled, the elderly, etc. to enhance the government's role as a public market and to improve the information environment through relevant industries and market vitalization. In addition, it deals with the development of guidelines to guarantee access and user convenience of the disabled and the elderly in using IT equipments and services, support for relevant content providers as well as developers/manufacturers of IT products and technologies, and provision of IT equipments for the disabled, low-income bracket, etc. at a cost or for free by the government or local municipalities, to promote the use of IT equipments by the information-alienated class.

For the endeavors to bridge the digital divide to produce actual results, budgetary support is essential; in this regard, the government or local municipalities are allowed to spend the national or local municipal budget on the programs to bridge the digital divide, and they should conduct regular surveys on the status and reduction of the digital divide and submit the results to the National Assembly to enable establishment of appropriate and effective policies.

4.3. Policy measures to bridge the digital divide

Korean policy measures to bridge the digital divide were introduced in 1996 to promote welfare and social integration, and were carried out with the focus on distribution of IT equipments and infrastructure until the late 1990s. From 2001 to 2005, under the First Comprehensive Plan to Bridge the Digital Divide, such measures as the implementation of high-speed Internet networks, establishment of information facilities and distribution of IT equipments were carried out with the focus on promotion of information access for information-alienated people. Since 2006, according to the second comprehensive plan, various policy measures have been implemented by various government agencies to increase the informatization rate of the deprived compared to the total population from 71.1% of the present to 80% in 2010.

A. Increased guarantee of Web accessibility

Efforts being made to increase information accessibility for information-alienated people include: infrastructure building to enhance information accessibility of online information and printed materials/publications to the visually impaired; gradual expansion of organizations covered by the Web accessibility survey; introduction of the Web accessibility certificate; improvement of automatic evaluation tools and the expansion of the Web accessibility quality mark system; establishment of a corner saved for the deprived in libraries in regions where a lot of multicultural families live; support for cultural and educational programs; and test operation of library information services. In addition, to improve information usage in underserved areas, more information facilities are being built and improved through establishment of Internet centers for the disabled and implementation of the informatization innovation cluster, while distribution of IT equipments, PCs and broadcast receivers are being made to provide information-alienated people with more opportunities to access information.

〈Table 5－8〉 Distribution of “Green PCs” by year (unit: number of PCs)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Domestic	722	1,387	2,081	3,467	5,085	9,894	16,440	18,563	22,019	26,694	38,069	30,246	21,352	196,014
Overseas	-	185	-	-	60	430	2,161	2,017	2,553	3,837	4,488	3,401	2,007	22,117
Total	722	2,196	2,091	3,467	5,145	10,324	18,601	20,590	25,572	30,531	42,535	33,637	22,360	218,131

Source: Internal data from the National Information Society Agency

B. Improved information literacy

To improve the information usage environment of information-alienated people and employees of small and medium companies as well as enhance their information literacy, customized education programs on information considering the characteristics of various groups are being held. Also, to improve the willingness of residents in farming and fishing villages and the elderly, various programs are being implemented such as an online information education system, a cyber education system for the disabled, IT volunteer groups for hometown, senior IT volunteer groups and rural informatization leader programs. At the same time, policy measures are being developed for the promotion of Internet use and increase of income in farming and fishing villages through informatization village shopping malls and experience tourism sites. Meanwhile, information on agriculture, fishery as well as farming and fishing villages are developed and processed for easy understanding of farmers and fishermen, and community services are being provided for information sharing of farmers and fishermen and exchanges between urban and rural communities.

〈Table 5－9〉 Online Education Programs and Courses by Year

(unit: KRW, number of courses)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Online education programs	16,394	91,008	152,191	139,440	150,007	145,986	161,056	146,003	135,522	1,137,607

	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Text materials / content	-	-	-	5	21	15	16	15	10	72
Operation courses	9	22	34	46	56	70	82	82	70	-

Note: Ten text materials among the total of 82 were revised from existing content.
The number of text materials currently in use is 72 in total.
Source: Internal data from the National Information Society Agency

In addition, IT expert training programs are carried out to provide income creation opportunities through informatization; informatization programs are provided for the youth under probation, inmates and those under care and custody to improve their adaptability to the information society and competency for further education and employment; commercial assistance devices are offered for the disabled who work; and professional IT education programs are held linked with the improvement of work competence. These programs are offered to support employment and business startups for the disabled, job creation and stability of employment.

〈Table 5－10〉 Digital Divide Index and Comparison to Overall Population

(unit: points, %)

	2004		2005		2006		2007		2008		2009	
	Digital divide index	Comparison ratio	Digital divide index	Comparison ratio	Digital divide index	Comparison ratio	Digital divide index	Comparison ratio	Digital divide index	Comparison ratio	Digital divide index	Comparison ratio
The disabled	58.9	41.1	50.0	50.0	39.0	61.0	36.6	63.4	34.0	66.0	27.8	72.2
Low-income bracket	50.1	49.9	41.7	58.3	32.9	67.1	32.4	67.6	30.9	69.1	25.3	74.7
Farmers/ fishermen	81.7	18.3	75.0	25.0	70.9	29.1	69.5	30.5	66.8	33.2	64.8	35.2
Middle-aged/ elderly	82.3	17.7	76.7	23.3	67.6	32.4	66.3	33.7	65.5	34.5	63.0	37.0
Average	72.5	27.5	65.8	34.2	57.1	42.9	55.5	44.5	54.3	45.7	51.1	48.9

Note: 1. Digital divide index = Informatization level of overall population (100) - informatization

level of the deprived compared to overall population (100)

2. Comparison ratio signifies informatization level of the deprived compared to overall population when informatization level of overall population is set to 100.
3. Average means weighted average considering the size of each deprived group; low-income bracket refers to those who receive basic livelihood security, and middle-aged and elderly group refers to those aged 50 or older.

It has been discovered that information literacy of information-alienated people was improved through informatization education. According to a recent survey, when the informatization level of the overall population is set at 100%, the average informatization level of four major deprived groups compared to the overall population rose 3.2% from 45.7% in 2008 to 48.9% in 2009. Also, about 200 potential workers are being produced through professional IT education programs each year. In 2009, 40.1% of these people became employed, showing that informatization can help the disabled to rehabilitate by enabling them to get jobs.

Chapter 6. Case Studies of Overseas ICT Use

1. Germany: ICT in Construction, Retail, Consumer Goods, and Manufacturing

1.1. Overview

Between 2000 and 2010 a number of industries in the German private sector were facing the challenge of inefficient channels and methods of business to business (B2B) communication between suppliers, partners, and customers. There was a lack of standards for the identification of supply chains items, exchanging documents between businesses (such order placement, delivery acknowledgement, and billing), classifying products, and exchange of product catalogues. The level of adoption of such standards, and of software compliance with these standards across SMEs in the German construction, retail, consumer goods, and manufacturing sectors was very low. In the past decade, SMEs across mature economies such as Germany were at a stage where IT adoption was limited to personal computers, core business applications and personal productivity applications. To leverage the benefits of IT and establish global B2B communication standards and technologies (such as RFID and Electronic Data Interchange or EDI), the government identified the need to support the private sector entities that which particularly in need of state assistance, namely the SMEs. Prior to 2000, Germany's ICT policy focused almost exclusively on promoting the growth and regulation of ICT infrastructure; this included entities such as Internet Service Providers. However, since then, the German government has shifted its

focus to a number of initiatives that promote e-business and B2B communication standards among SMEs.

The core objective of the German's government ICT policy for the sectors identified above was focused on increasing the adoption levels of business applications. This was implemented through the establishment of specialized vehicles that would promote the adoption of business applications among SMEs. Such specialized vehicles would enable software and standards implementation projects by providing subsidies and advice, as well as by implementing assistance unbiased by commercial considerations. The intended beneficiaries of such policy initiatives were typically SMEs in the target sectors; the target beneficiaries were almost always well defined by sector, industry cluster (such as an automotive ecosystem centered around a few 'anchor' automobile companies), or region. The policy initiatives would operate under German ministries at the federal level, one example being the Federal Ministry of Economics and Technology. Alternatively it may be run at a state level, with an example being the Ministry of Economics Baden-Württemberg, which is part of a local government body in a high tech region in Germany. These vehicles would launch and run initiatives in conjunction with existing networks such as industry bodies, private sector service providers, and large companies.

The PROZEUS initiative was developed by the German government, and was driven by collaboration between a government agency and two non-profit bodies. It was funded by the Federal Ministry of Commerce and Technology, and was aimed at enhancing adoption of software solutions and standards that would help SMEs exchange data in an efficient and cost-effective manner with suppliers and customers worldwide. The SMEs covered within the program spanned a range of sectors, including construction, retail, consumer goods, trading, logistics, corporate services, and manufacturing. In order to qualify, SMEs would need to be defined as independent companies with less than 500 employees. The initiative comprised funding of software implementation projects,

providing advice on project selection and execution, monitoring project progress, documenting individual cases, disseminating information, and providing a platform for SMEs to learn from each other.

A key component of the PROZEUS strategy was to leverage large private sector enterprise-led initiatives to connect better with suppliers. As a case in point, the one of the streams of the initiative was executed in conjunction with a large retailer-led drive, aimed at better connecting providers of consumer goods. The PROZEUS initiative faced numerous challenges following its implementation, such as the issue of restrictions associated with the network effect. With too few SME partners to exchange data, the incentive for standards implementation was low. The program was launched a few years after the technology sector crash and at a time when there were issues perception of IT software and service providers. In addition, a number of SMEs are owner-managed businesses were from a generation what was skeptical of the benefits of IT software. However a number of these challenges were overcome in the years leading to 2008, and uptake of the software and systems increased, allowing standards to be developed in multiple sectors, particularly manufacturing. Adoption of the enterprise applications were further adopted as they were delivered using a more user-friendly 'Software as a Service' mechanism, which significantly reduced costs.

The PROZEUS initiative was operational between 2002 and 2008 and companies that were part of the initiative report benefits such as reductions in order processing time, order processing error rate, time and costs for tracking deliveries and out-of-stock time. They also experienced increased sales, and successful launch of contemporary supply chain management strategies such as Vendor Management Inventory.

1.2. IT Policy Initiatives

A key element of the PROZEUS initiative was the creation of a fund that accepted proposals for the subsidization of projects. This initiative was funded and managed by the Federal Ministry of Commerce and Technology (FMCT) of Germany, and had a total budget of € 8m for the period that it was active. Projects that were selected for funding were eligible for grants that covered up to 50% of personnel cost, which typically averaged between € 20,000 and € 50,000. The ministry responsible stipulated that between 20% and 80% of the project must be executed by the company's employees; on average companies in the program used 40% of the funding on external service providers. In order to meet its stated goal of minimizing of keeping paperwork to a minimum, the process of applying for funding was kept relatively simple.

The FMCT partnered with two organizations in order to meet its objectives; GS1 Germany (manufacturing sectors) and IW Consult (consumer goods sectors). These two organizations provided their expertise to service providers (such as logistics companies and customs agencies) that supported their respective industries. GS1 is an international not-for profit body aimed at the formulation, promotion, and implementation of standards (such as RFID and bar code standards) that govern B2B data exchange. IW Consult is a process and business consulting company that helps SMEs in the PROZEUS program to identity opportunities for B2B data exchange improvement. PROZEUS maintained a list of trusted software and service providers, but did not go as far as to make specific recommendations relating to any provider for a particular project; the body remained a neutral source of advice. The website provided an easy to use search tool for SMEs to shortlist a set of service providers, based on criteria such as industry sector, region, and the B2B data exchange standard relevant to them. The PROZEUS initiative also organized experts from industry and government into workgroups across Germany. Over the six year period of

the initiative, these workgroups developed guidelines on standards and project best practices. SMEs across the country could access a local PROZEUS workgroup for advice on opportunity identification and project execution.

Through a series of organized events the body provided a platform for SMEs to network and to learn from shared experiences of issues such as enterprise application selection, implementation, and transformation and B2B standards. A key condition for the recipient of funds was that they document and share their experiences (both positive and negative), with other SMEs within the initiative. PROZEUS worked towards making the case studies widely available and visible to other SMEs, with the aim of demonstrating the benefits of the initiative's investment, to a much larger number of organizations. In addition to case studies, PROZEUS provided extensive documentation on the technologies involved. This documentation included information on B2B data exchange standards, Master Data Management, project management best practices, and requirements specification templates. The overall goal of these was to reduce the time to value, costs, and risks for SMEs.

1.3. Impact on Productivity/Job Creation

The SMEs which participated in the initiative experienced the following benefits and enhancements:

- More efficient communication across SME partners in industry clusters;
- More efficient communication between SME suppliers and large “anchor” companies in industry clusters;
- More efficient communication between SMEs in Germany and their international trading partners.
- More efficient management of the production process at SMEs.

- On occasions the ability to comply with standards leads to significant competitive advantage and on occasions compliance with standards is the price of entry for doing business with “anchor” companies.
- More efficient overall management of supply chains by SMEs.

1.4. Summary/Conclusions

The PROZEUS initiative was part of a broader policy objective aimed at increasing the adoption and usage of enterprise applications in the German industry, and specifically targeted the SME segment. It was aimed at increasing the adoption of standards-based B2B communication and the adoption of software solutions that would enable such communication across various sectors. The policy initiative comprised subsidies, project implementation assistance, case study documentation for information dissemination purposes, development of knowledge base on project management best practices, list of appropriate software providers, and information related to standards, and marketing the benefits of software and standards implementation.

Participants in the scheme report reduced order processing time, reduced order processing error rate, less severe stock out situations, reduced order processing time, and even increased revenues. Also, the projects enabled a few companies to implement modern supply chain management techniques such as VMI. In many cases, the ability to connect with major customers in the supply chain was the price of remaining competitive. The PROZEUS initiative was deemed to be a major success, which led to an extension of the program to 2008.

2. US: ICT in Health Care

2.1. Overview

Health Information Technology (HIT) has been a priority for the US government since the early 1990s. In 2007 healthcare spending in the US was US$ 2.24 trillion, which represented a per capita spending of US$7,421, and 16.2% of the country's GDP. Healthcare spending in the US as a percentage of GDP is higher than other developed countries such as Canada, UK, and Australia and this difference has further expanded in the years leading to 2008. State owned healthcare payer systems are facing critical budget pressures and spiraling costs. However in spite of these costs, figures do not indicate that US citizens are realizing significant incremental benefit. The World Health Organization (WHO) ranked the US health care system at number 37, behind most other developed nations. According to the Organization for Economic Co-operation and Development (OECD), life expectancy in the US, at 65 years, was only slightly above the average for all nations. Research by PricewaterhouseCooper's Health Research Institute indicates that wasteful spending could account for as much as 53% of total US healthcare spend in 2007. Areas of such waste include avoidable and unnecessary laboratory tests and inefficient health care administration. Health Information Technology has been cited by a number of experts, both within and outside the US government as one of the ways the US health care systems could deliver better health care at lower cost. This case study examines in some detail the opportunities HIT provide for cost savings and efficiency gains. Below is a summary of the technology areas that are involved in HIT:

Electronic Health Records/ Electronic Medical Records (HER/ EMR)

These are software solutions that maintain a record of the patient history, including the diagnosis, medication and procedures prescribed, results of testing procedures, and any other information captured by the medical practitioner; ideally it covers every visit across the entire lifetime of the individual. When fully implemented, an EHR/EMR system allows every new medical practitioner a patient visits to access the full medical record of the individual.

Computerized Physician Order Entry (CPOE)

Software solutions allow physicians to order procedures and medications which are communicated via the medical facility's telecommunications networks. These orders are directed to pharmacies, nurses, and radiologists. This software is aimed primarily at inpatient settings, and is aimed at increasing accuracy of orders and reducing the administrative challenges associated with transmitting them from one department another department within the hospital.

Clinical Decision Support Systems (CDSS or CSS)

These are decision support systems for clinical settings, aimed at enabling doctors to diagnose and prescribe medications and procedures better using a knowledge base and an inference system.

Health Information Exchanges (HIEs)

These are information exchange networks that enable all stakeholders within a healthcare market, (including payers, providers, and laboratories) to exchange information such as claims and clinical data, as well as medication and test data.

There are a number of potential benefits that are derived from HIT implementation,

see below for a summary of them. Some of the sources of cost reduction are replacement of paper, avoidance of unnecessary procedures, physicians recommending drugs that are lower cost alternatives using recommendations made by decision support systems, reduction in length of hospital stay due to reduced paperwork, and overall lower administrative costs from quicker and more accurate process execution. With HIT, all information items related to diagnosis, prescribed medication and procedure, and procedure results can be at one place. With such a rich information repository medical practitioners are better equipped to practice preventive care, comply better with procedures that need to be repeated periodically, and avoid prescribing medications that could lead to an adverse drug reaction. Overall, physicians are more likely to make better decisions. Clinical Decision Support systems are particularly adept at recommending procedures (or recommending that the physician abstains from performing a procedure) that help medical practitioners make better decisions. Experts hypothesize that a high level of HIT adoption would lead to a huge corpus of data of conditions, procedures, results, which would lead to better pricing of health care services and yield many insights into the appropriate kind of care. Such a database would also help spot and monitor the outbreak of diseases.

The key policy objective guiding the US government's role in the field of Health Information Technology is to improve the quality of health care and reduce the cost of health care by reducing wasteful administrative procedures and unnecessary procedures. The long term goal of this policy is to enable results-based payment for health care services, as opposed to procedure-based payments for individual services. Published figures indicate that the US health care system is still a long way away from achieving these goals. The policy objective and the individual policy elements and initiatives are aimed at all stakeholders in the healthcare market.

A range of policy initiatives have been undertaken, including incentive systems for Health Information Technology implementation and usage, loans for technology

procurement at attractive rates, government funding of health information exchange networks, legislation that mandates EHR/EMR technology adoption by a specific date, government agencies formulating data interoperability standards, and agencies certifying appropriate commercially available EHR/EMR solutions. A major component of this policy is coordination of the many different policy elements, which in turn are managed by a number of different government agencies at the federal and state levels.

Policy initiatives aimed at health care IT adoption have been in operation since the early 1990s and the government's involvement has led to a gradual rise in their adoption, although this is still far from universal. Given the awareness of the benefits of HIT, the private sector has responded with considerable investments in health care IT technology. The broader HIT industry was valued at US$16.38 billion in 2005, and companies such as Microsoft and Google, have developed products and services for this industry. HIT-related policy currently has a very high profile in the US, and this is reflected in the size of the stimulus package that was announced in 2009.

Research indicates that HIT adoption has led to many instances of healthcare cost reduction, as well as enhanced productivity in both inpatient and outpatient scenarios. In outpatient scenarios proven cost reduction scenarios include lower medical transcription costs, lower paper chart maintenance costs, reduced total costs from avoidance of laboratory procedures, cost savings from optimum drug dosage. In inpatient scenarios, proven cost reduction scenarios include reduction of nurses' unproductive time, cost reduction from avoidance of unnecessary tests, cost savings from optimum drug usage, reduction in the length of stay, and reduced medical records management costs. Proven scenarios for better health care includes reduced instances of erroneous drug dosage, enhanced compliance with immunization plans, reduction in turn-around-time from prescription to medication administration, and avoidance of morbidity due to adverse drug events.

2.2. IT Policy Initiatives

As of late 2008, the level of funding available across the US for incentivizing HIT implementation and usage amounted to US$703 million. The incentives have taken various forms such as bonus payments to physicians on proof of HIT (particularly EHR/EMR) usage. Proof of usage varied from the simple (the practice needs to have a certified EHR/EMR installed) to the complex (an eleven point quality measure of which the installation of an EHR/EMR is one of the criteria). Funding programs are often subsidy based, with the practice sharing the cost of implementation. In addition to government-only funding, public-private-partnerships and private sector insurance companies offer funding programs as well. However nearly every incentive program requires the practice to have a certified EHR system in place.

As part of such schemes grants (in the region of millions) are awarded to communities of medical practitioners who apply for the grants as a unit to implement interoperable EHR/EMR systems community wide. In addition to grants, incentive programs include interest free or low interest loans as well.

Alongside the incentives programs listed above, states have mandated EHR/EMR adoptions by larger health care provider units such as hospitals and community health centers. For example, by 2008 Massachusetts had mandated the use of certified EHR/EMR systems by all hospitals and community centers by 2015 and CPOE systems by 2012.

Interoperability has been a challenge for HIT adoption initiatives over the years. As stated earlier in the report, much of the value of HIT (particularly EHR/EMR systems) is lost if information cannot be easily transferred across different medical practitioners. At best, interoperability standards have so far worked at the state level, whilst national-level data interoperability standard is still some distance away. The government's role in developing interoperability standards comprises two distinct elements, namely, formulating

interoperability standards for EHR/EMR systems and state and local governments promoting and actively aiding the development and maintenance of Regional Health Information Organizations (RHIO). RHIOs aim at achieving data interoperability within a community or state across multiple stakeholder organizations (such as network of major hospital systems and hospitals that operate within a region).

The HIT certification program, the Certificate Commission for Health Information (CCHI) Technology (a private not-for-profit body) was set up in 2004 to certify EHR/EMR systems with the aim of reducing buyer risk and promoting data interoperability. As of 2010, the CCHI has certified around 50 EHR/EMR systems.

A significant percentage of Regional Health Information Organizations rely at least partly on state grants. States also play the role of mediators, bringing together the different stakeholder groups, such as hospitals, hospital systems, their affiliates, pharmacies, and payers (including US government-owned payers). Such state driven mediation is important for assuaging concerns that inevitably arise from the prospect of competitors sharing data. The history of regional health information networks also offer a number of instances of state-owned agencies leading the development of the core IT systems necessary for health information exchanges to operate. Also, the US states are all major payers and hold and curate a significant volume of patient information and this data, in many HIE initiatives, is typically an important starting point for building HIEs. As an example of the state's role in developing and sustaining HIEs (and as an example of the operating models for HIEs), the case of the Utah Health Information Network (UHIN) can be cited. The UHIN is a state owned body launched in 1993. It started operations with claims information and over the years expanded scope to clinical information (such as laboratory results and medication history). The state (with the federal government and the state government of Utah providing grants of US$5 million over five years and US$600,000 over two years respectively) provided the seed funding

and continues to provide a significant percentage of the HIE's budget. Apart from funding, the state government secured buy in from all the stakeholders and acted as a neutral third party to the stakeholders, the payers, individual medical practitioners, hospitals, laboratories, pharmacies, and consumer groups.

Research suggests that the number of government agencies involved in promoting the adoption and formulation of HIT is very high. A number of federal and state level bodies are involved in formulating and enforcing HIT adoption policies. The government is also involved in multiple capacities; as a payer, provider, regulator, and as a source of funding. Naturally, the need to orchestrate the many different activities was recognized; in 2004 with this in mind the Office of the National Coordinator for Health Information Technology was set up as the principal US federal government entity entrusted with the task of coordinating efforts to increase HIT adoption to improve health care.

2.3. Impact on Productivity/Job Creation

A large number of empirical studies have been conducted on the cost reduction benefits of HIT adoption in specific settings and under specific scenarios. The following section lists some of the key HIT benefits that have been observed in practice. The observations listed here are part of a 2005 RAND Corporation study which assessed the benefits of HIT systems.

A. Outpatient scenarios

Evidence of reduction in transcription costs:

The study reported an average reduction of transcription costs of US$600 per month or 48% per urologist. The sources of savings come from avoidance of labor cost as well as avoidance of the physical infrastructure necessary to capture and store transcription tapes manually. In addition to this, it allows for greater accuracy in the process.

Evidence of reduction in paper chart maintenance costs:

The sources of savings here are the avoidance of labor cost, increased medical practitioner productivity, quicker delivery of services, and avoidance of physical infrastructure to maintain the paper charts. The study estimated a 63.4% reduction in expenditures on medical records management personnel.

Evidence of cost savings from avoidance of laboratory tests:

The 2005 RAND study, combining data from multiple empirical studies, reported a 22.4% reduction in total outpatient laboratory costs. The corpus of research that RAND Corporation drew its conclusions from includes cases of between 6% and 88% savings in outpatient laboratory costs.

Evidence of cost savings from optimum drug usage:

The sources of savings here are physicians prescribing drugs based on their cost benefit profile, ordering lower cost generics, ordering lower cost alternatives, and discontinuing unnecessary medication, all through better information capture through CPOEs and recommendations made by Clinical Decision Support Systems. The 2005 RAND study combines results from multiple empirical studies to conclude that the sources of cost savings listed above would lead to a total saving of US$ 38,356 per physician (2005 dollars).

B. Inpatient facilities/Scenarios

Evidence of reduction of nurses' unproductive time:

In this instance savings are derived from nurses spending less time on documentation, avoidance of redundant data collection, and costs associated with maintaining a paper form-based system. Better utilization of nurses' time has lead to redeployment of nurses and managing an additional number of patients without increasing the nurse headcount while maintaining the same quality of care. The RAND Corporation study concluded

from three empirical studies that HIT adoption would lead to an 11.4% reduction in the demand for nurses.

Avoidance of unnecessary tests:

HIT adoption has lead to avoidance of unnecessary tests due to the easy availability of existing test data and easy access to different views of the same laboratory test data. Both patient records and Clinical Decision Support system lead to the aforementioned benefits. The RAND Corporation study concluded from two empirical studies that the HIT adoption leads to an average of 11.8% reduction in laboratory costs.

Drug utilisation:

The sources of savings here are the same as those cited in the outpatient scenario. The RAND Corporation study reports a 15.2% saving in drug costs based on an existing empirical study.

Reduction in length of stay:

The length of hospital stay is influenced by administrative procedures encompassing capture and communication of information such as patient charts, laboratory tests, and orders and approvals. CPOEs and EHRs can streamline the largely manual and paper-based process to reduce the length of hospital stay. The RAND study reports an average reduction in length of stay of 15.2 percent based on three empirical studies of the effect of HIT adoption on the length of stay.

Reduction in medical records management costs:

The sources of savings here are similar to those cited in the “Outpatients” section, namely the personnel and physical infrastructure costs associated with maintaining paper charts. RAND Corporation concludes from direct empirical evidence (based on a survey of hospital executives) that medical records expenditure may be reduced by 50%.

The 2005 RAND Corporation study extrapolated from the individual points of

evidence cited above to project potential cost savings on a national scale. The results of this extrapolation exercise are presented in the table below. The following points would help the process of interpreting the RAND Corporation extrapolations.

- Potential savings refer to savings per annum that will be realized when adoption reaches 100%. Also, potential savings are the savings that could be realized in a year at the time of analysis (2005) if the adoption were to suddenly increase to 100%.
- Cumulative savings are savings that would accrue in 15 years (with the base year being 2004) assuming the adoption rate curve would be in line with historical adoption rates (with certain optimistic assumptions).
- The benefits calculated are from the point of view of both Medicare (US government's payer program for the elderly and the disabled) and from the point of view of all payers.

〈Table 6－1〉 US: Health Information Technology Potential Cost Savings (billion US$)

	National savings		Savings to Medicare	
	Potential savings (in one year if adoption were to jump to 100%)	Cumulative savings (over 15 years, extrapolating from current adoption rates)	Potential savings (in one year if adoption were to jump to 100%)	Cumulative savings (over 15 years, extrapolating from current adoption rates)
Outpatient				
Transcription	1.9	13.4	0.4	2.7
Chart pulls	1.7	11.9	0.3	2.4
Laboratory tests	2.2	15.9	0.5	3.2
Drug utilization	12.9	92.3	2.6	18.7
Radiology	3.6	25.6	0.7	5.2
Total	22.3	159.0	4.5	32.3
Inpatient				
Nurse shortage	12.7	106.4	3.9	32.7
Laboratory tests	3.0	23.4	0.9	7.2
Drug utilization	3.7	29.3	1.1	9.0
Length of stay	36.7	289.6	11.3	88.9
Medical records	2.5	19.9	0.8	6.1
Total	58.6	468.5	18.0	143.8
Total	80.9	627.5	22.5	176.1

RAND Corporation

This section presents the results from a meta-study on improvements in quality of health care from HIT adoption. The study draws from 256 research initiatives on the impact of HIT on the quality of health care. A study based on information on a pediatric intensive care facility reported a 59% decrease in pharmacist interventions for erroneous drug doses. The automated alert service improved adherence to immunization plans in a pediatric facility reports from 48.8% to 50% in two out of five immunization procedures studied. Another study on the impact of an automated reminder service for vaccinations revealed that the group which was aided by alerts received an influenza vaccination 30 percent of the time compared to 7% for a control group that was not aided by such alerts. A study on the effect of CPOE technology on inpatient administrative processes revealed that a CPOE solution reduced the time taken from prescription to administration from 10.5 hours to 2.8 hours for medications and 42 minutes to 32 minutes for radiology tests. One study reported that easier access to data due to EHR/EMR led to quicker identification of patients experiencing ADE and quicker intervention which in turn led to lower morbidity.

HIT adoption has increased from the early 1990s to the present day and by most accounts state-sponsored measured have played a significant role in increasing adoption. A 2007 study by the American Journal of Medical Quality reported that EHR adoption of Florida physicians increased from negligible adoption in 1989 to 23.7% adoption in 2005. Another 2005 study conducted by the Medical Economics Journal revealed that EHR adoption was at 15%.

2.4. Summary/Conclusions

The evidence presented indicates that HIT policy has played a direct role in increasing HIT adoption. It also indicates that HIT usage has led to a reduction in costs

and improved health care. Projection of health care cost savings data on a national scale indicate costs savings of over US$620 billion over a 15 year period. Empirical evidence of improved health care from HIT usage includes cases of reduced morbidity from fewer adverse drug event cases. The government has used multiple policy tools, from subsidies to infrastructure development, taking HIT adoption (according to various accounts) between 10-15%; HIT policy remains a focus area for the US government.

3. Syria: ICT in Education

3.1. Overview

The Syrian government launched a number of IT policy initiatives between 2000 and 2005 with the intention of increasing the number of computer science, engineering and business educationtrained graduates. These initiatives also cited facilitating research-based tertiary education, and extending overall accessibility of tertiary education. Such initiatives were part of the broad-based policy objective aimed at increasing the usage of ICT tools across educational institutes at all levels. The following aspects of the Syrian higher education system and the following requirements of the Syrian industry led to the launch of the policy initiatives detailed in this case study:

There was a high demand for IT and business trained graduates in the Syrian private sector. Some of the architects of such policy initiatives cite the need for business and IT trained graduates as one of the key factors driving Syria's IT policy for tertiary education. One of the major policy initiatives was the establishment of a virtual university and one of the key courses (and one of the popular courses) offered by the virtual university is an "Associate Degree" course comprises Internet studies, Web development and programming, management, marketing, and "General Business". There

was a need for enhancing the quality of education. Parts of the Syrian academia believe that the country's traditional model of pedagogy is not in alignment with contemporary notions of knowledge acquisition. Syrian experts say that traditional system of pedagogy focused on memorization of facts and not assimilation of the subject's theme and exploration of many associated areas of knowledge. These experts believe that an interactive learning paradigm would be an improvement on the traditional Syrian model of pedagogy. The SVU founders cite such improvement as one of the core objectives driving the creation of a virtual university. There was a need for increasing the reach of higher education to all parts of the country. The number of centers of excellence in the field of tertiary education, particularly ICT education was low. Research indicates that ICT education mention ICT departments in just five universities, Damascus, Aleppo, Tishreen, and Albaath Universities.

The key objective of this policy was to increase the number of ICT and business education-trained graduates, extending the reach of higher education, enabling research-based tertiary education to previously underserved demographics, creating a more flexible education delivery infrastructure (and therefore better equipped to meet the changing demands of industry) and enhancing the quality of higher education were the goals driving IT policy. While these policies were driven in part by industry requirements, most of the impetus came from the government and the intended beneficiaries were the universities (both the academia and postsecondary students) and citizens in general.

The Syrian government launched a virtual university; the Syrian Virtual University (SVU) and a network grid that connected prominent Syrian universities and connected these centers of learning to global research agencies and universities. In parallel with such ICT-based initiatives, the Syrian government worked towards increasing enrollment in ICT courses across traditional state-owned universities.

SVU enrollment has steadily grown since its inception and this enrollment into ICT courses also encourages the uptake at traditional universities. The net increase in the ICT and business-trained talent pool as a result of the SVU could have helped Syria at a time of instability. Until recently, American software companies such as Microsoft were barred from conducting business in Syria, which naturally led to constraints in the supply of software and services. While mitigating the effects of US sanctions against Syria (which were launched in 2004 and partially withdrawn in 2009) was not the primary driving force behind these ICT policies; the policy initiatives played a role in addressing demand for ICT. To illustrate this, Transtek, a Syrian provider of Enterprise Resource Planning (ERP) software, had an 80% share of the domestic market. , and this was attributable to the lack of global competitors. Transtek met a demand for ERP software that would otherwise be left unmet. The company reports that fresh Syrian ICT graduates forms an important part of the company's employee base. At its peak, the sanctions had reached a point wherein access to online repositories of open source software. However its ability to train ICT graduates and continue modernization of its financial services sector bears testimony to the successful development of ICT talent.

The ICT policy initiatives have led to increased availability of ICT trained graduates across Syria, which in turn has enabled home grown IT companies to serve IT intensive sectors, such as banking in the domestic market. The SVU provided approximate 20% of ICT-trained graduates from state universities between 2006 and 2007.

3.2. IT policy initiatives

The SVU was established by the Syrian Ministry of Higher Education in September 2002. Its stated goals were to provide education to students who could not afford regular university education, increase the tertiary education sector's capacity, enable

continued education, and optimize the management of curricula. It placed a special emphasis on ICT education. SVU students took their classes via the e-learning system. They attended virtual classes where queries could be resolved in real time. It also allowed for communication with staff and fellow students via an online platform. Sessions could be recorded for review at the student's own pace. The administrative aspects of the SVU were also managed through online applications. SVU provides course content and teaching in Arabic wherever possible. On an ongoing basis the university works towards providing even advanced degrees in Arabic. Also, SVU's faculty includes professor of Arab ethnicity based across the world. Arabization of technical courses was far from simple, and SVU's target groups were not always proficient in English. To address such issues, the University provided a one year preparatory course in English which was also delivered offline. SVU offers programs run by its partners based in Australia, Europe, the US, and Canada. The courses are administered by SVU's university partners and its works towards localization of such courses on an ongoing basis. Inexpensive Internet access is not ubiquitous in Syria and SVU operates through a system of telecenters across Syria. SVU runs 20 telecenters across Syria, as well as one in Dubai. Students could use these telecenters to access course content, as well as online assets. The courses taught by SVU are fully recognized by Syrian laws governing university education and the degrees awarded are considered equivalent to those degrees awarded by traditional universities. SVU worked on an ongoing basis towards achieving such equivalence with programs managed by its partner universities. The telecenters described above provide the physical and connectivity infrastructure for conducting online assessments supervised by SVU-trained personnel. Such supervised or proctored assessments form an essential part of the SVU ran programs and are a mandatory element of the degree acquisition process. Some of the courses/programs facilitated by partner universities are too expensive for the average

Syrian citizen, and the government works towards subsidizing such courses.

Operational since 2002, the Syrian H.E. and Research Network (SHERN) is a network connecting universities, government agencies, and research institutes, it provides this connectivity both within and outside of Syria. The network is aimed at enabling distance learning and collaborative research. It also provided students with access to information resources; users are able to browse the Internet, use email, online libraries, e-learning systems, video conferencing services, multimedia broadcasting, an administrative information exchange system, and a research data center. It would be important to mention that Switzerland's CERN (the world's largest particle physics laboratory) is among SHERN's partners.

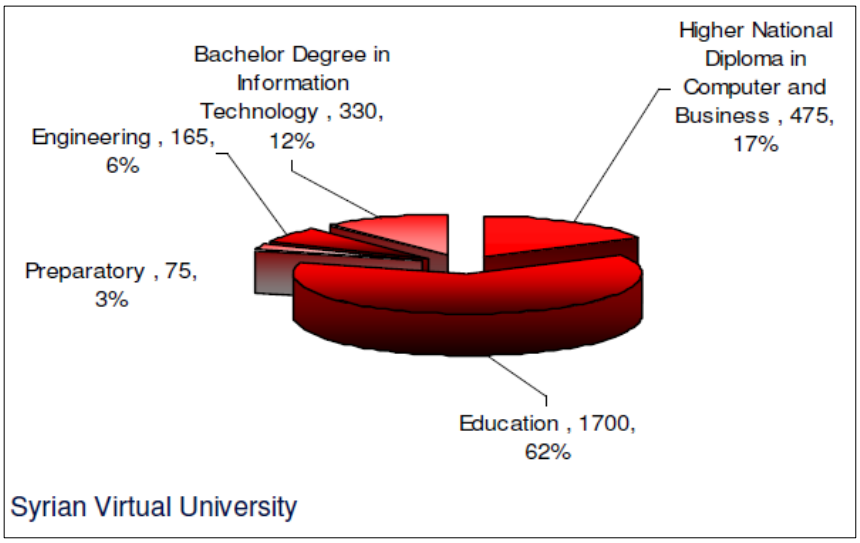
A number of the policy elements discussed have been launched with the assistance of international non profit agencies. For example, the SHERN was launched with the assistance of the United Nations Development Program (UNDP) in 2001.

3.3. Impact on Productivity/Job Creation

A. Increase in enrolment at the Syrian Virtual University

The SVU started with 200 students in 2002 and by early 2007 it had 5,000 students; of these 1,500 new students enrolled in 2007. The number of students enrolled in the Faculty of IT increased from just over 1600 in 2001 to over 3200 in 2005 across four universities, Damascus, Aleppo, Teshreen, and Al-baath. The number increased to over 3500 by end of 2006.

〔Figure 6－1〕 Syrian Virtual University: Enrollment by Program



B. Growth of the Syrian IT industry

The state's initiatives aimed at increasing the use of ICTs to increase the scope of ICT and business education has had a direct impact on augmenting the local ICT talent pool. The SVU accounted for over 18% of the ICT trained graduates from state-owned universities by 2006-2007. The Syrian Computer Society, established in 1989 aimed to promote the Syrian IT industry and increase the adoption of IT across all sectors within industry and government. As early as 2002, it had 85 member companies, comprising all areas within. In 2002, the Society reported that the Syrian IT industry was an exporter of IT services to the Gulf region and that the industry had played a key role in the modernization of the financial services and the public sectors.

Between 2000 and 2009 most major Syrian banks implemented core banking solutions. While the solutions implemented were developed outside of Syria (Kuwait and London), ongoing maintenance and managing the vendor relationship required

expertise which was sourced from indigenous talent pools. Transtek, the largest Syrian-based business software provider, offered financial, human resource, inventory, procurement, and supply chain management software to major Syrian companies across various sectors. Its ability to do this can in many ways be attributed to the ICT policies that were implemented. Indeed of the 200 employees it has, the majority received university education in Syria.

3.4. Summary/Conclusions

Syrian government's policy of expanding access to tertiary education, increasing the usage of ICT tools in education in general, and increasing the pool of ICT-educated talent have increased the pool of technology and business-educated graduates. The initiatives shaped by this policy objective have helped Syria through a difficult time of sanctions that effectively banned the entry of American software companies. These initiatives have also helped Syria implement and maintain technology systems in sectors where technology is essential.

4. Zimbabwe: ICT in Agriculture

4.1. Overview

In the years leading up to 2010, Zimbabwe embarked on a program to provide small scale, subsistence farmers with information through websites and software tools. These initiatives were part of the policy objective of leveraging ICT in agriculture to promote food security, achieve superior land management, manage production better, and promote information sharing for better forecasting and sustainable agricultural practices.

A multitude of historical factors have led to a lack of well informed farmers and the

dominance of subsistence level farming in Zimbabwe. With a long history of colonialism, Zimbabwe's land distribution pattern was highly non-uniform with a number of large commercial farms, a large number of small holdings characterized by mainly subsistence level farming, and communal farms managed by indigenous communities; with the distribution pattern was skewed along racial lines. The Zimbabwean government's land redistribution program involved redistribution of land from large-scale commercial farmers to the rural peasants, in two formats - a few hectares of land to households on one scheme and commercial farms under a different scheme. This scheme was aimed at reducing rural poverty, increasing agricultural output, reducing income inequity, and absorbing surplus labor. In contrast to its aims, research indicates that resettled farmers have the lowest levels of efficiency, and experts believe that land redistribution led to the loss of agricultural productivity as well as the loss of productivity, which can be partly attributed to the exit of experienced farmers. The government introduced this non-consensual land redistribution in 1997, and by 2000, it launched the Fast Track Land Reform program. This program was aimed at achieving quick identification, redistribution and transfer of land. The latter is often cited as the move that led to a catastrophic drop in agricultural production that Zimbabwe still has not recovered from. It is believed that in order to succeed, redistribution programs need to be executed using modern agricultural techniques, along with access to markets and appropriate irrigation. Relevant provision of information could potentially facilitate these techniques, as well as access to markets.

Urban farming is believed to be important for Zimbabwe's food security. It comprises on-plot farming around residential plots, as well as off-plot farming which involves farming on open spaces within built up areas. The capital city, Harare has one of the best agriculture soil in Zimbabwe. Most urban farmers have small land holdings and are not well versed with modern agricultural techniques.

Zimbabwe has a high literacy rate, making ICT-driven information dissemination a potentially feasible option. At over 90%, Zimbabwe has one of the highest adult literacy rates in Africa. In spite of the country's many pressing problems, online access to agricultural information had high potential for bringing about change in Zimbabwe.

The policy was aimed at enabling small scale and typically untrained farmers to produce food at subsistence levels; a goal that was consistent with the broader IT policy goal of food security. The scope covered all areas of Zimbabwe and focused on newly resettled farmers.

The program incorporated initiatives aimed at improving agricultural efficiency, facilitated by equipping farmers with information they would not otherwise have without ICT tools. An important component of this ICT-driven state intervention is the provision of farming software. As would be expected of a sub-Saharan country, the computing and connectivity infrastructure was poor and so an important precondition for farming software usage was the provision of pcs and Internet access to its citizens.

The benefits of internet access (that provided among others, meteorological information) and farming software are somewhat offset by the considerable challenges the country faced for most of the last ten years. Zimbabwe experienced GDP contraction of 40% between 2000 and 2007 and for most of the 2000-2010 decade the country has faced considerable economic and social challenges. It has been struggling with hyperinflation for a number of years and at its peak the rate of inflation was the second highest ever recorded in global economic history. The economic challenges limited access to ICT tools, as did issues regarding the lack of a continuous power supply. The benefits of ICT tools would have been far easier to realize were there fewer issues regarding basic requirements, such as availability of fertilizer and problems associated with land redistribution.

The initiatives have led to relatively high usage of the farming applications. In addition to this, the information access infrastructure has played a role in farmers

managing to maintain a subsistence level output. The benefits, while modest in absolute terms, can be considered significant when viewed in light of Zimbabwe's considerable economic and social challenges.

4.2. IT Policy Initiatives

One of the core problems of the agriculture sector in Zimbabwe was that a significant part of the arable land was managed by new farmers. The following technological and institutional elements collectively aim at providing these new farmers with the information and knowledge necessary to produce at least at subsistence levels and possibly expand to commercial levels of output.

Subsidized connectivity across the country, the ZARNet network

The Zimbabwe Academic and Research Network (ZARNet) provided Internet connectivity to communities that could not afford commercial Internet service providers. ZARNet, which is government funded and started with seed funding from United Nations Development Program (UNDP), connects research institutes, schools, NGOs, as well as communities that do not have or cannot afford commercial Internet access.

Telecenters

Since 1999, the Zimbabwean government has worked with non-profits, aid agencies, and local communities to establish telecenters. Each telecenter provides the local community with Internet and phone connection, computers, CD-ROMs, printers, radio, and television.

Agricultural Research Extension Services

The Agricultural Research Extension Services (AREX) drives most of Zimbabwe's ICT initiatives for the agricultural sector. It operates under the Ministry of Land and Agriculture and its remit includes research, farmer training, provision of technical and

advisory support to farmers, and information generation and dissemination.

e-Hurudza, an agricultural information software solution

One of the most remarkable components of Zimbabwe's use of ICT in agriculture is its farming software, e-Hurudza. It was developed by a private sector company (partly funded by the government and the development phase executed in collaboration with state-owned research agencies), e-Hurudza is distributed by AREX. The AREX agency also has the task of training users on e-Hurudza. This platform provides information on crops and live stocks, crop rotation methodologies, input requirements, and provides features that facilitate farm administration, financial report generation, and sales. It also facilitates the ability to model alerts (such as targets, and the farmer is notified when target is reached because over production would lead to losses), plan budgets (aided by updated information on input prices). The alerting feature recommends actions to farmer at each stage of the crop cycle, such as when to add fertilizers. Alerts can also be modeled such that the farmer is notified when profits are about to be seriously impacted by rising production costs. In addition to all of the aforementioned features, e-Hurudza at its core is a knowledge base. The new farmers needed to learn about crop varieties, way to control diseases, and chemical inputs. This knowledge based provides recommendations on the best crops to grow given a region's soil and climate attributes. Furthermore, e-Hurudza also provided ways for various stakeholders in the agricultural ecosystem (farmers, farm management, input providers (such as seed suppliers)), and lenders to work on a common set of data and shared documentation, which is required for transactions. For example, e-Hurudza made it possible for farmers to present detailed documentation to lending banks on how the loan was being used.

Other agricultural software

This initiative developed a more advanced farming platform, in the form of the Interactive 3d learning objects (I3dlo) software, which used virtual reality techniques to educate the

newly resettled farmers. Developed by a private sector South African company, I3dlo is brought to market in Zimbabwe by World Links Zimbabwe, a non-profit organization that has been working with the Ministry of Education since 1999, I3dlo enables farmers to navigate through a virtual environment and interact with models of agricultural artifact. The three dimensional format facilitates the process of learning for untrained farmers, and is being used to train farmers on preventing soil erosion through appropriate ploughing methods by providing a virtual reality environment that illustrates how the contours of a farm can be mapped and how ploughing along these contours can minimize soil run offs.

Other IT elements

Zimbabwean government agencies provide additional support to farmer via CD-ROMs, podcasts, and online weather forecasts. The telecenters provide information on CD-ROMs to newly resettled farmers. Podcasts developed in local languages and played on MP3 players with rechargeable batteries is one of the ways AREX workers disseminate agricultural information and knowledge. The Zimbabwean Meteorological Department maintains a Web site and provides information on seasonal forecasts, weather updates, weather forecasts, and forecasts and estimates on the right time to start planting operations, among others. Audio files have also been made accessible to farmers through mobile phones.

4.3. Impact on Productivity/Job Creation

A. Rapid adoption and impact of e-Hurudza

The e-Hurudza software solution has been moderately successful. The 2005 “Zimbabwe ereadiness survey” authored by the Department of Science and Technology Development in the Office of the President and Cabinet concluded that that the e-Hurudza software has enjoyed “rapid uptake”. Various estimates place the adoption

figure of e-Hurudza at between 8,000 and 10,000 farmers and approximately 2,000 installations of the software. Whilst a modest number, it must be considered against a backdrop of hyperinflation, political turmoil, GDP contraction and AIDs. A research study conducted by the Cape Peninsula University of Technology, South Africa reported the following benefits accrued from e-Hurudza software usage by groups of farmers:

- Increased understanding of commercial agriculture, including crop variants, disease control techniques, and chemical inputs
- Acquisition of information on the right crop to grow given a region's soil pattern and climate
- Improvements in basic information on how to grow a particular crop and raise a particular kind of live stock
- Provision of input prices which are continuously updated which helps the budgeting process
- Provision of all input factors in a structured manner

It is believed that e-Hurudza usage can be credited with helping untrained farmers supplement their food stocks at a time hyperinflation made food items unaffordable.

B. Instances of other farming software usage

It is estimated that the Interactive 3d Learning Objects system had helped 600 small scale farmers across four regions to understand the essential techniques required for productive farming, such as avoidance of soil erosion and improved marketing skills.

C. Evidence of helping urban farming and food security

It is estimated that approximately 50% of agricultural practitioners in Zimbabwe's capital city have access to information delivered via ICT technology. ICT access, as facilitated by the policy has played a role in ensuring subsistence level farming in urban Zimbabwe and in ensuring urban food security.

4.4. Summary/Conclusions

Provision of farming software and agricultural information to newly resettled/non-expert farmers contributed to urban food security and led to many instances of farmers acquiring basic information necessary for cultivation of crops suitable to their environment. It can be concluded from the Zimbabwe's experience with ICT policy tools in agriculture that given a literate population the potential benefits of IT tools are significant.

5. India: ICT in Telemedicine

5.1. Summary

Since the late 1990s, multiple government agencies in India have been working towards developing the technological infrastructure necessary to expand the footprint of telemedicine technology. These initiatives have led to a sizeable telemedicine presence, which in turn has facilitated greater access to highly specialized healthcare (particularly in remote locations), enhanced compliance with post-surgery consultation programs, and enhanced disaster management.

5.2. The case for telemedicine

It is believed that there is a strong case for the development of telemedicine policy in India, based on the aspects of India's healthcare system outlined below.

Specialized healthcare facilities in India are concentrated in the major urban areas - this limits access for a significant percentage of the population. Approximately 90% of secondary and tertiary healthcare facilities are located in cities and towns away from rural areas (where 68% of the population reside). In addition to this, 75% of qualified

doctors are found in urban centers, further exacerbating the accessibility issues for the rural population.

The country has a number of sparsely populated areas. Though it is the seventh largest country in the world, India has a number of sparsely populated areas with limited access to healthcare. One such region is the north east where the population density is much lower than in the north and in the Indian peninsula. In addition to this, two groups of islands, the Andaman and Nicobar islands in the east and the Lakshadweep islands in the west, have low population densities, and are also a great distance from centers of healthcare excellence. In addition to providing healthcare services on an ongoing basis, telemedicine was viewed as vital for the delivery of healthcare to these regions - care which would be even more vital for delivering relief at times of natural disasters.

Even primary healthcare has low penetration in rural India. In spite of a number of public sector and healthcare initiatives, the penetration of good-quality primary healthcare in rural India was low. A number of healthcare issues could be resolved using telemedicine. These include interpretations of procedures that require specialized expertise, postsurgery monitoring, disease surveillance, home care, and ambulatory monitoring.

The human resources necessary to make telemedicine work are already present. India's large IT services industry provided it with the hardware and software skills required to implement large-scale communication projects. It also has an established tele-communications network with over 10 million new mobile subscribers a month. India was also one of the leading nations in satellite technology, with a dedicated satellite addressing the needs of healthcare and education-related projects. Finally, the government had a number of research and development agencies that had a long history of working on citizen welfare-related projects.

Large-scale religious gatherings in remote locations present a difficult logistical problem for government agencies. With a very religious population, large-scale religious gatherings in remote locations are common. These present a serious logistical challenge to healthcare units within the government. The demographic profile of the visitors is biased towards senior citizens, and hundreds and thousands of people in close proximity lead to contagious diseases that can quickly get out of control. These gatherings typically take place in locations away from disease control and healthcare (particularly secondary and tertiary) facilities and therefore are perfect candidates for telemedicine technology.

5.3. The policy components

Government research labs for software and hardware development

The government-owned IT research and development center, the Center for Development of Advanced Computing (C-DAC) has developed a telemedicine solution with end-to-end capabilities including support for Electronic Health Records (EHRs) and for tele-cardiology and tele-radiology.

The government has launched and runs a number of telemedicine initiatives

The government's Department of Information Technology developed telemedicine networks which connected specialist healthcare centers, primary and secondary care, and centers of healthcare excellence. These networks were developed for cancer detection as well general and continued care in Southern India. They were also developed for tropical medicine care and disease surveillance in Eastern India, and general care in the north east, a sparsely populated area.

Government healthcare providers run telemedicine networks

The most advanced and specialized state-owned healthcare providers (e.g. the All

India Institute of Medical Sciences) had established telemedicine networks which provided interconnectivity to less specialized medical care facilities in other states, as well as remote primary care outposts.

The Indian Space Research Organization (ISRO) for connectivity

ISRO enabled telemedicine access by networking healthcare centers through the national satellite system. It was state-owned, and had a budget of $1.3 billion. ISRO's telemedicine initiatives started in 2001; the network of healthcare facilities connected by the space agency's satellite technology covers 78 remote, rural, and district hospitals, as well as healthcare centers.

Formulation of interoperability standards

Though the telemedicine initiative was being driven at a state level, implementation was typically carried out by the individual states. In addition to this, the rise of private sector healthcare provider chains (i.e., those with multiple and sometimes geographically distributed units) was a recent phenomenon that was growing rapidly. Naturally, telemedicine necessitated cooperation across different states and between the states and private bodies. Since 2003, the government has worked to release a number of guidelines aimed at ensuring interoperability between different telemedicine hardware and software systems.

The Indian government as a source of funding

As part of the Indian government's 2007-2012 plan, it allocated $50 million to telemedicine. Most of these funds were directed towards projects in which the government partnered with private sector healthcare providers.

5.4. The benefits

Provision of healthcare in remote/rural locations and cost savings to patients

The benefits of telemedicine have been felt throughout the country. For example, the

telemedicine network for tropical medicine in the eastern part of India had served over 800 patients by 2003, just a few years since inception. Since the first pilot project in 2001, the ISRO telemedicine network has provided healthcare services to at least 25,000 patients. Apart from delivering high-quality healthcare to patients who would not otherwise have access to it, the technology reduces the cost of receiving this healthcare. A study which reviewed the experiences of 1,000 patients in a district in Southern India concluded that, on average, patients benefited from an 81% reduction in costs through the application of telemedicine.

Post-surgery monitoring of patient progress

Telemedicine technology is being used to monitor patient progress following surgical procedures. Over a period of four years, 34 post-operative patients were monitored using the technology; the process involved 66 sessions over the telemedicine network. Feedback was collected from all 34 patients and of them 66% reported a satisfaction level of "excellent."

Improved disaster management

India suffered a devastating earthquake in January 2001 and the western region of the country was the most severely affected. State-sponsored telemedicine networks provided connectivity between the disaster site, (Bhuj, in the state of Gujarat in Western India) and over 750 sessions were conducted over a period of 30 days.

Managing the healthcare requirements of a large gathering of people

As stated earlier in this report, the government of India faces the tremendous logistical challenge of managing religious gatherings in the region of hundreds of thousands (and sometimes even millions) on a regular basis. The largest of these festivals is the Kumbh Mela, which is a gathering of 10 million people over a period of roughly 50 days in an Eastern Indian city. A state-level department of information technology and a government-owned healthcare provider collaborated to manage a range

of services. Here the scope of telemedicine covered regular monitoring of drinking water (bacteriological examination of samples), monitoring of food samples, the likelihood of a contagious disease breaking out (through examination of samples from individuals in the gathering), and tele-consultation.

6. Ireland: ICT in Construction

6.1. Summary

The policy initiative known as the 'Construction IT Alliance eXchange' (CITAX) was aimed at increasing the efficiency of inter-business processes within the Irish construction industry ultimately through the implementation of IT applications and infrastructure. The first step towards this goal was to identify the inefficiencies associated with current processes and to execute pilot projects that would establish the potential benefits of IT implementation. The policy initiative was funded partly by a government agency, Enterprise Ireland, and was executed by an industry alliance, the Construction Information Technology Alliance (CITA).

The initiative involved Enterprise Ireland and CITA collaborating to execute five projects that would demonstrate the potential benefits from increased usage of online information exchange systems. The five projects covered design, trading, electronic tendering, project collaboration, and computer aided measurements. The teams that have assessed current processes and monitored pilot projects report significant opportunities for cost savings and productivity gains.

CITA and Enterprise Ireland also believed at the onset of the project that a higher level of IT maturity was required for continued viability of the construction sector, an industry that accounts for a significant percentage of GDP and employment.

On a related note, Ovum's research indicates that Ireland lacks a well-articulated strategy for the private sector services and policy initiatives are typically executed by government agencies in an independent manner. The ICT policy direction is very much focused on the delivery of government services to citizens and businesses and on the ICT supply sectors.

6.2. The case for policy/state intervention

It is believed that SMEs in the Irish construction industry lag behind their counterparts in other sectors due to a number of factors. These include the level of fragmentation and the conservative nature of the industry, as well as the technology risk/incentive profile that makes companies reluctant to install IT systems.

While the benefits of such systems accrue to the client, most of the costs and risks of IT projects were typically borne by the design firms. This led to the realization that a pan-industry, government-funded effort was needed to create the IT platforms which would enable SMEs in the construction industry to collaborate better on projects.

In addition, CITA reported that the state was one of the largest buyers of construction services in Ireland and naturally has an interest in enhancing productivity and reducing costs.

6.3. The elements of policy/state intervention

Enterprise Ireland had a two-year funding contract with 25 CITA member organizations, with the contract covering 50% of expenditure. The remainder of the funding came from the participating organizations.

The five projects listed here were selected by CITA after high-level research on inefficiencies associated with current B2B exchange processes. The objective guiding

each project was to assess existing information exchange practices, identify inefficiencies, and establish with a high level of accuracy (and plausibility) the potential productivity improvement and cost saving opportunities. CITAX was also tasked with successfully executing pilot projects, and validating estimates through data gathered from these pilot projects. The following bullets detail the five projects:

- Module 1, Design: This was aimed at enabling the production and exchange of computer aided design (CAD) files during the design process.
- Module 2, Trading: This project was aimed at developing an eXtensible Markup Language (XML)-based standard for companies to exchange purchase orders, delivery notes, and invoices. The long-term goal guiding the trading project was the creation of an exchange platform that all construction companies in the Irish construction industry would use.
- Module 3, Electronic tendering: This project involved an assessment of contemporary tendering practices and their inefficiencies.
- Module 4, Project collaboration: This was aimed at assessing the inefficiencies of project collaboration processes and demonstrating through a live project that there exist more efficient and secure ways of exchanging product data online.
- Module 5, Computer Aided Measurement: This project was aimed at assessing current practices and selecting a set of readily available software that would enable a superior measurement approach.

6.4. The benefits

The projects teams made their assessments and the following potential benefits were presented to participating organizations:

- The design module team estimated that a set of 100 standard jobs could be

processed with 76% lower costs for complex drawings and 68% for simpler drawings. A pilot project was executed by one of the participant firms and the pilot project established that the estimated savings were achievable.

- The electronic trading module team estimated that 80% savings in administrative costs were achievable if uptake of e-commerce was universal.
- The electronic tendering team, through data aggregated from a few pilot projects, estimated cost savings of 10-11% over existing manual processes.
- The project collaboration team concluded that reductions in administrative costs, improved audit trails, and better reporting were some of the achievable benefits from online project collaboration.
- The computer aided measurement team reported that time savings of between 57% and 70% were possible, depending on the scale of the project.

7. France: ICT in Automotive

7.1. Summary

The Improvement of Business Relations in the Automotive Industry (ALFA) policy initiative was aimed at enhancing the ease with which tier 1 and tier 2 suppliers in the French automotive industry could collaborate, exchange data online, and execute transactions.

Tier 1 suppliers had traditionally focused on streamlining communication and data exchange processes with their customers, who were the automobile manufacturers. However processes with their suppliers, the tier 2 SMEs in the automotive industry, were far from mature. With the increasing use of IT tools for supply chain management in the automotive industry and the high level of integration between software solutions

at the customer premises and those installed at the supplier premises, integration with information exchanges became a price of entry for suppliers.

Typically SME suppliers were not equipped to manage IT projects of such scale. The project was financed by the Regional Government Office which operates under the French Ministry of Finance and Industry, and run by the industry association known as GALIA which was created by original equipment manufacturers (OEMs) in the French automotive industry. After launch in 2004, the project was anticipated to be operational until the end of 2010.

7.2. The elements of policy/state intervention

GALIA focused on information dissemination, raising awareness, advising SMEs, and facilitating conversations between SMEs on experiences with technology implementation. The ALFA project focused primarily on the following three categories of technologies, all of which enable improved communication between tier 2 and tier 3 suppliers:

- applications, such as electronic data eInterchange (EDI) and ERP tools that enable data exchange between companies
- communication tools, such as websites and web conferencing systems
- tools that enable online collaborative planning and design.

All of the aforementioned categories of technologies and tools were well proven and had previously been successfully implemented by the automobile majors and the tier 1 suppliers. The ALFA policy initiative involved GALIA setting up promotion teams in eight regions in France. Each regional promotion team conducted workshops to build awareness, liaised with local industry networks, and advised the target group of SMEs. Those SMEs that signed up for technology implementation were advised on the right road map and project management techniques and their progress was periodically

monitored. Successful cases were documented, published, and marketed to raise awareness. Funding for this project was set at approximately € 1m.

7.3. The benefits

The GALIA project's target was to advise 1,000 SMEs and 2,000 tier 2 suppliers and to get at least 100 companies to sign up for one of the IT implementation projects. As of 2008, 135 companies had signed up for the one or more of the technology implementation programs. SMEs in this groups report a number of benefits, such as improved demand forecasting, a reduced error rate, and reduced delays from EDI implementation. Companies that implemented ERP tools reported that the ERP installations facilitated the EDI installation process, helped meet growth targets, and reduced the audit workload.

8. Ethiopia: ICT in Agriculture

8.1. Summary

For over a decade Ethiopia has promoted a program to increase ICT penetration across the different government sectors, such as education, agriculture, and citizen services. The policy elements relevant to the agricultural sector includes laying out the network to connect agricultural research units, laying out the infrastructure to connect district-level administration units, providing information relevant to farmers (and those who educate farmers), and equipping training centers for farmers with ICT hardware and software. The overall goal of ICT policy for the agriculture sector is to improve agricultural efficiency through provision of information and knowledge and helping

farmers connect to markets. The government collaborated with global non-profits agencies in order to implement some of these policies.

8.2. The policy elements

Network connecting agricultural research institutes and facilities

AgriNet is a broadband network connecting 50 agricultural research centers. It was established by the Ethiopian Agricultural Research Organization, a government agency, and connected 23 floriculture firms and 34 industrial zones.

Networking connecting different administrative units

The WoredaNet network connects government agencies at the federal, regional, and district (woreda) levels, using both terrestrial and satellite-based connectivity. As of 2008, 565 woredas were connected to the network.

Equipping "Farmer Training Centers" with ICT tools

The government set up 15,000 Farmer Training Centers across the country. This was performed in collaboration with international non-profit organizations, with the government working towards equipping them with ICT tools such as computers, DVDs, printers, and Internet connections. The government's agricultural extension service leveraged all of the aforementioned ICT infrastructure elements to ease the process of educating farmers by providing them with a knowledge management system for agricultural information. The Ethiopian Agricultural Portal was set up to easily share agricultural knowledge and information.

Collaborating with international non-profit organizations and aid agencies

The government has set up Woreda Knowledge Centers (WKC) in partnership with the International Livestock Research Institute. Each WKC is equipped with dial-up Internet connection, five computers, and a DVD player. Electricity is far from

universally available in Ethiopia and a few WKCs are equipped with generators.

At each WKC, the farmers and their trainers can access information on crops and livestock, and can also access contact information for other farmers. The overall goal of the WKC program is to ease the process of information dissemination and sharing and create a knowledge management system for farmers to improve the efficiency of agricultural processes and grow new crops that are more suitable to their environment. Access to markets and market information is also one of the priority areas.

8.3. The benefits

The WKC infrastructure allowed farmers to grow produce that took greater advantage of local environmental conditions, and this allowed them to increase their annual income.

A study indicated that an average of 75.4% of regular WKC users reported that ICT tools made available through the scheme facilitated access to new information. The same study reported that an average of 63% of WKC users believed that the agricultural information provided was “useful.” It also reported that ICT tools eased the process of understanding agricultural knowledge and decreased the cost of information technology significantly.

9. India: ICT in Agriculture

9.1. Summary

The scheme involved developing and managing call centers/contact centers for farmers. In operation, the farmers would dial a toll-free number and speak with individuals who have expertise in crop management, veterinary, and livestock issues.

They would also obtain weather and market information. The scheme was launched in January 2004, and was tasked to provide farmers with easy access to relevant expertise. The service was provided in numerous local languages, and is still in use.

9.2. The case for government intervention

Low productivity, partly due to lack of knowledge of modern techniques, has been a perennial problem. It would be impossible to overstate the importance of the agriculture sector in the India. Agriculture accounted for 16.6% of GDP and 52% of the total workforce in 2007. The sector had been experiencing low productivity issues for a long time, which was attributed to a lack of scale (small size of land holdings), relatively small percentage of irrigated land, lack of modern technology, and lack of information and knowledge related to modern agricultural practices.

India had a well-developed agricultural academia. India had over 40 agricultural universities, which delivered more than 15,000 graduates, 11,000 postgraduates, and 1,000 PhDs annually. This provided an opportunity to connect a large number of farmers with those who were formally trained in modern agricultural practices.

Telecommunication networks are well developed. India has both a highly developed call center/contact center industry and a robust telecommunications network infrastructure. The telecommunications infrastructure was adding over 10 million mobiles subscribers a month. The business process outsourcing industry (which was largely made up of call center/contact centers) earned export revenues of $11 billion in the financial year 2008. These developments meant the government agencies were well placed for the delivery of its agricultural call center initiative.

9.3. The policy elements

This policy required the central and government agencies to set up and manage a call center/contact center for farmers. The scheme was known as the Kisan (farmer) Call Center (KCC) and was launched by the Department of Agriculture and Cooperation, a central government agency that reported to the Ministry of Agriculture.

Farmers across the country could call a toll-free number to contact experts in disciplines such as horticulture, animal husbandry, and marketing. The call center operated on three levels. Level 1calls were first typically routed to a recent agricultural graduate with a rural background. If the call was not addressed at that stage, it would then be transferred to level 2, in which the level one expert would engage in a teleconference with a level 2 expert. The level 2 expert would typically be more experienced in the particular area to which the query was related. These experts were typically based in research stations and agricultural universities, and were likely to have had between 10 and 15 years of experience in that area of specialization.

The queries and their resolutions were captured in real time through a knowledge management system. Queries were addressed during regular business hours and any generated beyond then were captured for processing using an interactive voice response (IVR) facility. These services were managed at the state level, and were provided in the local language of the state. The network of level 2 specialists was built at the state level, after an assessment of the important crops in that state.

If the query was not resolved at level 2, the query would be redirected to level 3 experts. These experts were part of a dedicated cell maintained by the unit that managed state-level KCC. Resolution at level 3 was not in real time; after consultation, a resolution was sent using email, fax, or phone within a 72 hour timeframe. The technology infrastructure was built by Telecommunications Consultants India Limited, a

public sector organization.

9.4. The benefits

In the seven years since the KCC went live, adoption has increased significantly. Between 2004 and 2006, the total number of calls (both live and IVR calls) increased from just over 670,000 to nearly 2 million. In the first three months of 2007, the KCC network fielded over 2 million calls. Between 2008 and 2010, one state-level KCC (Madhya Pradesh in central India) resolved queries from over 318,000 farmers. As of August 2007, the service was being provided in 22 languages and by January 2010 it was being delivered through units across 25 locations.

In June 2005, a one-month review indicated that a wide range of queries was handled by KCC. These queries included questions on varieties of crops, availability of crops, information about pesticides, local weather reports, contact numbers of administrative and agricultural units, fertilizer doses, seed treatment techniques and fruit treatment techniques. The KCC maintained a knowledge management system to increase the quality, accuracy, and consistency of response.

10. Greece: ICT in Technology-intensive SMEs

10.1. Summary

The Greek government developed a policy initiative in which it acted as a major funding source for projects that involved the procurement and implementation of hardware and software solutions. These would support intra-business and inter-business processes. It subsidized SMEs (companies with between 15 and 250 employees and revenues lower than €50m) that were already above average in terms of their

technology adoption, who wanted to augment their business application portfolios. Individual SMEs would apply for funding, and their cases for funding would be reviewed by the government.

The objective of this initiative was to fund aggressive technology-adopting SMEs, and promote technology uptake in the broader economy. By stimulating further investments, information on successful cases would then be disseminated.

10.2. The case for policy/state intervention

Greek SMEs in IT-intensive sectors were more mature adopters of software and hardware than their peers in other sectors. These companies still required funds and technical assistance to go beyond core business applications (such as accounting and ERP) and extend their IT footprint into areas such as B2B data exchange and customer relationship management (CRM). Recognizing this need, the Greek government launched the Digital Future initiative (DFI) in 2005.

10.3. The elements of policy

The state as a source of funds

One of the key components of the DFI was the funding it provided for SMEs. Between October 2005 and October 2007 (the duration of the policy initiative) €75m, or about 50% of the total cost of all projects, was made available to SMEs.

The DFI mandated that the program beneficiaries should cover 25% of the private sector costs, with other sources, including bank loans, covering the remaining component. On average, the grants covered between 45% and 55% of project costs.

The administrative body which ran the program, the General Secretariat for Industry at the Ministry of Development, selected 841 investment plans from the 1,000 that were

submitted. The average funding provided per project was in the region of €250,000. The initiative also mandated that all projects would have to be completed within 12 months of inception.

The projects typically involved the implementation of ERP, CRM, and CAD systems. They also involved the implementation of e-commerce solutions that streamlined exchange of information and execution of transactions within industry clusters, as well as the implementation of technologies that enabled the creation and distribution of electronic content.

Collaboration with industry bodies

The DFI's guiding principles were formulated in conjunction with prominent industry bodies such as the Association of Greek IT Companies.

11. Netherlands: ICT in Transprot and Logistics, Healthcare, Software Engineering, and Financial Services

11.1. Summary

In the Netherlands, SME adoption of IT has been limited by issues such as lack of funds, limited awareness of the benefits of software systems, and insufficient of knowledge of the right solutions and vendors. There is also a high perceived risk of implementation failure.

SMEs required an unbiased source of advice and a well-organized, non-commercial entity to aggressively market the benefits of IT. This realization led to the Digital Netherlands program. The program involved provision of advisory services and the introduction of awareness drives, and led to a high rate of recognition of the benefits of the prescribed technology initiatives in the target group.

11.2. The elements of policy/state intervention

The Digital Netherlands program was financed by the Dutch Ministry for Economic Affairs and managed by Syntens, a government agency. The program comprised the following key activities each aimed at disseminating information on the benefits of IT and IT project selection and execution best practices:

- facilitation of workshops and seminars
- provision of customized advice and project management assistance to SMEs
- publishing and marketing printed and digital information.

The project has been running for a period of time, and can be segmented into two phases. The first phase, spanning the period between 2002 and 2006, focused on increasing awareness of IT among SMEs and encouraging the innovative use of IT among SMEs. The second phase focuses partly on SMEs that already have a relatively high degree of IT maturity. This phase is still ongoing and does not have a scheduled completion date. While the state does not subsidize projects, the program is very well funded. Phase 1 funding has been estimated to be in the region of €38 million. It should also be noted that the project is long running and is aimed at a very large pool of SMEs - about 80,000. This would be considered very large scale for a country with a population of less than 17 million.

11.3. The benefits

As one would expect for a long running policy initiative aimed at improving awareness of IT, the documented benefits have been in the form of increased awareness of the program and its merits. A study conducted at the end of the first phase revealed that Syntens had a recognition rate of 29% for the SMEs that were part of the program. Those surveyed reported that they were satisfied with Sytens' programs and wanted the

programs to continue. The surveyed SMEs also reported that the IT initiatives had led to enhanced productivity, reduced costs, improved quality, and higher turnover.

12. Canada: ICT in Logistics, Tourism, Automobile Leasing, Livestock Production, Printing, and Publishing

12.1. Summary

The Canadian Network for the Advancement of Research, Industry and Education (CANARIE) e-business program was an initiative supported by the Canadian government. This initiative was developed with the aim of building Internet-based systems for SMEs to transact business in their clusters, and of providing funding for such projects. These consortia applied for projects with detailed five-year business plans and were selected for funding based on the strength of their proposals. One of CANARIE's objectives was to maintain a set of wide area networks (WANs) and to develop networking infrastructure and applications, primarily for educational and research purposes.

The policy initiative required the projects to be sustainable in the long term, and make repayments to the funding agency. Fourteen consortia were selected for the scheme, which implemented B2B transaction and data exchange systems. The beneficiaries went on to report increased revenues and head count.

12.2. The case for policy/state intervention

The challenge that the CANARIE e-business program was aiming to address was the lack of systems for SMEs to transact business with their suppliers and customers online. While the benefits of such systems are well known, such an initiative would have been

too expensive unless a good percentage of SMEs in a cluster could agree to collaborate for the common good. It would also require funding assistance and technical assistance. It also fulfilled the need to be a noncommercial unbiased entity, as it worked with SMEs that were often competing against each other.

An illustration of this scenario was found in the Canadian steel industry. Typically, in this industry, broad-based (i.e. comprising a very wide spectrum of requirements) requests for proposals (RFPs) were issued. Small and specialized SMEs could only meet small proportions of the requirements specified in the RFP and were therefore unable to bid for such projects. Such SMEs forming a community of interest and developing a web-hosted RFP-bid template to collectively bid for such projects would be an example of the kind of challenges the CANARIE e-business program was aiming to address.

12.3. Elements of policy/state intervention

The government agency as a source of funding

There were two sources of funding for the initiative: CANARIE provided Can $20m, while the private sector contributed the remaining Can $27m. Every consortium had to submit a five to ten page proposal, which executives from CANARIE helped refine into a formal business plan. The plan was comprised of a technology roadmap, the case for sustainability, and the role of each project stakeholder. CANARIE received 40 proposals, of which 14 projects were selected for funding; sustainability was the key decision factor.

As a part of each selected project, a network-based exchange for communication was developed, and so software and services providers would be project stakeholders within each scheme. Part of every contract was a repayment scheme, with the project stakeholders obliged to pay back the funding agency with revenues generated from sales

of software products developed as part of the project.

The information exchange system targeted groups of companies that were not part of the original alliance but which would benefit from usage of the information exchange system.

The agency reported that the provision of assistance in business case preparation was a key component of the initiative. Such assistance helped to define the requirements and the technological roadmap, and helped to eliminate the projects that did not really have a business case. CANARIE reported that the repayment terms brought significant commercial discipline to projects.

The state as an information disseminator and as an ICT usage champion

In addition to acting as a funding source and a source of unbiased information, CANARIE conducted workshops to promote the solutions being developed to the target companies in the sector. The agency also helped the leaders of the fourteen projects learn from each other's experience.

12.4. The benefits

The CANARIE e-business project was launched in 1999 and was terminated in March 2007. At the time of its closure, 13 of the 14 projects were developing without government assistance. A survey conducted among project beneficiaries revealed that program participation had led to a 55.6% increase in revenues, and an 88.9% increase in high-quality employment.

13. Uganda: ICT in Education

13.1. Summary

Uganda's ICT policy for the education sector had a number of objectives. These included increasing student (primary, secondary, and tertiary levels) familiarity with ICT tools, continued education, and enhancing the opportunities for employment.

As would be expected of Uganda, implementing ICT policies was a major challenge, given the lack of funds, limited sustainability of programs post initiation, limited access to telecommunications networks, and limited access to electricity supply. In spite of these challenges, ICT policy for the sector was moderately successful, though this was predominantly in the tertiary sector.

13.2. Policy elements

The government mandated that all secondary schools required an ICT budget, and by 2006 budgetary allocations had been made to some, but not all schools, for ICT infrastructure installation.

By 2006, the government had started working towards the development of an ICT curriculum for schools, students and teachers. The government provided some funding for the ICT training program which was rolled out to teachers. In addition to this, it worked with non-profit organizations and aid agencies to provide support for educators in ICT tools. The policy was aimed at enabling teachers to use ICT tools for teaching courses and preparing course content and to provide tuition on basic computer application courses. The curriculum for teachers also included courses on computer maintenance, which was necessary given the limited availability of PC maintenance

skills, particularly in rural areas.

The government mandated that the PCs and connectivity infrastructure in schools be made available to the wider community after regular school hours. While providing such access to the wider community, this also generated income for the schools, thereby making such programs more sustainable. This was particularly important for Uganda, given that the cost of a computer was equivalent to a teacher's annual salary.

The government's limited resources were supplemented through partnerships with non-profit organizations and aid agencies. As an example, the United States Agency for International Development supported the Connect-ED project. This project provided computers and the connectivity infrastructure to a number of Primary Teacher Colleges, facilities developed for the education of teachers. Another non-profit organization, UConnect provided low-cost refurbished computers to schools, and trained teams to set up local area networks (LANs).

By 2006, the government had signed an agreement with Microsoft for the provision of software licenses at subsidized rates. Similar agreements had also been signed with other technology service providers, predominantly Internet connectivity providers. With the agreements in place the government specified the minimum technical specifications for the technology systems installed by schools.

Some of Uganda's few public universities ran advanced computer sciences programs. These complemented other initiatives developed by the government.

13.3. The benefits

The 2005-2006 Education sector annual review reported the following developments:

- the number of website-enabled institutes increased
- the ratio of computers to students in the Makerere University rose

- software installations and hardware upgrades had been performed on 6,000 computers
- over 300 teachers had been trained.

While the benefits reported here are modest, it is worth bearing in mind that Uganda faced considerable challenges, with low ICT penetration and limited supply of electricity.

14. Portugal: ICT in Automotive, Retail, Pharmaceutical, Chemical, Retail, and Consumer Goods

14.1. Summary

Portugal's Digital SME program was aimed at enhancing SME adoption of IT tools, which enabled online presentation of information and Internet-based exchange of information. The program was executed in two phases. The first phase involved setting up seven information and technical assistance networks or RIATs (Redes de Informação e Assistência Técnica) across Portugal, with each network focused on a specific sector or region. The second phase involved the creation of a subsidy program that funds IT projects for individual SMEs. This program was deemed a success, as it provided technical assistance for 1,000 SMEs, and subsidies for hundreds of SMEs.

14.2. The elements of policy

The project was funded by the Ministry of Economy and Innovation and spanned the following key phases.

Information and technical assistance networks (Phase 1, 2001 to 2003)

These networks provided personalized assistance and identified e-business opportunities for SMEs, with one for each sector, and on some occasions, region. The budget for this phase was set at €8.5m, with the public sector contributing an additional €6.5m. In addition to the provision of expertise, the RIATs also facilitated collaborative knowledge exchange among SMEs, as well as between SMEs and other entities.

The state as source of funding (Phase 2, 2003 to 2006)

As part of this phase, the state provided grants of up to 30% of project costs to eligible organizations. The agency received 755 applications, of which 425 were approved, and 356 of these received a grant. The budget for phase 2 was €47.3m with the public sector contributing approximately €16.7m.

This and the previous phase supported the development of a software solution that enables superior internal processes. They also encouraged the development of systems that enabled exchange of data between companies. However, the key distinction between the two phases was that phase 2 focused on funding, as well as on facilitating the following types of project:

- Projects that aim at publishing information online.
- Interaction - projects aimed at enabling a level of data exchange with suppliers and clients, but with limited automation.
- Transactions - projects aimed at enabling execution of transactions with customers and suppliers. Naturally, such projects represent the highest level of complexity among the three types, and involve considerable automation and integration with internal systems.

14.3. The benefits

The stated goal of this initiative was to provide benefits for a large number of SMEs, an objective which was achieved. The sector-specific information and technical assistance networks covered 200 SMEs each, and collectively approximately 1,400. In the second phase, of 425 approved projects, 18 focused on a web presence, 254 on limited interactions, and 153 on transactions.

15. Slovenia: ICT in SMEs across Agriculture, Logistics, Financial Services, and Public Administration

15.1. Summary

SME sectors in Slovenia were hampered by a legacy of paper-based communication and information exchange. Not only were these more expensive and less efficient than electronic alternatives, they also lacked standardization.

Although the SMEs in the Slovenian market were fully aware of the benefit of electronic commerce, they found the cost of implementing such systems prohibitive. The Chamber of Commerce and Industry of Slovenia (a government agency), developed a council to formulate and implement a standard for B2B data exchange. The project aimed to promote B2B e-commerce and enhance the efficiency of B2B data exchange. This was achieved by reducing the cost of communications, and reducing the turn around time (TAT) and error rate. This would be essential for processes such invoicing, and reducing the time required for two companies to establish a working communication channel.

The project achieved these objectives, with the government acting less as a source of funding than as a mediator, which brought together appropriate expertise to create a

standard that was acceptable to the target sectors.

15.2. The case for policy/state intervention

Paper-based communication is inherently inefficient. The cost of paper-based communication was prohibitive, estimated at about € 0.50 per invoice for the sectors targeted by this policy initiative). In addition to this, communications were inherently slow and mostly unsuitable for modern supply chain management systems, such as just in time (JIT) and vendor managed inventory (VMI).

The lack of standards increased the time to value for B2B data exchange. It took an average of six months for two Slovenian companies to establish standards for communication, restructure their documents to conform to the new standard, and establish a working application. Naturally, the situation necessitated an easily implementable and commonly accepted standard. At the time the only standard available was the GS1 EANCOM standard, considered by many to be too complicated for most Slovenian SMEs.

Establishing a standard would have required a neutral entity, and one with considerable clout, to bring together the key stakeholders (most importantly the 'anchor' companies in individual industrial clusters). Working towards standards-based interoperability was a high-risk proposition for any company unless the standard was already widely accepted. The situation required an entity with sufficient influence to secure buy-in from the leading companies, which could then provide incentives for their suppliers to adopt them.

15.3. The elements of policy/state intervention

Bringing together a council to formulate B2B data exchange standards

The government agency created the following four separate groups to establish the standards necessary for B2B data exchange:

- Business content standards: This group focused on the development of standard documents for B2B data exchange, such as invoices, order forms, and dispatch advice/notification forms.
- Technology solutions: This group focused on developing a list of viable technology solutions for connecting various existing business applications platforms.
- Electronic signature: This group developed a manual for implementing digital certification processes and a tool kit for evaluating software solutions that enable trading partners to digitally sign documents.
- Payments standards: This group focused on developing documents necessary for executing transactions (not just between trading partners, but between companies and banks and government institutes) such as payment orders, debit notice, and bank account status.

The resultant standard that was developed was e-SLOG, which was based on the globally recognized EANCOM standard.

Promotion of e-commerce and e-invoicing

Government agencies promoted the benefits of e-commerce and e-invoicing across Slovenia using popular industry alliances. The agencies conducted e-invoicing implementation training sessions and workshops.

15.4. The benefits

As of 2008, 3,000 companies were using the e-SLOG standard primarily for invoicing, order placements, and order confirmations. The system allowed for lower transactions costs, enhanced speed of transactions, and a lower error rate due to reduced manual copying.

The standard was also incorporated into a number of enterprise applications. Critical mass was reached and the adoption of the e-SLOG standard is now being driven completely by commercial consideration, enabling the reduction of operating cost for industry cluster, which at the same time has increased the competitiveness of the suppliers.

Overall, the e-SLOG project played a significant role in increasing the penetration of e-commerce in Slovenia, and it is now referred to as the national invoicing standard.

Chapter 7. The Use of IT for the Advancement of the Manufacturing Industry

1. The Importance of IT Use in the Manufacturing Industry

1.1. Meaning of IT convergence and IT use

Before discussing IT convergence, it is necessary to understand the convergence phenomenon in and of itself. This is because the results of this study would vary greatly depending on whether the study dealt with IT convergence or IT use. The very first use of the term 'convergence' as part of a national strategy occurred in the United States in 2002 when it was employed in conjunction with its newly formed convergence technology strategy.

The phrase "convergence technologies" first raised in the 2002 NBIC (Nano-Bio-Info-Cogno) Report prepared by the NSF (National Science Foundation) referred to the synergistic combination of four major "NBIC provinces of science and technology (NSF, 2002). This can be construed as the achievement of economic and technological impacts by new industrial areas created through the synergistic combination of new technologies such as NT (nanotechnology), BT (biotechnology), IT (information technology), and Cognitive Science. It is through this process that convergence technologies are generated.

Contrary to this definition, Korea boasts an approach to convergence technology that is based on a more extensive understanding of the concept. More to the point, convergence technology was redefined in the Master Plan for the Development of

National Convergence Technology (2008) as a concept that includes the combination of various homogeneous and heterogeneous technologies, but which also encompasses the combination of disciplines and industries as part of efforts to meet economic and social demands. From the standpoint of the industrial development approach to the convergence phenomenon, which differs from the technological approach to the so-called development of convergence technology, the attributes of convergence are based on physical characteristics, and even during the innovation stage a clear trend towards concentration on commercialization and industrialization is evident. While the technological approach is focused on basic and original technology at the R&D stage, the industrial approach is concerned with application and development technologies.

In addition, under the technological approach, the focus of innovation is on the innovation of organizations and systems. Under the industrial approach, however, the focus is on the innovation of processes and products. In terms of the subjects of convergence, the industrial approach is focused on the functions, products, and services associated with actual business activities in the industrial sector. Viewed from the industrial standpoint, IT is the most important convergence technology followed by BT and NT. On the other hand, from the technological standpoint, where the convergence phenomenon is regarded as causing fundamental chemical changes, the order of significance is reversed so that it reads NT, BT, and IT. This concept is succinctly laid out in 〈Table 7－1〉

As there are various concepts of the convergence phenomenon, different approaches can be employed depending on the objectives of the study.

〈Table 7－1〉 Two Different Approaches to the Convergence Phenomenon

	Industrial approach	Technological approach
Attribute	Physical (A+B=AB)	Chemical (A+B=C)
Innovation stage	Commercialization/ Industrialization	R&D
R&D stage	Application/ development	Basic/ original
Orientation	Short-term market oriented	Long-term technology oriented
Importance of major convergence technologies	IT>BT>NT	NT>BT>IT
Targets for convergence	Function/ service/ product	Interdisciplinary / basic vs. application/ science vs. technology
Organization	Existing organization + related human resources	Converged organization
Innovation factors	Processing/ products	Organization/ systems
Spillover effect	Relevant industries	Overall industries

Note: NT, which causes a fundamental synergistic effect in a wide range of areas when technological convergence emerges, plays the main role.
Source: KIET(2009a)

Recently, a great degree of interest has been shown, for the most part in the advanced countries, in providing national-level of policy support for technological convergence. Investing in technological convergence has been perceived as a future-oriented strategy to propel national growth. As the convergence phenomenon that encompasses technological convergence can have a great impact on the reform of not only markets and industries, but also individual competencies, social structures, and national systems: Advanced countries have gone to great pains to establish a comprehensive strategy and measures to achieve such effects.

The development of an approach from the policy-making standpoint requires that a thorough analysis of the influence of technology convergence be carried out. To this

end, while technology convergence causes fundamental changes, it can also lead to destruction in the following four regards:

① Technological limitations: overcome technological limitations that cannot be overcome with existing technologies

② Technological fields: create new technological fields through technology convergence

③ Existing markets: form new markets based on the products and services generated by convergence technology

④ Existing systems: reform of the existing social system through individual, social and national development.

Given the widespread spillover effects of technology convergence, it becomes necessary to establish policy measures that are designed to maximize not only the technological effect of such convergence, but also the legal, institutional, cultural, and societal impact as well. In other words, there is a need to establish response measures to the advent of a convergence society based on an integrated consideration of related areas such as technology, institutions, laws, culture and society.

As far as the analysis of the convergence phenomenon based on the above-mentioned technology convergence is concerned, the present study analyzes the convergence phenomenon from the standpoint of the industrial approach, which is regarded as being better suited for the policy goal of advancing the manufacturing industry. In this regard, this study uses the term ‘IT use’ rather than ‘IT convergence’. However, the term, ‘IT use’ should be understood herein as referring not only to the industrial approach, but rather as also including IT convergence. Thus, from an industrial standpoint, rather than solely considering the IT technologies that can be immediately used, it becomes necessary, in order to bring about the advancement of the manufacturing industry, to

also give careful consideration to convergence with IT, which can change the technological paradigm.

1.2. The effects of IT use

Before analyzing the effects of IT use, let us take a brief look at the effects of IT convergence. The effects of IT convergence can be analyzed from two standpoints: supply and demand. The supply-related effects include a cost reduction effect occasioned by the advent of economies of scope and product combination effect (producer). Meanwhile, demand-related effects include an increase in consumer efficiency stemming from the product combination (consumer) and network effect (economy of scale on consumption). In addition, some of the other anticipated effects of IT industry-led convergence include the spread of the influence of convergence within the IT industry itself, the advent of ripple effects to other industries, creation of new industrial fields and changes to the industrial structure, and the development of response to new social and environmental issues.

This study examines the effects of using IT from the standpoint of the manufacturing industry. Such effects include the improvement of productivity due to the substitution of production factors, quality improvement, and the advent of economies of scope (technology and product development). The impact of IT use in the manufacturing industry also includes the recovery of the dynamism of the IT industry via the expansion of IT industry fields occasioned by the increase of the scope of application for IT technology. In addition, the use of IT in other industries is expected to directly and indirectly facilitate the development of IT technology and to positively influence the advancement of the IT industry.

1.3. Advancement of the manufacturing industrial structure

A. Improvement of productivity

As mentioned above, the primary reason why IT use is crucial to the manufacturing industry is that the establishment of an advanced communication infrastructure can facilitate the informatization of enterprise management; moreover, the overall productivity of the manufacturing industry can also be improved on the automation of the production process, etc. By inducing the innovation of the manufacturing process, IT convergence can decisively contribute to the improvement of functions, quality, and design.

B. Inducement of product innovation

The second reason to use IT for manufacturing is that the direct transplant of IT technology to the product brings about innovation needed to improve the functions of the product. This can be regarded as the embedment of IT in products, a process which is well underway in the automobile, shipbuilding and construction sectors. For example, in the case of the automobile sector, the latest trend is automotive electronics and intelligent vehicles, a process which refers to the enabling of the electronization of the heretofore mechanical operation of vehicles through convergence with IT. The convergence of the mechanical engineering and electronic engineering technology at the forefront of technological development has led to the acceleration of the electronization of parts and intelligence of vehicles. As the ratio of electronic components in vehicle is expected to increase from 20% in 2005 to 40% by 2015, the electronization of vehicles is expected to create a global market worth some 200 billion dollars (McKinsey, 2007).

Vehicle intelligence will no longer depend on the information collected by drivers but reach a point where, following the partial convergence of IT with vehicles, in-vehicle information can be gleaned from sensors and ECU. Based on the exchange of information

between the vehicle-embedded information systems and the external environment, it will become possible in the future for vehicles to make judgments and move for themselves.

C. Development of new markets

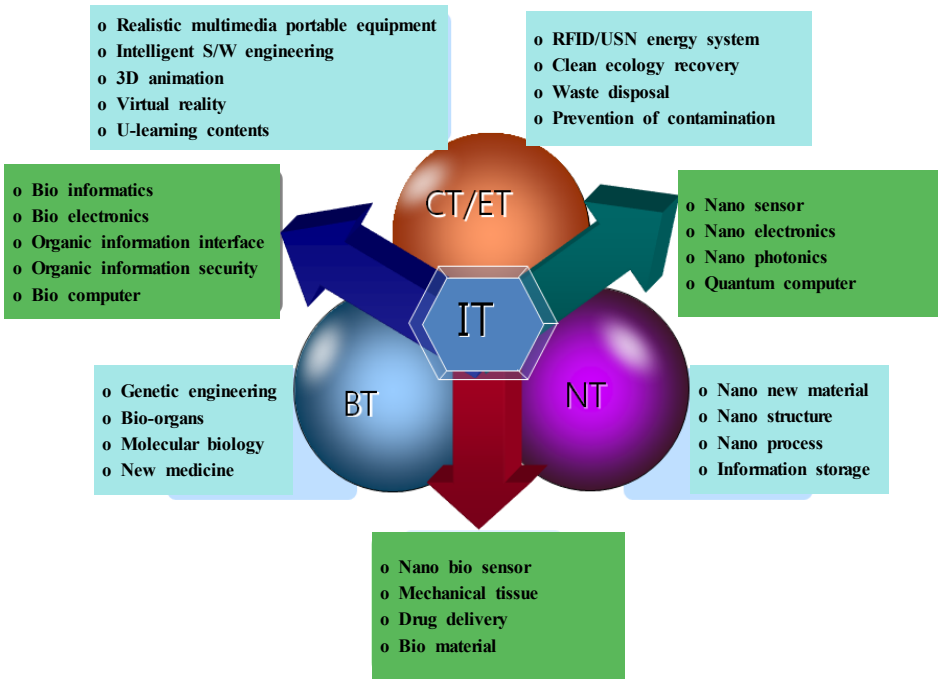
Once the usage of IT technology has been improved, new markets can be developed within the existing manufacturing sectors. In the case of the automobile industry, in-vehicle CE (consumer electronics) was identified as one of the most important characteristics of vehicles during the 2008 CES (Consumer Electronics Show) held in the United States. Meanwhile, in the case of the shipbuilding industry, IT accounts for 35% of the components of high-tech cruise ships. The use of smart clothing, or what is known as a wearable PC, is also on the rise.

The importance of IT use is evidenced by the fact that it becomes impossible for manufacturing sectors to even promote expansion into new industries without an IT foundation. The emergence of new industries such as robotics and u-health is impossible without an IT foundation. As previously mentioned, the expansion of IT technology can lead not only to the creation of new industries, but also to the destruction of existing ones. For instance, in the case of u-health where it is essential that a failsafe advanced communication infrastructure be established and that the medical examinations and practices be carried out based on this communication network system, the use of precise mechatronics control systems with integrated sensors and control functions.

In addition, an unlimited number of industries can be generated by the use of IT-based convergence technologies. IT convergence technologies can be regarded as representative examples of such industries. This refers to technological fields which are able to create new products/services through convergence between heterogeneous technologies, or to improve the quality of existing products through synergistic combination in rapidly developing new technological fields based on IT technology

accompanied by BT and NT. IT convergence is being generated at the point of overlap between the fruits of the technological revolution in computers and communications (IT) during the 1980s-1990s and the S-curve junction linking together the results of two of the CT/ET or NT revolutions. The results so far of such convergence have included intelligent robots, nano semiconductors, bio chips, optical sensors, and audio/image display technology.

〔Figure 7－1〕 IT-based Convergence Technology Fields



Source: Electronics and Telecommunications Research Institute (ETRI) (2008)

2. Case Studies of IT Use in the Manufacturing Industry

2.1. Automobile industry

A. The current state of the Korean automobile industry

1) Overview of the automobile industry

The automobile industry can be broken down into two overarching categories: finished vehicles such as passenger vehicles, commercial vehicles, and specialized vehicles; and parts, in the form of the 20,000 vehicle-related parts currently being produced. The Korean Standard Industrial Classification (KSIC) system subdivides the automobile industry into such categories as the Manufacture of Motor Vehicles and Engines for Motor Vehicles (D341), Manufacture of Bodies for Motor Vehicles; Manufacture of Trailers and Semitrailers (D342), Manufacture of Other Parts and Accessories for Motor Vehicles (D343).

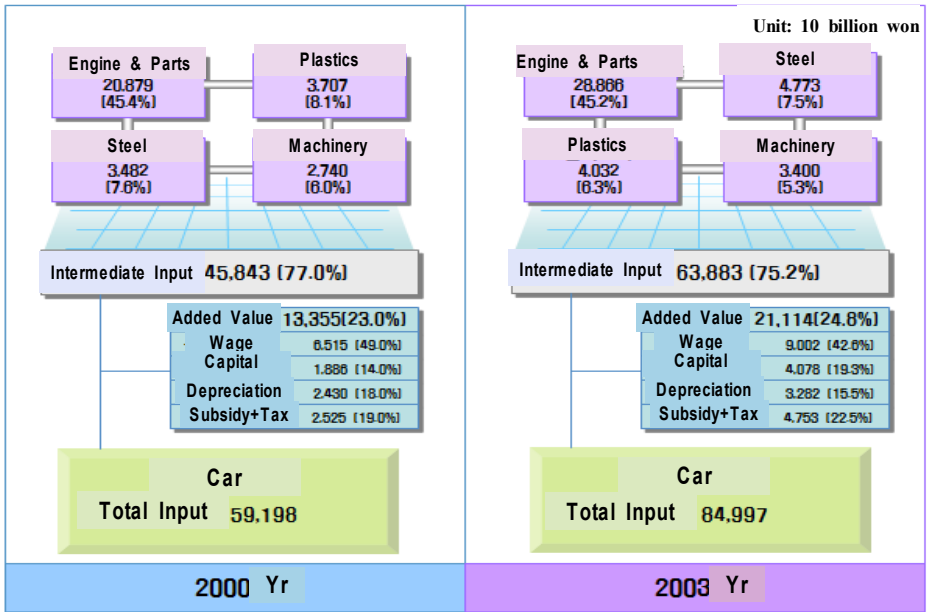
A capital-intensive industry which requires huge amounts of capital to enter the market, the automobile industry is characterized by the input of large-scale investment in equipment and facilities, as well as in R&D. The achievement of economies of scale is especially important for this industry. Factors such as the ongoing diversification of consumer demand, shortening of the new vehicle release cycle, and the increase in R&D expenses, have enhanced the importance that car makers attach to the establishment of a mass production system that lessens the burden from product development.

In addition, the automobile industry, which can be identified as a key industry when it comes to the advancement of a country's industrial structure, is regarded as having a significant economic impact on the related machinery and materials industries. The automobile industry has a tendency to rapidly adopt new technologies. Such a tendency and large-scale demand not only put pressure on the new technology industrial sector to

find ways to facilitate the application of such new technologies in the automobile industry located on the border between traditional and new industries, but also creates the impetus for such technologies to be accepted by conventional business sectors. The automobile industry also plays an active role in promoting the growth of new industries. In this regards, the automobile industry can be regarded as playing an important role in advancing a country's industrial structure as a whole.

Given the 20,000 or so parts that are usued during the various processes associated with design, processing, and assembly, the automobile industry is also regarded as a comprehensive assembly industry. What's more, the strong upstream-downstream linkages associated with the automobile industry results in the latter playing the role of a key industry capable of pushing forward the development of related industrial sectors. Downstream industries directly associated with the automobile industry include the parts and materials industries that produce such items as parts, steel, and plastic, as well as the machinery industry. An analysis of changes in downstream industries conducted using Input-Output Tables reveals that steel accounted for 10.9% of intermediate inputs in 1990, making it the second largest such input after parts. However, the increased use of light-weight materials as part of efforts to heighten vehicles' energy efficiency in recent years resulted in plastic (8.1%) accounting for the second largest share after parts in 2000. Although few changes were observed in terms of the ratios of other industries in 2003, the ratio of plastic and rubber was found to have increased to 9.5%.

〔Figure 7－2〕 Downstream Industries Linked to the Automobile Industry

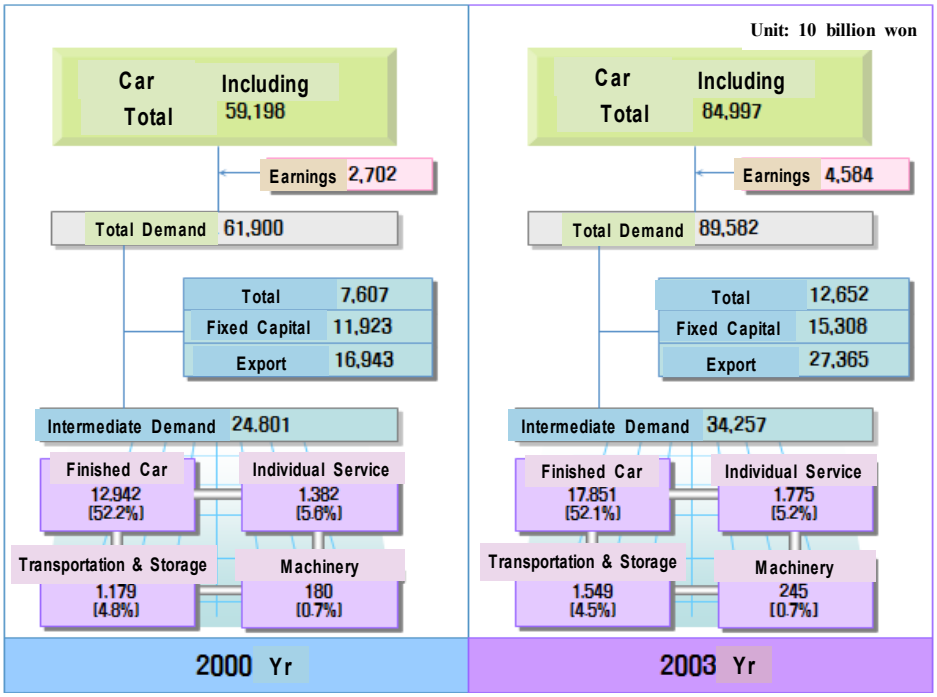


Source: Ministry of Knowledge Economy(2010)

In terms of the ratio of intermediate demand in the upstream industries linked to the automobile industry in 2000, while finished vehicles accounted for 52.2%, transportation and storage posted a ratio of 4.8%, and social and other services of 5.6%. The ratio of intermediate demand in the upstream industries linked to the automobile industry exhibited few changes from a structural standpoint in 2003, with finished vehicles, transportation and storage, and social and other services, exhibiting ratios of 52.1%, 4.5%, and 5.3% respectively. In addition to the fields mentioned above, the automobile industry also has close ties at the distribution stage with industries such as those associated with financial institutions & insurance, the sale of motor vehicles, and the sale of used motor vehicles. It also has broad links with not only the transportation sector in which direct use is made of vehicles, but also at the usage stage with the

auto-repair, oil sales, and construction sectors.

〔Figure 7－3〕 Upstream Industries Linked to the Automobile Industry



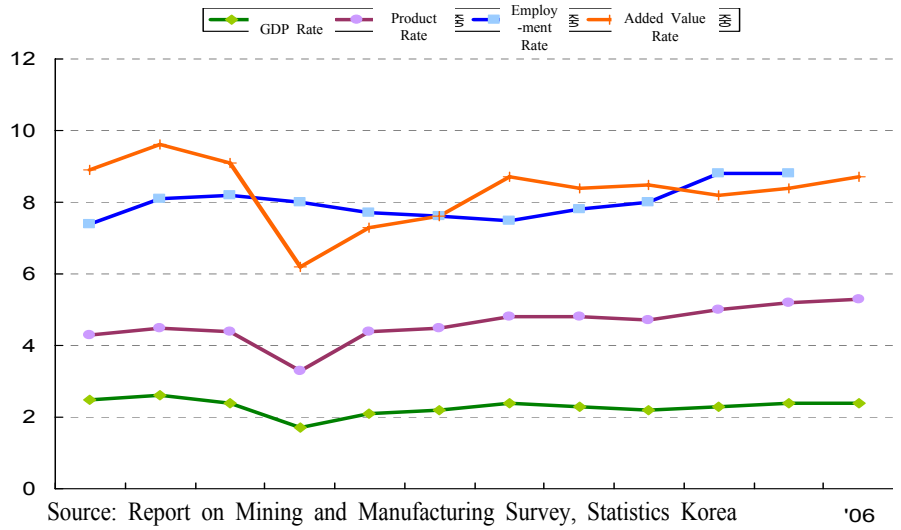
Source: Ministry of Knowledge Economy(2010)

2) The current state of the Korean automobile industry

The Korean automobile industry is widely regarded as a key industry situated at the forefront of the overall industrial structure. It accounted for 2.4% of overall GDP in 2006. The total output of the automobile industry has been estimated at approximately 103 trillion won, a figure which translates into 5.3% of the total for the entire manufacturing industry. Some 253,491 people work within the automobile industry, which employs 8.8% of all workers. The industry's value added has been estimated at 18 trillion won, or 8.7% of that of all Korean industries. Although the demand for

Korean automobiles rapidly decreased in 1998 right after the outbreak of the financial crisis – which drove down the production and value added rates of the manufacturing sector – the subsequent upturn in domestic demand and exports resulted in the industry's rates of production, employment, and GDP increasing from the onset of the recovery in 1999 to 2002.

〔Figure 7－4〕 The Status of the Korean Automobile Industry



Although domestic demand greatly decreased as a result of the economic downturn that began in 2003, the export of vehicles, which has set new records on a seemingly annual basis, has continued to serve as one of the key driving forces behind Korean economic growth. Nevertheless, the combination of the absence of any increase in domestic demand in 2006, and the slow down in exports, has made it necessary to seek out a new strategy to bolster the automobile industry.

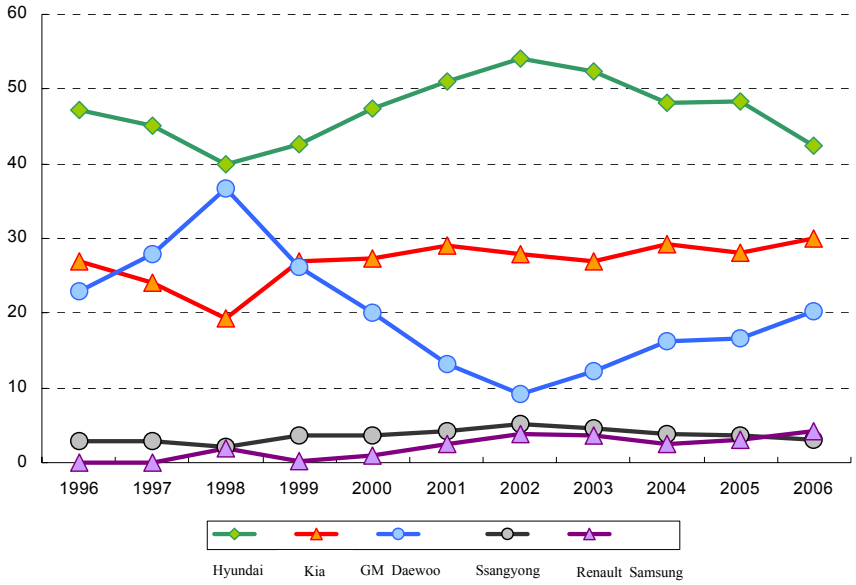
The global vehicle market has been dominated by 10 major companies. The fact that

these companies represent more than 70% of the global vehicle market has led many to conclude that an oligopoly has to all extents and purposes been formed. This oligopoly phenomenon has introduced cut-throat competition in the global car market. While GM and Ford, which have long led the world automobile industry have faltered amidst slumping sales, burgeoning welfare costs, and unsuccessful product strategies, other carmakers such as Japan's Toyota, Nissan, and Honda and Korea's Hyundai have become prominent within the market.

To this end, signs have emerged of a change in the rankings occupied by vehicle makers. Toyota has in particular been able to rapidly expand its share of the global vehicle market by promptly responding to the changes in the industrial environment and adopting simple and effective approaches to product development and knowledge acquisition. It has now surpassed Ford, which is in the midst of a management crisis, to become the 2nd highest selling automobile manufacturer in the world. What's more, Toyota is expected to soon surpass GM, too, and become the top selling maker in the world. For its part, Hyundai has been able to expand its share within the global market by establishing a global production system that has involved the full-scale international production and the strengthening of its quality and brand image.

While Hyundai boasts over 50% domestic market share, Kia accounts for 26-28%. Although Daewoo and Samsung's market share greatly decreased in the aftermath of the financial crisis, as exhibited by their approximately combined 10% share of the market, both enjoyed sudden recoveries after their respective mergers with GM and Renault. While Hyundai and Kia's dominance continued (73.3%) in 2006, GM Daewoo has come to be perceived within GM's global strategy as more than a simple production base; it is now regarded as a small car research center. Unlike GM Daewoo, Renault Samsung has established a strategy that is focused on the domestic market, rather than exports.

〔Figure 7－5〕 Market Share of Domestic Automakers



Source: Report on Mining and Manufacturing Survey, Statistics Korea

While the Yeongnam area accounted for 42.9% of the Korean automobile industry's overall production in 2005, which amounted to approximately 41 trillion won, the capital area followed with 31.1% of overall production and a value of about 30 trillion won, and the Chungcheong area accounted for 13.4%, and approximately 13 trillion won.

The Korean automobile industry can be divided into the following regions: the Southeast region that includes Busan, Gyeongnam, and Ulsan; and the Midwest region encompassing Gwangju, Jeonbuk, Chungnam and the capital area. Vehicle production has recently increased, with the majority of such activity revolving around the Midwest area. The improvement of transportation conditions, relocation of auto parts makers to the Chungcheong and Honam areas, as well as the spike in investment in these areas,

has resulted in greater production in these areas.

3) Industrial field endowed with a bright future

It is expected that the Korean automobile industry will in the near future experience an upswing in domestic demand that will revolve around luxury vehicles. Moreover, foreign demand will also rise as a result of the combination of the improvements made in terms of the quality of domestic vehicles and the emergence of new markets. This in turn is expected to facilitate the development of new models and boost domestic investment.

The development of new technologies has been accompanied by the necessity to develop next generation environment-friendly vehicles, a need that has been driven home by such issues as environmental regulations and energy problems. In this regard, hybrid and fuel-cell electric vehicles can be viewed as some of the environment-friendly vehicles that are expected to have the brightest futures. However, it will take some time for these vehicles to become regular staples within the market. To this end, the development and application of energy-effective engines, transmissions, and new materials, have emerged as particularly promising fields.

In addition, the increase in consumers' demand for convenience, development of electronics and IT technology, and strengthening of safety regulations, have had the effect of transforming intelligent vehicles boasting high safety levels, as well as related parts, into one of the brightest spots within the industry. The continuous development of individual safety and communication devices is expected to reach a point, most likely from 2010 onwards, where such individual devices will become integrated, thereby greatly increasing the safety and convenience of vehicles.

B. The use of IT within the automobile industry

1) IT usage strategy during various stages

Trends in the use of IT technology during the early stages of the automobile industry: 1960-1990

The first electric devices employed in vehicles were battery and ignition systems. Thereafter, starter motors and headlights began to be introduced. The equipment of vacuum tube radios in the 1930s marked the onset of electronic technology in vehicles. Charles F. Kettering of the United States established the company known as Delco (Dayton Engineering Laboratories Company) responsible for inventing the vehicle-mounted generators (1902), electrical ignition equipment (1911), and self-starters (1912) that marked the first stage of vehicle electronics. By the 1960s, electronic technologies had begun to be fully employed in the automobile industry, a denouement facilitated by the invention of transistors and the development of IC (integrated circuits). The application of semiconductor technology to silicon diodes, voltage regulators, and power transistors contributed to improving the functions and reliability of vehicle parts. The onset of the use of IC (integrated circuits) in conjunction with vehicles that took place during the late 1960s marked the full-scale implementation of vehicle electronics, with many electronic parts such as IC voltage regulators and IC igniters being introduced to engines.

While the fuel injection control, cruise control, and antilock brake systems were successfully incorporated into vehicles, the perceived absence of any benefits to consumers and high prices associated with such systems meant that they remained rather unpopular at the time. However, the implementation in the United States during the 1970s of the complicated and contradictive vehicle requirements contained in three major sets of regulations, namely the (① laws related to motor vehicle safety, ② laws regarding engine output, and ③ laws pertaining to fuel emissions and quality), proved to be beneficial to the spread of vehicle electronics technology. The laws related to

motor vehicle safety led to demands for an electronic system which could be used to stop the engine when a passenger did not fasten his/her safety belt. This in turn paved the way for the emergence of a system which could sense whether a passenger had fastened his/her safety belt or not, even when no electricity was provided to the ignition system. The microcontroller developed in 1971 was first used for the purpose of ignition timing control. In this regard, the implementation of precise controls proved to be beneficial to the heightening of engine output.

While the application of electronic technologies in vehicles began in earnest in the mid-1970s, the 1980s saw the rapid development of vehicle electronics technology based on the microprocessor system. It was also during this period that collaboration between semiconductor producers and vehicle designers to resolve various technical issues began to take off. In the 1990s, microprocessor technology became the key technology in vehicle electronics. As semiconductor technology further developed, more functions were assigned to a single chip. In this regard, the decrease of cycle time emerged as a core task.

The trend towards IT convergence in vehicles from the 2000s

The 2000s have seen rapid progress in automotive electronics. To this end, one of the main developments has been the convergence of traditional machinery technology and IT for safety and convenience enhancement. Toyota has since 2000 invested over 1 trillion yen a year in developing automotive electronics technology. Honda has sought to establish a hierarchical linear model for automotive electronics parts. Furthermore, as part of efforts to achieve light-weight vehicles, increased convergence with BT has become visible in such fields as automotive fibers, plastics, and alternative fuels. Under these circumstances, the ratio of the role played by IT within the automobile industry has rapidly increased. The ratio of automotive electronics found in vehicles, which was

less than 25% in the early 2000s, is expected to reach the 40-45% level by 2015.

The current trend of automotive IT convergence is expected to develop into a focus on the following 4 Cs.

□ Convenient automotive driving service

Provide a convenient interface system based on bio-physical information to minimize the safety load for automotive drivers. In addition, the growing consumer demands for the integration of multiple functions in their vehicles that would allow them to pursue such ends as relaxation, entertainment, and the conduct of business affairs, have led to the rapid spread of onboard entertainment systems.

□ Comfortable safety driving support

Provide integrated safety services based on awareness of the driver's situation by collecting, converging, and processing the driving space sensor information. The application of active and passive safety technologies occasioned by the strengthening of various safety related regulations has paved the way for the development of light-weight and high-strength vehicle bodies made using new materials and intelligent automotive technologies.

□ Convergence & Connectivity

Linkages with telematics and various other industries

□ Clean eco-driving service

Provide a control system which can lower fuel expenses and monitor the exhaust of pollutants. The convergence of the machinery and electronics industries has accelerated as a result of the change in the technology paradigm from the internal-combustion engine to electrical vehicles that has occurred as part of efforts to lower fuel expenses.

〈Table 7－2〉 Changes in the DNA of the Automobile Industry

	Traditional mechanism	Current mechanism
Drive system	Mechanical drive system	Electrical drive system
Power	Internal-combustion engine power	Electric motor power
Energy	Fossil energy	Electric and hydrogen energy
Control	Mechanical control	Electronic control
Driving	Independent driving system	Intelligence and cross linkages

Source: MIT (2010)

Ultimately, customers' growing desire to enjoy information technologies and the accompanying need to process huge amounts of information for the interior and exterior of vehicles is expected to result in increasing the necessity for future vehicles in the ubiquitous era to be equipped with highly advanced IT technologies. Furthermore, this trend is happening in conjunction with a change that has seen services replace manufacturing as the vehicle industry's main source of profit. As such, a new era of an expanded market within which the automobile and IT enterprises must cooperate with each other on the development of various devices, as well as highly advanced H/W and S/W technologies, has already begun.

2) Sources of IT technology

As mentioned above, there has been a convergence of IT technologies introduced in the automobile industry in such fields as safety, convenience, fuel efficiency, and networking. However, the source of these various IT convergence technologies incorporated into vehicles can be divided into semiconductors, embedded S/W, Telematics, and HMI (human-machine interface).

First, the convergence of technologies such as intelligent control systems, vehicle network SoC (system-on-a-chip) technology, radar and image signal IC designed to improve

convenience in vehicle driving, vision sensors, PIR(Passive InfraRed) sensors, power devices for fuel efficiency, and control modules was made possible by the development of automotive semiconductor technology. Here, automotive semiconductors refer to semiconductors specifically manufactured for vehicles, and which can endure much more extreme external conditions, i.e. temperature, vibrations, and shocks, than those associated with industrial semiconductors. To this end, semiconductors are expected to occupy an even bigger space within the automotive parts sector in the future. Currently, approximately 1000 of the 20,000 parts associated with the automotive industry are related to semiconductor technology. As such, the automotive and semiconductor industries have established an inseparable relationship.

Vehicle control RTOS (real-time operating systems), vehicle multimedia OS, automotive S/W platform and development support tools, and automotive S/W reliability verification tools can all be regarded as the offspring of embedded S/W technology. In this regard, vehicle control S/W and platforms such as the damping device and power-steering systems loaded onto the vehicle's internal systems, were originally developed from embedded S/W, and thereafter made their way into the automotive field.

In addition, telematics technology represents the original technology which made possible such feats as the establishment of in-vehicle network systems, as well as vehicle-to-vehicle communication based safety driving systems. Furthermore, wireless communications (telematics) technology has evolved into automotive IT convergence technology such as cooperative vehicle access systems, automatic parking and autonomous driving systems, environment-friendly exhaust gas monitoring, and route guidance (navigation) systems.

The origins of technologies such as HUD (head up display)-based guidance systems and Night Vision-based safety driving support devices can be traced back to HMI technology. In this regard, smart handle, eye tracking system, as well as voice chat and

voice command systems can be listed as good examples of the convergence of multiple HMI interface technologies.

HF-based next generation display systems such as the HUD (head up display) and IR (infrared) touch screen first applied by BMW can be regarded as complex yet convenient driving devices that could not have been crafted without developing advanced display-related technology.

〈Table 7－3〉 Sources of Automotive-IT Convergence Technology

Source	Applications	Main technology and products
Automotive semiconductors	- Semiconductors specifically manufactured for vehicles. These can endure much more severe external conditions, i.e. temperature, vibrations, and shocks, than those found in the environment in which industrial semiconductors are employed - Automotive semiconductors must be able to endure at temperatures of -40℃~105℃ and have a life expectancy of more than 10 years - Require advanced designing and processing capabilities as well as stable sources of investment	- Intelligent control system, vehicle network SoC (system-on-a-chip) technology - Radar and image signal IC, vision sensor, PIR(Passive InfraRed) sensor, power devices for fuel efficiency, and control module
Embedded SW	- Vehicle control S/W and platforms such as damping devices and power-steering systems loaded onto the vehicle's internal systems - Vehicle control S/W platform and development environment - As these are directly connected to the safety of passengers, there is a need for the S/W that is developed to be highly reliable. It is also necessary to improve technological capacity and to educate the relevant human resources.	- RTOS (real-time operating system) for vehicle control - Vehicle multimedia OS - automotive S/W platforms and development support tools - Automotive S/W reliability verification tool

Source	Applications	Main technology and products
Vehicle Network (Telematics)	- Linkages between in-vehicle and mobile devices, as well as in-vehicle communications technology - Information sharing network systems with V2V and traffic facilities such as Hi-Pass - Autonomous safety/ convenience/ environment-friendly system technology	- In-vehicle network systems - Vehicle-to-vehicle communication based safety driving systems - Cooperative vehicle access systems - Automatic parking and autonomous driving systems - Environment-friendly exhaust gas monitoring
HMI (human-machine interface)	- HF-based next generation display systems such as HUD (head up display) and IR (infrared) touch screen - Multi-HMI convergence interface technology such as smart handles, eye tracking systems, voice chat/ voice command systems and Haptic systems - Safety load-based adaptive interface devices	- HUD (head up display)-based guidance systems - Night Vision-based safety driving support devices - Convergence of Haptic-Visual-Audible HMI systems such as smart handles and eye tracking systems

Source: Ministry of Knowledge Economy(2008)

C. Linkage with IT related policy

1) Analysis of connectivity with IT related policy

Policy measures designed to facilitate the development of automotive semiconductors

The first step towards the development of the IT industry in Korea was the establishment at the national level of policies for the electronics industry during the mid-1960s. In conjunction with the announcement of a ‘Five-year Plan to Develop the Electronics Industry’ in 1966, Korea’s Ministry of Commerce and Industry implemented various measures designed to foster the development of the electronics industry. These included resorting to a policy of import substitution where electronic parts were concerned, the division of labor and specialization in assembly plants and parts

factories, reduction of prime costs for exports, education of technical human resources, and the diversification of export markets.

It was however during the late 1980s that Korea really began to pursue the development of its electronic industry in a full-scale manner. The Korean government released the epochal Measures for the Development of the Electronics Industry which effectively divided the then home appliance-centered electronics industry into two categories: industrial electronics, with the main focus on three strategic items in the form of semiconductors, computers and electronic switching systems, and the parts industry. The plan for the development of the electronics industry around three strategic items (semiconductors, computers and electronic switching systems) was implemented as a national level large-scale project.

As part of its policy of promoting the semiconductor industry, Korea introduced a 29 million dollar loan from the World Bank in 1979, money which it used to actively implement, with the Institute of Electronic Technology at the forefront, the development of semiconductors. These efforts to develop the semiconductor industry were continued by the Samsung Group, which in 1983 proclaimed its intention to invest in the semiconductor sector.

This was followed that same year, by Samsung's successful internal completion of the production, assembly and inspection of 64KD Ram. This in turn provided the impetus for the birth of the Electronics and Telecommunications Research Institute in 1985, which was achieved by combining the Institute of Electronic Technology with the Research Institute of Electrical Communications. The subsequent development of 256 KD Ram in 1984 and 1 MD Ram in 1986 had the effect of propelling Korea to the forefront of the global semiconductor market.

Policies in support of telematics-related IT technology

The development of CDMA (code division multiple access) began in earnest following the Korean government's identification of the 'development of digital mobile communication systems' as one of the national tasks in 1989. Soon thereafter, the Electronics and Telecommunications Research Institute signed a technical cooperation contract with the company that possessed the original CDMA technology, U.S. based Qualcomm Incorporated. In this regard, the opening of digital mobile phone services in Incheon and Bucheon on January 3, 1996 and in the entire Seoul area in April of that same year marked the official commencement of the commercialization of CDMA.

The 'IT839' strategy adopted in 2004 marked the opening salvo of the Korean government's state-led efforts to not only become a key player in the evolution of IT technology, but also transform Korea into a future IT leader globally. The IT839 strategy was a strategy designed to foster the development of the IT industry which organically connected eight services, three infrastructures, and nine new growth engines. The eight services consisted of the DMB·DTV service that represented the core service in terms of the then recent commercialization of the convergence of broadcasting and communications, Wibro, HSDPA services, telematics and location-based services, the Broadband Convergence Services (BCS) classified as a related service, u-Home service, RFID·USN services, and IT services.[42] The three infrastructures were made up of the BcN (Broadband Convergence Networks) which effectively integrate wired and wireless communications, USN (u-sensor networks) that constitute the foundation of the

42) The majority of technologies associated with these eight services were quickly linked to the automobile field, and contributed to the improvement of the functions of vehicles. Accordingly, the commercialization of telematics, location-based services and RFID services in the form of navigation, traffic information, and electronic approval systems (Hi-Pass) has greatly contributed to the development of automotive intelligence.

ubiquitous environment, and soft-infraware. These three infrastructures provide support for the eight services. Lastly, the nine new growth engines are mobile communications and telematics devices, broadband/home network devices, digital TV/broadcasting devices, next generation computing/peripheral equipment, intelligent robots, RFID/USN devices, IT SoC/convergence parts, embedded SW, and digital contents/SW solutions.

Policies in support of the development of HMI technology

As part of its attempts to establish the basis for the informationalization required for the nation's transformation into a creative knowledge state, and to support the introduction of the innovation of the industrial structure necessitated by the move towards a digital economy, the Korean government implemented a five-year plan for the development of information and communications technology. This plan included the selection of six major fields, namely next generation internet, optical communications, digital broadcasting, wireless communications, SW, and computers, and the provision of support for the development of these six fields. In addition, it also identified two major fields for which developmental support was to be provided: core parts such as IMT-2000 core parts, optical parts, and display devices; and original technology such as optical devices and human interfaces.

Policies in support of the development of embedded software

In its IT369 policy, the government identified embedded SW, digital contents, and SW solutions as three of the nine new growth engines for which support should be provided. SW and computers were also identified as core fields for which support measures should be implemented as part of the five-year plan for the development of information and communication technology. The development of embedded SW served as the basis for not only the improvement of the functions of vehicles, but also for the

development during the vehicle manufacturing process of automotive SW platforms and development support tools, as well as of automotive SW reliability verification tools.

2) The influence of IT related policy measures

The development of wireless mobile communication technology, which began with the advent of CDMA, provided an opportunity for all industries to use telematics as a means to bring about the convergence of bi-directional communication services. This also provided the opportunity for the automobile industry to develop the platform technology needed to establish automotive networks such as the connection between in-vehicle systems and mobile devices, in-vehicle communication networks, and the systems which make it possible to exchange information with other vehicles and traffic facilities (Hi-Pass). Furthermore, the domestic development of the computer industry helped to create a form of platform technology which made possible the computerization of the domestic automobile industry's manufacturing process, and the production of automotive parts rooted in highly-advanced electronic control systems. The development of the semiconductor industry and the advancement of semiconductor technology have facilitated the development of the automotive semiconductors that constitute core parts within the automotive electronics system. These automotive semiconductors have also contributed to helping Korea not only consolidate its standing, but also secure a technological advantage.[43)]

The government's active implementation of its IT839 strategy resulted in various convergences between the eight services, three infrastructures, and nine new growth engines, which in turn created new business fields and value added. The addition of

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43) The highly advanced technology that goes into these automotive semiconductors makes it possible for the latter to endure temperatures ranging anywhere from 40℃~105℃, and to have a life expectancy that exceeds ten years.

automotive electronics developed using Korea's world-class IT and related infrastructure to the existing mechanical systems has heightened the competitiveness of the automobile industry. Furthermore, the active forging of strategic alliances with IT companies has provided opportunities for new value added to be created. In conjunction with its strategic partner the Microsoft Corporation, the Hyundai Motor Company, has developed a speech recognition based audio system, automotive information system, and intelligent navigation system. Meanwhile, Samsung Electronics and its strategic partner BMW have developed a technology which makes it possible to communicate using UCC phones in a hands free manner, that is, using the Blue Tooth function without any additional connection devices, and applied it to the Samsung 5 Series.

The development of IT and related convergence has made it possible to strengthen the competitiveness of the automobile industry and to develop new growth engines for the society of the future, such as the Smart ForTwo. As part of its objective of creating five IT-converged new industries by 2012, the government has identified five major industrial fields in which IT convergence is to be implemented from 2008 onwards. In this regard, the list includes both the automobile and shipbuilding industries. The possibility of creating intelligent vehicles created by the convergence of IT and the automobile industry is expected to result in great improvements being made in automotive safety, convenience, and networking.

D. Policy implications

Although the nation's IT infrastructure is not far behind that of advanced countries, and the production technology employed in the automobile industry has begun to show signs of global competitiveness, Korea still lags behind when it comes to the development of basic/original technologies and core parts. In this regard, it is necessary to further enhance innovation in already strong aspects such as production and product

development and parts, carry out more thorough basic studies on such topics as convenient devices, safety, and environmental technology, and develop original technologies. In addition, there is also a need to carry out international standardization as a means to secure the fundamental technology needed to develop next generation vehicles that are based on new IT technology, and to actively implement strategic alliances with companies from advanced countries.

At the governmental level, it is essential that cooperation between related companies and research institutes, as well as joint research projects, be actively promoted. Such a step is necessary in order to effectively make use of national resources and to prevent overlapping investment. Most companies are currently independently pursuing the development of convergence technologies such as intelligent vehicles and fuel cells. Local governments have also invested significant amounts of time and money in the highly competitive development of intelligent vehicle technologies. The ability to reduce costs and heighten efficiency through optimal use of financial resources is predicated on the establishment of a cooperative system that facilitates collaboration and joint development between research institutes, auto makers, and parts makers.

Furthermore, it is also necessary to establish a strategy of selection and concentration. The high technical barriers put in place by advanced companies, as well as the huge amounts of R&D costs required, has resulted in transforming the field of automotive electronic parts into one that is difficult for automobile and IT companies to penetrate. As a result, it becomes necessary to establish a government-led, long-term, development plan, and to concentrate investment.

In addition, it is crucial that convergence related laws and institutions be enacted and adopted. As the existing legal system centering on the development of technologies for such fields as vehicles and IT is limited in its capacity to promote convergence technology, it becomes necessary to establish the governing laws that reflect the characteristics of

convergence technology. The development of the convergence industry can be facilitated through the retooling of related regulations such as those concerning standard industrial classifications, evaluation criteria, and various permit and approval regulations. As these intelligent vehicles will be driven under a new safety environment, there is a need to improve the segments of the existing safety laws that do not mesh with this new safety environment. Increasing the flow of intelligent vehicles will require the implementation of policy mechanisms concerning such matters as taxation, financing, incentives, and financial support for technological development, at the governmental level.

Next, the establishment of a successful automobile-IT business model has emerged as an urgent task. The establishment of a successful business model represents an essential step towards bringing about the convergence of automobiles and IT. While telematics services and in-vehicle information systems were released during the 1980s and commercialized in the 1990s, their relative lack of profitability resulted in limiting their spread amongst the general public. As such, the establishment of a successful, commercially profitable, automobile-IT convergence technology business model is critical.

Lastly, it is necessary to actively pursue convergence between auto makers and IT companies. In this regard, while auto makers do not know how to make proper use of IT and services, IT companies have had a hard time comprehending vehicle mechanisms. Thus, the priority in IT-auto convergence is to develop a better mutual understanding between the sectors. This can be brought about by cultivating convergence specialists. Above all however, it is essential to expand exchanges between the automobile and IT specialists so as to facilitate the joint development of convergence technologies.

2.2. Shipbuilding industry

A. The current state of the Korean shipbuilding industry

1) Overview of the Korean shipbuilding industry

Korea's shipbuilding industry, one of the nation's key infrastructure industries and the proud occupant of the top echelon within the global market, can be characterized as both an upstream and a downstream industry. In terms of its roles as an upstream industry, the shipbuilding industry carries out such tasks as the development and production of the various kinds of ships required in maritime transportation and fisheries, for maritime defense, and for the development of maritime resources. It is a strategic export industry whose production is carried out on an order basis. Some of its downstream industries include the steel, machinery, electric, electronics, chemical, and materials industries.

The shipbuilding industry, which simultaneously exhibits labor intensive and technology intensive characteristics, has an enormous ripple effect on other industries. In addition, the fact that many uses are made of the products of this large-scale industry makes it necessary to ensure that various types of products are produced, and that such products perform various functions. In this regard, the complex and varied nature of the shipbuilding process means that there are limitations to the extent to which automated manufacturing can be carried out. Moreover, as the majority of contracts are on a make to order basis, it becomes impossible to engage in mass production. What's more, the focus on single markets results in placing a tremendous amount of importance on the acquisition of international competitiveness.

In addition, as such vessels are used under the specific environment known as the ocean, construction costs can get exorbitant in the case of certain types of vessels. Moreover, as it is also directly related to human life, one of the key characteristics of

the shipbuilding industry is a high threshold level of safety, reliability, and precision.

A closer look at shipbuilding technology reveals that it is in fact composed of the fundamental technology needed to overcome, use, and manage the natural environment and maritime conditions, which must always be taken into account when designing, manufacturing, installing, operating and managing vessels and maritime equipment; as well as technologies integrated with other fields such as machinery, electricity, electronics, computers, and materials. Up until the 1980s, the technological development was focused on the component technologies essential to improving the construction of ships and the performance of the constructed vessels. However, technologies such as those related to automatic navigation, low pollution shipbuilding, and improvements in the productivity of shipbuilding have been implemented since the early 1990s as part of efforts to pursue a new concept of high speed vessels and propulsion systems.

The main types of vessels within the global shipbuilding market are currently tankers, bulk carriers, and containers. This makes the preservation of price competitiveness an important competitive element. It is therefore becomes necessary to increase productivity through the improvement of the production process, reduce transportation costs, and to establish a maritime disaster prevention system. Here, automatic navigation, energy reduction, and accident avoidance technologies have been identified as important technologies.

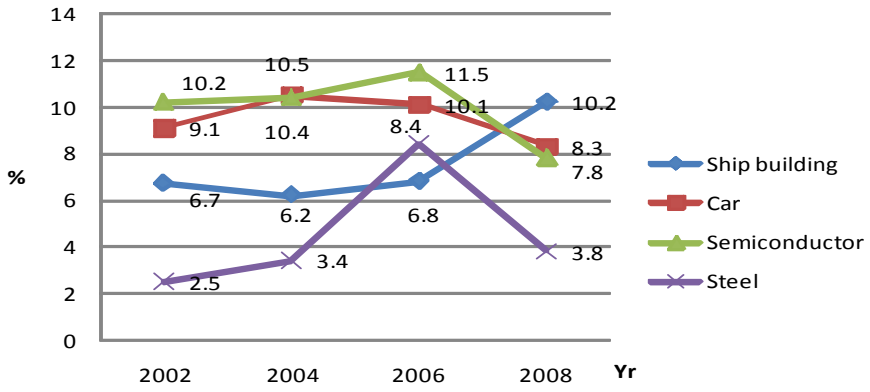
2) The current state of the development of the Korean shipbuilding industry

Korea became a global competitor in the shipbuilding industry in the mid-1970s. While there were instances in which the Korea Shipbuilding & Engineering Corporation, which was the biggest shipbuilding company in Korea at the time, constructed vessels for export during the 1960s, it was not until 1973 that Korea, via the Hyundai Heavy Industries Co, which boasted large-scale shipbuilding facilities akin to those of advanced

countries, actually entered the global market in a full scale manner. The 1970s has been evaluated as the period in which the Korean shipbuilding industry was able to enter the global market based on the development of its shipbuilding construction techniques. By the 2000s, Korea had been able to overcome various international and domestic difficulties, such as the global economic slump occasioned by the oil shocks, labor-management disputes, and the rapid decrease in exports caused by the revaluation of the Korean currency, to establish itself as a leader of the global shipbuilding market.

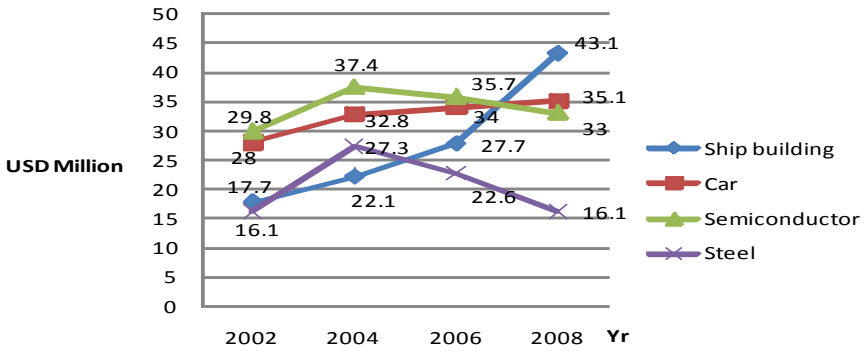
Factors that led to the development of the Korean shipbuilding industry included the entrepreneurship shown by those pioneers who raced into the shipbuilding industry at a time when it was still a relative wasteland, and the policy support for the development of the industry in the form of financial support, and help with the integration and organization of shipyards.

〔Figure 7－6〕 Change in the Ratio of Shipbuilding Industry Exports to Total Exports - Comparison with Other Industries



Source: KITA(2009), Korea Trade Statistics DB

〔Figure 7－7〕 Trends in Export Volumes for the Shipbuilding Industry - Comparison with Other Industries

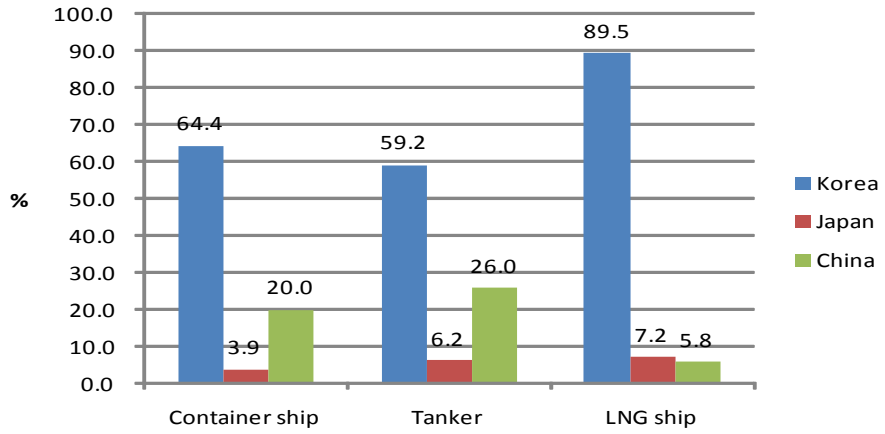


Source: KITA(2009), Korea Trade Statistics DB

Since 2000, Korea has emerged as a leading nation within the global shipbuilding industry in terms of such indicators as new contracts, shipbuilding tonnage, and backlog.[44] Korea earned some 17.50 million CGT(Compensated Gross Tonage) worth of shipbuilding contracts in 2008, a total which accounted for 41.1% of the global market. Meanwhile, China and Japan have consistently garnered 35.0% and 11.5% of the market respectively. Korea also finished first in shipbuilding tonnage with 14.90 million CGT in 2008 (36.8% of the global market), a feat which they repeated the following year. Korea also earned 35.8% of the global market share for shipbuilding backlog, with 67.70 million CGT, a result that translates into a full-work schedule for the next three years. Furthermore, Korea's market share of contracts for high value added vessels such as LNG carriers was estimated at 89.5% (64.4% and 69.2% respectively in the cases of containers and tankers). These figures exhibit the competitiveness of a Korean shipbuilding industry that now tops the global shipbuilding market.

44) Based on Lloyd's World shipbuilding Statistics

〔Figure 7－8〕 Comparison of Market Share by Vessel Type



Source: Lloyd's, based on shipbuilding contracts in 2007

Seven Korean shipyard companies were included amongst the world's top ten shipyards in 2008, a domination that is further evidenced by the fact that domestic companies occupied the top six spots on that list. In 2007, the domestic company STX Offshore & Shipbuilding Co. Ltd acquired the second largest cruise liner building company in Europe, Aker Yards, thereby paving the way for the domestic construction of a heretofore relatively neglected field of cruise ships. While the number of new contracts began to rapidly decrease from the second half of 2008 onwards as a result of the onset of the global financial crisis, the construction of backlogged vessels ensured that the shipbuilding industry nevertheless earned 43.16 billion dollars in exports and posted a 37.83 billion dollar trade surplus in 2008.

B. Trends of IT use within the shipbuilding industry

The introduction of IT technologies in the shipbuilding industry has been focused on guaranteeing the efficiency of production and safety during the shipbuilding process. According to organizations specialized in the analysis of shipbuilding such as Clarkson,

the ratio of the cost of IT converged equipment found in vessels to overall shipbuilding costs will increase from the current level of 6% to 15 %.

A SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis conducted in the field of Korean shipbuilding and IT convergence reveals that the industrial environment has changed so that such ends as energy reduction, protection of the marine environment, and the achievement of a high degree of safety and reliability have become the main pursuits. To this end, it is necessary to heighten IT technology use in areas such as the visualization of shipbuilding design technology, advancement of shipbuilding production technology, and the advent of intelligence in transportation system.

〈Table 7－4〉 SWOT Analysis of Shipbuilding-IT Convergence

Strengths	Weaknesses
- Abundance of experience in various kinds of shipbuilding - Possession of flexible design technology (makes it possible to immediately reflect market demands in design) - R&D, abundant shipbuilding facilities - Possession of IT technology clout in fields such as wireless networks, RFID, and networking	- Lack of high value added core shipbuilding solutions - Lack of technological clout with regards to such ends as the visualization of ship design technology, advancement of ship production technology, and the advent of intelligence in transportation systems - Lack of synergistic effects such as the joint development of technology for IT use caused by the existence of barriers between the shipyard companies
Opportunities	**Threats**
- Pursue energy reduction, protection of global marine environment, high degree of safety and reliability - Increase the necessity for IT use as part of efforts to improve productivity	-Strategic collaboration between Japan and China (Japan's technological clout and China's labor force) -Instability of global shipbuilding market in the future (concerns that productivity may decrease as a result of oversupply)

1) Stage (period)-based approach to IT use strategy

Up until the 1980s, the development of the technologies fundamentally used in the shipbuilding industry revolved around the component technologies needed to improve the shipbuilding process and vessel performance. However, from the early 1990s onwards, the main technologies developed were those such as automated navigation shipbuilding technology, low pollution shipbuilding technology, and the technology to improve shipbuilding productivity. These technologies helped to give form to concepts such as those of high speed vessels, propulsion systems, and the ship structural technology needed to heighten safety and reduce the workforce.

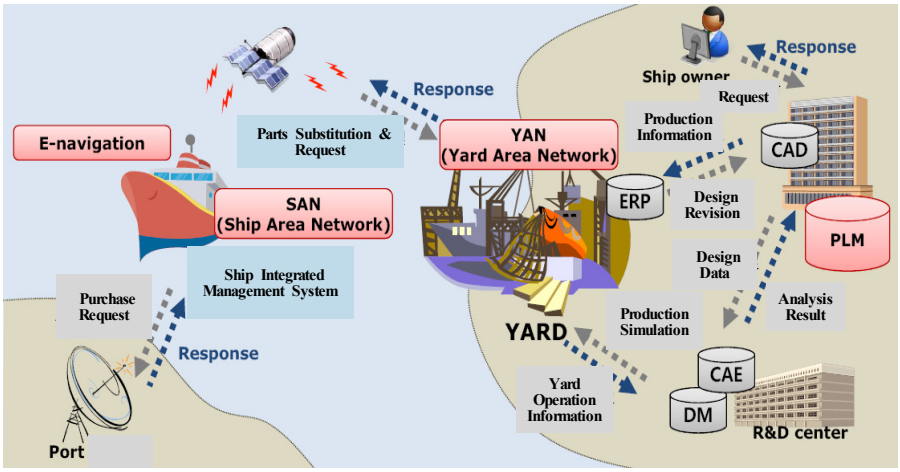
The main focal point with regards to shipbuilding industry technologies following the decline in freight space that took place after 1998 was on such ends as the development of energy reduction technology, the protection of the global marine environment, the achievement of a high degree of safety and reliability, the application of high quality IT technology, and the advent of technologies to improve productivity. In addition, as a result of rising labor wages, the shipbuilding industry was forced to pursue cost reduction measures. Such measures included the improvement of design tools, design methods, production processes, and production technology. The industry has in particular been able to heighten the value added of vessels by employing IT technologies in the ship design and shipbuilding processes, as well as through the installation of electronic control systems inside the vessel.

〈Table 7－5〉 Stage-based Approach to the Role of IT Use in the Development of the Shipbuilding Industry

	Stage 1 (Automation)	Stage 2 (Improvement of productivity)	Stage 3 (High value added)	Stage 4 (Digital ship)
Period	1980s～1995	1990～1997	1998～2007	After 2008
Main technological focal point	- Component technologies needed to construct ships and to improve the performance of ships	- High speed ship, propulsion systems, ship structural technology, automated navigation shipbuilding technology, low pollution shipbuilding technology, technology to improve shipbuilding productivity, etc	- Energy reduction technology, application of high quality IT technology, improvement of shipbuilding productivity	- Evolve into service technology capable of supporting safe transportation
Industrial environment	- Concentrate on improving shipbuilding productivity	-High speed, safety, and workforce reduction	- Pursue high value-added as a result of the reduction of freight space - Protection of marine environment, achievement of a high degree of safety and reliability	- Digital ships - remote maintenance of ships and development of autonomous transportation systems
IT use	- CAD design and augmented reality, ship design technology	-Technology to improve the productivity at shipyards	- Apply IT technology to ship design, construction of ships, and installation of electronic control systems inside of ships	- Integrated management of shipbuilding process, Integrated management of transportation, integrated management of navigation information, IT convergence with ship equipment, shipbuilding PLM, etc

The decrease in marine freight occasioned by the global economic slowdown that began in 2007 was also directly connected to the recession in marine transportation caused by the drop in shipbuilding contracts. However, R&D in areas such as the visualization of shipbuilding design technology, advancement of production technology, and the introduction of intelligence to transportation systems has greatly contributed to the further development of the shipbuilding industry. The IT convergence employed in the shipbuilding industry has included the integrated management of the shipbuilding process (YAN, Yard Area Network), integrated management of transportation (SAN, Ship Area Network), integrated management of navigation information (e-navigation), IT convergence with ship equipment, and shipbuilding PLM.

〔Figure 7－9〕 Concept of Shipbuilding-IT Convergence



Source: Presidential Committee on New Growth Engines (2008b)

Shipbuilding-IT convergence began with the development of ship design technologies such as CAD design and visualization of augmented reality (AR). Once the technologies needed to improve the productivity at shipyards had been developed, the focus switched

to the creation of digital ships which could monitor the state of equipment and systems based on the connection, through a network, of all the equipment and devices aboard the ship.

These intelligent digital ships are expected to further develop to the point where they essentially become remote maintenance and autonomous transportation systems. As such, shipbuilding-IT convergence began with the improvement of productivity in shipbuilding, and has since evolved into the development of the service technologies needed to support the safe transportation of ships.

A joint research conducted by ETRI and a large-sized ship yard company in Korea since 2008 has investigated the development of a platform technology that can improve productivity and lead to the production of digital ships. In addition, much research has been done on the development of technologies which can help bring about e-navigation designed to ensure the safety of ships, and those which can support safe and economic ship transportation.

One of these researches has focused on the development of the technology related to the actualization of smart ships. Based on the convergence of IT technology with SAN-based digital ships, smart ships are vessels that make economic transportation, safe navigation, effective crew management, and global maintenance possible. At a time when the ratio of IT equipment is on the increase, the actualization of smart ships will make it possible to manage the various transportation equipment employed on a ship under a common platform. Because of their ability to monitor the state of equipment and the environment surrounding ships, smart ships will also help prevent crashes between ships and determine the most economic marine routes.

The most important factor in the infrastructure components required to actualize these technologies is the development of maritime mobile communications designed to assist ship-land communications. Although satellite-based communications have become generalized

on long-distance voyages, integrated communication solutions must be designed in order to make more effective use of communication equipment. Furthermore, there is a need to develop methods of using terrestrial communications in berth areas.

Once the establishment of ship-land communication infrastructure has been completed, it will become necessary to develop various services to assist ships. To this end, a protocol and framework for exchanging data between ships and land will have to first be developed.

Shipbuilding-IT convergence technology will usher in an era in which it will become possible within 10 years to benefit from the safest and most economic transportation systems, and to enjoy various additional services aboard ships.

All the plans, implementation methods, and management information related to production activities at shipyards, that is, from the contracting to the design, construction, and delivery, will be integrated into a computer network. Furthermore, the securing of the flow of information will ensure that efforts to improve productivity will continue apace. While the CIMS (computer integrated manufacturing system) implemented by Japan from the late 1980s onwards was to be completed in the late 1990s, it now appears that the concept of CALS (continuous acquisition and life-cycle support) will be applied to the shipbuilding field. CALS refers to a system which makes it possible to organize the information about a product during its entire life cycle. In the case of defense-related organizations in the United States, this has meant organizing information from the acquisition of weaponry systems to the design, manufacturing, delivery, operation, maintenance and disposal thereof.

Above all, there is an urgent need to further develop the technologies in the shipbuilding industry. The preservation of the price competitiveness of main vessels such as tankers, bulk carriers, and containers in the current global shipbuilding market will require improvements in productivity, reduction of transportation costs, and establishment

of a maritime disaster prevention system, all of which can be brought about by upgrading the production process. To this end, it is necessary to introduce the automatic navigation technology, energy reduction technology, and accident avoidance technology.

2) The characteristics of the IT technology employed

Automation stage

① CAD (computer aided design)

CAD refers to a design system based on the use of computers that conduct drawings according to products or machines to be manufactured.

② Visualization of augmented reality (AR)

AR technology refers to the technology that makes it possible to view virtual 3D objects in a real environment. 3D design data can be synthesized and visualized, using this technology. Related technologies include the virtual ship simulators used to verify ship design.

Productivity improvement and high value-added stage

① CIMS (Computer Integrated Manufacturing System)

CIMS refers to the computerization of ship design and production as part of efforts to, using computer technology, automate the entire process of shipbuilding, namely from contracting to design, production, management, and delivery. Prior to the widespread development of technology that began in Korea during the late 1980s, automation technologies were introduced from abroad by large individual domestic shipbuilding companies and employed in the ship designing process. Meanwhile, based on government support, large shipbuilding companies, universities and research institutes participated in the development of ship design and production computerization systems that was carried out from 1989 onwards. The first stage of the development project was completed in 1995.

In the meantime, shipbuilding companies individually implemented the development of specialized systems designed to bring about the automation of the shipbuilding process, an endeavor that was not without producing salient results. Large shipbuilding companies and research institutes subsequently jointly participated in the second stage of the CIMS project, which was called “Development of next-generation shipbuilding production system technology.”

② RFID

RFID has mainly been used to improve production efficiency. Viewed from the standpoint of safety, this technology can help ensure smooth communications between workers conducting their respective work duties. GPS technology, which can be used to detect the location of isolated workers, also plays an important role.

③ Maritime mobile/satellite communication technology

Maritime mobile/satellite communication technology refers to the mobile and satellite communication technologies that make possible the ship-land and ship-ship communications needed to guarantee navigational safety. These communication technologies can be used in support of communication and information systems designed to ensure safe and effective navigation.

Digital ship stage

① YAN (Yard Area Network)

YAN refers to a technology which can be used in support of the real-time Wibro-based monitoring of group communications and major logistics at shipyards conducted to improve shipbuilding productivity. A YAN-based management system rooted in the use of RFID can help bring about the automation of the loading/unloading of steel materials and management of block production genealogy. YAN also makes possible the real-time tracing of materials and blocks using GPS technology.

② SAN (Ship Area Network)

SAN refers to technology which, based on optimized wired/wireless technology-converged networks, connects hundreds of types of equipment found onboard the ship, and facilitates the development of next generation additional services. The installing of sensor networks aboard the ship as part of the establishment of SAN enables implement effective transportation, the timely maintenance of engines and equipment, and precise freight management. It can also contribute to the health and safety of the crew.

③ e-Navigation

Essentially a method of ensuring the safe navigation of vessels, e-Navigation can be perceived as the key to standardizing the IT equipment used in the ship and to develop the tools needed to assist the navigator in his decision-making process. The development of e-Navigation was motivated by the fact that the application of IT technology to ships without standardization would, because of the related issues of compatibility and complexity, hamper the advancements in navigation. It was also facilitated by the fact that over 60% of maritime causalities are the result of human error. To this end, IT technology was perceived as a tool that could help navigators' decision making process.

In terms of the tools used to help navigators' decision making process, it is important above all that the equipment aboard the ship be connected to networks in order to make possible the monitoring and control in a real-time manner of the information related to the ship's navigation and equipment. In addition, it is also vital that the information on the ship be monitored on land, and conversely that any important information emanating from land be made available to navigators in order to assist their decision making process. The securing of information exchanges between ship-land is predicated on the maintenance of reliable information communication channels between the ship and land, and ship and ship. Through such means, the ultimate purpose of e-Navigation, namely the protection of the maritime environment, navigational safety, and the safety of ships,

can be achieved.

④ Real-time monitoring technology

By establishing a location tracking system for moving objects based on IDGPS and RFID technologies at the shipyard, real-time monitoring technology can be employed to monitor moving objects (ship blocks/transporters) and the shipyard itself.

The tracking technology used to locate moving objects is combined with GPS technology in LOS areas and RFID technology in shaded areas in order to ensure nonstop location tracking. It is also combined with IDGPS technology to decrease location information errors in a working environment where irregular reflections of electronic waves may occur as a result of the presence of steel structures.

The combination of ship block/materials and transporter monitoring technology with GPS and RFID technologies is designed to automatically identify the ship blocks loaded at shipyard and to trace the transporters which deliver the ship blocks in a real-time manner. Furthermore, the integrated management and monitoring of ship blocks and transporters in a real-time remote manner becomes possible by the compilation of a database of moving objects.

This technology can decrease errors in ship block arrangement caused by the manual management of blocks and transporters. As it can also heighten the efficiency of work processes by optimizing management and operation of moving objects such as transporters, this technology will eventually take the overall productivity of the shipbuilding industry to the next level.

⑤ Shipbuilding PLM (Product Lifecycle Management)

PLM refers to the management of a product lifecycle from the generation of an idea for the product to the designing and manufacturing of services and to effective disposal. Through the integration of ERP (Enterprise Resources Planning) and CRM (Customer Relationship Management), PLM enhances managerial efficiency. Furthermore, the

integration of information at all the stages of the product lifecycle means that PLM can help facilitate effective decision-making. The PLM methods used in other manufacturing sectors cannot be employed in the shipbuilding industry. This is closely related to the fact that not only must the shipbuilding industry focus more on strengthening project/process management than other manufacturing sectors, but it is involved with different targets and subjects as far as the precision of quantity estimations is concerned.

〈Table 7－6〉 Comparison of PLM in the Shipbuilding and Non-Shipbuilding Industries

	Non-shipbuilding industry (mass production)	Shipbuilding (make to order production)
Product	After having assessed potential customers through market surveys, a product is developed and produced in accordance with the perceived demand	Design and produce an optimized product based on the contract with the client (employer)
Lifecycle	Includes the development, production, delivery and A/S processes of similar products, as well as the comprehensive disposal of the product	Limited to the contract with the client, design/production, delivery, maintenance, and disposal of a ship
Management	Focus on the management of the product structure and components → Product innovation	Focus on the management of quantities and logistics → Process innovation
Purpose	Promptly adjust to changes in the market by immediately responding to customers' demands	Minimize material surpluses and shortages through precise measurements and estimations and abide by the agreed-upon delivery period with subcontractors.

Source: Kim Tae-wan (2009)

C. Linkage with IT policy

1) The basic IT technology use strategy

During the first stage, automation (1980s-1995), ship design technologies such as CAD and the visualization of augmented reality were mainly used. Meanwhile, during the second

stage, that of the improvement of productivity (1990-1997), technologies designed to improve the productivity of ships at the shipbuilding yard were introduced. These technologies came as the result of the implementation of a series of IT policies, including those related to the development of the electronics industry, advancement of informationalization, establishment of communication networks, and the development of communication equipment, and the subsequent application of these IT technologies in other industries.

These series of IT industrial policies resulted in the full-scale advancement of IT convergence, and ushered in a new perception of the IT industry as an engine that could help propel other industries forwards. A more aggressive IT use strategy was implemented in conjunction with the facilitation of direct convergence between shipbuilding and IT. However, the use of basic IT technologies was not as important as it had been at the previous level. Thus, the shipbuilding industry can be said to have gone from the market entrance stage to that of market development. The presence of such circumstances greatly enhanced the shipbuilding industry's ability to focus on the accumulation of its own independent technological capacity. From this standpoint, the development of computational systems to be used in conjunction with the design and production of ships and the advent of specialized systems to facilitate shipbuilding process automation in the late 1980s can be regarded as examples of the full-scale use of IT technologies to ensure the shipbuilding industry's technological capacity.

The IT policies implemented during the 1980s and 1990s can be regarded as having played a key role in expanding the use of IT technologies in the shipbuilding industry. Under the Measures for the Development of the Electronics Industry (1987-1996), the Korean government concentrated on the establishment of administrative communication networks and the development of semiconductors, PCs, and TDX. Meanwhile, the main focus under the Basic Plan for the Facilitation of Informationalization (1996-2000) was on the establishment of the information and communication (CDMA) infrastructure and

the spread of high-speed communication networks (ADSL and ISDN). These policies contributed to improving the productivity of the shipbuilding industry via improvements in ship designing, which in turn was the result of the increased use of computers, or, to be more specific, the growing use of SW in accord with the progression of informationalization, the establishment of communication networks, and the enhancement of the supply of electronic communications equipment.

2) Shipbuilding-IT convergence strategy

The third stage in the development of the Korean shipbuilding industry, that of high value-added (1998-2007), was focused on the application of IT technologies to such processes as ship design, shipbuilding, and the implementation of onboard electronic control systems. The fourth stage, the stage of digital ships (since 2008), has been focused on applying IT technologies to the integrated management of the shipbuilding process, integrated management of ship transportation systems, integrated management of ship navigation information, IT convergence of ship equipment, and shipbuilding PLM. As such, the main trend in IT technology has gone from the application of basic IT technologies to IT convergence as it relates to the integrated management of the entire shipbuilding process and ship navigation systems. In the past, basic IT technologies were used in conjunction with automation processes such as the introduction of CAD technology in ship design and of computation into the shipbuilding process. However, the development of the shipbuilding industry and growing sophistication of IT technology have resulted in convergence between the IT and shipbuilding industries being on the rise. As such, the emphasis has been on the development of direct IT convergence technology that can be used within the shipbuilding industry.

The major policies which have been implemented in the 2000s, including Cyber Korea21, have revolved around the integration of various development strategies. In this

regard, the Broadband IT Korea 2007 (2003-2007) can be regarded as the policy that established the implicit strategic direction known as the spread of IT technologies to other industries. Cyber Korea 21 (1999-2002) involved the implementation of measures such as the development and advancement of high speed communication networks, e-government, e-commerce, and the integration of networks between small and large enterprises. For its part, the policy known as e-Korea Vision 2006 (2002-2006) was characterized by a focus on the establishment of next generation internet base (IPv6, WLAN), home networking and wired/wireless integration, and mobile e-government. Here, we can see the trend towards the development of a network-centered IT industry.

The policies established after the Broadband IT Korea 2007 have had a direct influence on the shipbuilding industry. The Broadband IT Korea 2007 policy was concentrated on the development of BcN, IT Soc (next generation semiconductors), mobile communications, imbedded SW, digital contents, intelligent robots, next generation PCs, digital TV/broadcasting, RFID/USN, telematics, and wired/wireless home networks. Meanwhile, the core strategies developed under the u-Korea (2006-2007) policy involved the implementation of RFID/USN, BT+NT, imbedded SW, wireless internet (WiFi), Wibro, HSDPA, digital TV/broadcasting, home networks, telematics, intelligent robots, u-computing, digital contents, and IT convergence. The development and advancement of wired/wireless networking, product recognition, product awareness, ubiquitous communication environment, SW technology, and robot technology brought about as a result of these IT policies have greatly contributed to improving the productivity and safety of the shipbuilding industry.

The New IT Strategy launched in 2008 has involved the implementation of measures designed to facilitate direct IT convergence with other industries such as SW/computing, electronic information devices, information and communication media, next generation communication networks, robots, knowledge service USN, and bio medical appliances.

The facilitation of direct convergence between the traditional and IT industries to bring about shipbuilding-IT convergence is expected to speed up the development of the digital ships which the shipbuilding industry seeks to create. Here, the strategy of establishing a cooperative system linking together IT research institutes, the shipbuilding industry, and the academic sector is expected to emerge as an important policy variable. This cooperative system will lead to the implementation of joint research on the development of the platform technology needed to raise productivity and develop digital ships and e-navigation enabling technology.

D. Policy implications

The expansion of the scope of IT technologies that can be applied to the shipbuilding industry and furthering of technological convergence has rendered it necessary to develop IT convergence technologies that are specific to the shipbuilding industry, namely technologies that can cover a multitude of areas including communications, networking, systems, and sensors. The development of IT technologies such as those related to control/networks/communications is predicated on the establishment of a technological development support system involving the industrial, academic, and research sectors with a keen awareness of the technologies demanded by the shipbuilding industry.

In the case of communication-related fields such as ship mobile/satellite communication technology and RFID/USN, investment should be focused on special tag technology, interference avoidance and removal technology, and high speed tag attachment technology. In terms of systems, there is a need to develop remote maintenance/management systems and ship equipment electronic SW. Meanwhile, as far as sensors are concerned, investment should be concentrated on the development of maritime high-tech network sensors. The recent trend within the shipbuilding industry towards the increased focus on the development of shipbuilding and navigation systems, as well as global remote ship maintenance/management

systems, has in particular necessitated development of the SW technologies that can support optimization of shipbuilding and navigation systems.

In addition, there is a need to establish industrial standards in conjunction with the IT convergence technology specific to the shipbuilding industry, and to support efforts to ensure that these industrial standards are internationally recognized. Such a move represents an essential step to further enhance the competitiveness of the shipbuilding industry. Moreover, a further strengthening of the competitiveness of IT technology standards is expected from the extension of the fields in which such IT technology is employed.

The growing emphasis on the necessity of IT convergence technology specific to the shipbuilding industry has rendered it essential that proper support be provided for the development of the infrastructure needed to ensure the education of human resources and the exchanges of resources between the industries. There is a need to establish an education and training sphere within which the specialized knowledge pertaining to the interactive technology developed by the human resources involved in the IT and shipbuilding industries can be exchanged and further developed. In addition, there is a need to establish organized windows for the exchange of technological information so as to ensure the smooth access to technological information.

2.3. Construction industry

A. The current state of the Korean construction industry

1) Overview of Korean construction industry

The expansion of the scope of IT use from the convergence between machines into that involving other countries' technologies has resulted in the active coupling of the IT industry with other industries. The IT convergence industry, which is regarded as one of

the next generation infrastructure industries, is now capturing a lot of attention.

The construction industry is one of the leading convergence industries in that it involves the integration of the technology, materials, services, and human resources required for such ends as planning, design, construction, processing management, and intelligent customer service. From an economic standpoint, it can thus be regarded as a very influential industrial sector. Although the traditional construction industry has long accounted for a significant portion of the national economy, it has suffered from a shortage of technological investment and IT convergence on the perception that it is a mere analog industry lacking ability to create value added.

However, the introduction of new technologies, new concepts, and convenience, has resulted in the construction industry being transformed into a high value-added and high-tech new industry. Moreover, based on the effective use and convergence of IT technology, which can be relatively more rapidly developed than construction technology, the construction industry is now moving towards high value-added intelligent construction technology.

The grafting of linkages with IT technology would help the construction sector to reduce construction time and cost, as well as heighten overall quality via precise construction. This in turn would help advance the construction industry as a whole. Such steps, which would help prevent large-scale accidents such as the crumbling of bridges, subway accidents, and the collapse of buildings, could also create a symbolic effect of enhancing national safety. Given the fact that processing management capacity is regarded as a core technology, rather than one of the production technologies like construction technology, it becomes especially important, in terms of the international competitiveness of the construction industry, to ensure the convergence of engineering and IT technology.

Moreover, trends within the global construction industry, such as the focus on environment-friendliness, energy efficiency, intelligence, and the move towards mega-structures,

are expected to result in the improvement of productivity, the management and reduction of energy, development of countermeasures to the UNFCCC (UN Framework Convention on Climate Change), and the creation of environment-friendly technologies becoming the main themes within the construction market in the future. The ability to respond to the changes in the external environment is predicated on the actualization of energy reduction, the advent of an environment-friendly era, and intelligence through IT convergence.

In other words, the domestic construction industry must be transformed into a high value-added construction IT convergence industry if this traditional labor-intensive industry is to respond to the external changes in the global construction industry and with better productivity and profitability.

2) The current state of the Korean construction industry

The construction industry is one that not only has a great ripple effect on other industries, but also a high employment effect. There has of late been a marked increase in the size of both the international and domestic construction markets.

The Korean construction industry boasts the highest portion of the Korean economy of any single industry, garnering some 6.3% of GDP in 2009. As it also has a higher production inducement coefficient than other industries, the construction industry can be said to have a direct and indirect influence on the production inducement effect of other industries. The production inducement coefficient of the construction industry in 2008 was measured at 2.09, which was higher than the 2.06 score earned by the manufacturing industry, 1.71 by the service industry, and the 1.94 overall industrial average.

〈Table 7－7〉 The Korean Construction Industry's Share of GDP (Unit: %)

Industry	2005	2006	2007	2008	2009
Construction	6.9	6.8	6.7	6.3	6.3
Manufacturing	24.7	24.3	24.5	25.0	25.0

Source: The Bank of Korea, National Accounts

〈Table 7－8〉 Production Inducement Coefficient by Industry[45)]

Industry	2005	2006	2007	2008	Japan (2005)
Construction	2.02	2.04	2.06	2.09	1.98
Manufacturing	2.06	2.08	2.07	2.06	2.14
Service	1.70	1.72	1.72	1.71	1.69
Overall industries (average)	1.93	1.94	1.94	1.94	1.99

Source: The Bank of Korea, Industrial Interdependence Table

In addition, the Korean construction industry has been found to more greatly contribute to the creation of employment than the manufacturing and service industries. For example, while the construction industry boasted an employment inducement coefficient of 14.8 in 2007, the manufacturing and services industries earned an employment inducement coefficient of 6.6 and 12.6, respectively. The overall industrial average was 9.5. As shown by these figures, the construction industry has a significant impact on employment.

45) Refers to the scale of the directly or indirectly induced production effect within the relevant industry and other industries for every unit of the final demand for a certain industry's product.

〈Table 7－9〉 Employment Inducement Coefficient by Industry[46)]

	Industry	2000	2005	2006	2007
Employment inducement coefficient	Construction	14.6(9.6)	14.8(10.4)	15.2(10.7)	14.8(10.3)
	Manufacturing	8.8(4.0)	7.2(3.0)	6.9(2.8)	6.6(2.7)
	Service	13.7(10.4)	12.6(9.2)	12.6(9.1)	12.6(9.1)
	Overall industry (average)	11.1(7.0)	9.9(6.1)	9.7(5.9)	9.5(5.8)

Source: The Bank of Korea, “Annex to the Employment Table in the Industrial Interdependence Table: The employment structure of Korea and its labor inducement effect”

〈Table 7－10〉 The Current State of Overseas Construction Contracts

(Unit: 100 million dollars, number, countries, %)

	2004	2005	2006	2007	2008	2009	Average annual growth
Value of contracts	75	108.6	164.7	397.9	476.4	491.5	45.6
Number of contracts	224	281	326	619	642	559	20.1
Number of Countries	48	50	49	76	87	81	11.0

Source: Construction Association of Korea (CAK), 2010

The scale of the global construction IT convergence market is expected to balloon from 241 billion dollars in 2008 to 289 billion dollars in 2012, or by an annual average of 4.6%.

The Korean construction IT convergence market produced 5.9 billion dollars worth of output in 2009. Expansion is expected to be significant during the period 2008-2010, with annual average growth anticipated to reach 8.4%. However, the domestic market only accounted for 2.1% of the global market in 2008, a total which was a great deal lower than the 41.8% registered by the United States and 14.5% by Great Britain.

46) Indicates the number of jobs which are indirectly or directly induced for every 1 billion won of final demand within a specific industrial sector. () indicates the employment coefficient, which shows the direct employment effect.

〈Table 7－11〉 Trends in the Size of the Global Construction IT Convergence Market
(Unit: 100 million dollars, %)

	2008	2009	2010	2011	2012	Average annual growth
Global (A)	2,410	2,530	2,640	2,770	2,890	4.6
Domestic (B)	50	54	59	64	69	8.4
Expected market share(B/A)	2.1	2.1	2.2	2.3	2.4	3.5

Source: Division of Construction-IT Convergence, TFT, April 2008

B. Trends in IT use in the construction industry

While boasting relatively advanced construction technology, the Korean construction industry is somewhat behind in terms of the fields which make possible the creation of high value-added, such as engineering, environment-friendly energy reduction materials, and intelligence. In addition, the production and construction capacity of Korean construction companies remains at 83% that of the advanced countries, while the planning, designing, and overall construction process capacity are estimated at, respectively, 59%, 63%, and 67% that of the advanced countries.[47)]

With the exception of major construction companies such as GS E&C, Daewoo Engineering & Construction Co. LTD, Hyundai Engineering & Construction, Lotte Engineering & Construction, Samsung C&T Corporation, and SK Engineering & Construction Co. LTD, the low technological competitiveness of Korean construction companies can be explained by the continuation of the application of the design and managerial style of the 1970s-1980s without any new technological developments or facility investment.

The domestic construction industry achieved rapid growth until the late 1990s, with the main focal points of this expansion being production and construction. However,

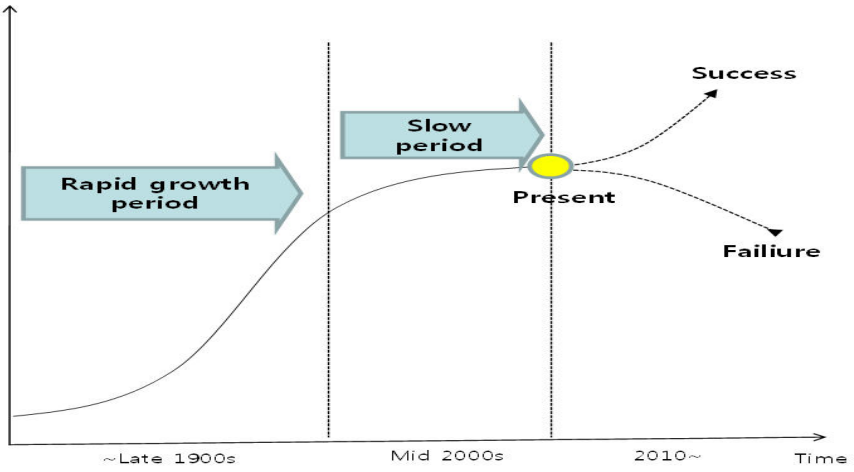
47) Choi In-seok et al, “Evaluation of the technological competitiveness of construction products sold overseas”, October 2006

growth has slowed since 2000. In this regard, the transformation of the domestic construction industry into a new growth engine for the national economy will require the development of cutting-edge construction engineering technologies through a convergence with IT technology.

The ability to improve the productivity of a Korean construction industry that currently suffers from low competitiveness, and to heighten profitability, will require more than the simple use of IT technology; what is in fact needed is the convergence of the construction industry with IT technology.

The rapid increase in the demand for construction-IT convergence helped by the growing desire to enhance the quality of life through such means as the development of environment-friendly goods, energy reduction, and the advent of u-Cities, is expected to result in the Korean construction-IT convergence industry emerging as a new national growth engine.

〔Figure 7－10〕 Need for Construction-IT Convergence



Source: Goo Ji-hee, “Prospect for Construction-IT Convergence”, 2007

Korea’s IT capacity in fields such as next generation mobile communications, telematics, and home networks has been estimated to be over 90% that of the world’s best in terms

of technological standards, whereas its next generation PC, intelligent robot, and IT SoC technology stands at the 80% level of the world's best. As such, the world-class status of Korean information technology & infrastructure, as well as its high IT competitiveness, is expected to provide conditions that are advantageous for construction-IT convergence.

However, as far as Korean construction-IT convergence is concerned, efforts will have to be made to overcome the fact that factors such as the stagnation of cutting-edge design technology, lack of global standard production systems, regional bias of overseas markets, as well as the absence of technological and price competitiveness, have meant that Korea does not enjoy a comparative advantage vis-à-vis the advanced countries and China.

〈Table 7－12〉 SWOT Analysis of Korean Construction-IT Convergence

Strengths	Weaknesses
- Securing of competitiveness in the fields of construction and engineering - Possession of world-class information technology and infrastructure - Development of competencies needed to improve the productivity of construction, environment-friendly construction, and value-added based on the use of IT technology - Accumulation of construction-IT convergence knowhow through the establishment of a U-City test bed	- Lack of high-tech construction design technology - Lack of global standard production systems - Regional bias in overseas markets such as the Middle East - Lack of the technological innovation infrastructure created through the linkage of construction and IT - Backward R&D system for construction technology
Opportunities	**Threats**
- Increased opportunities to enter the markets in Asia and the Middle East - Increased demand for construction occasioned by the enhanced desire for quality of life elements such as environment-friendly surroundings, energy matters, and pleasant spaces. - Rapid increase in demand for construction-IT convergence projects such as u-Cities	- Trend towards complex, large-scale, and technology-intensive construction projects - Comparative disadvantage vis-à-vis the advanced countries in terms of technological prowess, and vis-à-vis China and Southeast Asia in terms of price competitiveness - Competition for brand value, worsening of competitiveness within the global market

Source: Division of Construction-IT Convergence, TFT, April 2008

1) Stage (period)-based approach to the IT use strategy

Construction-IT convergence is aimed at upgrading the construction industry from a labor-intensive industry to a technology-intensive one through the selective convergence of the traditional construction industry and IT technology.

The convergence of the construction industry with IT has been implemented in three stages: namely, the informatization of the construction industry that began from the mid 1990s onwards, the advent of home and building automation systems during the early 2000, and the advancement of construction-IT convergence during the late 2000s.

Construction-IT convergence was designed to establish u-Cities, which are innovative cities where convergence, integration, and intelligence are combined on ubiquitous computing and information communication technologies. As such, the Korean construction industry has achieved a significant progress from the informatization of construction companies to the advancement of high value-added, intelligent, and human-oriented construction IT convergence.

〈Table 7－13〉 IT Use during Each Stage of the Development of the Construction Industry

Period	Stage 1 (informatization)	Stage 2 (home and building automation systems)	Stage 3 (advancement of construction-IT convergence)
	1990~1999	2000~2007	2008~
Core technology	Informatization of construction industry, integration of business process, establishment of collaboration system	Cutting-edge information &communications, integration of systems within each sector, such as building and office automation	Energy reduction, environment-friendly, and intelligent construction infrastructure
Industrial environment	Enhancement of the efficiency of the construction industry through informatization	Improvement of home and office environment, heightening of the value of building	Establishment of intelligent buildings, advancement of construction process and infrastructure, pursuit of

Period	Stage 1 (informatization)	Stage 2 (home and building automation systems)	Stage 3 (advancement of construction-IT convergence)
	1990~1999	2000~2007	2008~
			energy reduction/ environment-friendly construction
IT use	ERP, PMIS, PLM, BIMS, RFID etc	Home networks, IBS, IPv6, telematics, GIS, ITS, USN, BcN, RFID, e-government, etc	RFID/USN based real time location awareness technology. Introduction of robot automation in construction equipment, 4D CAD/BIM/GIS, construction and new materials technology, etc

The first stage of IT use, the informatization of the construction industry, was aimed at achieving the informatization and enhanced efficiency of the construction industry through such means as the introduction of RFID (radio frequency identification), ERP (enterprise resource planning), and PMIS (project management information systems).

The informatization of the construction industry can be divided into informatization at the enterprise, industrial, and project management levels. The informatization of the construction industry began at the enterprise level and evolved to the integration of processes related to business activities at the time of the establishment of the informatization of internal management and business processes. Thereafter, movement was made towards informatization at the industrial level where the functions of on-site management and business processes carried out at headquarters were linked and integrated, and towards the activation of interrelationships and e-business between the various participants in the construction industry using informatization technology.

Informatization at the project management level included the establishment of organic relationships between the participants, the production and management of the overall life

cycle, and the informatization of the on-site processes of construction enterprises.

The informatization stage of the construction industry was focused on the management of physical distribution based on the application of RFID technology, as well as the enhancement of the efficiency of the construction industry through the linkage of USN and ERP. The IT technologies employed at this level include the RFID, ERP, PMIS, PLM and BIMS.

The second stage of construction-IT convergence revolved around the establishment of home and building automation systems. This stage moved beyond the simple use of building spaces and towards the integration of systems such as cutting-edge information & communications, building automation, and office automation.

At this stage, while the occupants of a building were able to enjoy a much improved home and office environment, the owner/landlord benefitted from a significant heightening of the value of the building. This also marked the early stage of moving from u-Home to u-Town, with the ultimate goal being that of creating a u-City.

u-City, a comprehensive construction concept which encompasses home networks and intelligent building systems (IBS), denotes a city in which all the functions and services provided by a city, such as administrative affairs, transportation, environment-related matters, security, urban life, business activities, and disaster relief, are harmoniously organized in accordance with the concept of ubiquity.

The IT technologies used during the second stage included home networks, IBS, IPv6, remote measurement systems, remote treatment, and remote education. It also included USN, BcN, GIS, telematics, ITS, e-government, and the environment and disaster management systems needed for the construction of u-Cities.

The third stage, that of the advancement of construction-IT convergence, refers to a stage of integration approached from the standpoint of convergence rather than the use of IT technologies. This stage necessitates the presence of an intelligent construction

infrastructure capable of dealing with environmental pollutants at the national and enterprise level, resolving the issue of reducing the use of energy within buildings, and facilitating the establishment of u-Cities.

The third stage is thus divided into the following three parts: namely, development of smart construction services focused on intelligence and energy reduction; introduction of environment-friendly green construction; and establishment of u-construction that can be linked to u-Cities.

The IT technologies used during the third stage include Green IT; intelligent building safety management systems to prevent the advent of disasters; 4D CAD, GIS, and BIS to reduce the construction period; construction process management IT to diminish production costs; and automated materials management systems based on u-GIS.

Other technologies employed include highly-functional construction parts and new materials development technologies such as those related to the automation of construction robot collaboration designed to improve productivity and conduct precise construction; intelligent construction equipment technology; flexible emotional lighting; and information walls.

2) Characteristics of the IT technologies employed

Informatization stage

① RFID (Radio Frequency Identification)

RFID is a human resources and materials management system that makes it possible, based on the use of cards and tags, to manage real-time outputs and material quantities. It can also, based on GPS location detection mechanisms, be used to trace core materials. It is an essential tool when it comes to company's distribution, logistics, and inventory.

② PMIS (Project Management Information System)

The construction-related tasks carried out by companies within this particular industry

at the single facility level include the establishment of organic relationships between the clients, permit holders, project managers, designers, contractors, supervisors, building owners and building managers, and the production and management of the lifecycle of the facility. In this regard, it is necessary to secure the elements of informatization that encompass this overall process.

The informatization of clients' project management functions represents the core factor of informatization at the project level. This step can also help actualize the informatization of construction companies' on-site processes. This is linked to core solutions such as ERP, and also strengthens linkages with supply chain management.

③ PLM (Project Lifecycle Management)

PLM (Project Lifecycle Management) refers to the management of the information and processes related to a product based on the latter's lifecycle. The lifecycle of a product covers every stage from the initial assessment of the demand for a product to the definition of the concept, development, production, distribution and end-services such as operation, maintenance, and disposal or reuse. To this end, PLM generates and manages all information related to an industrial product in an organized manner.

④ Construction CALS (Continuous Acquisition and Life cycle Support)

Construction CALS is an integrated information system which allows contractors to more efficiently carry out construction related activities by promptly exchanging and sharing information about all aspects of a project, including planning, design, contracts, construction and maintenance, with their clients or employers through a network system.

⑤ BIM (Building Information Model)

BIM (Building Information Model) is an innovative construction process which has the potential to enhance the competitiveness of not only designing and construction companies, but also their employers. In addition to facilitating high-tech design and optimized construction through its function that allows users to model the entire construction process

within a multidimensional virtual space, from the planning, design, and engineering (structure, installation and electricity etc), to the actual construction, maintenance, and disposal of a building, this international information sharing protocol also contributes to environment protection.

Home and building automation systems establishment stage (early stage of u-Cities)

① Home networks

The term home network refers to an integrated communication service environment which makes it possible to establish networks between any equipment or devices found within the home, and to control or manage them even from remote places through a network system. Once the high-tech cities of the future are actualized, homes will no longer only be a residential space; they will rather serve as a smart platform from which it will be possible to see and make use of the various high-tech functions of the city. In addition, the quality of life will be further heightened through the transformation of core home appliances such as TVs and electric appliances into intelligent entities connected to one another via a network system.

② IBS (Intelligent Building System)

IBS (Intelligent Building System) is a concept in which the systems associated with various fields such as high-tech information and communications, building automation, and office automation are integrated, thereby ensuring that better use is made of the spaces found in a building. In the city of the future, IBS will have developed to the point where it becomes possible to construct high-tech office buildings and residential facilities. The installation of various sensors in a building's main facilities will make it possible to turn on and off the lights and control the air conditioning and heating systems based on the location of a person within the building.

③ RMS (Remote Measurement Systems)

First introduced in conjunction with the levying of electric and city gas fees, RMS (Remote Measurement Systems) is another field that makes use of sensor networks. It is now mainly utilized as a home network service. In this regard, various additional services that make use of the remote measurement system's sensor network have been developed.

④ Remote medical treatment

In the city of the future, people will be able to receive medical services without having to actually visit a medical institution. This will be made possible through the use of both wired and wireless networks, as well as image transmission and virtual reality technology. It is expected that this remote medical treatment system will lead to the establishment of a medical network that effectively links homes, medical clinics, and pharmacists.

⑤ GIS (Geographic Information Systems)

The actualization of a u-environment requires the analysis of a structure's spatial information and the subsequent inclusion of such information in a database. GIS (Geographic Information Systems) have been used in conjunction with the management of cities' main facilities, for crime prevention purposes, and safety management. There has been a full-scale move towards combining GIS and GPS information as the basic infrastructure used to establish the ubiquitous environment. The domestic GIS industry, which was for long focused on establishing two-dimensional DB, has now, in accordance with recent technological trends, moved towards the formation of three-dimensional DB. A new trend in which such systems are becoming advanced enough to contain ubiquitous information has also emerged.

⑥ ITS (Intelligent Transportation Systems)

ITS (Intelligent Transportation Systems) are transportation information systems that revolve around the installation of cameras and TICS (Traffic Information Collection

System) capable of capturing the traffic situation in real-time along the main roads of a city. The collected traffic information is processed in an urban transportation center which then transmits it to individual homes, vehicle drivers, and road information signs. ITS systems are also used to control the changing of traffic lights based on the traffic flow, and to establish cities' overall transportation policies.

⑦ Telematics

The traffic information collected at the urban transportation center via ITS can be promptly transmitted to a driver's vehicle terminal so that he can make informed choices about driving routes. The vehicle terminal can also serve as a multimedia office or entertainment environment.

⑧ Environment and Disaster Management System

Sensor and wired-wireless integrated network systems enable communities to receive information related to disasters such as floods and fires, as well as information related to air and water pollution, in a real-time manner, and to establish proper responses. Residents can receive vital information, such as damage assessments and evacuation information, through local portals and broadcasting services.

⑨ USN (Ubiquitous Sensor Networks)

USN (Ubiquitous Sensor Networks) is based on the concept of interlocking, managing, and controlling information related to the existence and location of an object in a real-time manner. This is achieved by incorporating the concepts of networking and real-time processing into sensor devices. USN can also be used in conjunction with other systems. Some examples include systems used to monitor natural disasters, survey enemy movements in times of war when access is difficult, and assess geological features; intelligent transportation control systems; and the ecological systems used to examine the ecosystem based on long-term environmental observations.

⑩ IPv6

IPv6 is a next generation internet address system in which the length of IP addresses is extended from 32 bits to 128 bits. This will provide unlimited IP addresses despite of the increase objects with such IP addresses. The introduction of IPv6 is required in order to actualize intelligent home appliances, home networks, and ubiquitous systems.

⑪ BcN

BcN, the next generation integrated service networks in which wired-wireless communications and broadcasting are conbined, creates an environment in which it is possible to access multimedia services anywhere and at anytime. Once the government's plan to establish a 50-100 Mps level BcN system capable of accommodating 20 million wired and wireless users by 2010 becomes actualized, it is expected that Korea can move beyond the current ubiquitous city level and establish a new dimension in creating a future city.

⑫ WiBro

By simply installing WiBro terminals providing wireless portable internet services that make possible the use of high-speed internet any time and anywhere in PC notebook computers, PDAs, and vehicle receivers, individuals can use the internet just like they would a mobile phone in moving vehicles or the subway.

⑬ HSDPA (High-Speed Downlink Packet Access)

HSDPA (High-Speed Downlink Packet Access) is a 3.5 generation mobile communication method which makes it possible to exchange data at a much faster speed than is the case with 3rd generation mobile communication technologies such as W-CDMA or CDMA.

Advanced stage of construction-IT convergence

<Green construction technology>

①Safe green construction technology

Such technology is designed to minimize safety failures and to create a green construction

environment through environmental management measures such as the promotion of safety, prevention of disasters, detection of hazardous materials, and the supervision of noise/pollution, sediment emissions, as well as hazardous substances at construction sites. Safe and pleasant construction services can be assured through such means as a real-time location awareness of on-site workers, real-time management of areas and facilities where a high risk of fall or collapse exists, and the management of environmental factors/substances such as dust, noise and land settlements.

The technologies for safe green construction include RFID/USN based real-time location awareness technology, hazardous materials/surrounding environment sensing technology, real-time site prediction/management technology for situational awareness, con-site space/mapping technology, and life-cycle management technology for construction materials.

② Life-cycle management technology for construction materials

This technology is used to improve productivity and to reduce logistics costs by enhancing the effectiveness of the management of the supply-demand, inventory, and recycling of construction materials. Life-cycle management technology can be used to provide various services. These include construction materials/logistics management services, construction material recycling services, construction materials/logistics location awareness services, and automated materials/construction supervision services. The technologies employed include RFID/USN based materials/logistics management technology, architectural RFID tag/sensor node technology, construction-site location awareness technology, and real-time architectural materials location management technology.

③ Energy reduction/ environment-friendly construction new materials technology

This technology is used to actualize high value-added in terms of construction technology by facilitating the convergence of new materials and device technologies with other high-tech technologies such as IT, BT, NT and ET as part of efforts to bring about energy

reduction and green construction. The introduction of a flexible emotional environment, disaster prevention sensors, and solar energy sources makes possible the provision of self-sufficient intelligent construction services. In this regard, related technologies include human-oriented information walls, emotional lighting, color-regulating solar cells, noise and EMI shielding technology.

<u-Construction technology>

① Automation of construction projects and robotic technology

This robot-based space management technology is used to automate the robot-based construction process and ensure the safety and maintenance of buildings and facilities. Such technology is employed in order to both ensure safety at construction sites, and improve productivity. This technology can also be used to provide other services at the construction stage such as vehicle engineering services featuring a convergence of IT-robotics, services related to the management of buildings based on the use of robots, facility management services, the establishment of a robot management system, and additional facility management services. The technologies employed include those related to construction automation design, u-robot based intelligent space management, three-dimensional environment awareness and robot position control, and u-robot management SW platforms.

② 4D GIS based environment-friendly virtual construction technology

This virtual construction technology introduces 4D CAD/BIM/GIS and VR technology as a means to bring innovation to construction processes such as 3D design and the management of the construction process. Moreover, overall construction efficiency can be heightened by simulating, analyzing, and predicting the relationship between buildings and the related environment with this technology.

This technology can also be used to integrate the management of the information and

processes needed during each stage of the life-cycle (design, construction, maintenance, and disposal), to minimize energy consumption, to preserve buildings based on the use of environment-friendly services, and to facilitate the provision of other services such as construction site assistance, in-door augmented reality, urban planning, and fire prevention services. The technologies employed include design automation technology that makes use of virtual construction programs such as 4-D CAD/BIM/GIS, and real-time decision making technology which makes possible the establishment of urban environment simulations.

③ Intelligent u-onstruction wireless network technology

This intelligent u-construction infrastructure technology based on error-free seamless wireless communications and sensor networking is in keeping with the new land mark-type building environment linked to u-Cities. This technology supports the introduction of integrated u-building management services based on wired, wireless networking systems, such as embedded sensor monitoring of the interior and exterior of buildings, energy-aware building management, location-based hazardous material detection, and building materials management. The technologies employed include embedded intelligent building sensor networks, barrier-free building interior and exterior wireless transfer protocols, and LBS technology based on an awareness of space within high-tech buildings.

<Smart construction technology>

① IT-converged home environment technology based on human-oriented emotions

This home environment technology is used to generate an interior space, including the lighting, walls, ceiling, and floors, which automatically adjusts to human emotions and the surrounding environment, and can also be employed to control the interior environment in a manner that reflects human’s natural behavior. It also supports the development of

intelligent building interior services that can be used to transform various environmental factors into a comprehensive well-being active environment that is rooted in human emotions and natural behavior. The technologies employed include emotional modeling/awareness, emotion-optimized autonomous lighting, wall-paper expression, and natural behavior-based environment interface technology.

② Environment-friendly intelligent residence/ building services technology

Environment-friendly intelligent residence/building services technology provides a safe and comfortable work/residential environment, helps enhance security/crime prevention, promotes energy management, facilitates building diagnostics and predictions, and simplifies the management of the main facilities/assets within the building. It also aids the development of services such as environment-friendly intelligent building services, environment-friendly residential/ office environment services, real-time in-building asset management services, and building/residential environment crime prevention/fire prevention services. The technologies employed include those related to structural audits and predictions, intelligent work/home environment sensing and control, integrated management of intelligent building/office/home, intrusion detection/moving path prediction, and in-building location awareness.

③ Environment-friendly cities and integrated u-construction infrastructure management technology

This technology helps to maximize the value-added of building and city services by integrating the management of cities and buildings in an environment-friendly manner, and providing various intelligent construction services. This in turn makes possible the provision of services such as the u-surveillance services used to develop awareness of the status of environment-friendly cities/construction, u-building and cooperative u-business infrastructure, GeoWeb based user participation type u-space information services, intelligent u-city and u-building management services, and convergence space services.

The technologies employed include those related to future situation prediction-based intelligent u-surveillance, GeoWeb based u-space information packaging and mash up, actual life/world/real-time modeling and visualization technology, and multiple use cooperative u-Business infrastructure technology.

C. Linkage with IT policy

The domestic construction-IT convergence market was created as a result of the combination of the calls for the construction industry to be transformed into a high value-added sector and the IT industry's desire to enter new markets.

While the construction industry sought to use IT as a means to improve productivity, bring about environment-friendly construction, and become a high value-added industry, the IT industry identified the development of new markets based on convergence with other industries as an important issue. It can thus be said that Korea's construction-IT convergence industry was born at the point of contact where the interests of both industries intersected.

The emergence of the Korean construction-IT convergence industry as a new growth engine for the national economy can be explained in large part by the fact that this new industry benefited greatly from Korea's world-class IT and infrastructure technology. More to the point, the majority of the IT technologies used by the construction industry have been developed as part of the government-led strategy to create such IT and infrastructure technology.

Although the IT industry developed under the leadership of the government, which regarded it as one of its strategic national projects, the New IT Strategy has seen private sector-centered development be promoted. It is believed that this new trend in terms of IT policy will have a direct and indirect influence on the construction industry's own use of IT technology. In other words, the high degree of connectivity

that exists with IT policy has meant that the construction industry has in effect developed alongside the IT industry.

Based on an examination of the informatization of construction industry related technology, home and building automation related technology, and construction-IT convergence related technology, this study delves into the influence which IT policy has on the construction industry and the connectivity that exists between the two.

1) Analysis of connectivity with IT policy

Informatization-related technology

The private sector became the main actors in introducing informatization-related technology into the construction industry in 1995. This dénouement was made possible by the establishment of the social basis for informatization, and the formation amongst private enterprises of a consensus on the need to pursue informatization, both of which were in turn facilitated by relevant IT policies.

Examples of IT industry-related policies which had a great influence on the advent of informatization within the construction industry include the Establishment of a National Basic Information System (1987), Measures to Develop the Electronics Industry (1989), Basic Plan for the Promotion of Informatization, and Cyber Korea 21.

The full-scale onset of the global competition to establish an information society in the 1980s and the convergence at the industrial and technological levels of computers and communications had the effect of greatly increasing the demand for informatization and efficiency within society. The Korean government responded to these demands by implementing in 1987 the so-called Establishment of a National Basic Information System project designed to promote the informatization of the government and of quasi-governmental organizations. To this end, the Act on the Expansion and Promotion of the Use of Information and Communications Networks was adopted in May 1986 as

part of efforts to prepare the legal basis and implementation structure for this project.

The Measures to Develop the Electronics Industry implemented in the late 1980s are also significant in that they paved the way for the reorganization of what had heretofore been a home appliances-centered electronics industry. Thereafter, the industrial focus was placed on three strategic items (semiconductors, computers, and TDX), and measures were taken to develop the industry in conjunction with the parts industry. These developmental measures in turne not only enabled the way for the strategic development of computers, D RAM, and TDX, but also constituted the basic step which subsequently made it possible for Korea to implement national the informatization.

From 1995 onwards, CDMA (Code Division Multiple Access) and ADSL (Asymmetric Digital Subscriber Lines) began to evolve and spread as part of the Basic Plan for the Promotion of Informatization. This in turn led to the spread of informatization beyond the government and quasi-governmental organization level to society in general, and to the further advancement of existing informatization projects. Meanwhile, Cyber Korea 21, which further expanded upon the Basic Plan for the Promotion of Informatization, was designed to enhance ADSL, actualize an e-government system, activate e-commerce, and establish the integrated network system linking together small and large-sized enterprises known as CALS (Computer-Aided Logistics Support).

Simply put, while the Establishment of a National Basic Information System (1987) project and Measures to Develop the Electronics Industry (1989) laid the foundation for Korea's informatization of society as a whole, the Basic Plan for the Promotion of Informatization and Cyber Korea 21 cleared a path for the establishment of the basis for network systems.

Rather than having directly influenced the introduction and development of informatization within the construction industry, the above-mentioned IT policies and measures' main contribution lies in the fact that they provided the cornerstone for the

actualization of informatization technologies.

The introduction of Cyber Korea 21 paved the way for the private sector-led development of PMIS and PLM within the construction industry. It was also during this time that CALS was introduced in the construction industry.

Home and building automation related technology

The construction industry's home and building automation related technology developed in close proximity with national IT policies. The IT policies which had a great influence in this regard include Cyber Korea 21, e-Korea Vision, Broadband IT Korea, and u-Korea. These IT policies allowed Korea to develop the world's best information and communications infrastructure, and facilitated the activation of IT use.

The enhancement of ADSL that resulted from the implementation of Cyber Korea 21 in 1999 led to the creation of networks between household appliances and office equipment. This in turn provided the basis for the full-scale actualization of home networks and building automation.

The e-Korea Vision strategy implemented in 2002 was designed to establish the world's best next generation information and communications infrastructure through such means as the development of next generation internet-based technologies (IPv6 and WAN), the facilitation of home networking and wired/wireless integration, and the advent of an on site-centered mobile e-government. This policy made possible the development and introduction of home networks and building automation related technologies.

The Broadband IT Korea strategy introduced in 2003 was designed to facilitate the establishment of Broadband convergence Networks (BcN) and U-sensor networks (USN) based on RFID, develop the way for the development of the next generation internet protocol known as Internet Protocol Version 6 (IPv6), and foster the strategic

development of the new IT growth engines contained in the IT 839 strategy. The IT 839 strategy is an IT industrial development plan which organically connects together eight services, three infrastructures, and nine new growth engines. By providing Korea with an opportunity to become a leader in the global IT market, this strategy replaced the development model that had been in place up until that point.

Finally, the Broadband IT Korea was implemented as part of efforts to develop various advanced IT technologies which made possible the advancement of home networks and building automation. To this end, this policy provided the technological and infrastructure-related foundation needed to actualize u-cities in the future.

〈Table 7－14〉 IT 839 Strategy

Strategy	Detailed technologies
Eight new services	- WiBro service - DMB service - Home network service - RFID service - W-CDMA service - Terrestrial DTV service - Internet phone (VoIP)
Three highly advanced infrastructures	- BcN (Broadband Convergence Networks) - USN (u-sensor networks) - IPv6 (Internet Protocol Version 6)
Nine new growth engines	- Next generation mobile communications devices - Digital TV·broadcasting devices - Home network devices - IT SoC - Next generation PCs - Embedded SW - DC (digital contents) & SW solutions - Telematic devices - Intelligent service robots

Source: Ministry of Knowledge Economy (Formerly Ministry of Information and Communication), 2005

Construction-IT convergence related technology

The U-Korea Master Plan and the New IT Strategy can be identified as the IT policies that have had a direct impact on construction-IT convergence related technology. In this regard, the New IT Strategy, which was implemented based on the pursuit of IT convergence with all industries, has had the greatest influence on construction-IT convergence related technology. The marked influence of this particular policy has stemmed from the fact that it revolved around the private sector rather than the government.

The advent of digital convergence in the mid 2000s had the effect of propelling the issue of creating a ubiquitous environment to the forefront of the tasks associated with the IT industry. In keeping with this denouement, the development of policies that could help to bring about such a ubiquitous environment also became the main focus of IT policy.

The U-Korea Master Plan was designed in accordance with the vision of establishing the world's best u-infrastructure, actualizing the first u-society in the world, and contributing to the construction of an advanced, next-generation Korea. In conjunction with this vision, the government identified tasks which could lead to the advancement of the five areas labeled as being essential to the advent of a ubiquitous society. Thereafter, it selected and implemented four growth engine optimization tasks that became the basis for the actualization of advancement in the above-mentioned five areas.

The U-Korea Master Plan not only provided the basic foundation for the establishment of u-Cities, but also the strategic basis for the implementation of new IT policies in the future.

〈Table 7－15〉 The Advancement of Five Areas and Optimization of Four Engines in the u-Korea Master Plan

	Detailed tasks
Tasks for the advancement of five fields	- Establishment of ubiquitous multifunctional administrative cities - Establishment of u-City management centers - Activation of u-Payment - Establishment of intelligent emergency communications networks for environmental disasters - Distribution of u-ID cards
Optimization of four growth engines	- Creation of international organization which can spearhead the implementation of u-IT - Development of u-core strategic industries (convergence terminal, bio, nano, REID, SW) - Enactment of laws facilitating the implementation of u-KOREA - BcN, USN

Source: Ministry of Knowledge Economy, 2006

For its part, the New IT Strategy had as its main objectives the facilitation of the move from the quantitative increase of the IT industry to the qualitative advancement thereof, the expansion of the scope of such policies from the IT industry to all industries, and the supplantation of the existing imitation strategy by one focused on becoming a new market leader. In addition, it also sought to change the composition of the main actors, which had heretofore been the government and large enterprises, so that while the private sector played a leading role, the government focused on providing support.

The New IT Strategy called for the strategic development of various IT technologies. These included many construction-IT convergence related technologies, such as industrial technology convergence, IT use in other countries, SW and computing, green IT, u-life, IT parts, and networks.

〈Table 7－16〉 Three Strategic Areas Covered by the New IT Strategy

Strategic fields	
Convergence IT	Industrial technology convergence*
	IT use (including non-R&D)
	SW · computing*
Problem Solver IT	LED (including non-R&D)
	Medical equipment (including non-R&D)
	Green IT (including non-R&D)
	u-Life
Advanced IT	Semiconductors
	Display
	Mobile communications
	Networks (BcN etc)
	IT parts (sensors, converged parts etc)

Source: Ministry of Knowledge Economy, 2008

2) Impact of IT policy

IT technology has traditionally been used in the construction industry as a tool with which to raise the efficiency of various work processes. However, recent efforts have been focused on the advent of a high value-added IT convergence industry with higher productivity and profitability within a construction industry that has traditionally been a labor intensive industry.

The transformation of the construction industry into a high value-added IT convergence industry has been made possible by the supporting role played by the IT technology and infrastructure developed under the auspices of national IT policies. In other words, whenever an advanced IT technology is selected and developed in a strategic manner as part of national IT policies, the construction industry can then redevelop and use the IT technology in question in a manner that brings about high value-added to the industry.

The informatization of the construction industry was made possible by the previous establishment of the social basis needed to introduce informatization systems. This social basis, which was brought about as a result of the implementation of policies such as the Establishment of a National Basic Information System and Measures for the Development of the Electronics Industry, included such elements as the distribution of computers, development of semiconductors, and the establishment of communications infrastructure and ADSL.

The subsequent advent of IT policies such as the Basic Plan for the Promotion of Informatization and Cyber Korea 21, as well as the further development of communications networks, had the effect of expanding informatization from the enterprise to the industrial and industrial management levels.

National IT policies also had a tremendous influence in terms of bringing home and building automation to the construction industry. The advancement of ADSL called for in the Cyber Korea 21 policy paved the way for the establishment of network connections between home appliances as well as office equipment. It also provided the basis for the full-scale actualization of home networks and building automation. For its part, the e-Korea Vision strategy supported the widespread development of home and building automation related technologies such as IPv6, WLAN, home networks, and integrated wired/wireless technology.

As for the Broadband IT Korea policy, its objective was to bring about the development of next generation IT technologies that could facilitate the advancement of home and building automation, such as next generation PCs, digital TV/broadcasting RFID/USN, and telematics. This policy generated technologies needed to actualize the u-Cities of the future and the basic infrastructure.

Construction-IT convergence related technology has also developed in a manner that has reflected the direction taken in terms of national IT policies. For example, the

development of IT technologies linked to the trend towards intelligence and environment-friendliness contained in the New IT Strategy, as well as the growing convergence between IT technology and all industries, has been replicated in the construction-IT convergence industry.

The New IT Strategy implemented from 2008 onwards has revolved around the implementation of IT convergence in conjunction with five major industrial fields, including construction, automobiles, and shipbuilding, with the end goal being the creation of five new converged industries by 2012. In keeping with this objective, the construction industry has selected green construction technology, u-construction technology, and smart construction technology as promising construction-IT related technologies.

As such, there has been a close relationship between IT use and the convergence technology developed for the Korean construction industry and national IT policies. However, as far as informatization and home and building automation are concerned, the relationship between IT policy and the construction industry was one of supply (IT policy) and demand (construction industry). In other words, rather than a joint partnership, what developed was a situation in which while IT policy assumed a leadership role in terms of the development of technologies, the construction industry limited itself to selectively adopting IT technologies in accordance with its needs.

As a result, IT use in the construction industry became little more than a tool used by constructors with a limited understanding of IT technology to usher in a spike in the price of buildings. In other words, IT technology failed to be positively introduced at the enterprise and industrial levels.

That said, in a clear departure from the past, a joint partnership has now been established between IT policy and the construction industry where construction-IT convergence is concerned. This increased collaboration between the IT and construction industries was

made possible by the formation of the perception within the IT industry of the need to create new markets through convergence with other industries, and within the construction industry of the need to transform into a high value added industry through convergence with the IT industry.

In this regard, the growing construction-IT convergence has paved the way for the emergence of a trend towards a joint partnership between IT policy and the construction industry. It has also established the framework for the eradication of the previous supply-demand based relationship in which while IT policy assumed a leadership role in terms of the development of technologies, the construction industry limited itself to selectively adopting IT technologies in accordance with its needs.

〈Table 7－17〉 Connectivity between Construction-IT Convergence Technology and IT Policy, and the Use of IT Technology

	1980~1994	1995~2004			2004~2007		After 2008
Stage	Establishment of information communications industry and the basis thereof	Development of information and communications industry and advancement of communication networks			Advancement of information and communications industry		Search for New IT through convergence
Plan	Measures to Develop of the Electronics Industry	Basic Plan for the Promotion of Informatization	Cyber Korea 21	e-Korea Vision 2006	Broadband IT Korea 2007	u-Korea	New IT Strategy
Period	1987~1996	1996~2000	1999~2002	2002~2006	2003~2007	2006~2007	2008~
IT Technology	Establishment of administrative information networks, semiconductors, PC, and TDX	Establishment of information and communications infrastructure (CDMA , ADSL, and ISDN)	Advancement of ADSL, e-government, and e-commerce, Establishment of integrated networks between small and large enterprises (CALS)	Establishment of next generation internet base (IPv6, WLAN), home networking, wired/wireless integration, and mobile e-government	BcN, IT Soc (next generation semiconductors), mobile communications, embedded SW, digital contents, intelligent robots, next generation PC, digital TV/broadcasting,	RFID/USN,BT+ NT, Embedded SW, wireless internet (WiFi), WiBro, HSDPA, digital TV/ broadcasting, home networks, telematics, Intelligent robots, u-computing,	Industrial technology convergence, SW·computing, electronic information devices, Information and communication media, next generation

<table>
<tr><td></td><td>1980~1994</td><td colspan="3">1995~2004</td><td colspan="2">2004~2007</td><td>After 2008</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>RFID/USN, telematics, wired/wireless home network</td><td>digital contents, IT convergence</td><td>networks, robots, knowledge services USN, bio medical equipment</td></tr>
<tr><td rowspan="3">Construction -IT convergence technology</td><td>Informatization</td><td colspan="2">Informatization at the enterprise level (ERP)</td><td colspan="3">Informatization at the industrial level (PIMS,CALS) Informatization at the industrial management level (PLM, BIM), Materials/logistics management and efficiency through linkages with RFID,USN, and ERP</td></tr>
<tr><td>Home and building automation stage</td><td colspan="2"></td><td>Home networks, remote measurement, remote medical treatment, remote education, IPv6</td><td>IBS,GIS,ITS, telematics, USN, BcN</td><td>WiBro, HSDPA</td><td></td></tr>
<tr><td>IT convergence advancement stage</td><td colspan="3"></td><td>Embedded SW, u-sensor, intelligent robot, LBS</td><td colspan="2">RFID/USN based location awareness technology, energy reduction/ environment-friendly construction, new materials technology, 4D CAD/BIM/GIS technology, Barrier-free building interior and exterior, wireless transmission protocol, BEMS, etc</td></tr>
</table>

D. Policy implications

The potential for construction-IT convergence to become one of the basic next generation industries has been recognized. This growing awareness has come about as a result of the overlap between the IT industry's desire to create new markets through convergence with other industries, and the construction industry's goal of transforming itself into a high value-added industry.

The use of IT by the construction industry has traditionally been closely related to national IT policies. The majority of the IT technologies applied within the construction industry were based on the IT and infrastructure technologies strategically developed under government leadership. In other words, the relationship between the IT and construction industries was one of supply (IT policy)-demand (construction industry) in which while IT policy assumed a leadership role in terms of the development of

technologies, the construction industry limited itself to selectively adopting IT technologies in accordance with its needs.

However, the New IT Strategy's promotion of the private sector-centered development of IT technology at the expense of government-led IT development had the effect of ushering in a gradual change in the relationship between IT policy and the construction industry, with the main focus being on collaboration between the IT and construction industries.

Although a positive joint partnership between the IT and construction industries has now been established, and the construction industry has increasingly begun to make active use of, and converge with IT, there remain some problems which must be resolved before concrete construction-IT convergence can be achieved.

These problems include: the failure to apply IT technology at the appropriate time occasioned by the technological development gap that exists between the IT and construction industries; the lack of support measures designed to facilitate the application of IT technology; and the low percentage of constructors willing to introduce IT convergence. Furthermore, constructors' hesitance to invest in IT convergence, whose profitability decreased in the aftermath of the financial crisis of 1998, has also served as an obstacle to the realization of construction-IT convergence.

Therefore, the ability of construction-IT convergence to function as one of the next generation growth engines is predicated on the resolution of these problems, as well as the implementation of policy measures that can help to activate construction-IT convergence.

It is essential that selection and concentration be brought about where construction IT convergence is concerned. To this end, it becomes necessary to select areas of focus which can be implemented within the construction industry life cycle, develop detailed areas of cooperation, and bring about a profitable convergence service model.

As the spread of some convergence technology has the potential to effectively reduce management costs, priority should be given to the derivation of technological fields which can in fact contribute to decreasing expenditures at the enterprise level.

It is necessary to gradually reduce the time lag between the development of new IT technology and its actual use in the construction industry. The gap in technological development between the IT and construction industries makes it necessary to strengthen links between IT technological development and the construction industry.

It is essential that construction-IT convergence related laws and institutions be improved. There is an urgent need to offer incentives to constructors who introduce IT technology, and also to establish provisions that make the introduction of IT technology obligatory.

There have been, up until this point, a lack of areas in which the construction and IT industries can achieve a win-win situation. To this end, it has become necessary for the government to establish a policy which can facilitate the active introduction of IT in a construction industry that continues to have a weak understanding of IT. There is also a need to bring about the creation of new markets and commercialization through the establishment of a construction-IT convergence R&D plan. In addition, it is essential that a structure be put in place so that the overall plan for the development of construction-IT convergence technology effectively involves not only the development but also the application of such technologies. Such a denouement can be achieved by alighing this plan with the government-led u-City pilot project.

It is also necessary to facilitate the establishment and participation of an international standardization organization related to construction-IT convergence technology. Finally, there is a need to introduce market-oriented (De facto) and technology-led standards (De jure) that could not only hasten the initiation of related technologies, but also the preemptive capturing of markets.

3. Policy Measures Related to IT Use as a Means to Advance the Manufacturing Industry

3.1. Analysis of the conditions surrounding the heightening of the degree of IT use

Recently, the IT industry has been focused on developing customer-oriented technologies. While the competition within the IT industry in the past was concentrated on assuring platform technology, the current competition is focused on improving market competitiveness by providing various kinds of additional functions. The increase in customer demands for sensible items has had the effect of making the provision of individualized contents related to sensibility a key to success in the market.

The onset of the network convergence era has heightened the quest for total solutions combining contents and digital devices. Under such circumstances, the provision of individualized contents in set products has been identified as the main factor behind the success of the set industry. It becomes necessary to develop smart set products and to embed network systems in set products. There is also an urgent need to improve the regulation system and to establish the open technology development system needed to support such products.

In addition, the emphasizing of the importance of additional functions in the competition for platform technology within the overall IT industry is expected to increase the importance of such additional functions also being enhanced in terms of the competition for the production of electronic goods. The growing social concerns about high oil prices, as well as environmental and safety issues, has raised the need for functional supplemental policies capable of actively responding to these social concerns. As such, the current situation is one in which securing the stability of materials, energy reduction, biometrics, security, and materials technology have become the key issues.

3.2. Establishment of an IT technology development strategy specifically optimized for the innovation of the manufacturing industry

A. IT-based core technology development strategy

As can be seen in the following table, the areas of IT technology regarded as being essential to the facilitation of manufacturing-IT convergence include networks, communication, interface, SoC, environment-friendly, and sensors. In this regard, it is necessary to establish an IT technology development strategy that is specifically optimized for the manufacturing industry.

〈Table 7－18〉 IT Technological Areas Needed to Facilitate Manufacturing-IT Convergence

Technological area	Industry	Required IT technologies	Technology development strategy
Networking	Automobile	o Infra-link control technology	
	Construction	o Intelligent u-construction wireless network technology	
	Textiles	o WBAN (Wireless Body Area Network) technology	
Platform	Automobile	o Standard platform technology	
	Textiles	o Intelligent/Autonomous daily product platform technology	
	Home appliances	o human body-oriented platform development and commercialization technology	
Communication	Automobile	o Vehicle communication technology o HF/HMI technology (vehicle)	
	Shipbuilding	o Maritime mobile/satellite communication technology	
	Textiles	o Wearable, battery technology	
Interface	Textiles	o Human body communication protocol and harmless-to-body interface technology o Eyeglass display and wireless interface technology o SoT based area display technology	

Technological area	Industry	Required IT technologies	Technology development strategy
		o Texture and Kinesthetic sense based haptic (tactile) interface technology o Accessory-type computers (watches, wallets, and belts etc) o Wearable computers, bio shirts o large area conductive fiber production and electronic interface technology	
Systems	Automobile	o Convenience systems o Auto parking systems o Autonomous driving systems	
	Shipbuilding	o Remote maintenance/management systems o ship equipment electronic SW	
	Construction	o Construction materials lifecycle management technology	
Automation	Construction	o Construction automation and robotization technology	
SoC	Automobile	o Vehicle SoC technology	
	Textiles	o SoT (System on Textile) computers o SoT technology (thin layer fiber packaging technology and optical fiber technology/ conductive fiber weaving technology)	
Intelligence	Shipbuilding	o Intelligent navigation systems	
	Construction	o IT-converged human-oriented sensibility home environment technology	
	Textiles	o Intelligent agent middleware technology	
	Home appliances	o Sensibility home appliance original technology and commercialization technology	
Environment -friendly	Automobile	o Environment-friendly systems	
	Construction	o Safe Green construction technology o Energy reduction/ environment-friendly construction new materials technology o Environment-friendly intelligent home/ building service technology o Environment-friendly city and u-construction infra integrated management technology o Energy recognition based building energy management technology o 4D GIS based environment-friendly virtual construction technology	
	Home appliances	o Well-being convergence home appliance original technology	

Technological area	Industry	Required IT technologies	Technology development strategy
Sensors	Automobile	o High precision sensor and converged sensor technology	
	Shipbuilding	o Maritime high-tech network sensor	
	Textiles	o Textile based wearable multifunctional sensor technology	
	Home appliances	o Real-sense augmented reality technology o Real-sense device technology o Real-sense home appliance service and commercialization technology	

First, to activate the manufacturing-based SoC industry, it is important to move away from an assembly type that is based on simple modulation, and produce goods which reflect the industrial characteristics required by demanders. As such, there is a need to first analyze the attributes of the products which can be employed within the industry, and then analyze the contents to be developed within the SoC industry and the industrial demand. In addition, it is essential to pursue reverse engineering-based production which can be used to satisfy potential demand and to develop SoC in a manner that reflects the overall design of the development process. In short, once the use that is to be made of SoC and the marketability of the production method have been ascertained, it becomes necessary to establish cooperative measures with companies manufacturing finished products and to establish a production system.

The effective application of wireless networking in the manufacturing industry requires the development of RFID/ USN core technology. To this end, it is necessary to strengthen R&D in the three major related fields, namely next generation RFID, USN factor technology, and convergence technology, and to facilitate the development of technologies which can mitigate on-site difficulties through such means as the improvement of the recognition rate within each application service sector as well as the

introduction and distribution of the developed technologies through the development of commercialization technology.

The main technological areas that need to be developed include special commodity specific tag technology, interference avoidance and cancellation technology, and high speed tag attachment technology. In addition, the transformation of RFID/USN into a leading demand sector will require that the social efficiency and transparency of items such as government commodities (procurement and defense), logistics infrastructure (ports and logistics hub), distribution (liquor, jewellery and beef), and finished products logistics (pharmaceuticals and clothing) be improved, and that the creation of industrial demand be promoted at the initial stage. To this end, it is essential that corporate competitiveness be strengthened by developing RFID-based parts logistics and incorporating them into large and small & medium-sized enterprises, and that a new work efficiency model be established.

The importance of next generation semiconductors within the manufacturing industry cannot be overstated. The development of next generation semiconductor technology should be divided into three areas: first, the next generation integrated memory for industrial convergence; second, the system semiconductors which can create large-scale markets; and third, industrial convergence promoting system semiconductors. The government's plans to develop next generation semiconductor technology includes the goal of raising the technological levels of these three areas vis-à-vis that of the advanced countries from 70% in 2008 to 90% by 2013.

The development of next generation display industrialization technology, which is regarded as a key interface area in the manufacturing industry, rests on the ability to ensure the industrial competitiveness of next generation displays such as OLED and flexible displays, as well as the strengthening of the competitiveness of downstream industries. It is particularly important that large area OLED core technology, processing/materials

& elements oriented flexible/ transparent display technology, and IPR be secured. The government plans to support participation in overseas exhibitions by establishing a display industry support center. Current plans are to implement the commercialization of five flexible display products in 2013.

Lastly, the strengthening of the competitiveness of the semiconductor and display industries is heavily dependent on the localization of the production equipment used in these fields through technological development. To achieve this objective, high value-added equipment should be localized through the development of commercialization technology for semiconductor and display equipment; moreover, the commercialization technology needed to promote new processing equipment that can be used in conjunction with next generation semiconductor elements and future displays must be established. The effective implementation of such a strategy requires that industrial competitiveness be strengthened by improving the system integration capability through the enforcement of organic cooperation between equipment and parts companies.

B. Technological innovation strategy in the manufacturing sector

The successful advent of a new paradigm based on the simultaneous development of products and services requires that the innovation of the manufacturing industry be implemented alongside the development of key factor technology. To this end, there is a need to, prior to the actual development of key factor and platform technologies, forge a successful business model which can be harmonized with the new industrial paradigm, and establish a technological development roadmap.

The achievement of effective technological development based on a technological development roadmap requires that a strong focus be placed on the selection and concentration strategy. To this end, it is necessary to derive key technological areas which can lead to the overall development of the industry within each sector. However, there

is a certain time lag between the production of new IT technology and its actual use in traditional manufacturing sectors.

It is therefore necessary to facilitate convergence between the IT and manufacturing industry sectors through a gradual approach based on a keen consideration of such time lags in terms of the industrial application of IT technology. The most important point here becomes that of ensuring the provision of information related to IT technology so as to enable enterprises in the traditional manufacturing industries to use the results of technological development during the IT technological development and commercialization process, and to bring about the establishment of policy measures designed to establish a sphere of exchange meant to facilitate the use of IT-related human resources. There is also a need to establish an IT convergence system that encompasses every process from technological development to commercialization by being connected not only at the IT convergence R&D planning stage but also, from the standpoint of new market creation and commercialization, to government-led pilot commercialization projects.

The advent of effective technological development based on a technological development roadmap depends on the establishment of a resources distribution plan under a clear selection and concentration strategy. Hererd, it is essential that the government and private sector both play an active role. For example, in cases where concerns exist about the heavy burden of R&D costs and technological barriers put in place by advanced countries, it becomes more effective, in terms of heightening the concentration of investment, to establish a long-term based technological development strategy that involves government leadership.

In addition, the effective implementation of a technological development strategy within the manufacturing sector must involve a joint prosperity strategy that is rooted in the establishment of a cooperative system and the division of roles amongst the main actors. When it comes to technological development and commercialization, it is necessary to establish a cooperative relationship between manufacturing enterprises and universities/research

institutes.

It is also essential that a strategic cooperative system capable of producing synergistic effects through the organic mutual connections be established. To attain this, it is important to establish a clear division of labor structure that is based on an industry-academy R&D cooperation system. In other words, while manufacturing enterprises take on planing the specifications of required products and services and the related commercialization technology, universities and research institutes provide platform and key factor technology such as H/W, S/W, and systems. Industrial sectors can contribute to the advancement of the industrial structure by cutting costs and enhancing productivity through the smooth operation of a cooperative system that includes joint research and technological collaboration with intermediate materials and parts suppliers.

3.3. Facilitation of green manufacturing based on IT use

To promote green manufacturing based on IT use, it is necessary to first facilitate the development of a green IDC model and bring about new commercialization. More specifically, there is a need to establish a green IDC model capable of minimizing electricity consumption and losses, both of which have increased as a result of the rapid spike in the distribution of information, and to introduce a new business model and complete commercialization for export purposes. The development and standardization of a green IDC model that can help to enhance IDC battery systems, integrate IT system resources, develop highly efficient servers and storage, and improve efficiency based on the use of cloud computing technology, must be brought about. It is also critical that a testing facility be established in order to remodel the existing IDC into a power reduction-type center, and that environment-friendly and new & renewable IDC also be developed.

Second, it is necessary to establish a green IT technology test bed. More to the point,

there is a need to create a test bed for the development of a green technology-converged green home model that can be applied to such products as solar cells, battery systems, high efficiency home networks and home appliances. To this end, it is essential that an industry-government-academic sector council be established to promote the commercialization of developed technologies through such green IT test beds, the distribution of the IT technology-converged Green Home model and the commercialization of exports.

Third, there is a need to ensure the diffusion of industrial EMS (Energy Management System). To do this, it is necessary to implement EMS pilot projects in the electronics industry to establish a real-time energy and resources consumption monitoring system. In the case of the electronics industry, energy consumption has been concentrated in fields such as clean room (42%), air conditioning (24%) and purity.

Fourth, there is an urgent need to manage waste resources within industrial complexes based on the use of u-IT technology. In this regard, waste information should, using GPS and RFID technology, be shared between enterprises in a real-time manner, and support should be provided for the autonomous exchanging and recycling of byproducts. To accomplish this, it is critical that the information related to byproducts be shared, and that an autonomous exchange system based on a collaboration structure between the enterprises within an industrial complex be established (Presidential Committee on Green Growth, 2009).

3.4. Industrial development strategy for manufacturing-IT convergence

The industrial development strategy for manufacturing-IT convergence should be implemented in accordance with the following:

A. Support for the development and commercialization of business models

The promotion of manufacturing-IT convergence requires the urgent development of business models for IT-traditional industries convergence, the establishment of standard test bed platforms, and the implementation of business model pilot projects in conjunction with local governments. The first step in advancing the structure of traditional industries is to establish a successful business model.

In terms of selection and concentration in the manufacturing-IT convergence field, it becomes necessary to develop particular IT cooperation fields and profitable convergence service models. This can be achieved by selecting areas to focus on during specific stages of the product and service lifecycle. In addition, the ability to commercialize the business model is predicated on the implementation of pilot projects which are linked to existing industries' regional innovation resources.

The adoption of such an approach can help reduce the risks associated with commercialization as well as contribute to the smooth formation of new markets. It also necessary to prepare support measures such as the installation of exhibition halls for IT-converged products bolster marketing.

B. Development of enterprises specialized in IT convergence

It is essential to develop enterprises specializing in IT convergence which are capable of strategically responding to the international environment by, through IT based technological convergence with the existing manufacturing industry, producing new goods, preemptively occupying markets, and bringing about the improvement of productivity. To attain this, it is essential to derive business areas which can strategically respond to the international environment and to actively support them.

For example, in the case of the automobile-IT convergence industry, the government has implemented a strategy to support the development of enterprises producing

cutting-edge IT technology that can be applied to vehicles and the advancement of vehicle IT. The end goal of this project is to develop 60 enterprises specialized in vehicle IT technology in three years. It is also important to prepare a system designed to support existing small & medium-sized enterprises.

In order to support the introduction of complex technologies in small & medium-sized enterprises, the government should implement programs for dispatch of outstanding human resources from research institutes and the academic sector to the industrial sector. Support should also be provided for the establishment of online and offline networks to invigorate the exchange of technologies and resources between small & medium-sized enterprises.

C. Management of an industry-IT convergence forum and innovation center

An industry-IT convergence forum should be established in order to create a sphere of discussions between various industrial sectors, draw up cooperative tasks amongst the enterprises, and draft measures to improve legal institutions. In addition, the establishment of an innovation center can help the formation of test beds for the converged products produced by the participating enterprises, strengthen support measures such as those related to technological development and investment inducement, and confribute to the development of innovative small & medium enterprises related to industry-IT convergence.

D. Improvement of laws and institutions

The commercialization of IT convergence requires improvement of related laws and legal institutions. Such a step is needed to move beyond the limitations faced by the manufacturing industries. The emergence of new concepts of products and services renders it essential to introduce new regulations and to reorganize existing permission and licensing-related regulations.

In addition, the need to introduce advanced institutions in the areas of information security, safety, and the security of IT-convergence related industries makes it

incumbent that measures to streamline the legal system be put into place. Furthermore, the industrial classification of IT-converged products and services that will emerge amidst the new industrial environment renders it necessary to improve regulations such as those related to quality evaluation standards.

It is also vital that the commercialization and industrialization of IT convergence be facilitated through the establishment of measures to improve laws and legal institutions. For example, the improvement of institutions such as the mandatory attachment of RFID on containers in ports (internal regulations on the management of ports, Ministry of Land, Transport and Maritime Affairs) and the mandatory introduction of RFID in conjunction with the management of in excess of 10,000 government procurement items (Enforcement Regulations of the Commodity Management Act, Presidential Committee on Green Growth (2009)) can accelerate the commercialization of RFID. In the case of automobiles, the announcement of the Long-term Vehicle Fuel Efficiency Regulation Plan designed to improve current 'Average Fuel Economy Standards' and reduce vehicle fuel consumption and greenhouse gases provided a significant boost for the environment-friendly automobile industry.

It is necessary to improve the IT convergence-related legal system as it pertains to government support. IT convergence can be facilitated through the inclusion of incentives related to the introduction of IT technology and the insertion of clauses pertaining to the mandatory introduction of such IT technology. Furthermore, it is essential that support measures that can ease the spread of IT converged products during the early stages be prepared. What's more, the high distribution costs associated with IT converged products during such early stages heightens the importance of the provision at the government level of taxation, financial, and institutional incentive during the early stage of the industrialization process.

E. Standard development and international standardization

The promotion of IT convergence and strengthening of the competitiveness of IT convergence requires the provision of support for the development of strategic standards, and that efforts be made to bring about the international standardization needed to strengthen cooperation with international standardization organizations.

In this regard, there is an urgent need to establish a domestic standard system. Such a system would not only help to take the initiative in terms of international standards by supporting active participation in the international standardization process, but would also lower prime costs by increasing demand and enabling mass production. For example, in the case of the automobile industry, international standardization is required to secure the platform technology needed to develop new IT technology-based next generation automobiles.

As for the construction industry, there is a need to bring about the establishment and participation of an international standardization organization related to construction-IT convergence technology. It is also necessary to seize the initiative and preemptively occupy markets for the related technologies based on the introduction of market-oriented (De facto) standard and technology-led (De jure) standards.

F. Education of IT convergence human resources

It is necessary to activate human resources exchanges between traditional and IT industries by implementing an IT convergence workforce education program. In this regard, the education of human resources specialized in industrial convergence that will play a leading role in the creation of IT-converged new industries through the combination of IT and traditional manufacturing industries, is essential.

To attain this, it is necessary to establish an education system that is geared towards an enterprise demand-centered convergence technology workforce. It is also important to

designate IT-convergence research centers (ITRC) at universities that will be responsible for not only educating highly-skilled R&D manpower, but also for producing human resources specializing in IT platform technologies such as RFID/USN, next generation semiconductors, and next generation displays.

In order to ensure organic convergence between traditional and IT industries, there should be a clear mutual understanding between the two sectors. While the key to this endeavor ultimately lies in the production of convergence specialists, a more urgent task is that of establishing support policies designed to build human networks responsible for strengthening exchanges amongst specialists in the existing manufacturing and IT industries. This can help induce various forms of collaboration until the final stage of commercialization by fostering the sharing of development strategies as well as actual technological development throughout the entire value chain.

Chapter 8. Conclusion

Korea's IT industry started with the electronics industry of the 1960s. During that period, local manufacturers of electronics goods were small-sized, and simply assembled radios, vacuum tubes, and black-and-white television sets for domestic consumption, building a foundation for the later growth of the industry. During the 1970s, the electronics industry experienced the expansion of the market as the manufacturers started making color television sets, radio cassettes and electronic exchangers, which diversified the list of items produced and so accumulated the production capabilities. The progress that the electronics industry made during these two decades was largely attributed to the Korean government's active introduction of foreign investments and intensive research and development efforts, made through the newly established research institute, all of which were based on the government's strong export-oriented policy. Since the beginning of the 1980s, large-sized electronics companies began to actively engage in the industry. With these conglomerates' large-scale investments in technology, Korea's list of electronics products was greatly expanded even to semiconductor memory chip and VCR, and the export rapidly grew from $2 billion in 1980 to $16.6 billion in 1990.

During the 1990s, the structure of the electronics industry changed to focus on value-added products and the government also shifted its focus to the three strategic items of semiconductor, computer and electronic exchangers. Especially, once the MIC was established in 1994 to centrally undertake the IT functions to grow the IT industry, the government started extending full-fledged support to the industry. The Ministry effectively strengthened the IT industry's competitiveness as it advanced the IT infrastructure, including

high-speed Internet infrastructure and promoted the application of IT technologies and services, including e-Government, in accordance with the IT industry promotion policies. The MIC also introduced competition to the telecommunication market and sought to maximize the benefits to consumers by imposing proper regulations on the operators. As a result, the local IT industry made significant progress since 1994, when the MIC opened, through 2007, one year prior to the agency's dissolution. During the same period, the total production of the IT industry speedily increased from 34 trillion KRW in 1994 to 268 trillion KRW in 2007, which is an annual 17.1% growth or 7.9 times growth over 13 years. The industry's exports made an annual average growth of 15.1% from $20.2 billion in 1994 to $125.1 billion in 2007. The industry's trade surplus jumped 16.6% on an annual average from $8.2 billion in 1994 to $60.3 billion in 2007. The accumulated trade surplus reached $379 billion over the 13-year period from 1995 to 2007 and it made a crucial role in the country's effort to overcome the 1997 financial crisis. It is noteworthy that during the same period, non-IT industries recorded $193 billion worth of trade deficit. The IT industry contributed to 21% of Korea's total exports in 1994 and has maintained about a 30% contribution rate since 1999 up to now, with the highest level of 36.9% recorded in 2004, keeping its position as one of the nation's core industries. The IT industry's percentage of the national GDP grew more than 4 times from 4.0% in 1995 to 16.9% in 2007. In addition, the rate of its contribution to the GDP growth soared from 10.6% in 1996 to 51.3% in 2003, which was a peak, and recorded 31.1% in 2007. More specifically, the IT industry's contribution was 0.7 percentage point of the GDP growth rate of 7.0% in 1996, but it dropped to 1.5 percentage points of 5.0%, in 2007. Semiconductor, display, mobile phone, storage device and digital television sets have become core parts of the Korean IT industry's development, recording the highest market shares in the world. Korea's DRAM semiconductor took the global top position, beating Japan in 1998 and semiconductor memory devices achieved the highest market share

globally in 2001. As for mobile phones, CDMA phones ranked first in terms of market share in 2001. TFT-LCD has continuously kept the No. 1 position since 2001 and digital television recorded the world's top market share in 2003.

The continued investments in IT research and development by both the government and the corporate sector produced outstanding outcomes: the world's first 256M DRAM semiconductor in 1994, TDX telephone switching system during the 1980s, the world's first commercialization of CDMA mobile communication system, based on the TDX technology, during the 1990s and WiBro and DMB during the 2000s, which made Korea a truly global leader in technology development, no longer a technology follower of the advanced world.

Korea's telecommunication service made extraordinary progress, building a large-scale infrastructure during the 1960s and the 1970s largely thanks to the government's 5-year Telecommunication Industry Plans. During the 1980s, the telecommunication service was greatly expanded to allow almost every house to have one telephone. In the 1990s, the explosive rise in the demand for telecommunication services, the government's policy to introduce competition in the market, and a steady supply of electronic exchangers fully satisfied the basic telecommunication demand of fixed line phones, and an innovative technological advancement in mobile communication technologies enhanced communication functions and mobility, which led to a rapid growth of mobile phones. In addition, the high-speed information infrastructure initiative, which was launched in 1995, completed the construction of the backbone networks with optical transmission lines, and the high-speed infrastructure was even extended to small administrative units such as eups and myeons throughout the nation at the end of 2001, ushering in the high-speed Internet era.The number of households with high-speed Internet access, which started in 1998, promptly grew to 60% of the entire households, ranking as the highest penetration rate in the world, and the rate increased further to 79.8% in 2007, indicating that most Koreans

get access to high-speed Internet.

The Korean government's IT policies focused on satisfying the basic demand for telecommunications, developing the industry based on the electronics industry and building a foundation for informatization until the mid-1980s. Since that point until the mid-1990s, the government made intensive efforts at the national level to boost the country to be an IT superpower. Especially, once the country was under the International Monetary Fund's supervision (IMF) in late 1997, the government injected a large-scale fund into the IT industry in its desperate move to overcome the crisis. The decision was effective. The world's best IT infrastructure was built, the nationwide level of informatization was significantly enhanced, and the IT industry became a main engine for the growth of other industries. The government's following drives of the IT839 strategy and the development of the new growth engines provided a stepping stone for Korea to move away from its old model of simply following the advanced countries' technologies to a new model to actively lead the development of novel technologies. With those innovative policies, the environments where different IT industries can grow together and Korea plays a leading role in the global IT development were created.

At the same time, however, several issues were raised. As for informatization, Korea now has the highest level of Internet users throughout the globe, but it has failed to build a foundation on which different sectors effectively utilize the Internet and is actively used in many different ways. The other issues are as follows: frequent changes in the government's policy undermined its consistency; a steady monitoring was not conducted according to the milestones of the policies; informatizaion was not extended to all walks of life; and the areas that actively use the Internet concentrate on computer games and other entertainment purposes rather than on productive areas.

This issue of the low utilization rate of the IT infrastructure is also witnessed in the corporate sector. The OECD (2004) pointed out in its Report on Informatization of

Corporate Sector that Korean IT companies promoted the informatization process based on the robust high-speed Internet infrastructure, the IT policies jointly implemented by different government agencies, the facilitation of e-Procurement and the rearrangement of relevant laws and regulations, but the informatization failed to properly translate into the productivity of the corporate sector. The report also described that despite the high level of high-speed Internet infrastructure and the businesses' participation in electronic commerce, their utilization of IT was still relatively low. In fact, Korea's e-commerce utilization rate (12.7%), was proved to remain at the level of the average of the OECD members and Korea failed to show tangible results of the innovation and productivity enhancement of the corporate sector that it pursued based on the informatizaiton, one of the common missions of the OECD member states.

Other issues are the lack of required institutional and legal systems following the government's growth-centered policies, the lack of demand-oriented policies, duplicate development of products and services with low entry barriers, insufficient efforts to protect information, including privacy protection, and policies discriminating against small IT companies. According to the IMD's World Competitiveness Yearbook that evaluates the competitiveness of key economies on 20 criteria, Korea ranked high in the factors such as basic infrastructure, technological infrastructure, scientific infrastructure, labor market and management practices, but it recorded low rankings in the factors of institutional framework and business legislation. Additionally, there were the observations that the government's supplier-oriented policies failed to properly reflect the needs of consumers and are still struggling to create the sufficient market, and more consideration for consumers is often proposed as necessary to boost the stagnant market. Another weak point is that insightful concern and criticism were not properly reflected in some policies, as we witnessed in the case of WiBro and HSDPA, and Korea is still vulnerable to the possibility of duplicate investment into projects that might compete with each other.

〈Table 8－1〉 Evolution of Korea's IT Policies

Timeline	Objective	Detailed Plan	Remark
The 1960s - 1986	Equipment and supply side-oriented	Science & technology 5-year plan	Develop and foster computers
		Semiconductor promotion plan	Lead DRAM development
		The 1st&2ndadministrationcomputerizationplans	Provide IT systems for administration and network them
		Develop TDX	Build networks and meet telecommunication demand
1987 - 2003	Network and demand side-oriented	Develop basic technology for next-generation conductors	Enhance the international competitiveness of DRAM
		Develop mainframe computers	Secure independent development capability of medium and large computers
		The 1st&2ndnationalbackbonenetworkimplementationplans	Raise the public's interest and awareness of IT
		Build and advance the nationwide high-speed communication infrastructure	Present national-level visions of informatization Induce the private sector's investment by creating the demand for informatization
		Cyber Korea 21	Utilize IT to create jobs and vitalize the economy
		e-Korea Vision 2006	Improve the efficiency of different operations through informatization
		Broadband IT Korea Vision 2007	Perform the project as a main strategy for the future of the nation
		CDMA commercialization project Reorganize the structure of the IT industry	Lead the global mobile telecommunication market Introduce full-scale competition in the telecommunication market
2004 -	All components of value chain covered and balanced approach between demand & supply	IT839 strategy	Integrate demand-driven and supply-driven policies using the IT value chains, following the global trend of digital convergence
		u-Korea	Seek to realize a ubiquitous society including informatiztion services

Source: Lee Myeong-ho et al (2006)

The last but not least weak point of the Korean IT industry is the relatively low level of development of the software industry. Korea's software industry started during the 1960s and the 1970s with a return of highly skilled resources from advanced nations and during the 1980s a number of services were developed and separate IT units were created in large companies. In the 1990s, the MIC was established and it provided guidelines for the growth of the software industry. Then the software industry matured as some powerful venture companies appeared and the personal computer telecommunication and the high-speed Internet infrastructure spread widely. In the early years of the 2000s, software companies had new opportunities for growth with the boom of IT venture companies and the establishment of the relevant laws and systems: the software industry promotion act, a quality assurance system, open-source software and restriction on the volume of project orders.

Despite its quantitative growth, the local software industry has not produced tangible results in terms of global competitiveness and ripple effect on the national economy. Therefore, it is the right time to develop a new software industry policy that fits the local environment to advance the industrial foundations, and continuously develop service models and utilize them to enter foreign markets so that qualified software resources can exert their capabilities as much as possible.

Korea is also required to develop very powerful software companies armed with global competitiveness in order to promote the software industry and it can be achieved through the adoption of the current global efforts to divide the development of software areas into different countries and also the nurturing of skilled resources. We need to be reminded of the fact that the three I nations, Ireland, Israel and India, emerged as global IT powerhouses through sharing of roles with the U.S. and Korea's participation in the current movements of nations to share different roles of software development needs to be one of the most essential strategies along with the exchange of software human resources. At

the same time, the government has to fully reorganize the relevant laws and systems by: improving the outsourcing procedure of public software projects; promoting the order assignment of different components of public projects to different entities, conducting pilot projects for software companies to perform its government project in remote locations, improving the successful bidder selection process and enhancing the conglomerates' closed business operation structure. All these improvement efforts are critical in that the software industry serves as the basis for the development of other industries. Increasing the productivity of the entire industrial sector through convergence between IT and other industries is only possible when the software industry grows sufficiently.

Jorgenson & Vu (2005) investigated the IT investments' contribution to the national economic growth in the 110 economies, using multiple data sources, including the Digital Planet Report of the WITSA (World Information Technology and Services Alliance). According to this extensive analysis, while the accumulated IT capital's average contribution rate of the 110 nations' economic growth during 1995 and 2003 is about 15%, Korea's contribution rate is only about 11%. The rate of G7 nations is as high as about 27%, which more than doubles Korea's figure. In his speech made in Korea in 2006, Mr. Jorgenson argued that Korea's low contribution rate in the IT industry was attributed to a relatively low utilization rate of IT and a slow development of the software industry. He also pointed out that Korea was very strong in terms of IT hardware, enjoying the 1 or 2 position in the world in terms of Internet penetration rate, but it was a way behind the developed nations in terms of the application of IT technologies such as convergence of IT and other industries and other software-style areas. To put this analysis in a positive way, Korea still has lots of potential to realize additional economic growth through IT.

The IT industry will continue to serve as a core part of Korea's economy. The most compelling tasks for the current Korean IT industry is to implement various

convergence efforts between IT and other industries, and also between IT and other technologies such as Biology Technology (BT), Nano Technology (NT), Environmental Technology (ET) and Space Technology (ST), and also between broadcasting and telecommunications, so that the productivity of the entire industry will be able to improve.

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정보통신정책연구원 기본연구 안내

▌2008 기본연구

기본연구 08－01 융합환경에서의 경쟁과 다양성에 관한 연구 (황준호, 신호철, 정은옥, 서상호)

기본연구 08－02 융합시대의 번호자원 관리방안에 대한 연구 (나성현, 김봉식, 전수연, 김지영)

기본연구 08－03 디지털 저작권 관리(DRM)와 경쟁정책 (손상영, 김사혁, 황지연, 이철남)

기본연구 08－04 IT를 통한 사회적 자본 축적 방안 연구 (최항섭 외)

기본연구 08－05 인터넷 포털사이트의 사회적 영향력 확대에 따른 대응 방안 연구 (이호영, 정은희, 서문기, 이창호)

기본연구 08－06 웹2.0시대 의사결정방식의 변화와 정책적 대응 방안 (이원태, 차재권, 홍순식)

기본연구 08－07 IT산업에서 기업주도형 벤처투자의 유인 및 실효성에 관한 연구 (정진한, 김정언, 강성진, 정현준)

기본연구 08－08 거시경제 변화에 따른 IT산업 파급효과 추정을 위한 계량모형 개발 (문성배, 김원중, 고준형, 임순옥)

기본연구 08－09 융합환경에서의 방송・통신콘텐츠 이용행태에 대한 실증 분석 (박유리, 이은민, 정부연, 이종수)

기본연구 08－10 통방융합 및 All-IP환경하에서의 필수 요소 분석 및 제도적 접근방안 연구 (김희수 외)

기본연구 08－11 양면시장(two-sided market)이론에 따른 방송통신서비스 정책 이슈 연구 (김성환, 김민철, 이재영, 김남심, 강유리, 김태현)

기본연구 08－12 한・ASEAN IT파트너쉽 강화방안 연구 (강인수, 김태은, 홍승연, 박지훈, 김동엽)

기본연구 08－13 한－중 IT교역관계의 현황과 FTA추진에의 시사점 (남상열 외)

기본연구 08－14 종합유선방송사업자의 소유구조 연구: 합병의 경제적 성과를 중심으로 (김창완, 정부연, 이경원)

기본연구 08－15 종합물류사업자 전환에 따른 성공요인 분석: 우정사업 종합물류업 기반조성을 중심으로 (이용수, 이영종, 안명옥, 곽준식)

기본연구 08－16 지식정보화의 전면화를 위한 공공정보화 혁신방안 연구(Ⅳ) 총괄보고서 (정국환 외)

▌2009 기본연구

기본연구 09－01 방송통신 서비스 경쟁의 지리적 격차에 대한 연구 － 초고속인터넷 서비스를 중심으로 － (김민철, 윤유진)

기본연구 09－02 종합유선방송사업자의 채널 번들링에 관한 연구 (임 준, 김창완, 김용철)

기본연구 09－03 융합 환경에 적합한 접속료 및 정산체계 연구 (김희수, 오기환, 김남심)

기본연구 09－04 IPTV 신규 방송서비스 도입과 소비자 행태에 관한 연구 (정진한, 박민수, 이인선)

기본연구 09－05 방송・통신 융합 환경에서의 플랫폼 경쟁정책 (손상영, 안일태, 이철남)

기본연구 09－06 소셜컴퓨팅 환경에서 집단지성의 사회적 생산 메커니즘 연구 (황주성, 최서영, 김상배)

기본연구 09－07 정보화 추진과정상의 갈등관리와 추진전략 연구 (정국환, 문정욱, 김영미, 김석주)

기본연구 09－08 다매체 환경에서의 방송콘텐츠 이용행태 분석 (박유리, 권지인, 유승훈)

기본연구 09－09 방송통신 융합시대 지상파방송의 역할 정립에 관한 이론연구 － 지상파방송 콘텐츠의 권리와 의무를 중심으로 － (황준호, 박민성)

기본연구 09－10 주파수 공유기술 적용을 위한 전파관리 모형 연구 (여재현, 임동민, 이일주)

기본연구 09－11 미디어 융합환경에서의 여론형성 재구조화에 관한 연구(I) (이종원, 강준석, 김남두)

기본연구 09－12 방송통신 융합시대의 통상정책 재정립 방안 연구 (강하연, 여혁종)

기본연구 09－13 방송서비스시장 예측모형개발 연구 (정용찬, 이은민, 정병철)

기본연구 09－14 저탄소 녹색성장을 지향한 친환경 우편서비스 구현 방안 연구 (최중범, 문성철, 이슬기)

협동연구총서 09－13－01 IT실용화를 통한 정보화 선진화 방안 연구(Ⅰ) 총괄보고서 (정국환, 문정욱, 안재민)

협동연구총서 09－14－01 방통융합의 사회적 순기능과 역기능에 대한 미래정책 연구(Ⅰ) 총괄보고서 (이원태, 유지연, 안재민)

▌2010 기본연구

기본연구 10－01 녹색성장을 위한 전자책 시장 활성화 방안 (박유리 외)

기본연구 10－02 IP 네트워크 요금체계 연구 (김득원, 김희수, 오기환)

기본연구 10－03 통신시장 구조변화에 따른 가치사슬 및 가치네트워크에 관한 동태적 분석 (주재욱, 윤두영, 이주영, 이경현)

기본연구 10－04 이동통신 이용자의 최적 요금제 선택 제한요인에 관한 연구 (전주용, 김태현, 이경현)

기본연구 10－05 국제회계기준 도입에 따른 규제회계제도 개선안 (함창용, 정훈)

기본연구 10－06 플랫폼 생태계의 후생적 이슈와 정책과제 (손상영, 김사혁, 석봉기)

기본연구 10－07 모바일 인터넷으로 인한 미디어이용패턴의 변화: 스마트폰 이용자를 중심으로 (황주성, 이재현, 이나경)

기본연구 10－08 거시경제가 방송통신(서비스)부문에 미치는 영향 분석 (박성욱, 이준희, 정현준)

기본연구 10－09 멀티플 플레이 서비스(MPS) 선택의 결정요인 연구 (김창완, 정부연, 박민수)

기본연구 10－10 해외진출 전략국가 ICT 마스터 플랜 정책자문 (고상원, 김창완, 김윤화)

기본연구 10－11 방송채널의 거래와 가격에 관한 연구 (염수현, 박민성)

기본연구 10－12 국내 시사정보미디어의 이용점유율을 통한 미디어 이용다양성 측정 연구 (성욱제)

기본연구 10－13 미디어 융합환경에서의 여론형성 재구조화에 관한 연구 (II) (김남두)

기본연구 10－14 글로벌 이슈에 대한 국제기구 ICT 분야의 대응논의와 시사점 (남상열, 정원조, 윤예린)

기본연구 10－15 u-City서비스 활성화 방안 (황성진, 공영일, 이기훈, 박상우, 박은영)

기본연구 10－16 우체국보험 해약 요인에 관한 연구 (이석범, 이영종, 옥주영)

협동연구총서 10－12－01 IT 실용화를 통한 국가정보화 선진화 방안 연구(Ⅱ) 총괄보고서(정국환 외)

협동연구총서 10－13－01 방통융합의 사회적 순기능과 역기능에 대한 미래정책연구(Ⅱ) 총괄보고서 (이원태, 유지연)

정보통신정책연구원 정책연구 안내

▌2008 정책연구

정책연구 08－01 방송통신콘텐츠산업 육성에 관한 연구 (김정언 외)

정책연구 08－02 방송시장의 공정경쟁 환경조성을 위한 제도 정비방안 연구 (김민철 외)

정책연구 08－03 방송시장 경쟁상황평가 체계 연구 (김성환, 김민철, 김남심, 오기석, 백윤미)

정책연구 08－04 2008년 TV 시청행태 조사 (정용찬, 이종원, 성욱제, 김해수, 이소현)

정책연구 08－05 방송통신 연차보고서 발간을 위한 사전조사 (나성현 외)

정책연구 08－06 보도전문채널 및 종합편성채널 제도 연구 (황준호, 초성운, 정용찬, 정은옥, 신호철, 전수연)

정책연구 08－07 방송통신 중장기 기본계획 수립 (고상원, 김사혁, 유지연)

정책연구 08－08 2008년 방송산업 실태조사 보고서 (정용찬, 이종원, 김해수, 이소현)

정책연구 08－09 글로벌 시대에 대비한 우체국택배 대응 전략 연구 (박중권, 김철완, 안명옥, 이명규, 조영주, 박찬석)

정책연구 08－10 우체국보험의 효율적인 조직 및 인력운영 전략 마련 (박중권, 남현주, 김수임)

정책연구 08－11 제24차 UPU총회 세계우편전략 이행을 통한 국제우편 품질향상방안 연구 (최중범, 정진하, 이경은, 김수임, 김은진)

정책연구 08－12 방송사업자 편성현황 조사 분석 및 백서발간 (초성운, 성욱제, 김인희, 김지윤)

정책연구 08－13 통신시장 공정경쟁 촉진을 위한 전파관리 정책연구 (박민수 외)

정책연구 08－14 주파수 할당 및 전파사용료 개선방안 연구 (박민수 외)

정책연구 08－15 방송통신융합 환경에서의 중장기 편성정책 수립 방안 (성욱제 외)

정책연구 08－16 방송통신 발전지수 개발 (황주성, 유지연)

정책연구 08－17 콘텐츠 허브 모형 구축 연구 (김정언, 박유리, 오정숙, 권지인)

정책연구 08－18 New IT 산업 발전전략 연구(Ⅰ), New IT 산업 발전전략 연구(Ⅱ), New IT 산업 발전전략 연구(부록) (강홍렬 외)

정책연구 08－19 IT산업동향 (문성배 외)

정책연구 08－20 산업전략 및 정책추진체계 변화에 따른 IT부문 통계체계 개선 (문성배, 정진한, 김민식, 이경남, 정현준)

정책연구 08－21 2009 IT 시장전망 (문성배 외)

정책연구 08－22 방송통신분야 중장기 재정계획 연구 (고상원 외)

정책연구 08－23 IT산업 고도화를 위한 기업간 상생협력 정책방안 연구 (임 준, 강홍렬, 권지인, 김민식, 오정숙)

정책연구 08－24 2007년도 통신시장 경쟁상황 평가 (김희수 외)

정책연구 08－25 북한 방송통신부문 및 남북 방송통신 교류협력 현황 보고서 (황성진, 김철완, 공영일, 홍현기, 박상주, 이우승)

정책연구 08－26 남북 인터넷 교류협력에 관한 연구 (황성진, 김철완, 공영일, 홍현기, 박상주, 고경민)

정책연구 08－27 방송콘텐츠 산업 실태조사 (이종원, 정용찬, 김해수, 이소현)

정책연구 08－28 TV홈쇼핑 채널 제도화 방안 연구 (이종원 외)

정책연구 08－29 The e-Business Strategy for APPU Countries (정진하 외)

정책연구 08－30 경영체제 개편을 대비한 법제도 연구 (정진하 외)

정책연구 08－31 경영체제 개편에 대비한 조직, 인력 운영방안 연구 (정진하 외)

정책연구 08－32 대내외 환경변화에 대응한 우편사업 경쟁력 강화방안 연구 (정진하 외)

정책연구 08－33 우체국 금융사업 성장동력 창출방안 연구 (정진하, 박중권, 박재석, 안명옥, 김수임)

정책연구 08－34 FTA,WTO 등 통상협상 대응전략 연구 (정진하, 최중범, 이기훈)

정책연구 08－35 국내외 우정동향 및 주요 경영정보 조사 분석 (정진하, 이석범, 이영종, 안명옥, 문성철, 남현주)

정책연구 08－36 통신시장 분류제도 개선방안 연구 (나성현, 박동욱, 주재욱, 김득원, 전수연)

정책연구 08－37 방송통신 융합에 대응한 분류제도 개선 및 통합법제 정비방안 연구 (초성운 외)

정책연구 08－38 공익산업에서의 진입 및 M&A 제도에 관한 연구: 기간통신사업 허가 및 M&A 규제제도를 중심으로 (나성현 외)

정책연구 08－39 단말기 잠금장치(USIMLock) 해제정책 및 보조금 규제제도의 효과분석 (주재욱 외)

정책연구 08－40 광대역 무선인터넷 서비스 활성화 방안 연구(WiBro, MVoIP를 중심으로) (여재현, 장범진, 박민수, 염용섭, 전수연, 김주란)

정책연구 08－41 방송통신 콘텐츠 동등접근 규제 연구 (염수현, 황준호, 신호철, 정은옥, 이상우)

정책연구 08－42 방송통신 융합서비스 발전전망과 이에 따른 법/제도적 보완 방안 연구 (황준호, 김남두, 정은옥)

정책연구 08－43 해외 방송통신 통합기구의 운영성과 분석 및 시사점 연구 (황준호, 성욱제, 신호철, 주재원, 김진기, 한영학)

정책연구 08－44 방송광고 현황 및 제도 개선방안 연구 (초성운 외)

정책연구 08－45 무선인터넷 망개방효과 분석 및 활성화 방안 연구 (여재현, 전수연)

정책연구 08－46 인터넷전화 번호이동성 및 번호사용료 제도 연구 (나성현, 김봉식, 전수연, 김지영)

정책연구 08－47 기업활력제고와 이용자보호강화를 위한 규제개혁방안 연구 (염용섭 외)

정책연구 08－48 한국 인터넷 문화의 특성과 발전방안 연구 (이호영 외)

정책연구 08－49 방송통신융합, 결합상품 활성화 등 환경변화에 따른 방송통신 시장획정 방안 연구 (김희수, 김성환, 강유리, 김태현, 정승희)

정책연구 08－50 역무통합 등 통신환경 변화에 따른 통신 회계제도 개선방안 연구 (함창용, 오성백, 정 훈, 맹승찬)

정책연구 08－51 통신서비스 재판매시장 영향분석과 재판매시장의 전망 연구 (이재영, 이종화, 임 준, 강인규, 오기석, 백윤미)

정책연구 08－52 글로벌 스탠다드에 맞는 상호접속 제도 개선방안 연구 (김희수, 이종화, 김남심, 오기환)

정책연구 08－53 08～09년도 접속료 산정방안 연구 (함창용 외)

정책연구 08－54 우리나라 이동전화요금 현황 분석 및 개선방안 연구 (이종화, 강유리, 강인규, 김종진)

정책연구 08－55 이용자 요구에 기초한 통신서비스 사전적 이용제도 개선방안 연구 (김득원 외)

정책연구 08－56 해외의 결합서비스 시장실태 분석을 통한 국내 결합서비스 활성화 방안 연구 (이재영, 임 준, 강인규, 오기환)

정책연구 08－57 인터넷전화 및 결합판매 활성화에 따른 보편적 서비스 제도 개선방안 연구 (함창용 외)

정책연구 08－58 방송통신 융합시대 방송의 사회적 역기능 개선을 위한 정책연구 (황준호, 김남두, 김인희, 김지윤, 박은희)

정책연구 08－59 수평적 규제 도입 추세하의 방송・통신・융합서비스시장 사후규제체계 개선 방안 연구 (김형찬, 김희수, 정경오, 오기환, 황주연, 박은영)

정책연구 08－60 행정제재조치의 실효성 제고 방안 연구 (이재영 외)

정책연구 08－61 통신시장의 조사기법 체계화를 통한 조사역량 강화기반 구축: 조사방향 설정을 위한 시장 동향 연구 (김민철, 김득원, 배동민, 백윤미)

정책연구 08－62 인터넷포털 서비스 사업자 경쟁제한 행위 합리적 규제 방안 연구 (이재영 외)

정책연구 08－63 금지행위 위법성 판단을 위한 시장획정 방안 및 경제 분석 연구 (김성환, 김득원, 윤충한, 강인규, 배동민)

정책연구 08－64 인터넷망간 상호접속의 불공정행위 개선방안 연구 (이종화, 오기환, 김남심)

정책연구 08－65 방송통신사업자 경쟁제한행위 사례조사 및 규제 방안 연구 (김성환, 염수현, 강재원, 황주연, 김남심)

정책연구 08－66 보편적 시청권 보장을 위한 규제방안 연구 (김희수, 강유리)

정책연구 08－67 이용자 이익저해 행위의 위법성 판단기준 정립 (임 준 외)

정책연구 08－68 통신서비스 이용자교육 및 참여 활성화 방안 (함창용, 조향숙, 양덕순, 정승희, 배동민, 강유리)

정책연구 08－69 방송통신 분쟁조정 관련 법제도 개선방안 연구 (염수현 외)

정책연구 08－70 방송통신 규제기관 국제협력방안 연구: 주요국 방송통신 규제기관 사후규제제도 분석 (강하연, 서보현, 김성웅, 박민정)

정책연구 08－71 새로운 통신정책 패러다임의 모색 (손상영, 김사혁, 김희연)

정책연구 08－72 정보사회의 미래와 통신정책의 새로운 패러다임 (김문조)

정책연구 08－73 사회통합을 위한 통신정책의 과제와 전망 (유승호)

정책연구 08－74 환경 및 생태계 유지 발전을 위한 통신정책적 대응 (김용학)

정책연구 08－75 미디어 진화에 따른 통신문화 변화와 통신정책의 역할 (최양수)

정책연구 08－76 모바일 미디어 확산 및 개인화에 따른 사회문화적 변화 (이종혁)

정책연구 08－77 고령화시대 통신기술 이용행태 분석과 정책방안 (조주은)

정책연구 08－78 정보사회 신인류의 등장과 통신서비스 이용행태의 변화 (이상훈)

정책연구 08－79 미디어 이용과 사회문화적 격차 및 양극화 문제 대응방안 (성동규)

정책연구 08－80 미디어 중독의 현황과 향후전망 및 대책 (방정배)

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정책연구 09－01 디지털시대 사회통합을 위한 시민의식 제고방안 (이원태 외)

정책연구 09－02 인터넷전화 번호이동성제도 연구 (나성현, 김봉식, 이주영)

정책연구 09－03 미디어 다양성 측정 방법 및 적용 가능성 검토 (성욱제, 정용찬, 염수현, 김인희, 김지윤, 박민성)

정책연구 09－04 디지털시대 지상파 방송의 방송 운용시간 자율화 방안 연구 (황준호, 김인희)

정책연구 09－05 ITU 전권회의 등 대규모 국제 행사 유치 타당성 검토 (남상열, 정진하, 김태은, 박민정, 이강신)

정책연구 09－06 우리나라 실정에 맞는 지능형 우편 서비스 도입방안 연구 (박중권 외)

정책연구 09－07 방송통신을 통한 국가브랜드 제고 방안 (윤석훤, 김민식, 김윤화)

정책연구 09－08 방송매체 이용행태 조사 (정용찬, 성욱제, 이은민, 김욱준)

정책연구 09－09 EMS 가격구조 개편 및 국제우편 신규서비스 도입 방안 연구 (이석범, 이용수, 정진하, 이영종, 이슬기, 유옥수)

정책연구 09－10 온라인 접수체계로의 전환에 따른 요금제도 및 프로세스 개편 연구 (이용수, 안명옥, 이경은, 김혜영)

정책연구 09－11 융합 및 통신콘텐츠산업 진흥에 관한 연구 (김정언, 박유리, 유선실, 오정숙, 강홍렬, 유지연)

정책연구 09－12 방송통신콘텐츠 저작권의 효과적 보호에 관한 연구 (박유리, 최진원, 김정언, 이경남, 안재민)

정책연구 09－13 2009년도 방송시장 경쟁상황평가 (이재영, 강준석, 안자영, 김지혜)

정책연구 09－14 디지털방송 전환 추진방안 연구 (이재영, 염수현, 김지영)

정책연구 09－15 아날로그방송 종료 시범사업 추진방안 연구 (이종화, 정용찬, 김남두, 신호철)

정책연구 09－16 융합화에 따른 통신시장 구도변화 연구 (나성현, 이주영, 이선영)

정책연구 09－17 와이브로 신규사업자 선정 방안 및 활성화 연구(로밍, 기지국 공용화 포함) (변정욱, 나성현, 여재현, 오기석, 이광희, 송영근)

정책연구 09－18 가계통신비의 사회경제적 가치 분석과 주요통계 관리 (김민철, 김득원, 강유리, 나상우, 윤유진)

정책연구 09－19 010번호 통합 및 중장기적 번호자원관리 방안 연구 (주재욱, 김봉식, 이주영)

정책연구 09－20 재판매 등 도매시장 정책방안 연구 (김민철, 강인규, 오기환)

정책연구 09－21 융합/결합이 통신시장에 미치는 영향과 규제발전 방향 및 법령정비 방안 연구: 시장 진입 활성화를 위한 중장기 정책방향과 법령정비 방안을 중심으로 (변정욱, 나성현, 오기석, 여재현, 신홍균)

정책연구 09－22 방송통신시장 결합판매 규제 발전방향 및 법령정비 방안 연구 (임 준, 이인선, 강병민)

정책연구 09－23 융합진전에 대응한 통신시장 활성화 및 경쟁촉진정책 패러다임 연구 (김형찬, 김희수, 황주연, 김진성)

정책연구 09－24 보편적서비스 권역 세분화 및 공중전화 제도개선 방안 연구 (전주용, 정 훈, 나상우)

정책연구 09－25 방송통신망 개방에 대한 해외사례 및 정책연구 － FTTH 등의 망개방 및 망중립성 － (정진한, 오기환, 이인선)

정책연구 09－26 요금인가제 완화에 따른 통신요금 정책방안 (김득원, 강유리)

정책연구 09－27 유무선 융합서비스 도입의 영향과 제도적 이슈연구 (김형찬, 김태현, 노성민)

정책연구 09－28 인터넷전화 활성화에 따른 시내전화 통화권 제도 개선 방안 연구 (주재욱, 함창용, 김태현, 이경석)

정책연구 09－29 기간통신망 이용 관련 불공정행위 실태조사 및 개선방안 (김희수, 김형찬, 김남심, 오기환)

정책연구 09－30 방송사업 회계분리 법제화 방안 연구 (오성백, 함창용, 정 훈, 나상우, 맹승찬)

정책연구 09－31 도매제공대가의 사후규제 방안 연구 (김희수, 오기환, 김진성)

정책연구 09－32 모바일콘텐츠 적정 수익배분을 위한 정책방안 연구 (김형찬, 강인규)

정책연구 09－33 방송・통신・융합서비스 이용자 통합 보호방안 연구 (김희수, 임 준, 김슬기)

정책연구 09－34 방송통신기반 온라인 비즈니스 활성화를 위한 법・제도 및 요금체계 개선방안 연구 (김득원, 김민철, 정 훈, 김태현, 이성엽, 박민철)

정책연구 09－35 방송통신시장 사후규제 효과 분석 (전주용, 강인규, 허다혜, 김성환)

정책연구 09－36 통신사업자의 이용자보호 관련 업무에 대한 평가제도 연구 (정진한, 김태현, 정승희)

정책연구 09－37 IPTV 도입에 따른 방송통신 시장 공정경쟁 이슈와 대응방안 (전주용, 황주연, 허다혜, 김성환)

정책연구 09－38 무선 인터넷시장에서의 이용자보호 개선방안 연구 (정진한, 김형찬, 김남심, 배동민)

정책연구 09－39 금지행위 세부유형 등 개선방안 연구 (임 준, 정경오, 황주연, 이인선)

정책연구 09－40 방송통신 이용자관점 정책평가 보고서 (임 준, 정진한, 김진성)

정책연구 09－41 효율적인 방송통신망 구축 및 활용을 위한 법제화 방안 연구 (변정욱, 맹승찬, 이경석)

정책연구 09－42 방송통신망 고도화에 따른 상호접속의 쟁점과 정책과제 (김희수, 김남심, 오기환)

정책연구 09－43 통신정책에 대한 인문사회과학적 연구(Ⅱ) (손상영, 김사혁, 김희연)

정책연구 09－44 최근 통신정책 이슈에 대한 탈근대론적 재조명 (손상영, 김사혁, 김희연)

정책연구 09－45 통신정책의 철학적 배경 재정립을 위한 연구 (김정오, 오태원)

정책연구 09－46 사이버 공간의 동학적 원리와 통신정책 (박길성, 김선업, 김상용)

정책연구 09－47 탈근대적 통신서비스 이용행태에 대한 실증분석 (이강형, 김동윤)

정책연구 09－48 새로운 통신문화의 형성과 통신정책 (배 영, 김경달, 송민택)

정책연구 09－49 고령층의 통신서비스 이용문화와 통신정책 (조주은)

정책연구 09－50 인터넷에서의 루머확산과 통신정책 (노기영)

정책연구 09－51 방송통신 발전지수 개발(2) (황주성, 유지연, 이준웅)

정책연구 09－52 2010 방송통신 시장전망 (문성배 외)

정책연구 09－53 방송통신융합산업 신성장동력 종합 추진전략 연구 (김정언, 이경남, 정현준, 이영수)

정책연구 09－54 방송통신광고 편성운용제도의 중장기 개선방안 연구 (초성운, 이종원, 김지영)

정책연구 09－55 시청자권익증진 활동의 활성화를 위한 포럼 운영 (KISDI방송정책연구그룹편)

정책연구 09－56 방송사업자 방송광고요금(전파료)의 합리적 배분방안 연구 (이종원, 김지영)

정책연구 09－57 2009년 방송산업실태조사 (정용찬, 김욱준, 김해수, 이소현)
정책연구 09－58 한국경제 60년사(산업분과 중 정보통신산업) (고상원, 오정숙)
정책연구 09－59 우체국택배 수익・비용 구조 개선 방안 연구 (박중권, 정진하, 이영종, 김혜영, 박춘식, 고재덕)
정책연구 09－60 유료방송 요금제도 개선방안 연구 (염수현, 박민성, 안자영)
정책연구 09－61 재난안전 무선통신망 정책방향 수립을 위한 연구 (윤석훤 외)
정책연구 09－62 통신시장 경쟁상황평가 (김희수 외)
정책연구 09－63 이용자보호 환경조성: ARS 및 이용약관 관련 이용자보호방안 연구 (함창용, 정경오, 황주연)
정책연구 09－64 2009회계연도 통신사업자 통화량 예측 (오성백, 함창용, 곽정호, 박상수)
정책연구 09－65 한국 인터넷 문화의 특성과 발전방안 연구: 총괄보고서 (이호영, 이원태, 김사혁, 신유림, 박현유)
정책연구 09－66 한국네티즌 연구 (이호림, 신유림, 장덕진, 이준웅)
정책연구 09－67 온라인 평판시스템의 순기능 제고 방안 (이호영, 김사혁, 서문기, 김용철)
정책연구 09－68 인터넷 참여문화 선진화를 위한 제도적 지원방안 연구 (이원태, 박현유, 조화순, 김 혁)
정책연구 09－69 인터넷 거버넌스 역학구조와 정책대응 방안 연구 (김동욱, 김동현, 윤 건, 정준화, 신성한)
정책연구 09－70 인터넷 비즈니스 분야에서의 경쟁력 강화 방안 연구 (신민수, 이지은, 박준용, 이영탁, 양신혜)
정책연구 09－71 방송통신분야 통계 분류체계 연구 (문성배, 정현준)
정책연구 09－72 산업IT융합의 활성화와 융합IT핵심역량의 도출 (강홍렬 외)
정책연구 09－73 모바일산업의 패러다임 변화와 향후 산업전략의 변화 (강홍렬, 권지인)
정책연구 09－74 중국 주요 IT기업의 경쟁력 및 전략 분석 (윤석훤, 김윤화, 오정숙)
정책연구 09－75 방송통신 활성화를 위한 정책평가 및 조사분석 (박성욱, 김정언, 이경남, 권지인, 최진규)
정책연구 09－76 방송통신 통합법제 정비방안 연구(2) (초성운, 염수현, 김남두, 나성현, 박동욱, 박민성)
정책연구 09－77 주파수 경매규칙 설계 연구 (최계영 외)
정책연구 09－78 주요 주파수 할당방안 연구 (최계영, 여재현, 임동민, 전수연)

정책연구 09－79 주파수 할당대가 제도개선 및 실행방안 연구 (여재현, 최계영, 주재욱, 이일주, 임동민)

정책연구 09－82 남북 방송교류협력에 관한 연구 (황성진, 공영일, 홍현기, 박상주)

정책연구 09－83 북한 방송통신부문 및 남북 방송통신 교류협력 현황 보고서 (황성진, 공영일, 홍현기, 박상주)

정책연구 09－84 우정사업 경영여건 시나리오별 대응전략 수립 (정진하, 이용수, 안명옥, 이영종, 김혜영)

정책연구 09－85 우정사업의 지속가능경영 종합 추진전략 (정진하 외)

정책연구 09－86 다자(WTO) 및 양자(FTA) 통상협상 지원 및 전략 연구 (정진하, 김철완, 이기훈, 김지영)

정책연구 09－87 09년도 국내・외 우정동향 및 주요 경영정보 조사 분석 (정진하 외)

정책연구 09－88 신서독점권의 체계적 관리 및 실효성 확보 방안 (정진하, 최중범, 이기훈, 이슬기)

정책연구 09－89 보험적립금 중장기 자산배분 방향 수립 (정진하, 박중권, 안명옥, 현승미)

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정책연구 10－01 IPTV 경쟁상황평가 체계 연구 (이재영 외)

정책연구 10－02 방송통신산업 종합발전전략 (고상원, 김민식, 정부연)

정책연구 10－03 2010 방송사업자 편성현황 조사분석 보고서 (성욱제, 주성희)

정책연구 10－04 금융사업 위탁 전문인력 효율적 운영방안 연구 (박재석, 이용수, 문성철, 고윤희)

정책연구 10－05 산업 전체 영역의 IT활용 확대가 일자리 창출에 미치는 영향 분석 (고상원, 박재민, 정현준, 임순옥)

정책연구 10－06 스마트폰 시장 성장에 따른 이동통신 단말기 제조업의 밸류체인 및 경쟁상황 변화 분석 (윤석훤, 김윤화, 김민식)

정책연구 10－07 도매제공 활성화를 통한 통신시장 경쟁촉진 방안 연구 (변정욱, 이경석, 강인규)

정책연구 10－08 통신시장 경쟁구도 및 가치사슬체계 변화에 따른 규제체계 개편방안 (김희수 외)

정책연구 10－09 초고속인터넷의 보편적 역무 정합성 연구 및 보편적 역무 제도 개선방안 연구 (전주용, 오기환, 나상우)

정책연구 10－10 통신환경 변화에 따른 상호접속 대가산정 모형 및 정책방향 연구 (김희수 외)

정책연구 10－11 전기통신사업법 개정에 대비한 허가 및 양수합병제도 개선방안 연구 (나성현, 김태현, 강유리)

정책연구 10－12 통신서비스요금 국제비교 방안 연구 (이종화, 윤두영, 강유리)

정책연구 10－13 통신시장 환경변화에 따른 통신요금 및 가계통신비 정책방향 연구 (김득원 외)

정책연구 10－14 방송통신 융합 및 결합서비스 활성화 방향과 성과분석 (이명호, 임준, 강인규, 김태현)

정책연구 10－15 신규서비스 도입에 따른 번호 제도 개선방안 (주재욱 외)

정책연구 10－16 무선인터넷 불공정행위 이슈 및 이용자보호 방안 연구 (정진한, 강인규, 황주연)

정책연구 10－17 이동통신서비스 이용자 정보제공 및 선택권 강화방안 연구 (전주용, 김태현, 이경현)

정책연구 10－18 해외 상호접속 정책트렌드 비교 분석 (김희수 외)

정책연구 10－19 인터넷의 철학적 문제와 탈근대적 통신정책 기조에 대한 연구 (손상영, 김희연)

정책연구 10－20 방송통신 국가 R&D 투자방향 및 성과체계 구축 (김정언, 정부연, 정현준, 서환주)

정책연구 10－21 전파법상 주파수 할당제도 개선방향 연구 (최계영 외)

정책연구 10－22 차세대 방송통신위성용 주파수 이용방안 연구 (여재현, 정인준, 전수연)

정책연구 10－23 주파수 중장기 이용방안 연구 (최계영 외)

정책연구 10－24 우체국 체크카드사업 발전 방안 (이용수, 김철완, 안명옥, 박주혜)

정책연구 10－25 방송회계제도 도입 및 통신회계 실효성 제고방안 연구 (변정욱, 정훈, 오기석)

정책연구 10－26 이동통신시장의 효과적인 관리를 위한 유통망 규제 방안 연구 (정진한, 홍명수, 강인규, 이경석)

정책연구 10－27 통신시장 융결합서비스 활성화를 위한 사후규제방안 연구 (임준, 정경오, 황주연)

정책연구 10－28 방송통신 진화에 따른 규제체계 고도화방안 연구: 사후규제를 위한 Solution과 이행방안을 중심으로 (임준, 정경오, 황주연)

정책연구 10－29 2009년도 통신시장 경쟁상황평가 (변정욱 외)

정책연구 10－30 국내 무선인터넷 생태계 선순환 구조 구축방안 수립 (나성현, 김남심, 강인규)

정책연구 10－31 IP 환경하의 데이터 통화량 검증기반 구축 (오성백 외)

정책연구 10－32 컨버전스 미디어지형 동향 분석 (황주성 외)

정책연구 10－33 산업별 IT융합 통계 구축 방안 (김정언, 박성욱, 김민식, 정현준)

정책연구 10－34 2011 방송통신 시장 전망 (박성욱 외)

정책연구 10－35 방송통신 발전지수 개발(III) (황주성, 유지연)

정책연구 10－36 방송통신발전 기본계획 수립을 위한 연구 (김창완 외)

정책연구 10－37 방송통신콘텐츠 유통환경 변화를 고려한 미래지향적 진흥정책 방향 -데이터방송 활성화를 중심으로(박유리, 김정언, 유선실, 오정숙)

정책연구 10－38 모바일 IPTV 도입방안 연구 (김남두, 박민성)

정책연구 10－39 시청률조사 검증 사업 (황준호, 한상태)

정책연구 10－40 방송평가기반조성사업: 방송 내용.편성.운영 영역 평가 (성욱제, 홍문기, 정성근, 노진백)

정책연구 10－41 방송평가기반조성사업: 방송 프로그램 수용자 평가 (정용찬, 신호철)

정책연구 10－42 방송평가기반조성사업: 방송매체 이용행태 조사 (정용찬, 이은민, 이승혜)

정책연구 10－43 2010년 방송산업실태조사 (정용찬, 김해수, 이소현, 이은민)

정책연구 10－44 남북방송통신 교류협력촉진 (황성진, 공영일, 이기훈, 박상주)

정책연구 10－45 보편적 우편서비스 유지비용 추정 및 제도 정비방안 (정진하, 최중범, 이영종)

정책연구 10－46 우체국 녹색금융 추진전략 연구 (정진하, 박재석, 최중범, 문성철)

정책연구 10－47 우체국금융의 종합자산관리서비스 전략 (정진하, 박재석, 이경은, 고윤희)

정책연구 10－48 우정사업에 있어 바람직한 IT의 역할 및 운영·관리방안 (정진하, 이용수, 안명옥)

정책연구 10－49 통상협상 다변화에 따른 우편분야 전략적 대응방안 수립 (정진하, 김철완, 안명옥)

정책연구 10－50 2010년도 국내·외 우정동향 및 주요 경영정보 조사 분석 (정진하 외)

정책연구 10－51　2010 방송시장 경쟁상황평가 (이재영 외)

정책연구 10－52　시청점유율 조사 및 검증방안 연구 (황준호, 김대규)

정책연구 10－53　방송사업자의 시청점유율 산정 기준 및 방법에 관한 연구 (성욱제, 최믿음)

정책연구 10－54　시청점유율 제한 관련 사후 규제 방안 연구 (염수현, 박민성)

정책연구 10－55　매체간 합산 영향력지수 개발 연구: 지수의 기본구조 시안을 중심으로 (김남두)

정책연구 10－56　방송종사자 미디어다양성 교육 방안 연구 (황준호, 김대규)

정책연구 10－57　방송분야 규제개선 연구 (이종원, 안자영)

정책연구 10－58　방송시장 사회·경제적 파급효과 분석 (강준석, 주재욱, 이종원)

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