Information Communication Technology Policy Landscape in Asian Countries

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Abstract

The era of globalization and rapid technology development forces policy makers for production of information communication policy that contribute for sustainable development of countries. Asia is the most dynamic region of the world consists of the developed, emerging and developing economies. This study illustrates the policy changes and economic dynamics of developed countries; Japan and Korea, because they have formed the basis for information communication technology development. The study then focuses on the developing countries; India and Pakistan, to explore the role of information communication technology and policy for development.

The paper uses content analysis and 20 years time series data to find the more familiar cases of information communication technology and policy. It quantifies the government activities and actions, and evaluates the impact of the policies on the country's economic development by using the World Bank/UN/OECD development indicators. The key points extracted from the historical analysis are compared with the development indicators to confirm the impact of policies on the economic growth. This comparison highlights the indicators of information communication technology policy that impact the growth of the country.

The study is twofold, first has illustrates information communication technology and policy changes with respect to economics dynamics of the developed and developing countries of Asia and secondly, evaluates the information communication technology indicator with the perspective of country growth. In the end we conclude with some recommendations for policy maker of countries.

Keywords: Information Communication Technology, Policy, Technology Adoption, Asian Countries, Research and Development, Economic Growth, Development Indicator

1. Introduction

This paper investigates the patterns of relationships between the information communication technology and the dynamics of policies in selected Asian countries. This study identifies the possible feedback effects between national institutions and different economic conditions and the relevance of their integrated effects on countries patterns of technological activities. The paper analyses the long run evolution of countries' technological specializations and confirms the most important findings of the literature on their stability. Hence, it provides a more precise view of the

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stability of national technological specialized patterns. Furthermore, the results suggest a more interdisciplinary view of the convergence process of national technological specializations that show significant sector specific features. Other than that, the relationships between information communication technology and economic growth reveal that country, sector and time specific effects clearly show up. Furthermore, the study focuses on case study of the relative persistence of the countries' specializations patterns in order to bring some empirical evidence for the problem of the relationships between the evolution of information communication technology and the dynamics of countries patterns of policies. In this study, Japan and Korea are selected as the developed countries' because of their success and importance in regional economy. Moreover, India and Pakistan are targeted as the developing countries. Through this study we analyze the stages of shaping developed and developing countries policies and their differences in adopting the information communication technologies in different sectors.

The study concentrates on how replicable lessons can be derived from policies of developed countries that are implemented in different phases of development. To achieve this aim, the paper illustrated the information communication technology policy of four countries Japan, Korea, India and Pakistan. Japan and Korea are first adopters of the Internet in Asia. Pakistan and India are belated adopters of the internet. The rank and group of these countries to indicate their economic conditions are shown in the table 1.We found that the Global Competitive Index (GCI) rank and the Network Readiness (NR) rank has strong correlation in the all four countries.

Table1: Countries Development Rank/Stage

	GCI ranking	NR rank	Stage of development	Income Group
Japan	10	18	Innovation-driven	High Income
Korea	19	12	Innovation-driven	High Income
India	59	60	Factor-driven	Lower Middle Income
Pakistan	124	102	Factor-driven	Lower Middle Income

Source: (GlobalCompetitivenessReport_2012-13, 2013; The Global Information Technology Report 2012, 2013)

Table 2: Correlation of CGI rank and NR rank

Correlation		
	CGI ranking	*NR rank*
CGI ranking	1	
NR rank	0.970827136	1

APO Productivity Year Book (2012), grouped the countries on the basis of initial economic level and their speed of catching up. They identified four levels of per capita income groups, "Group-L1, with per capita GDP at or above 60% of the US; Group-L2, from 20% to under 60%; Group-L3, from 5% to under 20%; and Group-L4, below 5%". The same, countries are also grouped on the basis of their catch-up speed relative to US, "Group-C1, at 3% per annum or above; Group-C2, from 1% to under 3%; Group-C3, from 0% to under 1%; and Group-C4, under

0%". The speed of catch-up is calculated relative to US as the difference in the average annual growth rate of per capita real GDP between each country and the US. Japan comes in the Group-L1 and Group C3, Korea Group L3 and Group C1, India Group-L4 and Group C2 and Pakistan comes in Group-L4 and Group C3. Pakistan is low income group and have failed to catch up. The Pakistan comes with Nepal and Bangladesh. However, other Countries of Group L4 specially, Cambodia and China have progressively catching up. However, Pakistan is the only country with no catch that has moved up one level as it reached to income group boundary from 5.0 % to 5.7 % as of the US.

This paper presents a convincing argument in this order. First, it highlight the previous work that enforces the importance of this research and basis for targeting these countries. Second section reviews the structural changes of information technology policy of each country. The third section highlights the research and development efficiency. The fourth and fifth sections present the technology and industry, technology and university respectively; their development indicator and its correlation with the economic growth. The correlation graph represents the simple relationship with the GDP. It does not show the cause of the growth of productivity. This is to show the trend in each country. Sixth section explains service economy and the role of science and technology policy integration in the seventh section. Then, in the last section, with the help of content analysis we discuss the development stages. Later in the section, based on discussion we draw conclusion.

2. Literature Review

In recent years, the globalization of rapid technological progress, especially in information communication technologies, has heightened the strategic importance of new technologies in a competitive marketplace. Technology adoption effect the productivity growth. Technology changes in information communication technology goods have accelerated productivity growth (Timmer & Van Ark, 2005; Van Ark, O'Mahony, & Timmer, 2008).

One of the study compared the Europe and USA and it is found that EU lagging behind the USA in terms of ICT contributions to productivity growth. The reason is less focus on regulations and structural impediments in product and labor markets factors to rapid catch up (Van Ark, Melka, Mulder, Timmer, & Ypma, 2002). The forces of the ICT transformation on labour productivity growth in European Union and the United States is analysed by using a growth accounting technique. The result showed that ICT capital deepening and total factor productivity (TFP) growth originating from ICT goods production are the factors that lead the US (Timmer & van Ark, 2005).

R & D activities are significant determinant for adoption of Information Communication Technology in Industries (Lal, 1999). There is correlation between fall and ascent of information technology spending and GDP (Rojko, Lesjak, & Vehovar, 2011). The impact of information communication technologies diffusion has negative relation with the market rigidities (Cette & Lopez, 2011). Lower growth of the country is the result of lower investment in ICT and small share of technology producing industries (Timmer & Van Ark, 2005).

In the era of globalization information communication technology has reached critical mass while risks are associated with the adoption of technology. The revolution of the technology which is considered as a bright new set of opportunities is going to be recognized as a threat to the established way of doing things in organizations and society at large (Perez, 2002). Government role is very crucial in mitigating these risks. The policies could limit the risk for disbelief against technology usage and upgrade its maturity level (Kyriakidou, Michalakelis, & Sphicopoulos, 2013).

It has been identified that role of government is salient in information communication technology adoption. Government policies about tax and tariff subsidies, rules regulations, restrictions, incentives and support with regards to a particular technology play an important role in adoption or rejection of any technology. (Bowonder, Miyqake, & Singh, 1993) also point out that the general stability of the countries in which the organization operates and the specific attitude of the elected government officials towards adoption of certain technology plays a crucial role in technology adoption decisions. New enterprises exhibit a higher likelihood of technology adoption. Therefore, they need to be nurtured through proper fiscal incentives for technology adoption including tax credits for research and development activities (Mahmood, ud Din, Ghani, & Iqbal, 2009). For technology transfer or technology adoption, market is primary actor but government is also major actor of market. Therefore, the government should take necessary administrative means for the factor those hinders the adoption of the technology. It is the government's main responsibility to take care of the economic growth, resources and socio-economic problems for the sustainable development of the country. Therefore, the government should take measures in policies and procedure to promote adoption of technologies.

Many studies have analysed the impact of technological advantages on countries' international performances. Three complementary issues have been addressed in this frame. The first issue relates to the long comparative to short run effects of technology, second deals with the international and fields differences in the way technology affects. Besides that some works have distinguished the impact of upstream and downstream technological linkages on the dynamics of trade performances (Laursen & Drejer, 1999; Laursen & Meliciani, 2002). Some studies argue that technology matters, although to different extent and according to the measure used. Moreover, their findings suggest that this pattern is relevant to country, sector and time specific basis. Most of the studies have focused on the period between the seventies and the early nineties.

Information communication technology policy production is required for economic growth. It is analyzed that the formation of virtuous cycle in new science and technology leading to functionality development which is vital in knowledge-based economic development. Hence, building infrastructures, and establishing supportive institutions and renewal of the system for the development of science and technology are vital to fuel the stock of knowledge (Wong & Goh, 2012).

"It has been noticed that technology development and rapid economic growth are two sides of the same coin. Development planners consider technology to be one of the most important factors determining economic and social development. Therefore, S&T indicators can contribute

towards economic growth by encouraging evidence-based policies which rely on the statistically collected data." (Bhutto, Rashdi, & Abro, 2012).

Policy research on science, technology and innovation significantly brings, not only impact on government policies but also benefits to business and society (P.-C. Lee & Su, 2011). "Government incentives can attract investors to new, riskier vehicles which result in job and wealth creation that would not otherwise have occurred" (OECD, 1997).

The growing importance is associated to the knowledge, innovation and technological change in policy-making. It is substantially important to better understand the connection between science and technology on the one side and economic performance on the other side (Lundvall and Borras, 2005).

Japan is the most developed country in Asia. It has the second largest National Science and Technology system in the world after the USA according to R& D expenditure and number of researchers. It is leading in the Information Technology Innovation; on the other hand it also has strong policies. Its science and technology policy has shifted emphasis over the past 60 years. The government changes S&T policies time to time according to technology innovation and current situation (Kitagawa & Schuman, 2007 ; "The New Strategy in Information and Communications Technology (IT) Roadmaps", 2012).

Denmark, Japan and the United States are countries where policies and programs are administered centrally, yet, with some differences (OECD, 2009). Japan had sharply contrasting growth rate by importing, improving, developing and diffusing new technologies, products and processes in the 1980s (Freeman, 1995).

Developed nations, as diverse as Canada, Japan and Korea, have achieved success in ICT development by effective government strategy. The government plays a role for integration of technology incubation (Kelly, Gray, & Minges, 2003). Korea is an example of notable catch up and is called as the "Miracle of Han River". Korea started with virtually nothing after Second World War and now is the developed country and third largest economy in Asia.

Korea, a newly industrialized country, has successfully shifted its current economic paradigm to post-industrial knowledge-based economy. Korea's economic growth is gradually shifting towards high technology manufacturing and knowledge-intensive business services. The country has achieved significant levels of science and technology production and in the process of development (Wong & Goh, 2012).

It was explored that the Government of India has a firm commitment for support to science and technology. India's annual economic growth rate is increasing drastically. Certain regions and cities of India have emerged as global centers for science and technology such as Bangalore. The country will be in a good position in the future (Rao, 2008).

Pakistan is a developing country. One of the issues and challenges in Pakistan is that the government policies should be conducive towards providing quality technological infrastructure as a backbone to run e-government portals in the country (Kazmi, 2010).

In the view of the literatures, this study performed the in-depth empirical analysis of the evolution of technological performances of last 20 years. More precisely the study focuses on the patterns of relative stability, on the changes in the levels, the structure and the convergence of technological specializations between the 1990~2010. Then the issue of the relationships between technological and economic performances is addressed at the country and sectoral level. In this frame we address mainly three set of issues; science and technology policy evolution and integration, R&D efficiency, Technology link with industry and university.

3. Structural Changes of Science and Technology Policy

Japan stepped to the developed country status after the shock of the Second World War. The following phases identified to analyse the steps of Japan's information communication technology policy development:

2nd world war ~1960	Catch-up technology
1960~1980	Technology exporter from technology importer, Mega National Projects
1980~ 1990	Standardized national innovation system, basic research shift
1995~present	Transformation for "science-based innovation", Incorporation of Universities, National public research institutes and funding agencies.

The fast growth countries of Asia are called Asia Tigers. Korea is also included in Asia Tigers. Ministry of Korea established a vision of a ''knowledge-based economy''. The vision is that every citizen will have a personal computer, the government will accelerate development of an information infrastructure and all the ICT stakeholders will contribute by joint work. The major structural changes of the Korea's information communication technology policy is as:

1967	Ministry of Science and technology (MOST)
1966~1970	National Innovation System (NIS)/Government Research Institute (GRIs)
1982	National R & D programme
2003	Public research organizations/ new role of S & T
2004	New science and technology administration system

Korea's information communication technology policy established a well defined National Innovation System (NIS). The NIS played important role in the fast pace economic growth of the country since 1970's. The NIS policy is integrated with the other polices for the national economic and industrial development. Korea has strong S & T infrastructure. The ministry of science and technology (MOST) is mainly responsible for decision. The government established

Korea Institute of Science and Technology (KIST), Industrial technology research institute and Science and Technology promotion Law.

Indian information communication technology policies since 1979 have positive impact on major sectors. Science and technology policy has following main phases:

1947~70	Policy for Sciences
1974~ 1979	1st Science and Technology Policy
1983	Technology Policy Statement
1991	Economic reforms and Industrial Policies
2003	Science and Technology policy (not implement)
2012	Industry University collaboration

Science and technology policy of India has played an important role in the social economic development. R & D for the technology development promoted by the Indian Patent Act 1972 and related IPR policies.

Pakistan came into existence in 1947. At that time, Pakistan had not inherited any technology infrastructure. Therefore, government realized the importance of science and technology and established the Pakistan Council for Scientific & Industrial Research. These are the main stages of science and technology policy development:

1947	No Infrastructure
1984	1st Science & Technology Policy
1988~93	Science and Technology Fund
1994	First National Technology Policy & Technology Action Plan
1996	Review Committee
2000	Committee of National Commission for Science and Technology Policy 2008 Draft National IT Policy
2012	National Science, Technology and Innovation Policy

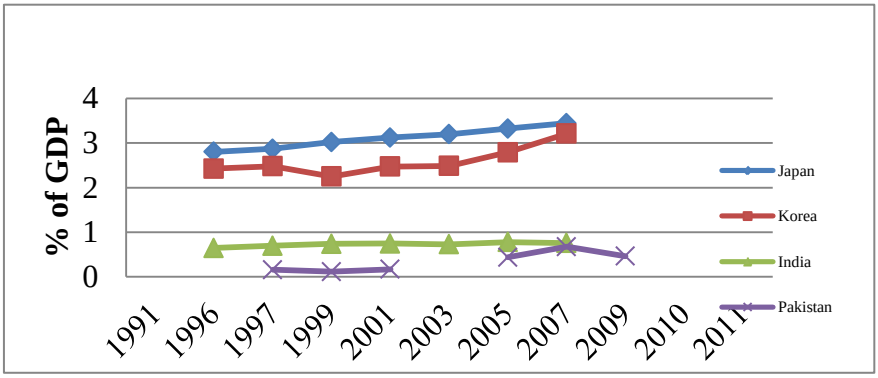
Pakistan's Science and Technology Development Corporation established for development in the area of technology. In 1988~93 science and technology fund considerably increased to meet the requirement of the time. Government realized the importance of the policy and started working for formulation of technology policy. The first National Technology Policy and Technology Action Plan approved in 1994. The Technology Policy emphasized on R&D, established Human Development Program, sandwich-type PhD programs, new universities and new projects. A committee constituted to review the progress of Science and Technology in 1996.

4. Research and Development Efficiency

In the globalized knowledge based economy, there is a pressing need to develop the technology innovation policies on regional and national level. Japan gradually increased its R&D expenditure that is now surpassing the US. The R&D initially was based on imported technology and then shifted to innovation. (Kitagawa & Schuman, 2007).

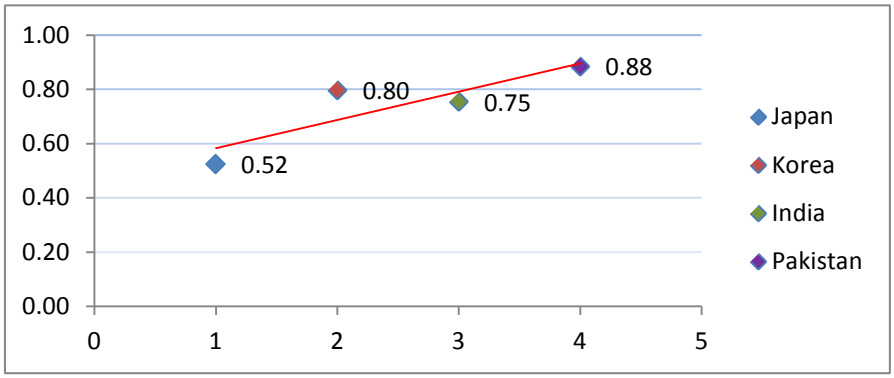
The Research and Development Expenditure of Japan, Korea, India and Pakistan is taken from the World Bank Development Indicator. The author calculated the correlation of R&D with the GDP per capita. The purpose of this comparison is to show simple relationship of GDP and R&D expenditures. The graph shows time series data of Japan has steady positive growth in R&D expenditure in Asian countries during last 20 years. While, now Korea has drastically increased R&D expenditure. The correlation with the GDP per capita is higher in Pakistan and Korea. This shows that R&D expenditure in Pakistan and Korea is comparatively significant for the economic growth.

Figure 1: Research and Development Expenditure



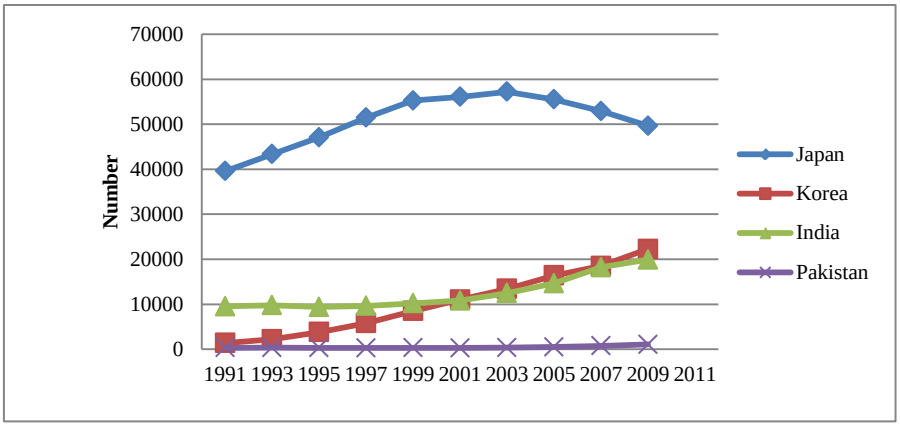
Source: World Development Indicators, 2013

Figure 2: Correlation Coefficient of R& D Expenditure and Natural logarithm of per-capita GDP



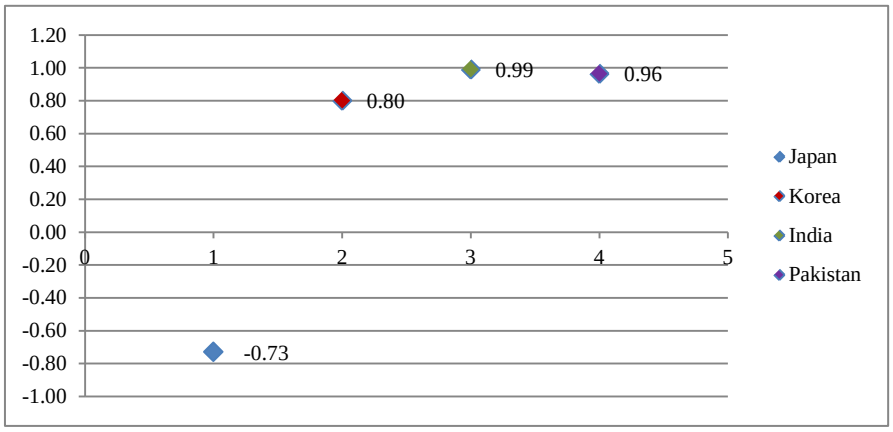
Source: Author

Figure 3: Scientific and Technical Journal articles



Source: World Development Indicators, 2013

Figure 4: Correlation Coefficient of S& T journal & GDP per Capita

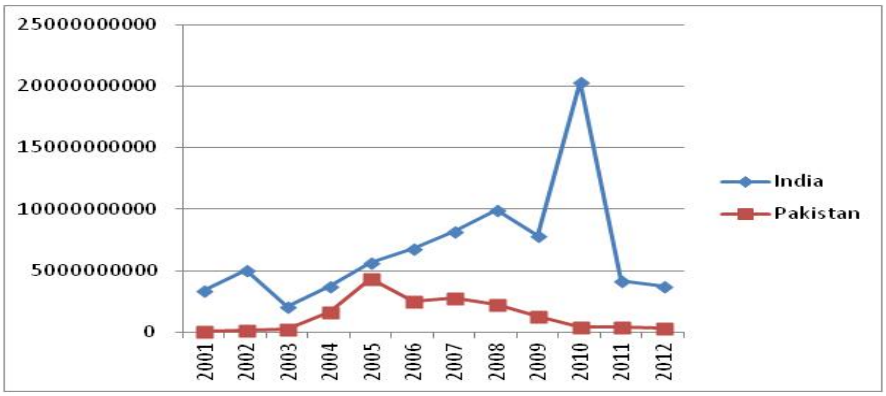


Source: Author

The Science and Technology Journal publication is shown it is considered as one of the science and technology indicator. It is clear that Japan has the highest rank of science and technology journal publication in Asian countries during last 20 years. While India has highest correlation of the scientific journal publication with the GDP. It shows that in developing countries, science and technology journal publication has high impact with the growth of the country.

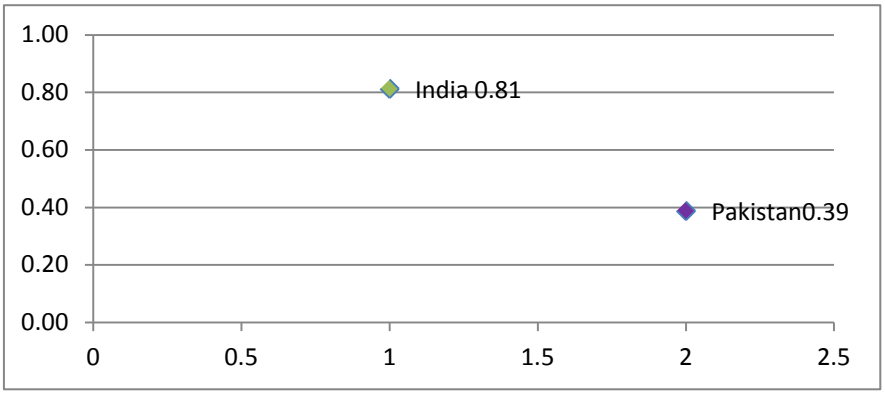
Many studies have analysed that even the ICT investment itself is not the cause of the growth productivity. To analyse the output efficiency many factors other than ICT is also directly related such as human resources and organizational effect.

Figure 5: Investment in Telecoms with private participation (current US$)



Source: World Development Indicators, 2013

Figure 6: Correlation Coefficient of Telecom invesmtent



Source: Author

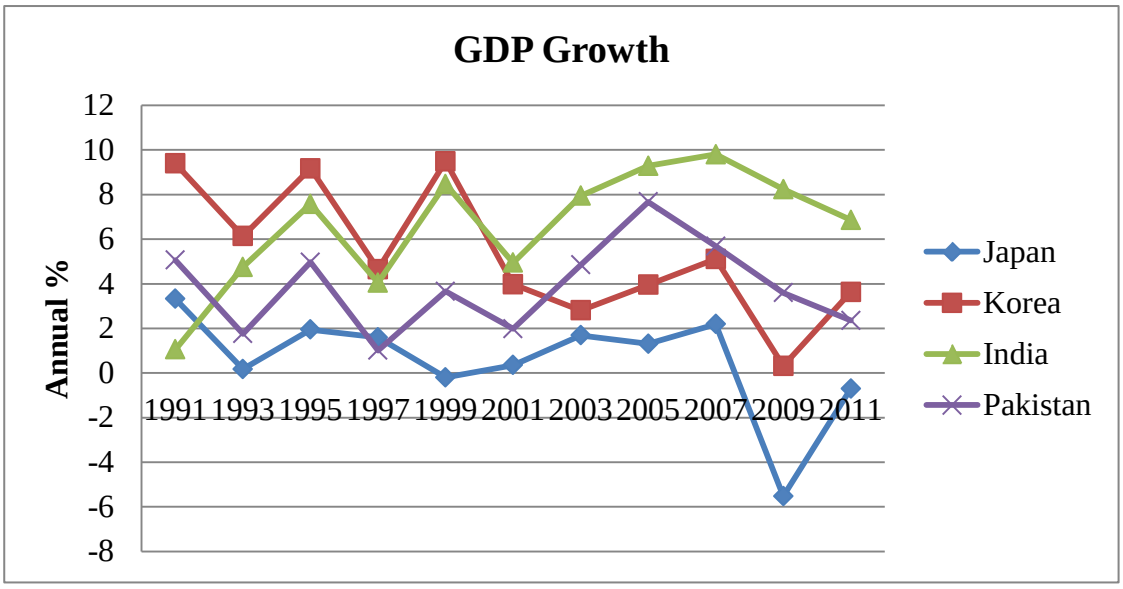
The investment in the telecommunication is higher in the India and has high positive correlation with the GDP. We could not find the Investment in Telecom data for Japan and Korea from the World Bank Development indicator.

5. Technology and Industry

This section discusses the Industrial development of selected countries. Japan University Industry cooperation was established in the post war period. Industries contacted the universities for hiring the skilled labors. As a result, Japanese industries achieved world class status in 1980's. The Ministry of International Trade and Industry (MITI) was responsible for policies related to the manufacturing sector and financially supported a number of R & D projects. A legal framework was established in Japan to promote university- industry technology transfer (Yamamoto, 2004; Fukuda, Watanabe, Korenaga, Seimaru, 2008).

The Indian government formulated policies regarding ICT software and established Special Economic Zones and Software Technology Parks (Krishna, 2007). The policies to support Public Private Partnership also played an important role in technology development of India.

Figure 7: GDP Growth



Source: World Development Indicators, 2013

The time series graph shows that India has steady positive GDP growth. India has developed rapidly and impressively institutional and human resource base. India has impressive growth especially from 2001.

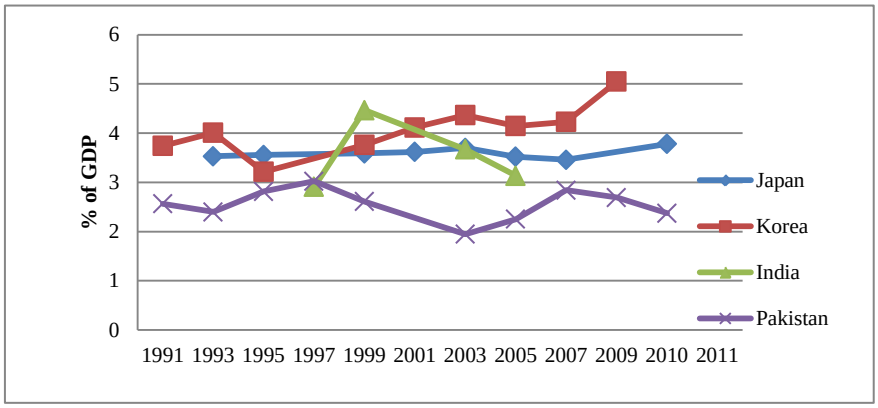
Government of Pakistan formulated the trade liberalization and privatization policies first time in 1990's. Pakistan Council for Scientific and Industrial Research and the Pakistan Atomic Energy Commission scientists collaborated with the Universities. But there were no collaboration between Public R &D institutions and private industry. Moreover, the GDP growth rate was not sufficient for large population growth rate (Saeed, 2006).

6. Technology and University

This section explores the University's role in the selected countries for economic development. Higher education sector R & D expenditure is growing fast in Japan. Universities have a new role in the information communication policies. University reforms are considered a part of transformation of Japanese research and innovation system since the 1990s. Legal government structure of the national universities changed to "corporate status" for better efficiency and increased independence. Educational reforms were accelerated towards economic and industrial policy objectives during 2001 to 2004. (Chen, Watanabe, Griffy-Brown, 2007).

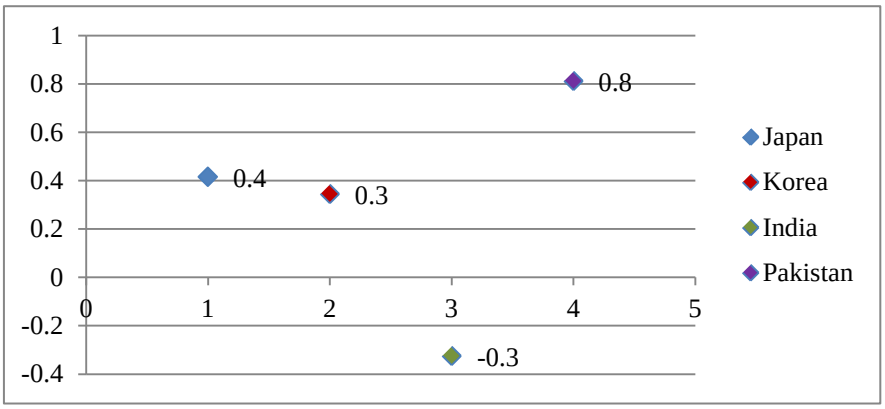
The universities financial system was reformed by introducing the "black grant system". The budget for the universities substantially increased in the past few years with the objective of having world top level research universities.

Figure 8: Public Spending on Education



Source: World Development Indicators, 2013

Figure 9: Correlation Coefficient of Education



Source: Author

In recent trends, Korean government is focusing on the basic science and technology education. Korea's universities have the most active role in Publications. (Hargittai, 1999) The recent phenomenon is to produce qualified doctoral and master human resources in the science and engineering field. Even now the supply for education has increased from the demand of the education. It is expected that it will reach to saturation point.

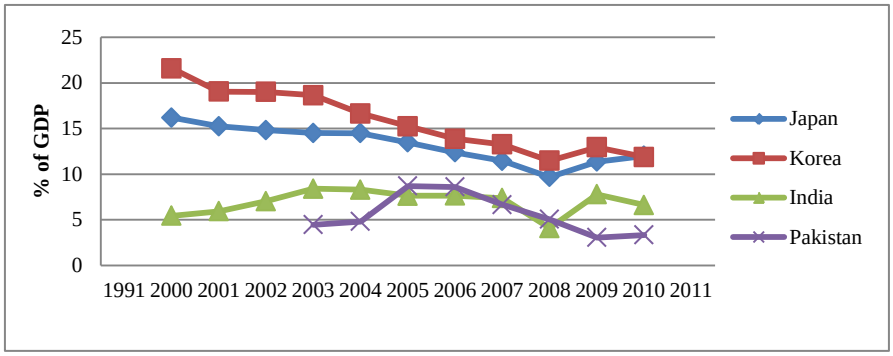
Pakistan has 132 Universities including four new universities established in 2009-10. However, during 1995~2005 the four engineering universities produced only 4-5 PhDs. Universities and colleges established to train R &D personnel. Many new institutions has been established but the finances for research are not enough to do R&D (Turpin & Krishna, 2007).

The above comparison shows that Pakistan has lowest public education spending, and Pakistan has highest correlation of education with the GDP. However, Korea has highest spending on the education and has low correlation. The reason behind the low correlation of Korea is that the country has already achieved saturation level of education, while in Pakistan; there is still a capacity for improvement.

7. Service Economy

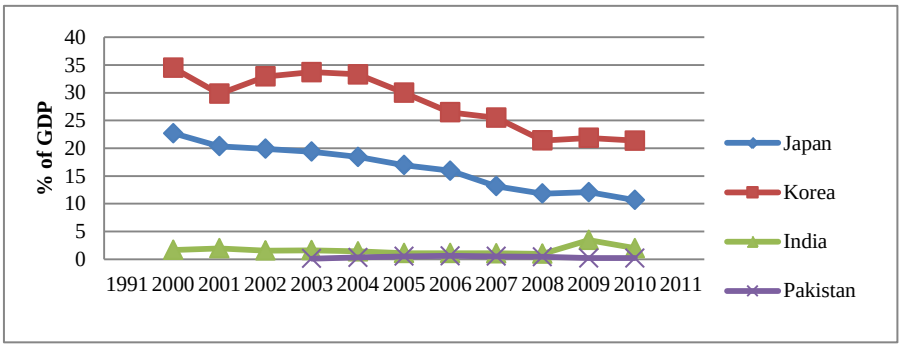
Service economy sector has also effect on the economic growth of the countries. Korea has the highest imports and exports of technology goods and services among these selected countries. Korea is utilizing imported technology goods for Research and Development. R &D expenditure is increasing for technology development.

Figure 10: Imports of Good and Services



Source: World Development Indicators, 2013

Figure 11: Exports of Goods and Services

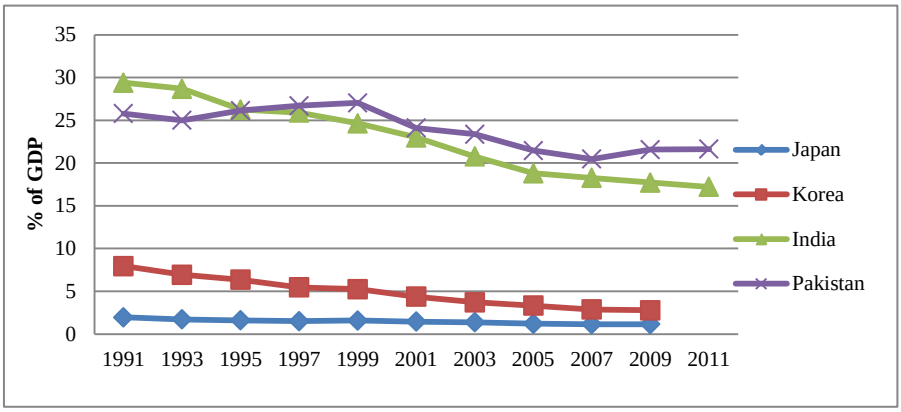


Source: World Development Indicators, 2013

It is clear in the graph that from 1991 to 2011 Korea had highest imports and exports of technology goods and services. In Korea's NIS the lion's share of the R&D is from the industrial sector. Most of the share of R&D is from the top 20 companies. Large companies share is high, then the SME's and after that venture businesses. (Saleem & Higuchi , 2012)

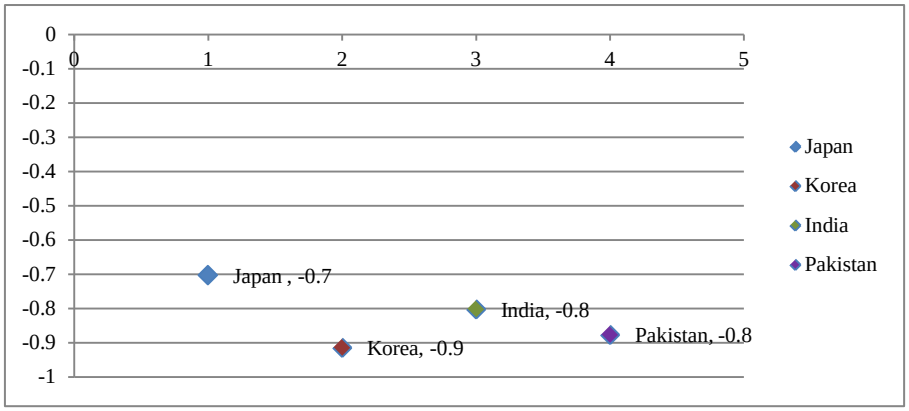
Pakistan's population is 180.71 million of which only 67.55 million live in the urban area. The economy is mostly dependent on the agriculture and 45.1 % of the total workforce is employed in agriculture sector. The government's main focus remained on the agricultural related R &D (Pakistan Economic Survey 2011-2012).

Figure 12: Agriculture value added % GDP



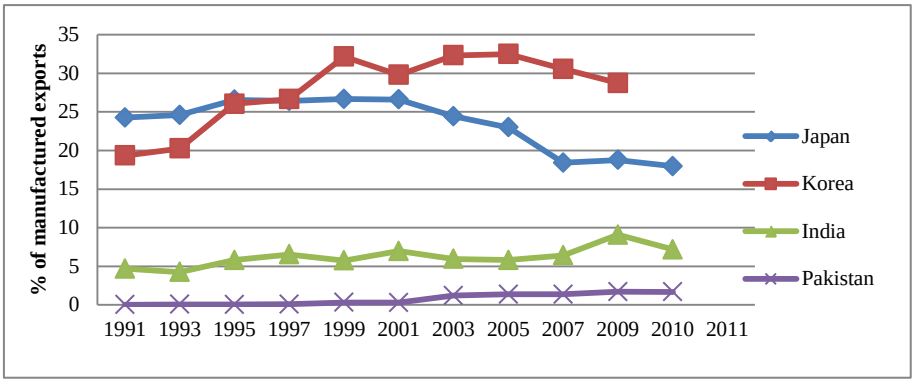
Source: World Develpment Indicators, 2013

Figure 13: Correlation Coefficient of Agriculture value added and Natural logarithm of per-capita GDP



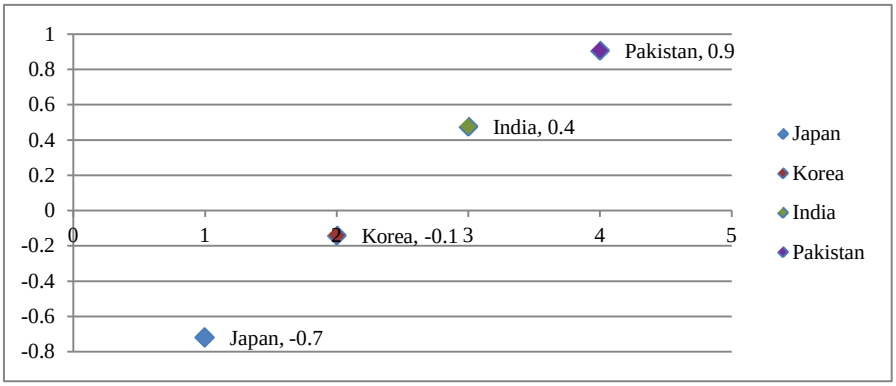
Source: Author

Figure 14: High Technology Exports



Source: World Development Indicators, 2013

Figure 15: Correlation Coefficient of High Technology exports exports (% of manufactured exports) and Natural logarithm of per-capita



Source: Author

In Pakistan, agriculture sector is contributing to the main portion of the GDP, while the Industrial Sector is not efficient. However, it is not surprising because it is the same in most of the developing countries. Many developing countries are not able to do R & D and have high risk and low funds so they rely on the technology from other countries. The decision to adopt the right technology at the right time is also very crucial. However, it is the best solution considering their current situation. In past years, the technology was imported in Pakistan to fulfill the requirements of the country but there were no technology policies and appropriate regulation controlling the flow of technology, the technology transfer process was biased for imported technology and on turnkey basis. There was no real transfer of technology and R& D for imported technology.

8. Science and Technology Policy Integration

Here we discuss the efforts of countries for integration of their science and technology policy. Ministry of Economy, Trade and Industry (MITI) in Japan proposed a plan for reforming universities as part of the national industries policy. After that MEXT released “Toyama Plan” for basic principles for structural reforms on Universities. In the plan three changes i.e. reorganization of national universities including merger of some institutions; introduction of business methods to national universities through the process of “incorporatization” and introduction of competitive mechanism into the university sector, including national, public and private universities.

As the case of Korea, in the beginning of development Government Research Institutions (GRIs) played important role and after that private sector also contributed for NIS. The number of GRIs expanded. Meanwhile, management system of GRIs changed for research and operational efficiency (Yim, 2007).

Knowledge is a fundamental factor in building the innovation base sectoral system in the India. But India still lags behind the Japan and Korea in transformation of its overall science and technology regime. The latest five-year plan 2012 is focusing on the innovation gap. The plan is to

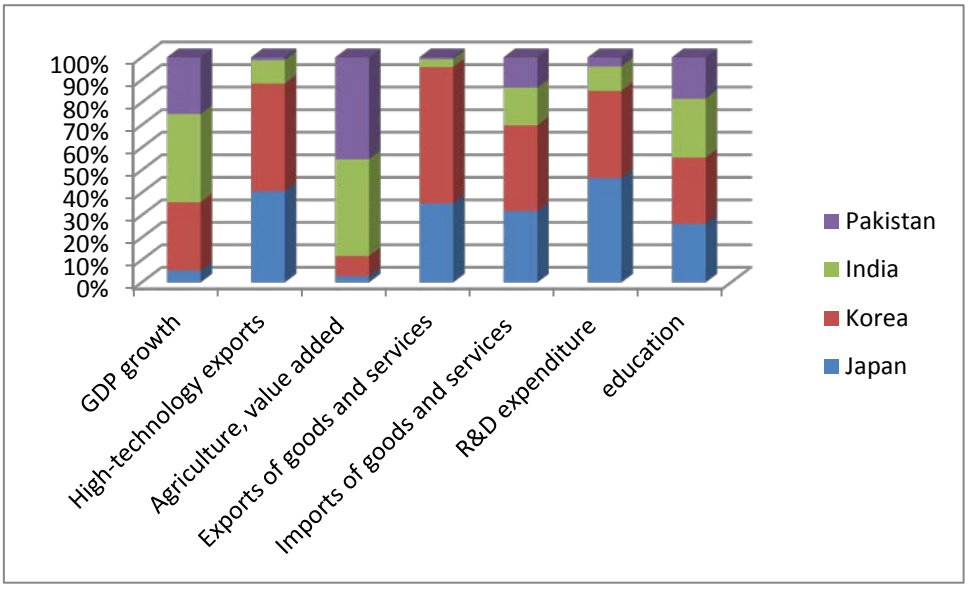
promote the industry-university collaborations to develop new programs and skill in the graduates of science and technology (National Industrial Policy, 2012).

Pakistan Council for Science and Technology (PCST) is responsible to advise the government on S&T policies and plans. PCST proposes measures for the promotion, development and application of science and technology. PCST also works as the Secretariat of the National Commission for Science and Technology (NCST), the high level decision-making body for S&T development, headed by the Prime Minister of the Country. PCST, in consultation with the ministries and government departments, R&D institutions and universities, skilled scientists and technologists, and representatives of industrial sector, plans for Science and Technology and R&D activities. These plans are reviewed by the Executive Committee of the National Commission for Science and Technology (ECNCST). Finally, approved by NCST (Pakistan Council for Science and Technology, 2013; Government of Pakistan Ministry of Science and Technology, 2013).

9. Discussion

First, it was shown that the Information communication technology has different growth relationship in different sectors. It was cleared that the R & D and Scientific and Technical Journal publication has highest correlation coefficient in the developing countries compared with the developed countries. That shows that the developing countries have high information communication technology absorption capacity. Therefore, the developing countries should pay more attention to technology improvement, which can be in any form such as research and development or from imported technology. It was also observed that Pakistan's government focus is on agriculture sector polices and this is the reason that 20 years development indicator shows substantial growth in this sector. However, it is not reflecting much benefit on the country's economic growth. Pakistan does well in terms of readiness than in the environment and usage of technology. So it should focus on use of technology. In developing countries; Industry, University and Research Institution coordination can reduce the gap and create better environment for the research and development of the technology.

Figure 16: Average of Last 20 years



Source: Author

This paper attempts to synthesize the lessons from each country into a consistent advice for the other developing countries. An important lesson emerging from research is that policies need to reflect the diversity of information communication technology. Technology varies in terms of its accessibility to the people, its functionality, and its user requirements. Many people in low income economies cannot even read or write and they may have only restricted access to electricity. The countries differ in the degree and nature of their resources and infrastructure. Their population may live in urban or rural areas and they may vary with regard to literacy and other capabilities. Therefore, mega projects need to be initiated for the adoption of information and communication technology. The policymakers should produce effective ICT policies with the integration of other sectors such as industry, education, energy, and transportation according to the requirement. The policymakers must promote and push for the development of digital highway applications, such as cloud computing etc.

It is suggested based on the analysis that information communication policy can be used as a development tool. Policymakers need to move beyond simply tracking the availability and adoption of technology and establish tools for monitoring and assessment of its impact. Measuring the contribution of technology to economic and societal progress can make their benefits more evident. Therefore, increase the demand and stimulating the creation of even more applications. For doing this policymakers should identify the key metrics that allow for impact assessment, develop process, methods and tools for monitoring impact, and publish these outputs. These types of metrics can impact in the countries growth.

This analysis provides the opportunity to review the role of information communication technology policy in developed and developing countries. Nevertheless, the developing countries face different challenges including lack of financial resources.

10. Conclusion and recommendations

This paper aimed to analyze the relationship between information communication technology policy and countries economic growth. The analysis used different type of technology indicator and economic growth indicator. Secondly, changes over time traced by time series data during the period 1991 to 2011 and their correlation coefficient with the growth. The analysis of these combined indicators allows us to deeply understand the role of information communication technology policy historically. The paper attempted to present some major distinguishing indicator of information communication technology policy and more detail considering in economics and social. The paper endeavors rich content analysis concerning the identification of the economic structures and process of changes in information communication technology policy.

It is found that Japan's success depends on strong research and development. It is proved from the research & development expenditure and scientific and technical journal publication data. Korea is growing fast because of transferring vision from industrial to high technology knowledge based economy. Korea has the highest import and export of technology goods and services. Korea use imported technology for R & D. It is an important point that high exports require high imports. India has the highest growth in terms of GDP. This country has achieved high social economic development. Pakistan has highest growth in the Agriculture sector.

Finally, we conclude with a discussion, which is helpful to distinguishing the key indicators of the information communication technology adoption and realizing its importance for development of the country. This paper concludes by evaluating the growth trends of these countries and suggests what they can learn from developed countries.

This research is limited by the lack of officially published latest data for some countries. However, the study uncovered the strengths and weakness of each country's information communication technology policy. In addition this research explored new direction for information communication technology study in the developed and developing countries. The conclusion gives direction for further research. It shows that the Industry and Universities are the major sectors for the economic growth of the developing country and developing countries have capacity for improvement in these sectors.

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