

Globalization and ICT Innovation Policy: Absorption Capacity in developing Countries

Ayesha SALEEM, Kiyohide HIGUCHI

Graduate School of Global Information and Telecommunication Studies, Waseda University, Tokyo, Japan

dua@fuji.waseda.jp, higuchi@waseda.jp

Abstract— This paper is about the new role of academic institutions in the economic development of developing countries. Educational institutes are significant in propelling economic development as they are the powerful drivers, technology centres, developers and investors. Universities can affect the economic growth of developing countries. The purpose of this new role of academic institutions is to touch virtually every aspect of daily lives and the prosperity of the communities living in rural areas. At a larger scale it aims to initiate a process of policy learning, exchange between countries in different stages of economic development and knowledge sharing with their universities research students. The study identifies the current technology innovation in the field of education and analyzes the case of developing and developed countries. To demonstrate, we do an in-depth study of Pakistan’s education system.

This paper explores strategic decision by using game theoretical analysis. The paper constructs a game model subject to preferential policy between Government and Universities. It offers three games that give the overview of the role of the government to promote the quality of education. The paper finds the equilibrium of the game under three specific conditions. The result shows that better policies lead to quality education that foster the development of the country. It clearly shows that having an autonomous body to regulate the education policies can promote the innovation and technology adoption. This study is two-fold; it provides the insight of university-government interaction as well universities’ interaction among themselves.

Keyword— ICT, Innovation Policy, Role of Universities, ICT education, Technology catch-up/transfer, Game Theory

I. INTRODUCTION

THIS research focus on Pakistan, officially the Islamic Republic of Pakistan covers an area of 796,096 square kilometres. Pakistan has a very high growth rate and is the sixth most populous country in the world with an estimated population of 184.3 million in 2012-13. Almost 70% of the its population (i.e. 110 million) lives in rural areas. Adult literacy rate (10 year and above) is 58 %, literacy is higher in urban

areas (74%) than in rural areas (49%), Public spending on education as percentage of GDP is 2.1 %. According to Labour Force Survey of 2010-11, 44.9 % of the total workforce is employed in agriculture sector, 13.02 % in manufacturing, 6.62% in Construction, 5.23% in Transport, 13.66 % in services and 0.1 % in others. Whatever progress Pakistan has made, most of its gain is not shared in the rural area. In rural area, structural changes and improvement in factor of production is very low. Human Development Indicators are also low. [1][2]

Most of the rural areas of Pakistan are similar with respect to their infra structure, economy and resources and are diverse in nature at the same time by their socio cultural conditions. Rural areas are generally backward in every aspect. There is a need to educate people, improve their healthcare services and to create job opportunities; there are many fields to develop like a considerable number of developmental project are being implemented by World Bank, ADB and NGOs. However all such projects have adopted the progressive approach for development which takes time. If we follow the same pattern that has been adopted by the OECD countries then it will take the same time which they took to be in the present position. They follow the same traditional pattern. If we start to educate all the children from a village, it will take 30 years for that village for all children to be educated and use their knowledge for the growth of their village. The other point is to provide health care services which also have a long term affect on the economic development.

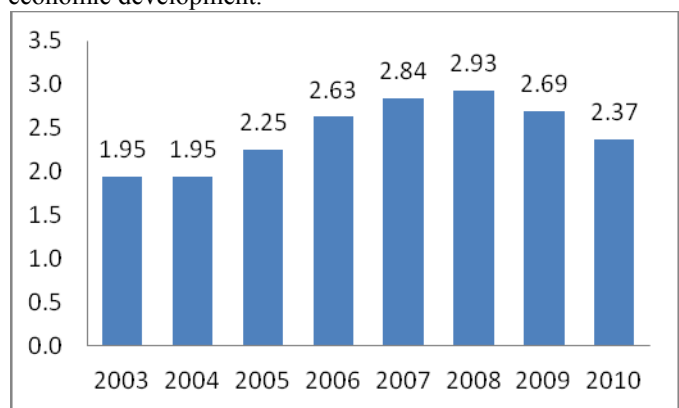


Figure1: Public Expenditure on education (as % of GDP) [2]

Many Universities around the globe have started comprehensive reviews of the curricula and introduced new strategies to transform the university learning and teaching approach. However, the quality of higher education in Pakistan is way below. Pakistan has 138 Universities including six new

Manuscript received September 27, 2013.

Ayesha Saleem is PhD student in Graduate School of Global Information and Telecommunication Studies, Waseda University, Tokyo, Japan (corresponding author phone: +81-80-3240-5875;+33-758-200-164 e-mail: dua@fuji.waseda.jp; Ayesha.saleem@OECD.org).

Kiyohide Higuchi is Professor of Graduate School of Global Information and Telecommunication Studies, Tokyo, Japan (email: higuchi@waseda.jp)

universities established in 2010-11. There is a pressing need to re-assess the current curriculum with the hope of adjusting its standard. Many universities have regarded understanding Information Technology (IT) and mastering the basic skills and concepts of IT as part of the core of education, alongside reading, writing and numeracy. In order to enhance the global competence by universities is the latest proposal for the developing countries like Pakistan.[3][4][5]

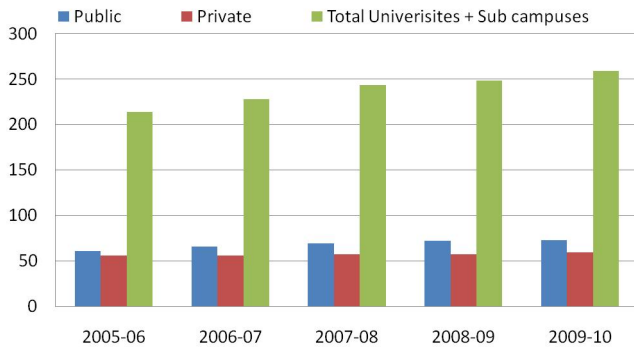


Figure2: Universities/Degree Awarding Institutions in Pakistan [3]

II. LITERATURE REVIEW

Internationalization is not only about learning elsewhere, but it is also about learning to solve local problems or address local issues within an international context; or learning to address international or global issues within a local context. Globalization is constantly changing the employment prospects of our workforce. Universities can do this by providing employers with graduates who are not only technically knowledgeable, but globally competent, as well.

Now the question arise who is responsible to take initiative and how it is possible. According to OECD share of private expenditure on educational institution is highest in Chile, United Kingdom, Korea, Japan and United States respectively. It is important policy aspect to balance the share of public and private financing of education and currently it is an important issue in many OECD countries.

There we discuss some challenges to overcome for promoting the technology adoption capacity with the help of universities.

A. Globalization and Change of Technology

The world has changed, it has become flat, more facilities are available, new techniques has developed. Thomas L. Friedmans’s in his book discuss with the help of examples that how and why globalization has now shifted into wrap drive [6].

Growth is not the process of simple replication. It reflects a never ending flow of inventions, innovations and technological advancements leading to improvement in the production possibilities. Technology and the process of production have changed, and new products and services has introduced. Innovation has enabled doing things in different yet more efficient and cost effective ways.

Before 20 years, there was no computer, no concept of the internet no search engine, telecommunication was not available. These technologies were not used for the economic development. There are new conditions for future prospects,

hyper growth is possible, and mobility of the resources is also possible. Use of new techniques changed the life and sudden change towards modernization can be possible.

The author discussed the entry condition in the world market for catching up has changed and is entirely different from 50 or 100 years ago. He grouped the countries on the basis of the patterns of economic growth as innovator, 19th century followers, 19th century cases of stumbling back, underdeveloped and stay behind, Learner or 20th century followers, 20th century cases of stumbling back. Pakistan is included in Group IV that refers to the country “underdeveloped and staying behind”. [7][8]

In the era of global competition it is recognized that changes in technology and competition have diminished many of the traditional roles of location. Yet clusters, or interconnected companies with in the same area, are a striking feature of virtually every national, regional, state, and even metropolitan economy, especially in more advanced nations. The prevalence of clusters shows important insights about the microeconomics of competition and the role of location in competitive advantage. In the globalized world the old purposes for clustering have diminished, it has new impacts of clusters on knowledge-based and dynamic economy. Clusters represent a new way of thinking about national, state, and local economies, and they necessitate new roles for companies, government, and other institutions in enhancing competitiveness [9].

B. Internationalization of Higher Education

“Innovation involves getting new ideas accepted and new technologies adopted and used. The introduction of new technologies, methodologies or content into a university IT course can thus be considered as an example of innovation.”[10].

“Internationalization of Higher Education is the process of integrating an international/intercultural dimension into the teaching, research and service functions of the institution”.[11] With the economic rationale as a backdrop to internationalizing the higher education, the term “internationalizing the curriculum” is proposed as a strategy for internationalization. Internationalization has been discussed as the relevance and importance of student outcomes, teaching strategies and knowledge content and inclusive curricula and pedagogy.[12][13][14]

Numerous researchers emphasize the centrality of the curriculum and the internationalization of the curriculum, teaching and learning processes as critical elements of internationalization. Knight describes the curriculum as “the backbone of the internationalization process”. Other researchers concur, emphasizing the importance of an internationalized curriculum in providing a student-centered learning experience for all students and in preparing students to be successful in today's increasingly interdependent global society.

Indian IT industry has advantage on the other Ireland because of focused on English language skills for engineers and higher quantities of quality engineers. [15]

C. University–industry links

University links with the industry can enhance the performance of the faculty [16]. Institutional policy regarding University Industries links can build institutional direction as well give clear and explicit regulations for understanding relationships [17].

In the post war period Japan University Industry cooperation was established. Industries contacted the universities for hiring the skilled labors. As a result Japan industries achieved world class status in 1980’s. The Ministry of International Trade and Industry (MITI) was mostly 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 [18][19].

In Pakistan during 1990s first time Government formulate the trade liberalization and privatization policies. Scientists at the Pakistan Council for Scientific and Industrial Research and the Pakistan Atomic Energy Commission collaborated with the Universities. But there were no collaboration between Public R & D institutions and private industry. The GDP growth rate was not sufficient for large population growth rate [20].

III. UNIVERSITIES ROLE

In Japan the higher education sector R & D expenditure is growing fast. University has new role in the science and technology policies. Universities reforms considered the part of transformation of Japanese research and innovation system since 1990s. Legal government structure of the national universities changed to “corporate status” for better efficiency and increased independence. From 2001 to 2004 educational reform were accelerated towards economic and industrial policy objectives [21].

The universities financial system was also 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 of research universities.

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.

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 and its adoption.

A value chain model is suggested in which... “a central agency will play the role of helping in national intellectual property (IP) system in promotion and encouragement of local inventions and innovation. It will facilitate creation and management of IP assets in Institutions of Higher Learning, especially in assisting researchers on how to identify patentable inventions and take appropriate action to safeguard them from

exploitation. Also it will facilitate in commercialization of R&D results and innovation. This includes the process involving business strategies and techno-entrepreneur’s development that need to be implemented so as to reap best possible returns from R&D investment. Most importantly it will address significant issues as how to obtain financing for development of innovations via government and private venture capital funds for the commercialization of new and indigenous technology”[22].

Therefore, there should be new role of universities. The knowledge sharing by the universities is a way to achieve development, because the World has changed it is not the same

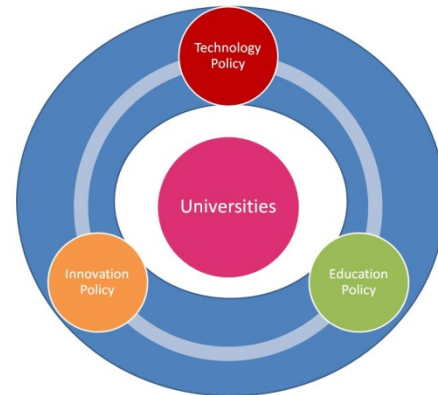


Figure3: Proposed Model

as it was 20 years earlier. A strategy should be evolved with collaboration of research universities and stakeholders of rural area.

A. Globalized Trend of Internationalization of Higher Education

As espoused in the abovementioned literature, internalization of higher education curriculum is vital towards economic development of a country to prepare students for careers that are potentially international and contribute to local economic development and competitiveness. Recent years have seen a tremendous expansion of ways in which higher education goes ‘international’. As well, international trends and developments taking place beyond national boundaries impact more easily on higher education policy at institutional and national levels, thus creating additional inter-connections between various changes. Consequently, it is not only difficult to keep track of the various concepts and terms used to describe new processes in the international aspects of higher education, it is also difficult to capture these interconnections. An additional challenge comes from the fact that innovations and changes are on-going and thus the field is evolving constantly.

University curricula in Information Communication Technology (ICT) necessarily require frequent changes, updating and even complete revision due to advancements in technologies and changes in how people and organizations make use of computers. The increased focus on achieving economic benefits and the technological advancement demands higher education policies on internationalization of ICT education. The most important reasons for integrating international topics into the ICT curriculum are:

1. To identify key issues, trends and area of growth and to elaborate policy statement that call for change and improvement.
2. Results in a more global orientation on part of students.
3. Sensitizes students to differentiate between countries in technologies.
4. Results in more interesting class discussions, and
5. Makes students more desirable in the marketplace. [11]

In effect, countries can be able to match other countries, such as India, in producing this 'raw material' of university-educated professionals in high enough quality and quantity it can become a 'Services-export Tiger' rivaling the growth rates of the fastest growing Asian economies. This, however, should not be seen as a case of 'picking the latest fad' but rather an example of one opportunity where investment in higher education could yield very high economic returns.

Acknowledging the growing needs to better prepare students for living and working in an increasingly culturally diverse and socially complex world, universities should develop new teaching and learning strategies to attain an internationalized curricula. Likewise, there is a need for a customized national curriculum in order to cope with the global world that could ultimately lead to the future production of quality graduates for job opportunities within and outside of the country, and be at par with other universities.

B. Model Universities

In this respect the University may introduce an internship program for the students for duration of six months. This should be made as a requirement of their study program. The student will have to spend that time in rural area of countries and then work to solve the rural area problems. They will be working as "Brain Circulation". That will affect the living status of the village. People of the rural area don't have facilities so even their own person after getting education don't want to come back to the place. The highly qualified people from different universities will work there, share their knowledge and will see the real situation to solve their problem. Education should begin from home.

People of the rural area of the developing countries should provided with free internet and mobile phone. That will not be a high cost. After implementing this strategy the social inclusion, gender equity, reaching remote areas and regional imbalances/disparities will be eliminated. The experiment and prototype manufacturing and the use of that prototype in the live environment will change the economic condition.

In many analyses it proves that universities play an important role for innovation because R & D is the key aspect of the innovation. So doing this initiative it is the knowledge investment in the rural area. Universities, public research institution and Science Park play important role in the innovation. Economic Development of the rural sector is strongly related to technological and scientific specialization and innovation. From the traditional process the developing country has to face painful transition process towards techno economic system.

C. Innovation Universities Example

An example of how a university can undertake its new role in different ways to enhance innovation explained in RMIT's initiatives in the East Gippsland region. In consultation between RMIT and the local community, RMIT questioned about the issues confronting the region and find out the way how best it might assist. They had a report on degradation of the ecological systems which had identified problems but there had been little follow-up. They recruited nineteen post-graduate students to follow up the initial report and identify solutions. Their research is being conducted in the region, and with those affected by the problems they seek to solve. They will report progressively on their results, reducing the normal dissemination time-cycle. They will have access to local, often informal or undocumented data, available only on the spot. This exemplifies a new way of working in collaboration and partnership with others and identification of research agendas by others.

A research university is one of the necessary conditions for economic restructuring. Research universities play a important role to provide scientific knowledge, technical expertise, and skilled workforce for implementation in the field. While in industrial growth we have successful examples of Silicon Valley in California, Route 128 in Massachusetts, and Research Triangle area in North Carolina are all close to major research universities, and this fact has been perceived as instrumental in positioning these areas on new growth trajectory.

John Hopkins Institute for Policy Studies in Baltimore offers service to the community through graduate and undergraduate student internships, seminars and briefings, and volunteer activities, each year the Institute's first-year students research a policy issue of particular interest to the City of Baltimore, and present their findings and recommendations to city leaders, community activists, local business owners, and concerned citizens, among others. [23]

Massachusetts Institute of Technology (MIT) has a program for International Development "D-Lab". The purpose is to foster the development of appropriate technologies and sustainable solutions within the framework of international development. In India M S Swaminathan Research Foundation (MSSRF) a Centre for Research on Sustainable Agriculture and Rural Development has established to harness the power of ICT in the knowledge, skill, economic and social empowerment of rural families based on the principle of reaching the unreached and voicing the voiceless. The MSSRF has collaboration with the D-Lab program. [24][25]

D. Initiative in Pakistan

Namal college is the initiative to trigger innovation for the benefit of the society with collaboration of University of Bradford, UK and LUMS, Pakistan. Namal Knowledge City is built in Mianwali a small district of Pakistan. Project building consisting of Computer Science, Software Engineering and Electrical Engineering departments with their laboratories has now been completed.

The development of Namal Knowledge City (NKC) is planned in three phases. The Phase-1 short certificate courses,

diploma in higher education programmes and undergraduate degree programmes has established, after that it will offer postgraduate degree programme in various disciplines. One of the main planned activities of Phase-2 is Namal College staff development and establishment of links with industrial partners to promote knowledge transfer at local and national level. Phase 3 will establish Technology Park, enterprises and commercial. [26].

In Pakistan Higher Education Commission is the primary regulator. Higher education commission is the autonomous body and is responsible for higher education policy, quality assurance, degree recognition, development of new institutions and uplift of existing institutions. Higher education commission program “Program for Collaborative Research” (PPCR). The objective of this program to involve the experts from foreign universities in developing curriculum, updating laboratory techniques, and provide guidance to post graduates students in universities of the Pakistan. This program encourages the community of foreign experts to develop joint-research programs with local faculty and to enhance expertise for the overall development of concerned departments. On the other hand Higher education commission is building the Nation Innovation policy for the university industry collaboration to promote the innovation. Nation Innovation policy preparation has started with the creation of an Innovation Strategy Working Group (I-SWOG) in May 2009. The members of the working group were the government, private sector and academia. Two workshops also organized in Karachi and Lahore. The CSF Karachi workshop released a Draft Strategy document “Pakistan Innovation Initiative: Towards Strategy and Implementation”. This document has sound base for making the innovation policy.

IV. ANALYSIS

Game theory has become a cross- disciplinary study of great importance for the mathematical social sciences. It offers the tool- kit applicable to decision problems in which the consequences of one decision may depend on the decisions of others, previous decisions creating the conditions for current decisions, simultaneous and subsequent decision. Game theory analysis is used to analyze that where the structural flaws lie and begs the question, "Can fix those flaws? The reasons to think where rules don't apply in particular case?" Understanding of game theory is vital to technology prioritization. It is also an important thing to evaluate for the think tank that was their predictions correct?

It has been argued that “operational characteristics of economic models, and in particular stability considerations, point strongly toward an equilibrium concept for dynamic dominant player models which implies that the players determine their best decisions depending on the current state of the system and the decisions of the other players, and rationally expecting that equilibrium decisions will be chosen in the future. This solution is called the feedback solution. It has the property that the original plan is consistent under replanning. The difference between the solutions in this regard does not depend on the presence of uncertainty. Because of this property, the feedback solution is the only one that seems likely to be

stable in the sense that decision makers grouping for equilibrium decision rules will converge on these decision rules” [25].

As Aumann has observed “those two aspects of game theory are really not two separate disciplines; they are part of the same whole”. For the purpose of the public policy, though it is not enough that cooperative and non- cooperative analysis are complementary, as Aumann observes. Rather we need analysis of given models that are linked, drawing on cooperative and non- cooperative approaches. This reflects the different roles of cooperative and non- cooperative models in the pragmatic project of the public policy, in that it is commonly the non-cooperative models that identify the problems, so that cooperative analysis of the same example is necessary in order to propose solutions [27][28].

Game theory concept has been used in solving problem of education [29][30][31]. However, this paper is using a new approach between Government and University role for adopting the technology.

Therefore, this paper uses this tool “Game Theory” for the solution of issue “How do the Government interact with the university to promote and adopt the technology and innovative integral process for the development of the country”.

Now we construct the following game between the government and University. The game is simultaneous game. There are two players, Government and university. The players also have two strategies.

Players:

Government and University.

Sequence of events:

Sequential decision by government and then University

Strategies:

(1) Government don't take any action in case when Universities are self aware.

(2) Government strategy is to take action and provide latest technology in the form of machinery/equipment, staff and investment.

(3) Government strategy is to make integral policies for the industry university collaboration.

Payoffs:

C1 = Government's cost to do action.

C2 = University's Investment cost

α = University extra cost to do action for adopt of technology the in the absence of Government support.

Pg = Government probability to provide subsidy

Pg- 1= Government probability for no subsidy

Pu = University probability to do action

Pu-1 = University probability not to do action.

S= Social Benefit

K = Technology

K1= New Technology

Y= Output $Y=y(K+K1)$

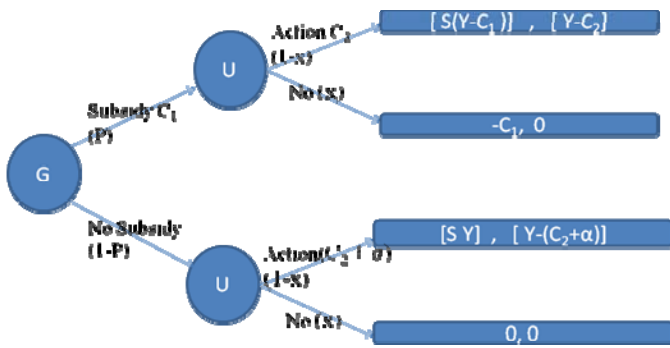


Figure 4 : Government University Game

If $Y-(C2+ \alpha) \geq 0$ then the University should do action

$Y-(C2+ \alpha) \leq 0$ then Government should do action or better policy.

Government Pay off:

Government provide technology /integrated policy

$$\begin{aligned}
 &= [Pg.Pu(S.Y-C1)] + [Pg(1-Pu)(-C1)] \\
 &= [PgPu.SY - PgPu.C1] + [Pg - PgPu(-C1)] \\
 &= Pg.Pu.SY - PgPu.C1 - Pg.C1 + PgPu.C1 \\
 &= PgPu.Sy - Pg.C1 \\
 &= Pg(Pu.SY - C1)
 \end{aligned}$$

Government do not provide technology /integrated policy

$$\begin{aligned}
 &= [(1-Pg)Pu.S.Y] + [(1-pg)(1-Pu)(0)] \\
 &= [(1-Pg).Pu.SY]
 \end{aligned}$$

University Pay off:

Government provide technology /integrated policy

$$\begin{aligned}
 &= [Pg.Pu(Y-C2)] + pg(1-Pu)(0) \\
 &= [PgPu.Y - PgPu.C2] \\
 &= [PgPu(Y-C2)]
 \end{aligned}$$

Government do not provide technology /integrated policy

$$\begin{aligned}
 &= [(1-Pg).Pu(Y-(C2+\alpha))] + [(1-Pg)(1-Pu)(0)] \\
 &= (1-Pg).Pu.Y - (1-Pg)Pu(C2+\alpha) \\
 &= (1-Pg).Pu(Y-(C2+\alpha))
 \end{aligned}$$

It is clear that Government payoff is greater if don't do action and university do it by them self.

$$Pg(Pu.SY - C1) < [(1-Pg).Pu.SY]$$

In other case

$$PgPu(Y - C2) > (1-pg).Pc(Y - (C2 + \alpha))$$

Now the decision of action base on the probability of the University if the probability of the university to do action Pu is near to zero such as Pu= 0.01, the government should provide the technology in the first stage of the game. The University's probability will increase. We construct the repeated game. In the second stage when the University's probability will increase to take action such as near to 1 Pu= 0.9 then government should not do action.

The government's aim is to provide preferential support to University's for the taking action and encourages them. As a result the government's pay off revenue increase in the form of increased social benefit of countries.

The game process on adoption of the technology and government role to provide preferential support to the Universities is explained in game tree and with the help of equation. The game has three strategies for government and Universities. Government takes action to provide preferential support for adoption of technology. The government will manage some expert to evaluate the technology for its effectiveness and make policy and process to adopt that technology. These expenses are shown as "C1". The Government provides new technology or implements a integrated policy which is the investment cost. Then University adopts new technology or in other case follow the integrated policy as a result the increased output in the form of human capital. The government social welfare increases. If government does not take any action then University will not be able to do action due to risk factor, less intensive and funds. The University has two strategies to adopt the technology and not to adopt. We use the Backward Induction game to take the decision of government bases on Univesity's strategies. As this game has both cases symmetric and asymmetric information game, in symmetric information both players clearly understand their strategies and asymmetric Information when only government aware of the strategy.

A. Case 1: Government University Non Cooperation Game

The institution is the backbone of the country, credibility of the education system is very important. Therefore, to keep the high standard in education, government should have information. Government should evaluate the education system and their capability. In case Government gets information that Universities has capability to do action and University is self aware and decides to do action by investing cost C2, University has more resources than government. In this case government plays not to do action as government has constrained to play A (action) because government has limited fund and the university plays action. The government gets 3 and the university 2. We assume in this case that both players are rational and the structure of the game is common knowledge. The university self awareness is the way to achieve to quality of education and improve the role of university. University hire competent faculty, improve the research and development facilities and collaborate with the industry. The government is likely to choose N with other players being better off and government save the fund for the other development projects.

The payoffs are intuitive. This is the government best strategy, as the government plays no action to the university and saves costs. The government knows that the university will take the right approach for the greater good by drawing upon its comparative advantage in the creation and transmission of knowledge. The government gets worst payoff of 0, as the university could not produce skilled human resource in all fields and that will not be able to cope with the current economic situation.

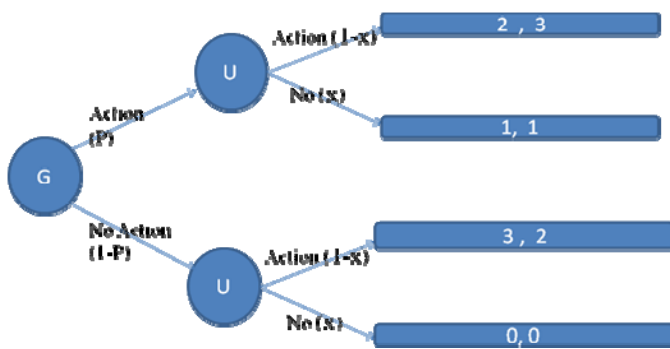


Figure 5: Government University Non Cooperative Game

While at (2, 3) the university obtains its best payoff of 3 in this one-shot game. For the government, (2, 3) is ranked next to the best, with a payoff of 2, as the government is playing role. On the point (1, 1) the university gets q. In the game the university has dominant strategy (2, 3) if the government plays A then university is better off playing A as well, and if the government plays N, the university is better off playing A. Thus, no matter what the government plays, the university is better off playing A. So the government would play N to get 3 instead of A and get payoff 2. The strategy pair (N, A) emerges as the unique equilibrium of the game yielding a payoff of (3, 2). In the first phase the universities do actions and in the second phase it revised simultaneous game is played. The strategy is (N, A) is a good outcome.

B. Government University Cooperation Game

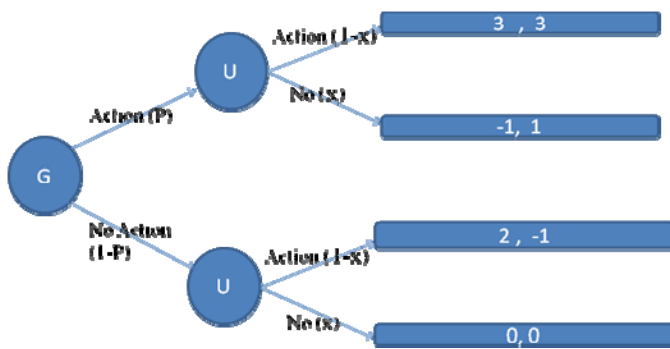


Figure 6: Government University Cooperative Game

In this case we assume that Universities don't have capability to do action and don't have information and resources. Then the new game is mentioned in Figure. If government unable to do this practices that result the failure of the expected outcome. This case assumes that the government has fund, therefore able to do actions and adopt the strategy A. The university's new dominant strategy is to follow that action. The equilibrium of the revised game would be (3,3) at which the government gets its best payoff of 3, and the university gets its payoff of 3. The new equilibrium is also Pareto optimal in the sense that no player can be made better off without making the other worse

off. It is also the case that the university would find its way to do action what the government says under (A, A). The self awareness is a strategic move, a move that induces the other player to choose in one's favor. It constrains the other player's choice by affecting his expectations. So in this game as the Government strategic move to do action and change its payoffs encourage universities to do action government's expectation that the university would also play A.

C. Case 3: Government University Cooperation Game with Policy

In this case universities assume that there are integration policies that stimulate the university to play A. The policy imposes rule and is a game changer. The new game is represented in Figure. Now university has a dominant strategy to play A and (A, A) is the dominant strategy equilibrium. The policy induces cooperation such that the universities and Government are better off.

In this case all other payoffs remain the same. The new equilibrium is also Pareto optimal in the sense that no player can be made better off without making the other worse off. They are both better off because they play (A, A) and get 3 each. Therefore, it is perfect cooperation because Government does effort in the form of policy and University also use it resources to follow the policy.

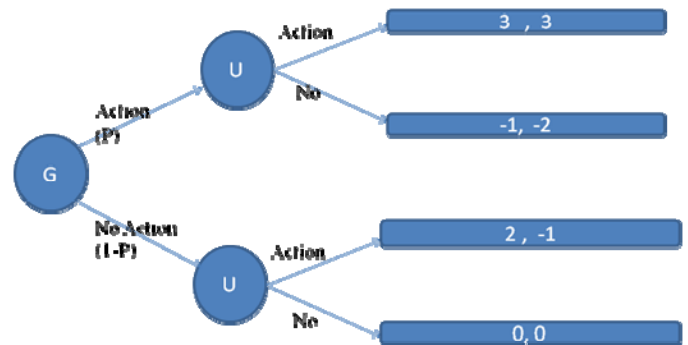


Figure 7: Government University Non Cooperative Game with policy

The following conclusion seems evident. Universities with the ability to compete and having the means to play A while the government implement and enforce policies. It is obvious that once the policies are implemented, the universities follow the rule and will be better off. The policy will change the role of university; universities with the new role will be part of the Government towards the development. The government of the developing countries does not have funds and do not want to implement such policies. Therefore, is still gearing up to implement policies. Credible commitment to swift and effective implementation of the policies is thus critical. There is pressing need to improve the policies for the quality of education and to make well defined policies for the development of the country.

V. CONCLUSION

In essence, this study is proposing a new role of universities for economic development of the country. It is concluded that

to transfer or catch up technology to developing countries, new universities should be established in the rural areas with the Internationalization of ICT curriculum. The highly qualified people from different universities will work there, share their knowledge and will see the real situation to solve their problems. This study would not only be significant to the developing countries but also to universities in other developed countries that need to upgrade higher education system to compete with the globalized world.

The role of the government is to initiate and promote the technology by the effective policies and rules. Government can do action by providing the technology or by effective integral policies for the better control of Universities. There is need to design the mechanism that specify the institutions, procedures and the rules of the game with a desired outcome in mind. The mechanism should consider the all the stake holders and the communication system. The desired outcome can be achieved if the players of the game have full information about the game. While in education system it would be fatal to relay on the universities only because moral hazard is a serious issue and is likely to be misused. It also does not seem wise to keep the education in the government sector under direct control of the politicians. The wise option is education system should be under the autonomous body like Higher education commission (HEC) in Pakistan to deal with policy formulation as well as policy implementation. The commission should formulate policy on a continuing basis, analyze real-time data for mid-course correction, and prosecute cases against unscrupulous providers of education.

REFERENCES

- [1] Government of Pakistan. Federal Bureau of Statistics (FBS) Pakistan Statistical Year Book 2011, <http://www.pbs.gov.pk/content/pakistan-statistical-year-book-2011>
- [2] Economic Survey 2012-13 http://www.finance.gov.pk/survey_1213.html
- [3] Higher Education Commission Pakistan Annual Report 2010-11
- [4] State of the Economy Annual Report 2010-11, <http://www.sbp.org.pk/reports/annual/arFY12/Anul-index-eng-12.htm>
- [5] Khawaja Amjad Saeed. (2006). *The Economy of Pakistan*. Karachi: Oxford University Press
- [6] Thomas L Friedman. *The World Is Flat: A Brief History of the Twenty-First Century* (4th updated and expanded). New York: The Washington post, 2007.
- [7] Claes Brundenius, Bo Goransson and Jan Agren (2008). *The Role of Academic Institutions in the National System of Innovation and the Debate in Sweden*, (UniDev Discussion Paper Series paper no. 9). Retrieved May 08, 2010, from <http://developinguniversities.blogspot.com>
- [8] *Convergence of Productivity: Cross-National Studies and Historical Evidence* by William J. Baumol, Richard R. Nelson and Edward N. Wolff (Jun 30, 1994) Oxford University Press, USA. *Staying Behind, Stumbling back, Sneaking up, Soaring ahead: Late Industrialization in Historical perspective*, Takashi Hikono, Alice H. Amsden
- [9] Michael E. Porter (1998). *Clusters and the New Economics of Competition*. Harvard Business Review (Nov- Dec 1998)
- [10] Tatnall, A & Davey, B. (2004). *Improving the Chances of Getting your IT Curriculum Innovation Successfully Adopted by the Application of an Ecological Approach to Innovation*. *Informing Science Journal*, volume 7, 2004.
- [11] Knight, J. (1999). *Internationalisation of Higher Education. Quality and Internationalisation in Higher Education*, OECD.
- [12] Rizvi, F. (1999). *Internationalization of Curriculum: RMIT Teaching and Learning Strategy*. RMIT. Retrieved March 2, 2003, from <http://www.pvci.rmit.edu.au/ioc/back/icpfr.pdf>
- [13] Gayle, F. (1997). *Where does Australian higher education need to go from here?* In E. J. Sharpham and G. Harman (Eds.), *Australia's Future Universities*. University of New England, NSW.
- [14] IDP Education Australia (1995). *Curriculum Development for Internationalisation: Australian Case Studies and Stocktake*. Canberra: DEETYA.
- [15] S. Sadagopan, "IT in India," *IT Professional*, vol. 14, pp. 14-17, 2012.
- [16] Gulbrandsen, M., & Smeby, J. C. (2005). *Industry funding and university professors' research performance*. *Research Policy*, 34(6), 932-950.
- [17] Debackere, K., & Veugelers, R. (2005). *The role of academic technology transfer organizations in improving industry science links*. *Research policy*, 34(3), 321-342.
- [18] Yamamoto, K. (2004). *Corporatization of National Universities in Japan: Revolution for Governance or Rhetoric for Downsizing?*. *Financial Accountability & Management*, 20: 153-181.
- [19] Fukuda, K.; Watanabe, M.; Korenaga, M.; Seimaru, K.; , "The progress of the strategic technology roadmap of METI (Ministry of Economy, Trade and Industry of Japan): Practical business cases and sustainable manufacturing perspective," *Management of Engineering & Technology*, 2008. PICMET 2008. Portland International Conference on , vol., no., pp.2102-2114, 27-31 July 2008
- [20] [20] Chaojung Chen, Chihiro Watanabe, Charla Griffy-Brown (2007). *The co-evolution process of technological innovation—An empirical study of mobile phone vendors and telecommunication service operators in Japan*, *Technology in Society*, Volume 29, Issue 1, January 2007.
- [21] Khawaja Amjad Saeed. (2006). *The Economy of Pakistan*. Karachi: Oxford University Press
- [22] K. Ahmad and A. Hassan, "Policy Implications for Government and Higher Education in Pursuing Innovation," in *Technology Management for the Global Future*, 2006. PICMET 2006, 2006, pp. 957-966.
- [23] Maryann P. Feldman, *The University and Economics Development: The Case of Johns Hopkins University and Baltimore*. *Economics Development Quarterly*, Vol. 8 No. 1, February 1994 67-76, 1994.
- [24] D Lab: <http://d-lab.mit.edu/>
- [25] M S Swaminathan Research Foundation (MSSRF) a Centre for Research: <http://www.mssrf.org/>
- [26] *Namal College of Pakistan* <http://www.namal.edu.p>
- [27] Fudenberg, D., & Tirole, J. (1991). *Game theory*. 1991: MIT Press.
- [28] Hart, S., (2006), *Robert Aumann's Game and Economic Theory*, *Scandinavian Journal of Economics* 108, 185-211
- [29] Alex Baker, Emily Oh Navarro, and Andr'e van der Hoek. *Problems and Programmers: an Educational Software Engineering Card Game*. In ICSE '03: *Proceedings of the 25th International Conference on Software Engineering*, pages 614-619, Washington, DC, USA, 2003. IEEE Computer Society.
- [30] Emily Oh Navarro and Andr'e van der Hoek. *SimSE: an Educational Simulation Game for Teaching the Software Engineering Process*. In ITiCSE '04: *Proceedings of the 9th annual SIGCSE conference on Innovation and technology in computer science education*, pages 233-233, New York, NY, USA, 2004. ACM Press.
- [31] W. Bian, A. I. Wang, J. E. Strom, and T. B. Kvamme, "An Evaluation of Using a Game Development Framework in Higher Education," in *Software Engineering Education and Training*, 2009. CSEET '09. 22nd Conference on, 2009, pp. 41-44.
- [32] Roger A. McCain (2009). *Game Theory and Public Policy*. Edward Elgar Cheltenham, UK. Northampton, MA, USA
- [33] Yong Cao; Sakai, H.; Xie-lin Liu; Nagahira, A.; Iguchi, Y.; , "Technology Catch-Up in China Compared with Japan: A New Development Model," *Technology Management for the Global Future*, 2006. PICMET 2006 , vol.3, no., pp.1030-1039, 8-13 July 2006
- [34] Steenhuis, H.-J.; de Bruijn, E.J.; , "Innovation and technology based economic development: Are there short-cuts?," *Management of Innovation and Technology*, 2008. ICMIT 2008. 4th IEEE International Conference on , vol., no., pp.837-841, 21-24 Sept. 2008
- [35] Robertson, S. et al. (2007). *Globalisation, Education and Development: Ideas, Actors and Dynamics*, Department for International Development, University of Bristol.
- [36] Christian Aid (2004) *The Politics of Poverty: Aid in the New Cold War*, London: Christian Aid.
- [37] Fasih Uddin & M Akram Swati, *Pakistan's Economic Journey, Need for New Paradigm*, Institute for Policy Studies, Islamabad, 2006
- [38] Ladha, Krishna K. (2012), "Strategic Opportunities for Quality in Higher Education in India", *IIM Kozhikode Society Management Review*, Vol. 1 No. 2, July 2012, pg. 65-74.

- [39] Khadria, Binod (2010), "The future of South Asian migration: a look at India, Pakistan and Bangladesh", OECD Journal: General Papers, Vol. 2009/4.
- [40] W. Dong, "Preliminary analysis on international business negotiation strategy in a game with incomplete information," in Information Management and Engineering (ICIME), 2010 The 2nd IEEE International Conference on, 2010, pp. 363-365.
- [41] Ayesha Saleem, Kiyohide Higuchi (2012) "Globalization and ICT Innovation Policy: Absorption Capacity in developing Countries" IEEE the 14th International Conference on Advanced Communication Technology ICACT 2012, February 19-22, 2012, PyeongChang, Korea.



Ayesha Saleem has done Masters of Science in Information Technology. She had been awarded with the Gold Medal in Master of Information Technology after securing 1st Position. She has done Masters in Public Policy as well, from National Graduate Institute for Policy Studies (GRIPS), Japan. She is also certified Project Management Professional by Project Management Institute USA. She is doing PhD in GITS (Graduate School of Global Information and Telecommunication Studies), Waseda University, Tokyo, Japan.

She had been working in a World Bank's Project titled "Land Records Management Information Systems" (LRMIS) in the capacity of Project Manager. She also has experience to work as section leader & team leader of configuration management/Software quality assurance Department in multinational software houses. These days, she is working as trainee in the Directorate for Science, Technology and Industry (DSTI), Economic Analysis and Statistics (EAS), Organization for Economic Co-operation and Development (OECD), Paris.



Kiyohide Higuchi is PhD in Economics from Graduate School of Economics, Waseda University. He had been Professor of School of Science & Engineering of Waseda University and Meikai University, Japan. Currently he is Professor of Graduate School of Global Information and Telecommunication Studies of Waseda University and Graduate School of International Culture and Communication of Waseda University, Japan.

He has published many books and research paper as author and co-author. His latest publications are: (1) "The way of new information and communications market-status and trends of information and communication in major countries and international organizations", International Telecommunication Union and the World Trade Organization (WTO) Sixth chapter PP.299-305(co-author)(foundation), International Communication Economic Research Institute Reviews, February 2004. (2) "The IT business strategy in open- platform era" second chapter representative "public policy outsourcing as IT Business" PP.12-22(co-author)(foundation), International Communication Economic Research Institution Reviews. March 2005. (3) "Fairness and effect of tolls", Japan Transport Policy study Group Series A-418, 2006.