From Information Society to Knowledge Society: The Asian Perspective

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In an era, where 'traditional society' is replaced by a 'knowledge society', there is a global inclination towards creating knowledge and nurturing its affiliated factors. Accordingly, this paper intends to scrutinize the hypothesized causal relationship between ICT and knowledge creation. Variables for ICT and knowledge creation are taken from World Development Indicators (WDI).To the best of our knowledge, this is the first study of its kind that explicitly constructs an empirical framework for ICT and knowledge creation. Depending on the availability of data, 24 countries have been selected from Asia. Time dimension for the data set is from 1990-2013, yielding a panel data set. To conduct statistical analysis of the relevant variables, we use Pooled Mean Group Estimator (PMGE), Mean Group Estimator (MGE) and Dynamic Fixed Effects Estimator (DFEE).Recommendations are made on the basis of findings from empirical analysis. To nurture knowledge creation in the knowledge society, the role of ICT is found to be positive. For a mature knowledge society, ICT, expenditure in R&D and researchers in R&D have a constructive role.

Keywords: Knowledge society, ICT, Scientific research, Panel unit root, Pooled Mean Group Estimator (PMGE), Mean Group Estimator (MGE), Dynamic Fixed Effects Estimator (DFEE), Panel Granger causality.

1. Introduction

Among Utopian discussions, one of 'an almost jobless ideal society' by French thinker Gorz (1980) befits here. His philosophy had the radical idea of minified and 'socially necessary' labor working hours via advent of new technology transforming the society. The notion of knowledge did not gain much attention till the 20th century. Leslie (1993) notes that initial efforts were done during World War–I via creation of research councils and offices of technology. While more consolidated efforts were done after World War–II, with the amalgamation of science into military.

Rostow's (1960) envisaged five stages of economic growth, picturing a society of mass consumption. This idea has been in vogue for nearly half a century, but during current times, newer terms have been coined for 'society' based on economic, educational and behavioral aspects that have led to a new-fangledtype of society that has knowledge as a salient trait.After 1970s, Ronald Reagan's presidency brought forth increased expenditures on information technology, space research and applied mathematics. Such instances from history have laid the foundation for information and knowledge societies. More recently there has been an upsurge in the discussion of these novel-type of societies.

Experts stated that we stand on the threshold of a new era of 'knowledge' (Bindé & Matsuura, 2005). Moreover, 21st century has brought forth novel changes such as the advent of information and communication technology (ICT). Korotayev & Tsirel (2010) suggested that since 1990's, the world is living the 5th of Kondratiev waves in the form of information technology era. Information revolution has reformed societies and economies around the globe. Terms such as information society and knowledge society are surfed during the last decade (Bindé & Matsuura, 2005). Powell & Snellman (2004) defines a knowledge economy as an economy where production and services are based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advancement, as well as rapid obsolescence. Therefore, for any knowledge society/economy there is a need for persistent technical and scientific advancement.

OECD (2009) suggests that information society has two dimensions namely economic dimension and social dimension. Former deals with economic implications of ICT. For instance, it transforms the supply and demand chains of businesses, besides their internal organisation that allows the businesses to benefit from ICT. Governments' functions of service delivery are also not free from such implications. In addition, consumption and spending comportment of masses are also evolving. In a nut shell, almost all of the economic strands are undergoing change.ICT has triggered 'creative destruction', by means of the rise/fall of new/naïve firms and industries. ICT also decreases market friction and transaction costs that leads to rise in productivity and hence economic growth. The social dimension of ICT stems from general purpose technology(GPT). It has transformed the individual behavior. Newer modes of digital-personal communication have also enhanced the social implications of ICT. Social dimension of ICT is also reinforced due to 'digital divide' (unequal access to ICT). If in a society a note worthy segment of population is deprived of benefits of ICT, it can culminate into social insecurity or even a jeopardy of social disintegration.

Teltscher et al. (2010) are of the point of view that an information society develops through at least three stages namely; ICT readiness (extent of networked infrastructure and ICT-access), ICT intensity (extent of use of ICTs in the society) and ICT impact (consequence of effectual use of ICT).International Telecommunication Union (ITU) measures information society via Information Development Index (IDI). As per 2013 report of ITU, Denmark has the 1st rank with an IDI value of 8.86, while Pakistan has 142nd with an IDI value of 2.05 out of 166 countries of the world.

In current digital era, generation of wealth and affluence is affected by access to information and knowledge, which in turn is affected by access to ICT. World Bank and other international financial institutions agree that ICT can be useful in developing skills relevant to the Information Technology-enabled Services (ITeS) industries and knowledge economy. Research in almost all fields is assisted by use of ICT and ITeS are being extensively used in technical and scientific research. Among others, Marx, Bellamy and Morris during late 19th and early 20th centuries, future societies were imagined to be dependent on knowledge and knowledge seeking (Manuel, 1973). Borrowing from this notion, emancipation and improved productivity can be attributed to knowledge creation. Coexistence between the two types of societies(Information society and knowledge society) can be observed. A country that is rich in ICT is also observed to be rich in scientific literature, instances of which include USA, Japan and UK among others. We base our empirical analysis on the basis of this coexistence. This theoretical framework leads us to hypothesize of a causal relationship between ICT and knowledge society (in terms of scientific and technical advancement).

1.1 Objective

This paper attempts to explicitly and empirically examine the hypothesized connection between ICT and knowledge society which is stated in the following proposition:

P_A: *Information and Communication Technology (ICT) has a causal relationship with knowledge creation (knowledge society).*

To fulfill this objective, a brief review of existing literature is conducted and methodology is selected, thereafter.

2. Literature Review

Classic ideology about knowledge is that it has no inputs (Arrow, 1962). However, in modern times knowledge is considered as an intangible product of thought and research. Other terms such as 'intellectual capital', 'intangibles', 'intangible assets' and 'knowledge capital' have been used in literature referring to knowledge. In this study, that part of knowledge is considered which is economically productive.

2.1 Operationalizing Knowledge

From an operational point of view, knowledge is the information that is specific to the country where it is created in the first place. For instance, the indicators like research expenditures and researchers are primarily specific to a country and are like not to create 'free' knowledge for other countries at least promptly. Property rights and patents can also be considered as a few factors that hinder this economically productive knowledge from becoming a public good or free good. From a definitional point of view, such knowledge is excludable if not rival. Therefore, on the basis of lags in transfer from one country and excludability, economically productive knowledge is not considered as public good.

However, the inevitable process of knowledge spillovers is not refuted in this analysis, though this possibility is relaxed for the sake of simplicity.

A handful of researchers have explored the role of ICT in assisting scientific activities. For instance, disseminating ICTs, such as electronic journals, popular media, weblogs, and project web sites, transmit the discoveries in one way broadcast and do the informationalization of knowledge process (Lamb & Davidson, 2005; Jaswal, 2006; and Dhanavandan, Esmail, & Mani, 2008). Barjak (2006) used self-reporting of book chapters, journal articles, working papers, and conference papers thereby covering a wide range from very polished and distant from the research to less formal works in progress. The study also reported a positive relationship between productivity and computer network use of the scientists (Elzawi & Wade, 2012; Pearce, et al., 2012Farhadi, et al., 2013 and Mehmood et al. 2014a, among others).

Anderson (2008) introduced the concepts of information and knowledge society and explained their bearing on education. These concepts mainly limelight multiple social changes that are simultaneously happening with advances in ICT. He proposed a conceptual framework to illuminate the role knowledge can play in education's attempt to apply technology to learning. In addition, the link between knowledge and ICT literacy assessment is elaborated. The author also stressed the role that knowledge plays in teaching within communities of practice and that technology plays in augmenting the teaching and learning procedures.

Välimaa& Hoffman (2008) assessed the role of higher education with reference to knowledge society dialogue. Authors analyzed how knowledge society acts as an ongoing intellectual instrument in transforming higher education at national, regional and global levels. They also limelight the present challenges and hopes produced for higher education and the effects these hopes have for higher education research. Bušíková (2012) empirically found that knowledge economy is influenced by the mushrooming growth and usage of ICT, and the wave of globalization. Author noted that human capital is the driving force behind ICT and globalization and focused on the role of universities in the knowledge economy by calculating the correlations. He used expenditure on R&D, patents applications, Hi-tech exports among others as knowledge economy indicators, labor force with tertiary education, expenditure per student, and tertiary educational attainment among others as indicators of tertiary education. Strong correlation between most of the indicators of the knowledge economy and tertiary education was found. It revealed that improved tertiary education serves as support system for knowledge society. However, this research neither attempted to quantify the relationship nor elucidated the cause-effect relationship between knowledge economy and tertiary education.

This paper attempts to explicitly scrutinize causal relationship between ICT and research creation.

3. Theoretical Framework

During recent past, ICT has affected the means of knowledge creation, transmission and processing (Bindé & Matsuura, 2005).The mechanism through which ICT engenders creation of knowledge is portrayed in Figure 1:

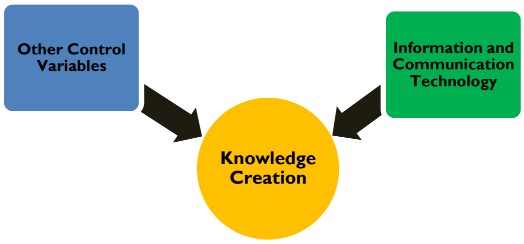

Figure 1: **The role of ICT in creation of knowledge**

Knowledge creation is based on valid information. Such valid information is manageable, transmissible and consumable. In this era of information explosion, societies are flooded with valid information and hoaxes. But the process of its conversion into knowledge requires certain cognitive, critical and theoretical skills that enable us to orient ourselves in thought (Bindé & Matsuura, 2005). Similar to information, the knowledge should also have the properties of manageability, transmissibility and consumption – 'Informationalization' of Knowledge. This happens when new knowledge is disseminated in the form of scientific publications. We use the logic of this mechanism to develop the model, which is explained below.

4. Estimable Model

For this paper, an innovative model has been developed. The process of knowledge creation has been termed as 'Scientific and Technical Journal Articles'. While ICT is represented by 'ICT Expenditures (% of GDP)'. Role of ICT in knowledge creation is suitable since ICT (internet) can serve as a gigantic pool of ideas. Other variables like 'Research and development expenditure (% of GDP)'and 'Researchers in R&D (per million people)'are also included as determinants of knowledge creation. In the form of a statistical model, it is furnished as follows:

$$SCPUB_{i,t} = \alpha_0 + \alpha_1(ICTE_{i,t}) + \alpha_2(RDY_{i,t}) + \alpha_3(RCHRD_{i,t}) + \varepsilon_{it} \text{ ....(1)}$$

$$\varepsilon_{i,t} = \rho_i(\varepsilon_{i,t-1}) + \omega_{it} \text{ ....(1.1)}$$

Where
SCPUB =Scientific and Technical Journal Articles
ICTE =ICT Expenditures (% of GDP)
RDY = Research and Development Expenditure (% of GDP)
RCHRD =Researchers in R&D (per million people)

$\varepsilon_{(i,t)}$ is the disturbance from the panel regression and ρ_i shows the autoregressive vector of residuals in the ith cross countries. The model parameter α_0 allows for the possibility of the country specific fixed-effects and the coefficients α_1, α_2 and α_3 allow for the variation across individual countries.

4.1 Variable Selection

Following are the definitions of the variables notated in equation (1):

SCPUB: "'Scientific and Technical Journal Articles' refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences."

ICTE: "Information and communication technology expenditures include computer hardware (computers storage devices printers and other peripherals); computer software (operating systems programming tools utilities applications and internal software development); computer services (information technology consulting computer and network systems integration Web hosting data processing services and other services); and communications services (voice and data communications services) and wired and wireless communications equipment."

RDY: "Expenditures for research and development are current and capital expenditures (both public and private). Creative work is undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development."

RCHRD: "Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students (ISCED97 level 6) engaged in R&D are included."

4.2 Data Sources

This paper borrows data on the selected variables for ICT and knowledge creation from international database of World Development Indicators (WDI) version 2014.

4.3 Unit of Analysis

The unit of analysis in this study is country. The number of countries selected for the analysis is 24 and the time span covered is from 1990 to 2013. The selection of time series and countries is driven by the availability of data. Selected countries are Bangladesh, Brunei Darul Islam, China, Indonesia, India, Iran, Israel, Jordan, Japan, Kazakstan, Kryzgystan, Cambodia, Korea, Kuwait, Lao PDR, Malaysia, Oman, Pakistan, Philippines, Russia, Saudi Arabia, Thailand, Tajikstan and Yemen.

4.4 Software Application

Eviews 8 is used for Panel Unit root tests for stationarity and Panel Granger causality test for cause-effect diagnosis, results of which are interpreted in section 5. Moreover, Standard Edition of Stata 12.0 is used to perform all estimations. However the built-in command for methodology used in this paper is not available. Therefore, user defined command is installed for estimating mean group, pooled mean group and dynamic fixed effects. These estimation methodologies are explained in methodology section.

5. Methodology

5.1 Panel Unit Root Tests

Our panel dataset has time dimension of 24years which is composed of a substantial length of time series and therefore, existence of unit roots in variables, cannot be ruled out. To confirm the presence of time series variables contain unit root, we employ three different yet popular tests: Levin et al. (2002) (LLC), Im et al. (2003) (IPS) and Maddala and Wu (1999) (MW) tests. The LL tests are based on homogeneity of the autoregressive parameter, while the IPS tests are based on heterogeneity of autoregressive parameters. Thus, no pooling regressions are associated with IPS tests. MW tests, on the other hand, are based on Fisher type unit root tests that are not restricted to the sample sizes for different samples (Maddala and Wu, 1999).

We use three different tests to confirm our results. Maddala and Wu (1999) argued that "other conservative tests (applicable in the case of correlated tests) based on Bonferroni bounds have also been found to be inferior to the Fisher test."Results from all these tests are given in Table1. The selection of the appropriate lag length was made using the Schwarz Bayesian Information Criterion.

Table 1: Unit Root Tests

	Intercept	Intercept & Trend	Intercept	Intercept & Trend	Intercept	Intercept & Trend	Intercept	Intercept & Trend
	Δ(SCPUB)	**Δ(SCPUB)**	**ICTE**	**ICTE**	**Δ(RDY)**	**Δ(RDY)**	**Δ(RCHRD)**	**Δ(RCHRD)**
LLC	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)	I(1)	I(1)
IPS	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)	I(1)	I(1)
MWADF	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)	I(1)	I(1)
MWPP	I(1)	I(1)	I(0)	I(0)	I(1)	I(1)	I(1)	I(1)

Source: Authors' estimates

Δ denotes first difference. Both variables are taken in natural logarithms. All tests take non-stationarity as null.
Note: Table shows the individual statistics and p-values with the lag length selection of one. Intercept is included in all terms with or without first differences. Probabilities of fisher type test are using asymptotic χ^2 distributions while other type of tests assumes asymptotic normality.

Table 2: Cointegration Results

	MGE	DFEE	PMGE
Long Run Parameters			
$ICTE_{i,t}$	0.0810 (0.097)	0.0937 (0.001)	0.0540 (0.000)
$RDY_{i,t}$	-1.1032 (0.767)	0.2016 (0.012)	0.6332 (0.000)
$RCHRD_{i,t}$	0.9062 (0.000)	0.8471 (0.000)	0.6950 (0.000)
Average Convergence Parameter			
Error Correction Term (φ_i)	-0.4711 (0.000)	-0.1364 (0.000)	-0.0831 (0.005)
Short Run Parameters			
$\Delta(ICTE_{i,t})$	0.0054 (0.751)	0.0578 (0.000)	0.0477 (0.000)
$\Delta(RDY_{i,t})$	1.6452 (0.153)	0.0299 (0.105)	3.0269 (0.295)
$\Delta(RCHRD_{i,t})$	0.2728 (0.018)	0.9195 (0.000)	0.5665 (0.001)
Intercept	0.0518 (0.000)	0.0870 (0.000)	0.0470 (0.005)

Note: In parenthesis, p-values of parameters are given.
Source: Authors' estimates

5.2 Panel Cointegration Tests

Results of all four tests in Table 1 show that the SCPUB, RDY and RCHRD series are integrated of the same order, i.e. I(1), but ICTE is integrated at level, i.e. I(0). Eberhardt & Teal (2011) suggested the use of macro-panel data techniques when time span is more than 20 years. Here t = 24, so we can resort to macro-panel data techniques. Since the series involved in our analysis are not integrated of same order, Pedroni and Kao tests cannot be applied. There is a need to use the Panel ARDL approach to co-integration in this situation. Accordingly, we employ three recently developed econometric technique generation, i.e. MGE, DFEE and PMGE to identify the appropriate sign and the size of the slope coefficient in the long run equation. Applying these three contemporary techniques allows us to verify the validity and stability of the results. For recent deployment of these estimators, see Mehmood & Raza, 2014a; Mehmood & Raza, 2014b and Mehmood et al. 2014b among others. Moreover, these are explained as follows:

5.2.1 Mean Group Estimator (MGE)

Pesaran and Smith (1995) provided mean group estimator of dynamic panels for large number of time observations and large number of groups. In this method separate equations are estimated for each group and examined the distribution of coefficients of these equations across groups. It provides parameter estimates by taking means of coefficients calculated by separate equations for each group. It is one extreme of estimation because it just makes use of averaging in its estimation procedure. It does not consider any possibility of same parameters across groups.

5.2.2 Pooled Mean Group Estimator (PMGE)

Pesaran and Smith (1997) suggested pooled mean group (PMGE) estimator of dynamic panels for large number of time observations and large number of groups. Pesaran, Shin and Smith (1997, 1999) added further in PMGE and extended it. Pooled mean group estimator considers both averaging and pooling in its estimation procedure, so it is consider as an intermediate estimator. PMGE allows variation in the intercepts, short-run dynamics and error variances across the groups, but it does not allow long-run dynamics to differ across the groups.

5.2.3 Dynamic Fixed Effects Estimator (DFEE)

In addition to PMGE and MGE, Dynamic fixed effects estimator (DFEE) is also used to estimate the co integrating vector. DFEE specification controls the country specific effects, estimated through least square dummy variable (LSDV) or generalized method of moment (GMM). DFEE relies on pooling of cross-sections. Like the PMGE, DFEE estimator also restricts the coefficient of co integrating vector to be equal across all panels. Adopting from Pesaran, Shin and Smith (1997, 1999), PMGE estimable model has an adjustment coefficient$\varphi_i$thatis known as the error-correction term. In fact this error-correction term $\varphi_i$tells about how much adjustment occurs in each period.

Results in Table 2 reveal the comparison of panel co-integration estimation using MGE, DFEE and PMGE. All three alternative methods of co-integration (MGE, DFEE and PMGE) show long run relationship between scientific publishing and its determinants (ICT expenditures, R&D expenditures and researchers in R&D). It is evident from error correction terms (φ_i), that are less than the unity and negative in terms of signs with statistical significance at all levels. However the most efficient of the three estimators should be chosen. Moreover, the speed of adjustment is negative (-0.0831) and significant, like it was expected to be, and it is not much high. This implies that the model does not return immediately to equilibrium after a shock that push the model away from the equilibrium. The time for the series to be on long run equilibrium path is $\frac{1}{\varphi} = \frac{1}{0.0831}$ =12 years.

5.3 Hausman Test

Hausman test (Table 3) is used to decide the appropriate estimator between Mean Group Estimator and Pooled Mean Group Estimator. Null hypothesis of test is PMGE is efficient and consistent but MGE is inefficient against the alternative hypothesis i.e. PMGE is inefficient and inconsistent but MGE is consistent. It allows deciding between MGE and DFEE. Since it is already found that results using MGE, DFEE and PMGE reveal cointegration. Therefore, we apply Hausman test on MGE, DFEE and PMGE cointegration estimates in order decide the most efficient estimator among them.

These results are supported by the Granger representation theorem (Engle & Granger, 1987) which implies that the error correction term would be significant if, significant cointegration exists.

5.4 What Causes What?

The logical question after estimation of cointegration equation is to inquire the causality between scientific publication and ICT and R&D related variables. Table 4, reveals the results of panel Granger causality test. Probability values of F-statistics show that ICT expenditures cause scientific publication and vice versa. This is expected as the increase in ICT facility increases the flow of ideas and helps the frequency of generation of scientific literature. Similarly, the bi-causal relationship is present between R&D expenditures and scientific publication. The expenditure in R&D is expected to have direct effect on the scientific publication and there is presence of feedback effect in this case. Causality is not evident in case of researchers in R&D which is justified since researchers in R&D cannot solely cause scientific research without R&D ICT expenditures.

Here the concept of human capital, presented in Mincer (1958) comes into light. His work challenged and extended work of Solow (1956) which emphasized the role of technology in economic growth only. Furthermore, the boom in the 1980s and 1990s supported the work of human capital lead growth. A practical example of it was demonstrated by OECD in early 1970s via depending on science and technology as an input to growth.

Table 3: Hausman Test for Selection Between:

MGE and DFEE	MGE and PMGE
$\mathbf{H_o}$: DFEE is efficient and consistent, but MGE is not efficient.	$\mathbf{H_o}$: PMGE is efficient and consistent, but MGE is not efficient.
$\mathbf{p-value} = 0.7913 \nless 0.05$	$\mathbf{p-value} = 0.9844 \nless 0.05$
Since $\mathbf{H_o}$ is not rejected, DFEE is efficient and consistent than MGE.	Since $\mathbf{H_o}$ is not rejected, PMGE is efficient and consistent than MGE.

Overall Decision: Both DFEE and PMGE are found to be more efficient and consistent than MGE in both Hausman tests, respectively. While PMGE dominates the DFEE because it permits heterogeneity in short run coefficients. Hence PMGE should be relied upon, among the three estimators.

Source: Authors' estimates

Table 4: Panel Granger Causality Test Results

Causality	F-Statistic	p-value	Remarks
SCPUB → ICTE	3.4677	0.032	Bi-causal Relationship between SCPUB and ICTE
ICTE →SCPUB	20.1198	0.000	
SCPUB→ RDY	13.8617	0.000	Bi-causality from SCPUB and RDY
RDY →SCPUB	2.5389	0.080	
SCPUB→ RCHRD	1.1069	0.331	Absence of Causal Relationship between SCPUB and RCHRD
RCHRD →SCPUB	2.1096	0.122	

Source: Author's estimations using EViews 8.

6. Discussion

Empirical results are obtained using panel unit root tests, MGE, DFEE & PMGE and panel Granger causality tests. Results affirm the hypothesis set in the beginning that ICT positively affects scientific publication (knowledge creation). With exponential increase in the power and capability of ICT, researchers' creativity, productivity and ability to disseminate research has increased. This mechanism is affirmed by the cointegration and causality analysis in this research. The catalytic impact of ICT on research publications has enabled networking and communication, data transfer, storage, discovery, retrieval, computation and processing.

In addition, the role of R&D expenditures and Researchers in R&D is also highlighted in this empirical research. The human capital with higher education and research skills contributes directly to scientific research. Highly skilled manpower and scientists are pivotal in generating new knowledge and research. Since the ideas and thoughts are originated by them.For further research, quality of knowledge (research) should be included in analysis.

Practical examples of such nature are visible in even in developing region of Africa where research organizations (e.g. University of Tunis) were networked via ICT for improved research output. ICT has also helped such organizations to boost research and distance learning. Besides Virtual University of Tunis, Virtual University of Pakistan and Multimedia Super Corridor of Multimedia University are also playing a role model for ICT based learning and research. Japan has been successful in replicating the success of Europe and US in terms of performance in science and technology with weaker performance in basic science.

Our findings also corroborate that of Brynjolfsson & Hitt (2003). It is now a common consensus among researchers that ICT alone cannot be a good determinant of increased performance, until coalesced with investment in human capital and other complementary factors. Recent researches have affirmed the presence of such complementarities between ICT, human capital, knowledge creation and productivity (Mehmood, Azim, & Asghar, 2013; Mehmood, et al. 2014a and Mehmood & Azim, 2014, among others).In developing countries, investment in human capital is not the top priority of the politicians. However, investment in mega projects of infrastructure is the political stunts that attract funds and are based on vested interests. This hampers the spending in research and education leading to poor quality of human capital. Hence it is likely that the complementarities between human capital and ICT remain weak and growth of knowledge society remains bridled.

There are potential factors that function both at regional and global levels to flourish knowledge societies. For instance, increased globalization and liberalization can play a conducive role at global level. The international spillovers of knowledge sharing and cross-border interaction of human capital can lead to exponential growth of knowledge society. At regional level, deregulation as well as eased mobility of financial and human capital, and goods and services are instrumental in this regard. Europe is leading example in this regard, which is considerably attributed to the Lisbon Strategy, which entails quickening structural change, capital flow and migration in the EU. A similar strategy for the Asian region can be a good recipe in this regard. However, patience shall be required to see the fruition of such strategies. Development of human capital is a long run phenomenon, spanning over decades and abnormally high lags are involved before the increased productivity of human capital could be felt. Our analysis has empirically analyzed the ‘long run’ relationship between information development and knowledge creation. Short run dynamics might not be the best option for acute analysis. We recommend focus on long run manpower planning for an ameliorated human capital and hence a dynamic knowledge society.

The current era of mass production and consumption is in fact triggered by ‘disruptive’ technologies. Among these disruptive technologies, ICT is a major type of technology that has triggered change in every race of life. Research and knowledge creating industries are no exception to it. Yet there is a caveat that needs to be considered. The quality of research is also to be taken into account while considering the rise and development of knowledge society. This aspect could not be addressed in present research and is left for the researchers to delve deeper into the debate of knowledge society. Data availability for quality of research is an issue in case of Asian countries. Perhaps, for future inquiries, a good method to fathom the quality of research is the number of articles published in impact factor journals rather than non-impact factor journals.

As we morph into the future even an ideal society could not convincingly be termed as a knowledge society that is not accompanied by economic prosperity and social peace. Befitting is the statement made in Oppenheimer (1954), in which he highlights that knowledge is “the power of betterment – that riddled word.” For developing countries to join race of development, they need to develop their ‘digital infrastructure’ and move on the ‘information superhighway’. This can allow the traditional societies in developing countries to become knowledge societies.

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