Ques. 1

Influence of Society and Cultural Issues on Technology Development in Asian Countries (Describe)

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1. Introduction and Background

In the last few decades the development and application of science and technology has affected in fundamental ways the whole range of activities in manufacturing, services and agriculture. The "technology content" is significantly increasing in all products and services which an businessman/industrialist/agriculturist wishes to produce and provide. Technology is often credited with being the single most important factor, which has facilitated development in the modern Western/European industrial world. In the two and half centuries between 1473 and 1727, one of the greatest intellectual revolution in human history occurred — **the Scientific Revolution** — initiated by the work of a relatively small group of geniuses working in the universities of Western Europe. This was obviously the early beginning of the technological revolution and development of scientific knowledge that has taken place in recent times.

However, the progress of material and intellectual development that is currently assumed to be the product of Western Civilization only was actually the end product of knowledge and major inventions made by older civilizations like Chinese, Indian, Islamic etc. For instance, it is also now common knowledge that Indian mathematical and scientific accomplishments of the earlier era went to Europe almost entirely through the works of Arab and Iranian mathematicians and astronomers (Sen, 2005). There are other examples, which will be mentioned later in these notes.

The earlier scientific and technical development of the three regions referred to above and the civilizations which developed there should be considered as a complex whole, whose various elements which lead to development of a scientific environment have been in continuous action. However, in recent centuries the Western one has influenced us all. Yet, these other cultures have preserved, for better or worse their individuality. *The notion of all civilizations and cultures of the world converging to the greater glory of Western civilization, "implicit in the metaphor of different cultures as tributary rivers that converge on the sea of Western culture", merits re-examination (Sagasti, 1998).*

The regions selected for the purpose of this article, viz., China and East Asia, South Asia and the Middle East, are now referred to as **developing regions** and are currently at various stages of transition with respect to accumulation of scientific and technological knowledge and capabilities. As mentioned earlier, these seats of civilization did demonstrate some elements of "creativity" and "innovation" centuries before the relatively recent scientific and technological revolution and consequent dominant position of the West. During the second half of the twentieth century there has been a general awakening in the developing countries on the need for **'catching up'** with the West with respect to science and technology (S & T) and removing the **"cultural road blocks"**. However, some of these regions have fared better than others in their policies and plans for adoption of scientific methods of inquiry, creation of a climate for creation and adaptation of modern technology.

Given the higher technological complexity in the industrial and business enterprises in this new century, the urgent need to bridge the "knowledge divide" that separates the developed from the developing countries and create the right S & T environment, **it is now necessary to examine the reasons which have been responsible for keeping some countries behind others in catching up with the current global technological transformation.** As mentioned earlier, the developing region chosen for these discussions in this article were not devoid of scientific knowledge and technological developments. Yet, as it shall be demonstrated that some social, cultural, political events and economic problems during subsequent periods of history caused a shift towards orthodoxy and negative policies which forced these countries to remain backward with respect to scientific and technological developments. Initially, we shall briefly focus on the relationship between culture and technology in order to identify in general terms some of the negative elements in the socio-economic systems prevailing in the regions which are believed to have acted as **road blocks** for development of technology.

The discussion on the cultural dimension is followed by a section, which presents the current status of some selected countries in these regions in respect of specific indicators. These are considered important to the development of S & T development. The objective is to highlight the differences between the regions in achievement of technology-friendly development in recent years.

In the subsequent sections each region is discussed separately to highlight the recent developments and an attempt is made to link their historical scientific achievements and the social and cultural traditions inherited from earlier generations which may have either restrained or facilitated the necessary courage to build a knowledge society capable of developing their own S & T.

2. The Cultural Factors

Throughout history new technologies have been developed taking into consideration the social and cultural environment of the country in question. Introduction of any new technology — either developed locally or through cross-border diffusion — is a cultural phenomenon. It has been said that all technologies develop in a particular cultural context as the result of changing needs or constraints (Cravens, 2003). When a technology diffuses to another society/culture, the local cultural environment affects the speed or manner in which the technology is adopted or adapted (on occasions rejected!).

Thus, **introduction of a new technology may be considered as a cultural phenomenon,** which affects the value system of the society. According to one observer (White, 1959) technology not only determines the direction of cultural development but *"it also determines the need for building social foundation".*

Europe was the technological, cultural and economic backwater of Eurasia for most of history, importing virtually all of its ideas and technologies from the Middle East and Asia. The Age of Discovery in Europe permitted the diffusion of technologies and ideas, creating an open, innovative atmosphere there and a decentralized, competitive environment that further stimulated innovation and growth (Weisenfeld, 2003). Since modern technologies are products of the Western industrialized societies, they seem to carry "the genetic codes of cultures" where they have been produced. This process led to the emergence of the culture of scientific inquiry and entrepreneurship in the west and created the environment for innovation that ultimately transformed European society and culture and its North American "cousins" into the dominant economic powerhouses of today.

During the later half of the 20th century various attempts to transfer technology to non-western countries (with the exception of Japan) have met with widely varying degree of success. Efforts to identify the causes of failure in the developing regions have seriously focused on the social and cultural factor. However, we are conscious of the difficult task of correlating the development of science and technology in a given region or country with its particular social and cultural environment.

Technology Culture: Before going into the identification of the specific elements or factors which result in the vicious circles in the developing regions, perhaps it would be wise at this stage to briefly introduce the concept of "technology culture".

Technology culture refers to an attitude of individuals in a given cultural environ. The spirit of inquiry, the degree of acceptance of the right to question and be questioned is to be considered fundamental to the development of technological temper. It calls upon one to seek the "how", "what" and "why" of everything that goes on in the society. The existence of a technology culture is complementary to the initiative taken by a country in the introduction of productive forces, which can lead to technological development.

Ques. 2

A socio-economic entity may decide to develop the "technoware" part of technology based on its relevant factor endowments existing at a given period of time. However, simultaneous development of the other three components i.e., "humanware", inforware" and "orgaware" of technology constitute the more innovative and intellectual aspects and presupposes existence of a technology culture in the country. For the sake of simplicity it is assumed that such a culture exist in a well developed form in all leading industrial countries and developing countries are currently at various stages of acquiring it. However, in this mission to develop a technology culture, they are also engaged in the process of removing some "road blocks". We discuss below some of those "road blocks" or "negative elements" in the society which probably are more significant than others among the different causes of uneven progress in developing a technology culture.

[negative elements chaile just point likhbi are discuss bolle points er sathe ektu explanation likha lagbe ..disgusting dattebayo:( ]

a) Traditional Value System and Orthodoxy

Distrust of new technologies is deeply rooted in most cultures with old value systems because people in general do not want to change. The fears of changes that usually follow introduction of new technology results from the belief that these changes are likely to be adverse. New technology, be it the product of local development, a transfer from abroad, or some combination of the two may not agree with existing traditional values. Scientific and technological changes can undercut systems of belief.

In our later discussion on these issues relevant to particular regions we shall look at some historical events of technological change and their relationships to other issues of culture and try to understand the nature of the process and the range of possible results of introduction of a new technology. It will seem that there is always a fear in a society steeped in orthodoxy (evident even in western cultures during earlier centuries) that something important (e.g. religious belief, family values, social equilibrium among classes, etc.) would be lost as a result of the new technology (DeGregori, 1989).

b) Ancient Habits of Resignation

Many people in developing regions continue to believe that there is a limited quantity of resources and attempt to expand resources through some form of technological innovation is

likely to result in a smaller share for them. Increased productivity can increase the share for everyone, yet in many countries people do not believe this and are resigned to the older modes of production.

c) Stratified and Exclusive Societies

Two persons in a society may possess identical material and intellectual resources and yet be treated as unequal because of social stigma. Many countries in the developing regions selected for discussion here still retain stratified social structures that resist change and continue with rigid class or caste systems. Such **exclusive societies** restrict social mobility, which is considered fundamental in building a dynamic society. In some areas the colonial legacies and in others ancient pseudo-religious practices and beliefs intensify their problem.

People from lower classes or castes who attain high levels of educational and intellectual success are often prevented or debarred by social practices in their desire to technologically move forward. Culturally rigid social classes in such exclusive societies artificially reduce the availability of appropriate human resource for development. **Meritocracy** is not encouraged and the excluded section of the society (wrongly called the "lower class") is resigned to the rule of the ruling classes. Thus, the urge to excel is lost and the spirit of competitiveness is discouraged.

d) Highly Centralized Bureaucratic Decision-Making Systems Discouraging Diffusion of Ideas and Technologies

Almost all cultures in the world have been borrowers of technology throughout history. A vast majority of the technology in a culture was, in all probability, developed by others. Most innovations are borrowed from other societies and improved upon. In fact, for several centuries there was a continuous and fruitful (occasionally not so fruitful!) exchange of tools and diffusion of ideas in the area that included South Asia on the east and stretched to Europe in the West. **Useful technologies spread, either through migration of populations or by diffusion of techniques to neighboring population** both within and outside geo-political (Cravens, 2003). The diffusion of technology is critical and often more important than its invention, because most complex technological advances depend upon previous mastery of basic problems. Thus technology develops in a cultural environment which welcomes cross border diffusion and exchanges.

Unfortunately, however, in the developing regions there have been periods when some ruling classes or powerful centralized bureaucracies intentionally decided to resist S & T interchange and diffusion process thus stopping local innovation activities. Such policies can be adopted and implemented only when a ruling elite or highly centralized bureaucracy in a country exists. Such negative decisions are taken out of fear of "corrupting" influence of new technologies. In general, centralized systems discourage innovation. The movements and expeditions for political unification over large areas in Asian regions in the past resulted in centralization of decision-making in vast eastern empires. Wrong decisions taken by such centralized bodies negatively influenced vast populations. In contrast, decentralized environment in Europe (with its small states and principalities) stimulated innovation.

e) Education System Discourages Nurturing of Questioning Minds and has Inadequate Focus on Tertiary Education

Since the later half of the last century the products of scientific research and technological innovation have given rise to a "knowledge society". According to Peter Drucker, "The emerging [knowledge] society is the first society in which ordinary people — and that means

most people—do not earn their bread by the sweat of their brow" (Drucker, 1968). Presumably he was referring to "knowledge workers" in the industrialized nations. Given the knowledge "explosion" that is taking place in this century it is important to note ***"it took from the time of Christ to the mid eighteenth century for knowledge to double. It doubled again 150 years later and then again in only 50 years. Today it doubles every 4 or 5 years. More new information has been produced in the last 30 years than in the previous 5000 years"*** *(Linowes, 1990).*

The above quotes clearly establish the strong reasons for a massive shift towards higher education in S&T in developing countries. The response of a majority of countries to the need for S&T modernization has been to import technology to meet the knowledge gap. Plans for education reforms often lead to proposals to import computers, involve foreign experts/consultants (encouraged by donors), fund health care diagnostic laboratories etc. We do not deny that some of these are necessary technologies (mostly in the form of technoware). However, creating an environment that **inspires local talent to innovate** requires additional efforts in terms of openness to cross-border exchanges of teachers and students, creating atmosphere for interdisciplinary dialogue and debate, and the deliberate **promotion of questioning minds and creativity in the school curricula. Such determined and purposeful initiatives are seen only in a few countries of the developing regions.**

No one denies the fundamental and basic need for a sound primary and secondary school system in a country. **But it is the system of tertiary education that plays the key role in generating and applying knowledge in this new age** that can help produce new technologies and narrow the ever widening technology gap.

The following table (Table 1) shows the progress on the educational level of labor force in newly developed as well as developed countries. The figures demonstrate the validity of the arguments made earlier in favor of tertiary education for a developing country. The low figures for China and India (in 1992) reflect the lower levels of their achievement during the nineties in narrowing the knowledge divide. However data for 2010 (not shown in Table 1) show that **tertiary education has progressed very rapidly even in China and India in recent years.** Remarkable strides made by Korea (Rep. of) and Taiwan in this respect are quite evident from the following table.

Table 1: Adjusted years of education per person aged 15-64, 1950-92

Year	Korea	Taiwan	China	India	Japan	UK	USA
1950	3.36	3.62	1.60	1.35	9.11	10.84	11.27
1973	6.82	7.35	4.00	2.60	12.00	11.66	14.58
1992	13.66	13.83	8.50	5.55	14.86	14.09	18.04

Source: Maddison 1998:63, **Primary education is given a weight of 1, secondary 1.4, and higher 2.**

As will be elaborated further in later sections of this paper, in several developing countries tertiary educational institutions do not encourage students to develop questioning minds which could challenge the "business as usual" environment. In most causes the students during their primary and secondary stage go through a poorly designed assessment procedure and find it convenient to depend on rote learning. **Twelve years of rote learning can easily kill the natural creativity in a young mind.**

f. Poor Connectivity with World Systems and Inadequate Communication Tools

The use of communication tools has been critical in enabling some societies to develop complex organizations, which in turn create the correct social environment for technology to grow. These tools are a medium for the spread of technology and ideas, which help develop an innovative culture. Societies which did not welcome early adoption of communication tools failed to adopt technological advances and were unable to make them available to the population. Even before the advent of modern hi-tech devices, earlier communication tools had lowered the cost and increased the speed and number of exchanges that encourage innovation.

For instance, the printing press had its positive effect in Medieval Europe (Wright, 2000). Europe's adoption of this advance greatly facilitated cross-border exchange of technology and ideas. In contrast, by **banning printing press** due to its fear of corrupting Western influences, the Ottoman Empire hastened its own technological and economic decline (Weisenfeld, 2003).Rapid development of modern cutting edge communication technology allow for quicker and extensive diffusion of existing technology and ideas than ever before (internet, video conferencing, etc.). However, only those who have "plugged in" can take advantage of this worldwide interconnectedness. **This also requires broad literacy, investment in information and communication technologies and shift towards openness to the free exchange of ideas.** ho eituk e :") ar koto porbi??!

3. Ranking of countries in three developing regions in terms of Composite Indices

In this section we shall endeavor to rank the three Asian regions, chosen (and the countries within each region) for discussion in this paper, in terms of some generally accepted composite indices. We think the numbers shown in the tables will provide a rough idea of the level of achievement and current trends for accumulation of intellectual capital in the regions. The differences in levels will be evident from the tables. The two composite indices used for the purpose are as follows:

a. *Human Development Index (HDI) published by UNDP*
b. *Technology Achievement Index (TAI) developed by Desai, Sagasti and others (Desai, 2001) for the Human Development Report 2001.*

The HDI is based on three indicators: longevity, as measured by life expectancy at birth; educational attainment as measured by a combination of the adult literacy rate and the combined gross primary, secondary and tertiary enrolment ratio; and standard of living, as measured by GDP per capita (Purchasing Power Parity, US $).

The TAI (Technology Achievement Index) focuses on four dimensions of technological capacity that are important for reaping the benefits of network age. The methodology used to calculate the TAI is similar to the human development index: a simple average of the dimension of the index, which in turn are calculated based on the selected indicators. The TAI has eight indicators, two in each of the four dimensions:

- Technology creation measured by the number of patents granted to residents per capita and by receipts of royalties and license fees from abroad per capita.
- Diffusion of recent innovations, measured by the number of Internet hosts per capita and the share of high-and medium-technology exports in total goods exports.
- Diffusion of old innovations, measured by telephones (mainline and cellular) per capita and electricity consumption per capita.
- Human skills, measured by mean years of schooling in the population aged 15 and above and the gross tertiary science enrolment ratio.

TAI estimates have been prepared for 72 countries for which data are available and of acceptable quality. For others, data were missing or unsatisfactory for one or more indicators, so the TAI could not be estimated. For a number of countries in the developing world, data on patents and royalties are missing. Because a lack of data generally indicates that little formal innovation is occurring, a value of zero for the missing indicator was used