A Case Study: Information and Communication Technologies Adoption in Higher Education in China and India

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ABSTRACT
Human knowledge and intellectual capital are essential in economic growth and social development of a country in knowledge economy, and a higher premium is often placed on education especially on higher education. China and India play significant roles in the globalization of knowledge economy. In this ongoing research study, we investigate how socio-cultural factors influence technology adoption in college education in China and India, and observe culture, infrastructure, and policy as three major influencing factors. Particularly, our findings show that in both countries hardware infrastructure is growing, but technical support and management of technology and corresponding issues are behind; China implements push style technology policy while India's policy is pull style; and students of both countries influence the adoption of information technologies in their families especially communication technologies.

Keywords
ICT adoption, higher education, China, India, socio-cultural factors

INTRODUCTION
The knowledge economy is transforming the demands of the labor market in economies throughout the world. A knowledge economy demands high-skilled workers, particularly high-skilled information and communication technology (ICT) workers [1]. Because knowledge is at the heart of economic growth, higher premium is placed on education especially on higher education [2].

As two most populous and largest developing countries in this world, China and India are having huge impact on global economy [3]. As the access to higher education to younger population is expanding, these two countries are also becoming the major players for high-end knowledge labor forces. Given that ICT plays important role in improving higher education, it would be interesting to study socio-cultural factors that affects adoption of ICT in higher education in China and India.

Information technology service sector in both China and India has been advancing at a fascinating speed, China and India will have more Internet users than U.S. by 2010 [4]. Although China adopted Internet technology later than India, Internet adoption is much deeper in China than in India [5]. In China, number of Internet users with bachelor degree (39%) is greater than internet users with graduate/post graduate degree (2%). However, in India, Internet users with graduate/post graduate degree (39%) are greater than internet users with Bachelor's degree holder (37%) [5].

Asian Development Bank report [2] suggests that countries in Asia and Pacific region have responded to the need of trained labor force required for developing knowledge economy. Particularly, China and India are rapidly increasing the average education of its labor force than any other region of the world. In India higher education systems have mix of private (60%) and public universities. India has world-class elite universities, but Universities in China are much more research oriented
and much more tied into a production sector innovation system [2]. In India, universities along with government agencies are developing ICT aided instructional material to be used for both distance and traditional learning programs [6]. Due to the significant contribution of ICT, China has provided education for 73 per cent of the nation’s population [6].

In recent times, there has been rapid growth with ICT adoption in higher education in China and India [7, 8], but there is disparity of ICT adoption patterns between these two countries. Bagchi et al. suggest that this disparity of ICT adoption is due to the differences of culture and other national-level social factors across different countries [9]. In this research, we would like to investigate socio-cultural factors that contribute to the disparity of ICT adoption in higher education in China and India.

RESEARCH METHODOLOGY

To investigate and compare how different socio-cultural factors may influence the ICT adoption in higher education in China and India, we take the qualitative inquiry strategy in our research, following Trauth’s argument about choosing research approach when she studied the socio-cultural factors that influence the growth of information economy in Ireland [11]. We take the interpretive epistemology in this study with no preexisted theory or hypothesis, which aims at understanding the phenomena (ICT adoptions in higher education) through meanings that people assign to them [10]. More specifically, we investigate the experiences and attitudes of Chinese and Indian college graduates to understand the socio-cultural contexts of ICT adoption in higher education in these countries.

Our research design takes into accounts of the affordance and limitation of our research conditions. All investigators of this study are from a major U.S. university, in which a large number of Chinese and Indian student are enrolled in Graduate Programs each year. The target population of this research is the first year Chinese and Indian graduate students who have recently received higher education degree in their native countries. Their experiences of how they and their fellow students use ICT in their college education reflect the up-to-date ICT adoption in these two countries. As direct participants, their behaviors and attitudes can indicate how the surrounding socio-cultural factors play important roles in their experiences.

Data Collection

The data collection method of this research is semi-structured face-to-face interview. Our interview guide consists of five parts to seek information related to demography, pre-college ICT experience, college ICT experience in formal education settings, college ICT experience in informal education settings and for entertainment purposes, and ICT experience of their social networks such as friends and families. We have finished interviewing six Chinese students and seven Indian students, including different geographic locations, genders, and majors to avoid possible biases. Traditionally, ICT is more popular in engineering disciplines than in non-engineering disciples in both China and India. Therefore, we need to have interviewees from both fields.

Data Analysis

We use open-coding approach to analyze the data. We take the inductive approach to develop main and sub categories from data reading. The main categories then become the broad factors, and the subcategories become the detailed tangible factors under the broad factors. Between each transcript, we try to find out what are consistent, what are inconsistent, and what is new. We test the category with new transcripts and compare the similarities and difference. When there is a category change, we go back to previous transcripts and recode that part. Therefore, the open-coding data analysis is an ongoing iterative process.

Data Evaluation

The process of data analysis such as reading data, developing codes, and retrieving data into codes is a group process. The three investigators work collaboratively throughout the study. The group process in data analysis helps to remove the individual researcher subjective bias, thus increase the reliability of coding and analysis, which in turn assure the inter-coding reliability. We also maintain close contacts with our interviewees for member checking purpose. Member checking technique helps to ensure the credibility and reliability of data analysis.

FINDINGS AND DISCUSSION

Our data analysis has shown that culture, infrastructure, and policy are three major socio-cultural factors affecting the ICT adoption process in education of both China and India, and the adoption has impacts on these factors as well. In this section
we discuss our findings from our analysis of data gathered through interviews. This result is consistent with Trauth’s research on understanding the socio-cultural influences on information economy development in Ireland [11].

**Culture**

Two distinct perspectives on culture are represented in the literature: culture is relatively stable vs. culture is variable and situated. The major advocate of the first perspective (where culture is a stable entity, based on shared assumptions) is Hofstede, who defines culture as “the collective programming of the mind which distinguishes the members of one group or category of people from another” [12, p. 25]. The other perspective on culture characterizes it as variable, historically situated, and evolving with the context. Rather than being a holistic and relatively stable entity, culture is seen as fragmented, variable, contentious, and “in-the-making” [13, 14]. Taking these into consideration, we analyzed our data by articulating what we understand as how culture reveals in ICT adoption process, instead of using the five dimensions proposed by Hofstede.

Our interviews show several cases that Indian students have organized themselves and negotiated with their school administrations for a better IT environment. For example, one participant explained to us that in her college, there wasn’t any computer lab facility before. A group of students talked with school management and started a computer club with 25 computers. Even though School management provided funding for the computer club, students took completely charge of the infrastructure. We have not found similar cases from interviewed Chinese students.

Our findings also show that in general, Indian students have earlier exposure to computers and computer technologies than Chinese students, and most of the Indian students’ parents have encouraged them to learn computers at younger age. Our interview data also suggests that collectivism influences the usage of ICT in education in both countries. However, this is reflected from different aspects in two countries. For example, it is common that college students in China purchase a computer together and share it, while Indian students buy computers individually avoiding sharing a computer with roommates. However, Chinese students tend to learn technologies independently while Indian students like discussing about technology issues with their friends.

**Social structure influences individuals’ choices on learning technologies**

It is interesting that almost all interviewees had taught their parents how to use computers at home in both countries. Interview data also shows that students obtain tacit knowledge on technology learning from senior students, e.g., a Chinese interviewee told us that he was advised to take C programming class from some senior students, and Indian students asked for advices from senior students on which technology skill to master when they enrolled in colleges.

**Long-term perspective and strong learning attitude on computer technology**

Both Chinese and Indian interviewees have long term goal in learning computer technology. They all acknowledge the importance of the technology in their future career and are self motivated in learning.

**Professors in both countries prefer face-to-face meetings with students to email, and have open hours for helping students on courses and research**

In both Chinese and Indian colleges, students can go to professors’ office at any time to ask questions. Moreover, the professors do not like using email to discuss questions. Instead, they prefer face-to-face interactions.

**Infrastructure**

Infrastructure in this study is mainly referred to information and communication technologies and related facilities, such as computer lab, Internet connectivity, online education, and digital library.

High schools in both China and India offer computer courses in general, and the content taught is similar (e.g., DOS, BASIC). College technology infrastructures are somewhat different in both countries. In China, the networking systems of most higher education institutes are parts of an integrative national networking system called CERNET (Chinese Education and Research NETwork). Compared to websites outside CERNET, it is free and faster to access those within CERNET. India college education does not have a networking system like CERNET. Additionally, Chinese universities tend to have both non-engineering colleges and engineering colleges co-located within a large campus. Therefore, these colleges share and benefit from the similar infrastructure. In India, because different colleges are geographically dispersed, engineering colleges have better technology infrastructure than non-engineering colleges. This difference explains our finding that while Chinese
students take computer courses in colleges many non-engineering Indian students learn computer skills through private institutes of ICT. Private institutes of ICT play a very important role in facilitating ICT educations of students in India. They provide more learning opportunities for students to take classes that are not offered in their college curriculum. They also provide a better technology infrastructure of which students can really take advantages.

Our findings indicate that ICT in college education of China and India develops at a fast speed in past five years and penetrates deeper and deeper in various education domains such as improving curriculum, developing hardware infrastructure, and expanding extra-curriculum activities (e.g., students form computer clubs).

**Hardware infrastructure is growing, but technical support and management of technology and corresponding issues is behind**

Although infrastructure growth is evident in both countries such that universities build new computer lab, add new computers, and increase Internet speed, the technical support and management corresponding to this growth is behind. For example, one Indian interviewee told us that the college bought hardware needed for building LAN in the dormitory, but students had to set up the network themselves because there was no technical support staff or administrator to do the job for them. In one Chinese college, the administrative staff members who make decisions on curriculum improvement are not knowledgeable enough to tell whether a course is appropriate or not. They decide on the course offering based only on the number of students who want to register the course. It is expected that administrative staff members should master certain computer knowledge in the future so that they will be able to make better decisions related to ICT adoption.

**Policy**

In both China and India, high schools in general offer mandatory computer introduction courses but students’ performances are often not graded. The courses serve as a way of exposing students with computer technologies.

Based on our interview data, we have found out that educational policies in college in these countries are quite different. In China, it is often mandatory for students to take computer courses regardless their major, and non-computer science departments sometimes offer major related computer courses. In India, very few non-engineering colleges require their students take computer courses. Usually, those “encouraged” students take computer courses from private institutes which offer various teaching models on ICT learning, and provide better computer facilities. In India, government policies on college education give more attention to engineering majors than art majors, and government has close control of government-owned universities, such as making decisions on courses in the curriculum of these universities.

**China implements push style policy while India’s policy is pull style**

There are several evidences in the data that indicate how policy demands teachers and students to adopt ICT in China. For example, in one university, teachers’ evaluation has included their computer skills now; in another university, teachers who use PowerPoint slides in teaching get three times paid than those who do not; a university publisher has a policy that if the new textbook does not include a CD containing class overheads in PowerPoint slides, the new textbook cannot be published; one interviewee’s elementary school formed interest group and selected students to join the interest group; one interviewee told us that new national educational policy is under discussion that college students will have to pass a national computer skill test in order to graduate in the near future.

We did not see this push style of policy and management in India education. Instead, we found that in some colleges, students can request for specific software from the college if they need; in one college, when students formed a computer club and requested for financial support, the college accepted the students’ request and funded the club.

We think these two different styles of management and policy might be due to the different political background of China and India.

**Economy**

Although we expected that economy must have played an important role in ICT adoption on education in both countries, we were not able to collect sufficient data on this issue, compared to other categories (e.g., infrastructure, policy). One reason might be that interviewees of the projects were students of universities and were not aware of economical issues in their universities. It is also possible that economy intertwines with policy issue and it is not easy to find evidence directly related to economy. For example, a new policy on ICT adoption such as providing financial support to students’ computer clubs might indicate the impact of ICT adoption on policy making of the college (policy issue), or might be that the college has enough funding to support all students’ organizations (economic issue).
RESEARCH LIMITATION AND FUTURE WORK

In this exploratory and ongoing study, we have several research limitations due to the constraint of recruiting process and the qualitative data collection and analysis techniques. Because of the location and financial constraint, we were only able to interview Chinese and Indian students that are currently studying in the United States, which adds bias to the analysis, e.g., these students were very good students when in college, hence the attitude towards IT adoption and the IT experience may be more positive than general college students. In data collection process, we relied on students' memory about their college life to collect information, which adds another bias to the study. In the analysis, we as students from these countries have helped interpreting and understanding the data better as well as adding our own bias to it. Moreover, the number of interviewed students was very small compared to the large population of the two countries. Taking these limitations into account, we will look for new data sources besides interviews, such as policy analysis and website content analysis of the university websites, and we will triangulate our interview data for better understanding of ICT adoption in China and India. Conducting a survey will also be considered once we have a better understanding of the factors that affect ICT adoption in both countries.

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