THE IMPACT OF ICT INVESTMENTS ON FUTURE WORKFORCE DEMOGRAPHY IN EMERGING SOCIETIES

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Abstract

This paper reports on a research-in-progress investigation of the extent to which trends in information and communication technology (ICT) investments impact the future trends of three workforce demography measures in emerging societies: (1) the proportion of administrative and managerial positions held by women in those societies; (2) the proportion of professional and technical positions held by women in those societies; and (3) the extent to which women are able to exert control over economic resources in those societies. As levels of institutionalized democracy and adherence to different religions and denominations are known to yield varying impacts on cultural acceptance of gender equity in the workforce, the predominant religion of each emerging society and its level of institutionalized democracy are also included as covariates in the research model. Early results indicate that at least two of the study's three hypothesized relationships may be tenable, implying substantial repercussions for the global development community.

Keywords: ICT, workforce demographics, emerging societies, gender equality, globalization

Introduction

In 1995, representatives from nearly 200 nations gathered in Beijing at the UN-sponsored World Conference on Women to discuss the practices and cultural attitudes that continue to perpetuate gender inequalities in the modern era. One of the primary outcomes of this historic meeting was the Beijing Declaration, in which the nations of the world declared in a single voice that "Women's empowerment and their full participation on the basis of equality in all spheres of society, including participation in the decision-making process and access to power, are fundamental for the achievement of equality, development, and peace" (UN, 1995). In the intervening years, information and communication technologies (ICTs) have become inseparably interwoven into the fabric of developed societies, wherein women constitute nearly half of the workforce and contribute substantially to economic production (Economist, 2006a). Furthermore, as they now comprise the majority of university students in the developed world, women are expected to play an increasingly important role in the high-technology workforce of the future (Economist, 2006b). One might, for example, consider the case of the Middle East, wherein women comprise as much as 63% of the university population in some countries, but on average account for only 32% of the workforce (WBG, 2005). In many emerging societies, women's participation in the workforce thus remains quite limited, and significant cultural, political, and economic barriers to workforce gender equality still exist (UNDP, 2006).

Despite the reassuring words put forth by the governments of the world in the Beijing Declaration, the suppression of women's participation in the workforce is still common in emerging societies, and is often sanctioned or even mandated by the state. International obligations notwithstanding, narrowing the workforce gender equality gap should be a priority for emerging societies seeking to accelerate their development, as gender parity in the workforce has been found to have substantial social and economic benefits (Scanlan, 2004), not the least of which are a reduction in poverty (Kabeer, 2003), and improvements in health and standard of living (UNICEF, 2006). Unfortunately, gender inequalities in emerging societies are often anchored to deeply-entrenched cultural and religious beliefs, making progress toward workforce parity difficult to achieve. Recent research, however, suggests that the processes of modernization and globalization may have important implications for the status of gender workforce equality in emerging societies (Bayes and Tohidi, 2001; Inglehart, et al., 2002). While many scholars have argued that globalization may exacerbate gender inequalities (Baliamoune-Lutz, 2006; Bergeron, 2001; Keohane, 2005), there is also a mounting body of evidence which suggests that globalization can be beneficial to women in emerging societies. Globalization has, for example, been credited with expanding employment opportunities for women (Seguino and Grown, 2006), providing women with greater independence and autonomy (Ganguly-Scrase, 2003), improving the ability of women to control economic resources (Datta and Kornberg, 2002), and endowing women with greater opportunities for political decision-making and participation (Gray, et al., 2006; Inglehart, et al., 2002; Walby, 2000). Globalization, however, is a complicated and multifaceted process, and the specific mechanisms through which globalization affects gender demography in the workforce are not well understood. In an effort to contribute to the resolution of this gap in the knowledge, the current paper reports on a research-in-progress investigation of the extent to which ICT investment trends -- a principal driver of globalization in the modern era -- impact trends in future workforce gender demographics in emerging societies. In so doing, it is hoped that this study will usefully contribute to the debate surrounding women's participation in the burgeoning global workforce, and will serve to illustrate the important role played by information and communication technology investments in transforming workforce demographics in the developing world.

Workforce Demography and ICT-Driven Globalization in Emerging Societies

The gender demography of the workforce in many emerging societies is today in a state of rapid transformation, much as it was in developed societies several generations ago. Prior to the middle of the 20th century, cultural attitudes toward gender greatly limited both the scope and the availability of employment opportunities for women in developed societies. As the developed world descended into the darkness of World War II, a sense of collective identity and shared destiny emerged which galvanized peoples on both sides of the conflict to work together toward a common goal. Cultural objections toward gender equality in the workforce were thus put aside as economic necessity required that millions of women on both sides join the workforce to replace the men who were away at war. Following the cessation of hostilities, cultural attitudes toward women in the workforce had been irrevocably altered in the developed world, and women thereafter would become increasingly important contributors to economic growth and development.

Theoretical insight into such societal transformations first requires an understanding of how societies are structured. Recent work in this regard has led to the identification of five primary societal structures: ecology, polity, technology, economy, and culture (Fuchs, 2003). The ecological realm consists of the natural environment in which a society exists; it is from this realm that societies obtain the natural resources necessary to achieve their goals. The polity realm refers to a society's political and governmental structures. The technological realm refers to the use of tools and technologies by the members of a society as a means of meeting their needs and achieving their goals. The economic realm refers to a society's system of production, distribution, and consumption. Finally, the cultural realm refers to the set of norms and values that are shared by a society's members. The nature of the interdependent relationships among these five societal structures is addressed by Giddens' structuration theory (Giddens, 1984). This theory posits that a duality exists between a society's members and its structures insofar as the actions of the members both define and are constrained by the structural components of the society. Given that the members of a society act in all five structural realms, each societal structure influences and is influenced by the other structures. Implicit in this theoretical framework is the notion that a societal structure will not adapt instantaneously to changes in another structure, but rather that the structural adaptations will occur over time. Changes in technology, for example, can be expected to impact the future constitution of a society's political, economic, cultural, and ecological systems, which, in turn, will alter the way in which the society later uses its technology. It is for this reason that temporal effects must be considered -- and indeed anticipated -- when conducting research into societal change. In the context of structuration theory, the inclusion of time as a central component in such research also allows causal assessments to be made with respect to societal characteristics that may on the surface appear to covary. From the perspective of this theoretical framework, the historical transformation in workforce demography within developed societies was initiated by a substantial disruption to the polity (i.e., the crisis of imminent war), which in turn led to economic disruptions that necessitated a softening of cultural attitudes toward women in the workforce.

Whereas women in developed societies were driven into the workforce by the galvanizing forces of war and conflict in the 20th century, women in emerging societies are today being driven into the workforce by a new galvanizing force -- that of globalization. While it is true that in many emerging societies both men and women are still commonly accepting of gender inequalities, the process of ICT-driven globalization has introduced substantial disruptions into the cultural fabric of those societies, leading to a pronounced and ongoing shift in cultural attitudes toward women, especially among the younger generations (Inglehart and Norris, 2003). Thus, while ICTs enable emerging societies to participate more fully in the rapidly-globalizing world and capture a share of the economic benefits associated therewith, the adoption of those technologies also carries with it substantial cultural implications, including implications for gender workforce demography. From a theoretical perspective, one can rely upon Castells' theory of network society to gain insight into this phenomenon. This theory proposes that societal members act as nodes on a social system network that has important consequences for the lives of each member (Castells, 2000). Nodes on the network connect with other nodes that share similar resources and interests. If a node fails to remain connected (via communication) with other nodes on the network, it may be dropped from the network and lose its ability to influence the organization or group. Participation in the network can be characterized as an ongoing cycle of inter-nodal information production, sharing, and absorption. In enabling these networks to exist on a global scale, and in allowing ideas to be shared and influence to be applied over large geographic distances, ICTs have a direct impact a society's distribution of power and influence. Further, as a society evolves into one based upon knowledge and information, the power within that society becomes increasingly decentralized; i.e., access to information yields a more balanced distribution of power among those to whom the information is available. Because ICT investments greatly expand the ability of individuals to acquire and share information, they can be expected to yield increases in the desire for gender equality. There are several reasons for this: First, information networks can be used to spread the ideas of equality and universal rights and to help foster debate on worldwide democracy. Second, networks of international governmental and non-governmental organizations can serve as cradles of gender equality for emerging societies. Third, decentralized, complex networks can provide some degree of immunity from authoritarian structures that may seek to suppress gender equality due to the lack of control that can be exerted by those structures, thereby preventing such ideas from being stifled. Finally, ICT networks act as channels for the rapid dissemination of information and other news, and can act to counter the often distorted and repetitive voice of a monotonic state-run media.

Institutional theory (Scott, 2004) and power transition theory (Tammen, 2000) also provide useful lenses for examining the relationship between ICT investments and workforce demography. In the context of ICT investments, these theories predict that societal members will recognize that ICTs can be a force to determine or constrain the behaviors of individuals, groups, organizations, and governments, and that those ICTs can be leveraged to accomplish current or new objectives that impact the participants' self-interests. Investments made into ICTs can

therefore be expected to have substantial implications for the role of women in emerging societies. When considered together, these theories imply that the introduction of power-altering ICTs in emerging societies generates disruptive ripples that travel outward from the technology subsystem to cause changes in those societies' cultural subsystems. As a greater and greater proportion of a society's citizens become connected to one another and to the rest of the world by participating in an ICT-enabled social system network, the network has an increasingly important influence on their values and beliefs (Castells, 2000). With respect to globalization, the cultural norms and values that are embedded within developed societies' economic, political, and social structures can be readily transmitted via ICT networks to citizens in emerging societies, thereby leading entrenched cultural attitudes within those societies to be disembedded and later reembedded with ideologies adopted from developed societies. Thus, ICT-driven globalization is enabling the structural shifts that took place in gender workforce demography within developed societies during the latter half of the 20th century to be gradually incorporated into the cultural fabric of emerging societies in the 21st century (Inglehart and Norris, 2003). Consequently, as emerging societies increasingly invest in information and communication technologies, mainstream cultural support of gender inequalities can be expected to slowly erode, and women's participation in the workforce can be expected to increase. Given that this anticipated ICT-driven shift in cultural attitudes toward gender equity in the workforce is simultaneously converging with an improving educational climate for women and rapid economic modernization (Inglehart and Norris, 2003; Limbach, 2006; Meng and Li, 2002), employment opportunities available to women in emerging societies can also be expected to materialize in newly-created positions that require an administrative or technical skillset. These expectations form this study's first two hypotheses:

> Hypothesis 1: ICT investment trends in emerging societies will impact future trends in the proportion of administrative and managerial positions held by women in those societies.
>
> Hypothesis 2: ICT investment trends in emerging societies will impact future trends in the proportion of professional and technical positions held by women in those societies.

If ICT investments do indeed yield future increases in the proportion of skilled positions in emerging societies occupied by women, it can likewise be reasoned that the proportion of economic resources controlled by women within those societies will also increase. This expectation forms the study's third hypothesis:

> Hypothesis 3: ICT investment trends in emerging societies will impact future trends in the proportion of economic resources controlled by women in those societies.

Deeply ingrained societal religious beliefs are widely recognized to influence cultural attitudes toward gender roles in the workforce, with the size of the impact varying among adherents of different religions and denominations (Inglehart and Norris, 2003). Given that religious beliefs continue to exert a great deal of influence over cultural norms and values with respect to the role of women in the workforce, the predominant religion of each emerging society will be included as a covariate in the research model. It is also important to consider the role of the state in determining the constitution of an emerging society's workforce. In many autocratic societies, official policies constrain or prohibit women's participation in the workforce. As the extent to which a society supports the ideals of gender equality has been linked with the extent to which the society supports the principles of democracy (Inglehart, et al., 2002), the nature of the state -- as indicated by the extent to which a society has institutionalized the principles of democracy -- must be considered when evaluating ICT investment impacts on women's workforce participation. Controlling for the effects of inter-societal religious and democratic differences should allow a much more accurate determination to be made regarding the impact of ICT investments on future workforce demography in emerging societies.

Research Model

Given the discussion above, this study will seek to evaluate the research model shown in Figure 1. As the theoretical framework anticipates time-lagged effects, time is included as a component of the model.

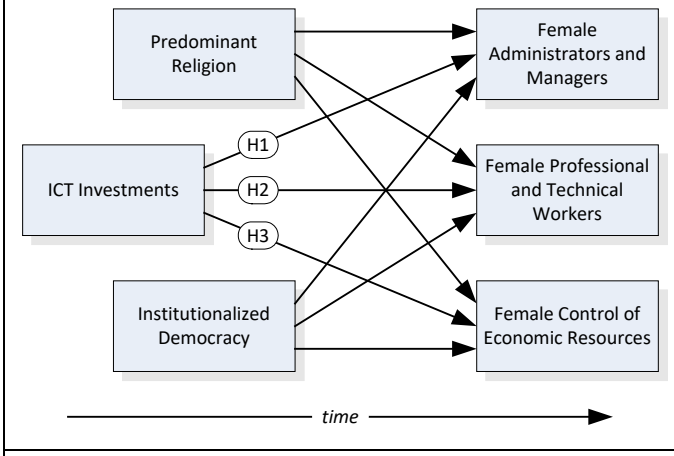

Figure 1. Research Model

Data and Methodology

This section describes the quantitative data and methodological approach used to evaluate the hypotheses developed above. Specifically, this section details the operationalization of the theoretical constructs contained in the research model, the processes through which the data were collected and prepared for analysis, and the longitudinal growth curve model through which the study's hypotheses will be evaluated.

Operationalization of Constructs

In order to evaluate the research model put forth above, it was first necessary to identify a tenable set of emerging societies. Standard and Poor's defines a country as emerging if it is classified as low or middle-income, or if the investable market capitalization of the economy is low relative to the country's gross domestic product (S&P, 2000). Using the S&P definition, fifty low and middle-income emerging countries were identified for inclusion in the current study[1]. It is believed that a country serves as a good proxy for a society, as the citizens of a country typically identify with a common set of laws, beliefs, and values that endow them with a shared sense of history, belonging, and solidarity -- what Emile Durkheim has termed a "collective consciousness" (Durkheim, 1982 [1895]).

With respect to the independent constructs in the research model, the 'ICT investments' measure was operationalized as the 'ICT expenditure' variable contained in the World Development Indicators Database (WBG, 2007). This measure quantifies the percentage of a country's GDP that is spent on computer hardware, software, computer and communications services, and wired and wireless communications equipment. The 'predominant religion' variable was constructed using the United States Central Intelligence Agency's World Factbook, which provides detailed demographic information for nearly every country in the world (CIA, 2007). This resource allowed the predominant religion for each country in the analysis to be identified and coded into a numeric control variable. When the predominant religion reported in the CIA World Factbook was not sufficiently specific (e.g., when the religion was reported simply as 'Islam' rather than *Sunni*, *Shia*, or *Ibadi* Islam), the U.S. Department of State's

[1] Data from the following fifty emerging countries were used in this study: Argentina, Bahrain, Bangladesh, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Cote d'Ivoire, Croatia, Czech Republic, Ecuador, Egypt, Estonia, Ghana, Hungary, India, Indonesia, Jamaica, Jordan, Kenya, Latvia, Lebanon, Lithuania, Malaysia, Mauritius, Mexico, Morocco, Namibia, Nigeria, Oman, Pakistan, Peru, Philippines, Poland, Romania, Russian Federation, Saudi Arabia, Slovak Republic, Slovenia, South Africa, Sri Lanka, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, Venezuela, and Zimbabwe.

Report on International Religious Freedom was used to make a specific determination (USDOS, 2006)[2]. The 'institutionalized democracy' measure was operationalized using the Freedom House assessment of democratic freedoms, which is an additive function of political rights and civil liberties (FreedomHouse, 2006). Specifically, this measure considers the extent to which all citizens (including women) in a given country can: (1) participate in the political process; (2) vote in legitimate elections; (3) freely exercise expressions and beliefs; (4) freely assemble and associate; (5) have accountable representation; (6) have access to an established and equitable system of rule of law; and (7) have social and economic freedoms, including equal access to economic opportunities and the right to hold private property. This measure is published in the Freedom House annual survey of political rights and civil liberties, which is widely considered to be the definitive report on freedom and democracy around the world (FreedomHouse, 2006).

Country-level data published in the United Nations Development Programme's annual Human Development Report were used to operationalize the dependent constructs in the research model (UNDP, 2006). Among other measures of human development, this report assesses the status of women in a given country by considering three interrelated components: (1) the extent to which women are able to participate in political decision-making; (2) the extent to which women are able to participate in economic decision-making; and (3) the extent to which women are able to exert economic power (UNDP, 2006). With respect to the current study, the second and third components were of primary interest. The 'female administrators and managers' construct used in the current study was thus operationalized as the percentage of administrative and managerial positions in the target country that were held by women during a given year, as indicated by the UNDP report. Similarly, the 'female professional and technical workers' construct was operationalized using the UNDP report as the percentage of professional and technical positions in the target country that were held by women during a given year. Finally, the 'female control of economic resources' construct was operationalized as the ratio of female to male earned income in the target country in a given year, as reported by the UNDP. Together, it is believed that these three outcome measures can provide useful insights into the nature of gender workforce equality in emerging societies.

Data Collection and Preparation

Given that the theoretical framework on which this research is based anticipates temporal lag effects, it was necessary to acquire several years' worth of data for each of the countries in the analysis. As data from the five sources described above were only concurrently available for the years 2000 through 2005, the dataset was restricted to that six-year time span. As there were six observations per country, the final dataset consisted of 300 unique cases. After compiling the data into a single repository, a missing values analysis was conducted which indicated that approximately 9.85% of the data were missing. The data were thus subjected to Little's MCAR test (Little, 1988) which revealed that the missing values in the dataset were missing completely at random ($X^2 = 27.920$, df = 19, p = not significant). As the MCAR assumption had not been violated, the Markov Chain Monte Carlo (MCMC) multiple imputation method was used to impute missing values in the dataset (Gilks, et al., 1996; Rubin, 1987). This approach is optimal in that it avoids the biases that are introduced into a dataset when cases with missing values are deleted, and prevents the loss of statistical power associated with listwise deletion (Schafer, 1997). Finally, an a-priori power analysis was conducted which indicated that with 300 observations, the research model would have the capability to detect an effect size (Fisher's f^2) as small as 0.037 at a power level of 0.80 and a probability level of 0.05 (Soper, 2007).

Longitudinal Growth Curve Model

Longitudinal growth curve (LGC) modeling using maximum likelihood estimation was selected as the optimal evaluative framework for testing the study's hypotheses, as it does not assume a zero error variance and also allows for the simultaneous estimation of all of the interconstruct paths in the research model. Using this approach, it will be possible to evaluate the extent to which ICT investment trends in emerging countries are able to account for future workforce demography trends in those countries. For stability purposes, a minimum sample size of 100 is generally recommended when estimating a structural model (Medsker, et al., 1994). Based upon the S&P definition

[2] The countries in the analysis were classified according to the following predominant religions: Catholic Christianity, Orthodox Christianity, Protestant Christianity, Sunni Islam, Shia Islam, Ibadi Islam, Hinduism, Buddhism, Syncretic / Indigenous, and Atheism.

of emerging countries (S&P, 2000), however, the 50 countries contained in the current dataset constitute a population rather than a sample. As such, it will be possible to obtain stable results from the LGC model by employing bootstrapping techniques during the model estimation process (Kline, 2005; Smith and Langfield-Smith, 2004). Prior to defining the LGC model, however, it was necessary to examine the shape of the trend for each of the time-based constructs in the dataset (Duncan, et al., 2006). These trends are shown in Figure 2 below.

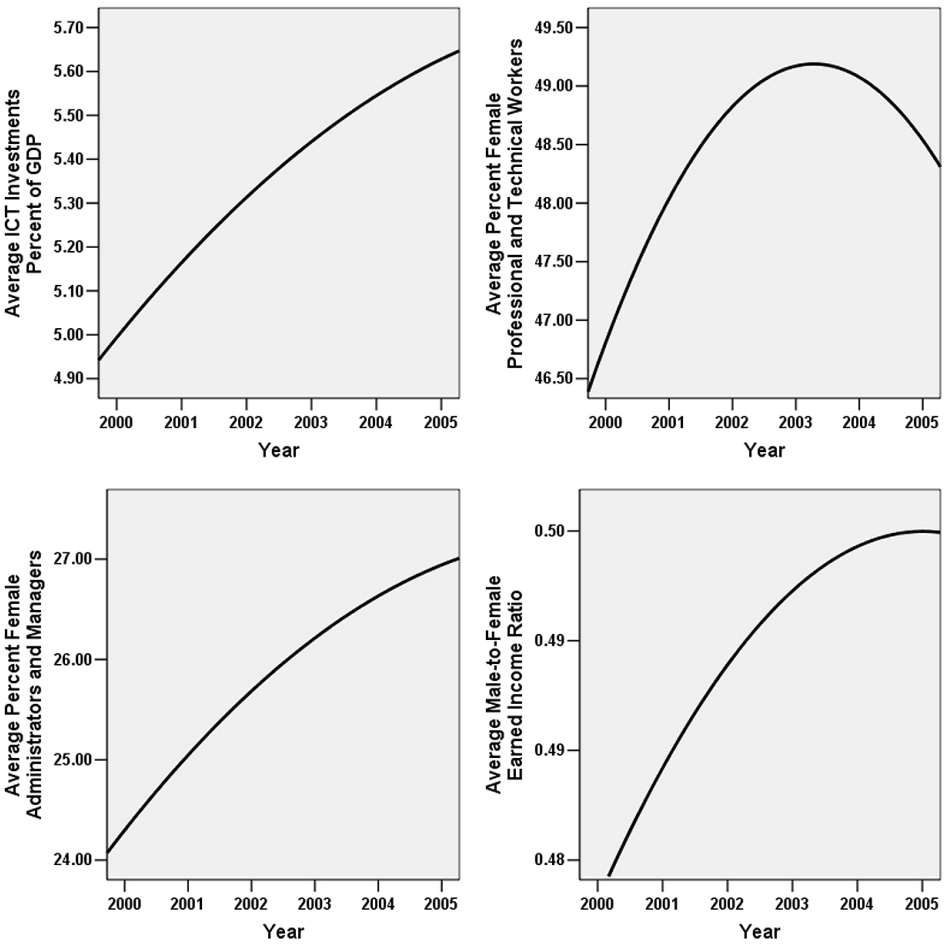

Figure 2. Average Growth Curves for Time-Based Model Constructs

As shown in the figure, all four of the time-based constructs under investigation exhibit quadratic growth during the six year period evaluated by the study. As such, the longitudinal growth model was defined using a quadratic estimation structure for both the independent and dependent constructs. This model is shown in Figure 3 below.

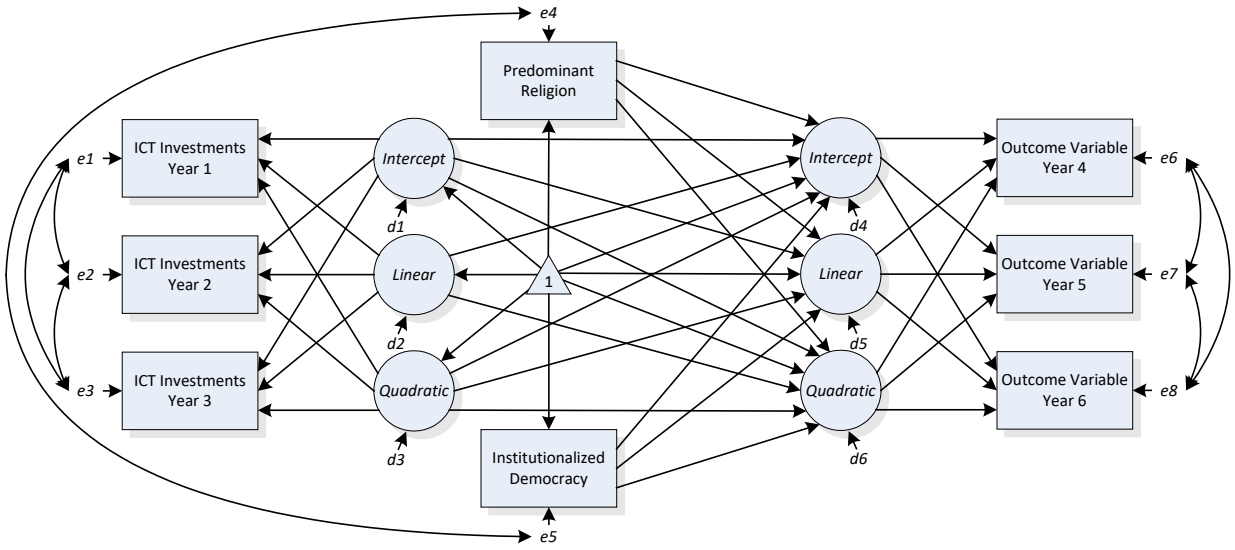

Figure 3. Longitudinal Growth Model

As shown in Figure 3 above, the longitudinal growth model will assess the extent to which the quadratic growth trend in ICT investments during the first three years of the study can usefully account for and predict future quadratic growth trends in the three workforce demography outcome measures, after controlling for each emerging society's predominant religion and level of institutionalized democracy. If ICT investments are found to be significant in predicting the intercept factor for the outcome measures, it will indicate that those investments can usefully predict the future initial values of the workforce demography measures. Similarly, if ICT investment trends are found to be significant in predicting the quadratic factor for the outcome measures, it will indicate that those trends can usefully predict future quadratic trends in the workforce demography measures, thereby lending support to the study's hypotheses.

Early Results and Discussion

Although data analysis for this study is still underway, there are several interesting early results that can be reported here. It is important to note that a much more complete set of analyses and results will be available at the ICIS conference if this paper is accepted for a poster presentation.

Table 1 below contains the results of an initial assessment of bivariate correlations between the above-described variables in the research model.

Table 1. Bivariate Correlations and Significances

	ICT Investments	Predominant Religion	Institutionalized Democracy	Female Administrators & Managers	Female Professional & Technical Workers	Female to Male Earned Income Ratio
ICT Investments	1.000					
Predominant Religion	-0.055	1.000				
Institutionalized Democracy	0.135**	-0.519***	1.000			
Female Administrators and Managers	0.275***	-0.546***	0.523***	1.000		
Female Professional and Technical Workers	0.181**	-0.540***	0.622***	0.830***	1.000	
Female to Male Earned Income Ratio	-0.036	-0.208***	0.448***	0.586***	0.742***	1.000

** $p < 0.01$ *** $p < 0.001$

As shown in the table, ICT investments were observed to be positively correlated with the relative number of female administrators and managers, and with the relative number of female professional and technical workers in emerging countries, but not with the ratio of male to female earned income. This outcome indicates a reasonably strong possibility that the first two hypotheses are tenable, while the third hypothesis may not be supported. If this is indeed the case, it may be that male earned income is growing at an equal or faster rate than female earned income in emerging societies, or that changes in earned income occur too slowly to be detected over the study's six-year time horizon. It is, of course, difficult to conclude anything concrete with respect to this study's hypotheses by examining bivariate correlations, however the observed values nevertheless imply the possibility of interesting results that may have significant implications for both theory and practice.

The correlation table also provides evidence that the study's control variables (i.e., predominant religion and institutionalized democracy) are likely to subsume a significant proportion of the variance in the outcome measures. The direction of the correlations between institutionalized democracy and the workforce demography outcome measures indicates that higher levels of institutionalized democracy may be associated with higher levels of female workforce participation, and supports the inclusion of institutionalized democracy as a covariate in the study. The direction of the correlations between predominant religion and the workforce demography outcome measures, however, has little interpretable meaning, as the numeric coding scheme for the predominant religion variable was arbitrary. Nevertheless, given that the predominant religion variable was categorically coded, a one-way analysis of variance can provide some insight into the efficacy of the variable as a covariate. This analysis is shown in Table 2 below.

Table 2. One-Way Analysis of Variance between Predominant Religion and Workforce Demography Measures

Workforce Demography Measure	Sums of Squares		df	Mean Square	F	Probability
Female Administrators and Managers	Between	144.379	9	16.042	31.093	< 0.001
	Within	149.621	290	0.516		
	Total	294	299			
Female Professional and Technical Workers	Between	168.036	9	18.671	42.984	< 0.001
	Within	125.964	290	0.434		
	Total	294	299			
Female-to-Male Earned Income Ratio	Between	68.935	9	7.659	9.869	< 0.001
	Within	225.065	290	0.776		
	Total	294	299			

As shown in the table, significant differences were observed among the levels of the predominant religion covariate across all three workforce demography measures, thereby lending support to its inclusion in the study. Broadly speaking, the early results described above support moving forward with an assessment of the study's hypotheses. When carried out using the longitudinal growth curve model described previously, such an assessment should be illuminating with respect to this study's hypotheses.

While the investigation described herein is still in progress, and although little can currently be said with respect to this paper's hypotheses, the author believes that this research will have significant implications for both the IS field and the global development community if even one of the hypotheses is ultimately supported. Such a finding would indicate that the proliferation of information and communication technologies can substantially affect the future empowerment of women in developing and emerging societies by acting as an agent of change in workforce demography. As gender equity in the workforce has been found to yield reductions in poverty (Kabeer, 2003) and to effect improvements in health and quality of life (UNICEF, 2006), the results of research endeavors such as this may one day usefully inform policy decisions that can elevate the status of the world's subjugated women, and therethrough improve the emerging global society in which we all live.

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