INFO3060

Industrial Research

An Investigation into the State of Information Technology in Chile and Indonesia

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Contents

Executive Summary

Four important themes found within the literature on developing countries and information technology are the importance of education and consequently human resources to IT development, the function that the Internet can perform in development, how IT is and can be used by small businesses, and the role of the government in the process of using IT for development.

These areas were partially investigated by this report through World Bank Group statistics, a literature search and an email survey sent to Chilean and Indonesian academics, as two examples of developing countries using IT in the context of development.

The literature without exception finds IT education crucial to the success of IT within developing countries, and hence achieving development through it. One problem encountered by developing countries that attempt to develop their local IT skills is the phenomenon of 'brain drain'. This refers to the situation where the best skilled IT people within a developing country are attracted to developed countries through extra pay and opportunities. The email survey confirmed this as an issue which Chile and Indonesia face. The email survey responses also suggested that the university system in Indonesia is not always the process whereby people gain IT skills, and that it may actually not be the best method of IT skilling.

The Internet is often mentioned within the literature, usually to point out its potential to assist development and the fact that this potential is rarely reached as the infrastructure and communication costs of developing countries are often prohibitive.

Another area regularly dealt with in the literature on the topic of the Internet is the disproportionate amount of information originating from developed countries (especially the US), and what cultural effect this might have. Responses to the email survey suggest that while both Chile and Indonesia do not have the ideal Internet situation (especially Indonesia), access is still obtainable, and this access is a valuable source of IT information and learning.

The literature has a wealth of information and opinion on the area of business use of IT in developing countries. Some authors suggest that in an information intensive and globalised world developing countries and their businesses are being excluded thanks to a lack of technology and know-how. Other authors feel that developing countries are faced with numerous advantageous opportunities in relation to IT, being able to cheaply purchase developed world technology. The importance of small businesses to developing countries economies, and the advantages IT can bring to these businesses is another common theme. The academics who responded to questions on this area provided information which helps build a picture of business demand for IT, but did not give evidence to support either a negative or positive business use of IT scenario to match those found in the literature.

Another topic within the literature that receives as much attention (if not more) as business use of IT in developing countries, is the role of developing countries governments in relation to IT. Almost without exception the point is made that IT alone will not assist a country's development, instead a concerted effort needs to be made by government to support and encourage it. Within this broad area, the issue of deregulation attracts the most comment and controversy. Some authors (perhaps

representing the more mainstream view) suggest that governments need to deregulate their industries to encourage competition and decrease the price of IT and ICT in particular (information and communication technologies). This in turn will make IT more accessible and more effective in its potential development function. Others suggest deregulation prevents governments from intervening to ensure equitable access, and also opens up developing countries to exploitation from developed countries. Another regular theme within the literature is that regardless of which direction developing countries governments take (regulation or deregulation) they face significant obstacles to encouraging IT within their country, among which are costs, lack of human resources, and lack of infrastructure and business culture to support it.

The respondents who answered offered opinions on these areas suggested that regulation and deregulation were important issues in their countries, with the mainstream opinion being in favour of greater deregulation. Their responses to the survey as a whole confirmed the existence of major obstacles to IT development within their countries, but also suggested that IT was a positive developmental force that would grow in time.

Introduction

This report examines some important aspects of the information technology situation in Chile and Indonesia. These aspects are: the university system of Chile and Indonesia in relation to information technology, the Internet in each country, how business in each country takes advantage of information technology, and how government policy toward information technology stands in each country.

A survey was sent to Chilean and Indonesian academics in information technology related disciplines via email, asking questions on the previously mentioned areas (see Appendix A). This report relies on their responses, the literature and some basic statistics supplied by the World Bank Group.

Before examining these areas a brief overview of the broad demographic, geographic and economic situation in Chile and Indonesia is given. To give the reader some perspective Australia's statistics are included in the table. This table assists in providing a background understanding to some of the points raised in the specific sections.

Brief Demographic, Geographic and Economic Overview of Chile and Indonesia

Statistic	Chile	Indonesia	Australia
Population	15.2 million	210.4 million	19.2 million
Population growth (annual %)	1.3	1.6	1.2
Illiteracy rate, adult male (% of males 15+)	4.1	8.1	
Illiteracy rate, adult female (% of females 15+)	4.5	17.9	
School enrolment, primary (% net)	89.4 (1996)	94.8 (1996)	94.9 (1996)
School enrolment, secondary (% net)	58.3 (1996)		88.9 (1996)
Surface Area (sq. km)	756.6 thousand	1.9 million	7.7 million
GDP (current $)	70.7 billion	153.3 billion	394.1 billion
GDP growth (annual %)	5.4	4.8	4.2
GNI pet capita, Atlas method (current US$)	4,600	570	20,530

Source: The World Bank Group (World Development Indicators database, April 2001)

The University Information Technology Situation in Chile and Indonesia

Literature Summary

The role of the education system in assisting developing countries to utilise information technology to their advantage is emphasised in the literature. The quality of information technology human resources available in a country is directly related to the quality of the country's education system. As John Hayman writes: "Sufficient education and experience is needed among users, among technical staff who must service and maintain equipment, and among administrators who must manage it. The adequacy of knowledge and skills varies broadly, with a shortage of skilled personnel in most developing countries. Education and training at all levels are very important."[1]

John S. Mayo affirmed this opinion during a speech on the topic of 'Information Technology and Development', commenting that: "there is a need for heavy investment in the development of the human infrastructure, not just the physical infrastructure. The global leaders of the 21st century will be those countries that have not only invested in the right technologies, but also in the intellectual growth of their people."[2] He also noted that the Internet provided new opportunities for learning and developing such human capital. Interestingly one Indonesian academic surveyed felt that human resources was the number one problem for his country, while another strongly felt that the Internet was the best means available to help develop their IT human resources.

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[1] Hayman, J. (1993) Bridging higher education's technology gap in Africa. *T H E Journal (Technological Horizons In Education)*, 20, 6, p 63.
[2] Mayo, J.S. (1995) Information technology for development. *Vital Speeches*, 61, 8, p 244.

One threat to the human resources of developing countries is the phenomenon called 'brain drain', whereby capable students interested in IT, IT graduates and IT workers are attracted to developed countries by the better opportunities or pay on offer. Lokongo summarises the end effect with the conclusion that "The best talents of the developing world are being gulped up by the west."[3] Obviously this phenomenon further exacerbates the difficult position developing countries find themselves in relation to information technology, and if most commentators are correct, consequently economical health in an increasingly globalised and information based world.

Despite the IT human resources problem faced by developing countries, the literature suggests that they should continue to focus on encouraging their local IT industry as a means of assisting their development. One obvious 'advantage' developed countries have in relation to IT is to take advantage of the latest technology developed in richer countries, skipping ("leapfrogging") the intervening (and expensive) stages that led to its development[4]. Many commentators bring this point up in the literature while a paper by Morales and Melesse suggests that the notion is "…dangerously naïve and unrealistic…" and instead concludes that "…the best long-term development investment that can be made using ICTs [Information and Communication Technologies] is to apply them to the training and education of the new generation, rather than to transform these technologies into short-term ends in themselves."[5] If

[3] Lokongo, A. (2000) Immigration policy without humanity? *New African*, 390, p 37.
[4] This "leapfrogging" concept is very common in the literature. For a typical and concise example see: (2000) Leaders: Catch up if you can. *The Economist*, 354, 8152, p 20-21.
[5] Morales-Gomez, D and Melesse, M. (1998) Utilising information and communication technologies for development: The social dimensions. *Information Technology for Development*, 8, 1, p 3.

this is indeed true, then the importance of IT education can be seen as even more central to developing countries development.

The following table gives a broad and incomplete understanding of how Chile, Indonesia and Australia stand in relation to science and engineering education and research. This should somewhat reflect their relative standings in the field of IT also.

Statistic	Chile	Indonesia	Australia
Science and engineering students - % of total tertiary students	42	39	24
Scientific and technical journal articles 1997	850	123	11793

Source: The World Bank Group (World Development Indicators 2001 – Science and Technology)

Findings from Email Survey of Chilean and Indonesian Academics

The role of the university system in developing the information technology infrastructure of Indonesia and Chile does not seem as central as one might have thought. According to one Chilean academic the demand for information technology degrees in Chile is low in comparison to engineering degrees, with strong industry demand for the latter over the former. An Indonesian academic declared most of the Indonesian information technology curriculum useless due to its lack of currency, instead suggesting the source of up-to-date and useful information technology knowledge is the Internet, the subject of the next section.

The estimated percentage of new information technology workers with a university degree by the respondents was low in both Chile and Indonesia – around 20%. It is important to note that other non-university education institutions exist. Indeed one Indonesian academic notes that the demand for IT education in general (not just university IT education) by parents for their children is very high. This does not however necessarily translate into an increase in the importance of the role of universities, or indeed an increase in industry demand for such students. One Indonesian academic stressed the distinction between student demand for university IT education and industry demand for these graduates. The difficulty measuring which university graduates are working in the IT field was also mentioned by an Indonesian academic citing the often “freelance” nature of their work, taking advantage of flexibility of IT work.

The academics surveyed gave varying responses to inquiries about the level of their university’s computer resources. Apart from one Indonesian academic who was

disappointed by the computer resources at their university and suggested that this problem was exacerbated by lack of good management, all of the other academics seemed satisfied. As could be expected all of the universities were primarily serviced by PC based hardware. One Indonesian academic noted the high incidence of pirated software being used. Perhaps this can be justified in the context of a developing country facing developed world software licensing fees. A more difficult but feasible idea would be to invest energy into taking advantage of the Linux and free software environment in general that exists. An Indonesian academic surveyed was heavily interested in this area as a means of improving their country's IT human resources, which as mentioned in the previous section is an area of critical concern to developing countries.

Questions related to the 'brain drain' issue elicited answers that generally conformed to its concerns. One major university in Indonesia has on average 15% of its IT graduates find work overseas, while those academics surveyed who answered questions on this area did not think many IT graduates who left would return to work in their home country. An Indonesian academic noted that graduates had the option of working for multinational companies without actually leaving their country, while another noted that it is possible for graduates to work for global enterprises from home.

The literature emphasises the need for skilled IT human resources while at the same time acknowledges that developing countries often lack this. The Indonesian responses from the survey suggest that while there is high demand for IT education, this demand does not necessarily result in quality IT university graduates, and these

graduates do not necessarily find employment in their home country. A Chilean academics response suggests that there is only a low demand for IT university degrees. Caution should be taken before reading any conclusion into this; the respondents may not be representative of the general opinion or actual situation in their country, and specific mention was made by the Indonesian respondents of the distinction between IT education and university IT education, the latter being more rare.

The Internet in Chile and Indonesia

Literature Summary

The literature suggests that the Internet is a major tool for economic success and its importance will grow over time. As Dedrick, Goodman and Kraemer note "IT production and use both benefit from an advanced telecommunications infrastructure…Telecommunications and computers are converging in the development of national information infrastructures (NII), which link computers and provide information services over high-speed communications networks. A high quality NII linked to the developing global information infrastructure (GII) is likely to be a critical competitive factor in the future."[6] The quality of the Internet in a country is obviously related to that country's communication infrastructure. Mayo emphasises the importance of good communication infrastructure in the context of developing countries commenting, "In general, investment in communications infrastructure would contribute greatly to a nation's overall economic development. Moreover, the new technologies that developing countries would be investing in are becoming more and more cost-effective. So there is a strong need to ensure sufficient investment in construction and management of a country's communications infrastructure."[7]

Most developing countries, however, do not have good communications infrastructure.[8] Indeed Thabo Mbeki reminded the world at a Group of Seven Brussels conference that "…half of humanity has never made a telephone call."[9] Creating a

[6] Dedrick, J.L, Goodman, S.E, Kraemer, K.L. (1995) Little engines that could: computing in small energetic countries. *Communications of the ACM*, 38, 5, p 21.
[7] Mayo, J.S. (1995) Information technology for development. *Vital Speeches*, 61, 8, p 244.
[8] Nidumolu, S.R, Goodman, S.E, Vogel, D.R and Danowitz, A.K. (1996) Information technology for local administration support: the Governorates Project in Egypt. *MIS Quarterly*, 20, 2, p 197.
[9] Fleming, J. (1996) Poor nations leapfrog to future via new technologies. *Christian Science Monitor*, 88, 124, p 1.

good communications infrastructure requires monetary and human resources that many countries simply do not have. This results in difficulties accessing the Internet, categorised by Petrazzini and Kibati into two main areas: very high set up costs and very high operating costs. The operating costs are in part so high due to the cost of international leased lines being passed onto the consumer from ISPs. The high cost of the international leased lines are in turn, according to Petrazzini and Kibati, due to the lack of competitiveness in the international services market of most developed countries. The high end user cost and requirement for at least some communications infrastructure to be present means that there is an internal division within developing countries between those living in the larger cities with access to the Internet and everyone else.

These high end user costs result in developing country users paying on average three times more for Internet access than developed country users[10]. Another statistic that highlights the disparity is that more than 97% of all Internet hosts are in developed countries, which are home to only 16% of the world's population. Consequently most developing countries do not get "…to contribute as equal partners in the worldwide enterprise of knowledge production and dissemination"[11] as reflected generally by the fact that "…the majority of contents flowing on the Internet is of U.S origin."[12] Such statistics point out the difficult situation many developing countries are in, and that the difficult situation in itself serves to prolong the condition, through for example its

[10] (2000) Falling through the net? (information technology in developing countries), *The Economist*, 356, 8189.
[11] Arunachalam, S. (1999) Information technology: What does it mean for scientists and scholars in the developing world? *Bulletin of the American Society for Information Science.*
[12] Petrazzini, B and Kibati, Mugo. (1999) The Internet in developing countries. *Communications of the ACM*, 42, 6, pp 31-36.

effects on the country's global competitiveness. This issue will be further explored in the section on government and IT.

The following table gives an overview of the Internet situation in Indonesia, Chile and Australia.

Statistic	Chile	Indonesia	Australia
Telephone mainlines per 1,000 people 1999*	207	29	520
Cost of local call $ per 3 minutes 1999*	0.12	0.02	0.16
Personal computers per 1,000 people 1999**	66.6	3.3	469.2
Internet hosts per 10,000 people July 2000**	33.78	0.32	683.26
Internet users (thousands) 1999**	700	2800	6000
Monthly service provider charge 1998** ($)	32	13	22
Monthly telephone call charge 1998** ($)	7	0	6
Information and communications technology expenditures 1999** (% of GDP)	5.74	3.46	8.85

*Source: The World Bank Group (World Development Indicators 2001, * Power and Communications, ** The Information Age)*

Findings from Email Survey of Chilean and Indonesian Academics

The respondents indicated that the cost of PCs in Indonesia is quite cheap (not taking into account the large average yearly earnings difference), while PCs in Chile are roughly of the same cost as in Australia. The respondents were asked to estimate the cost of a 500mzh Pentium III with a 10gb hard drive. This was asked in August of this year (2001) and at the time of writing was the midrange PC configuration, worth approximately $1500 dollars in Australia. Indonesian responses varied from around $500 AUD to $1200 AUD. One Indonesian response implied that the low cost PC also came with expensive software installed.

For a middle class family located in a large city with access to ISPs, the set up cost in Chile and Indonesia would be steep but not unreachable, taking into account the need for a PC, modem and telephone line. The operating cost can be measured in terms of cost per hour to access the Internet. One Indonesian academic estimated the cost per hour to access the Internet at IDR 3,000 (AUD 0.60) for the ISP and IDR 6,000 (AUD 1.20) for the local call. A Chilean academic estimated the cost of access to the Internet at CLP 24,000 a month (AUD 67). Obviously gaining access to the Internet is a costly affair for the average citizen.

A Chilean academic estimated the typical modem Internet connection to run at 4 to 5kb/sec – speeds roughly equivalent to Australian modem standards. According to one Indonesian academic Internet speeds in Indonesia vary greatly, as there is no national “backbone”, some connections being very poor some quite good. Another Indonesian academic rated the quality of the average connection as poor.

Responses to a question attempting to investigate whether overseas Internet web sites are more popular than local sites brought mixed results. One Indonesian academic felt that the proportion was approximately equal, another that overseas sites were more popular. A Chilean academic was firm in his belief that overseas sites are very popular compared to Chilean sites. Perhaps a greater number of English speaking Chilean citizens (than Indonesian citizens) can explain this phenomenon – regardless it appears that the Internet is a significant source of overseas information for both countries.

The respondents seem to confirm the points made within the literature summary as to the quality and cost problems developing countries face in relation to Internet access. Similarly those who responded indicated an acknowledgment of the skewed origin of the data on the Internet. However, none of the responses to any of the survey questions (see Appendix A) suggested a belief in the critical need for IT (and the Internet) to survive in an increasingly information based economy of the same strength seen in the literature.

Business Use of Information Technology in Chile and Indonesia

Literature Summary

The literature on the topic of business use of information technology in developing countries contains several common themes. These can be broadly seen as: exclusion of developing countries businesses from the new global age, the need for deregulation to make improvements for developing countries businesses, the possibility of leapfrogging old technologies and ways of carrying out business, the importance of small businesses for developing countries, how developing countries can benefit from attracting multinationals, and how developing countries economies can be stimulated through the application of information technology.

As world trade becomes increasingly globalised and information based developing countries face difficult challenges. Some are pessimistic about their ability to rise to the challenge, for example John Mukela of the Centre for Development Information in Lusaka, Zambia, who says: "Information-based production processes will increasingly elude developing countries and consequently exclude them from advanced manufacturing and world trade – thus further exacerbating their poverty."[13]

What these information-based processes involve and require is elaborated on by Belisle and Czinkota who suggest "Worldwide manufacturing and outsourcing strategies have made the production of goods cheaper, faster and better. To compete, producers must be able to measure levels of competitiveness and correct weaknesses. This requires market information, an ability to understand and forecast demand and

[13] Holderness, M. (1995) Falling through the net. (developing nations lack Internet access). *New Statesman & Society*, 8, 374, p 24.

creativity in adapting products and finding a market niche. These requirements add up to three strikes against developing countries. They have serious limitations in research and development, great difficulty in accessing trade information and often lack sophisticated marketing skills."[14] Belisle and Czinkota do have some optimism however, when they conclude, "Creativity and new technologies, on the other hand, present these countries with unique opportunities to catch up with the industrialized world."[15]

The distinct disadvantage that developing countries find themselves in is sometimes not mentioned at all; instead a picture of opportunity and advantage is portrayed. An example of this is provided by Woodall who writes, "…developing countries have huge scope to grow rapidly by buying rich countries' technology and copying their production methods. This allows them to grow faster than developed economies, even if they start with fewer computers. As latecomers, poorer countries do not need to reinvent the wheel or the computer, but merely to open their economies to ideas from the rich world." As shown in the literature summary of the section entitled "The University Information Technology Situation in Chile and Indonesia" other authors are more cautious about the 'leapfrogging' notion common within the literature.

Woodall writes positively about the future of developing countries that use information technology. She suggests that information technology reduces the optimal size of a firm, and allows them to participate in global commerce. The former being important, as small businesses are often central to the economy of developing countries. Woodall also sees information technology bringing cheap communication

[14] Belisle, D.J and Czinkota, M.R. (1999) Trade must extend to poorer countries. *International Trade Forum*, 3, pp 11-13.
[15] Ibid.

advantages to developing countries that in turn attracts foreign investment through multinationals setting up in their country[16].

In her first point regarding the benefit to small business that information technology can bring, and the special relevance this has for developing countries is supported by Rovere and Lebre. They suggest “In developing countries capital is a factor relatively scarce, so they can draw great benefits from policies to support competitiveness in SMEs” Rovere and Lebre outline the benefits IT bring to SMEs in terms of innovation and its consequent effect of increased productivity and competitiveness. They also note that the introduction of IT to SMEs promotes its spread throughout that sector of the economy. Rovere and Lebre conclude “Although the challenges to define an IT diffusion policy in developing countries are greater, the relevance of an IT diffusion policy for SMEs in those countries is also increased, due to the important role these firms have in the economy.”[17]

Another common theme in the literature is the importance of industry deregulation for the improvement of developing countries development. This somewhat controversial issue will be dealt with in the next section on government and IT.

[16] Woodall, P. (2000) The new economy: Falling through the net? *The Economist*, 356, 8189, pp 34-39.
[17] La Rovere, R.L (1996), IT diffusion in small and medium-sized enterprises: Elements for policy definition. *Information Technology for Development*, 7, 4, p 169.

Findings from Email Survey of Chilean and Indonesian Academics

Indonesian demand for IT workers is mostly from business as opposed to government, while in Chile the situation is reversed according to Chilean and Indonesian academics. According to one Indonesian academic within the demand from business multinational companies demand as much as the local SMEs. A Chilean academic estimates that over 70% of business demand for IT workers is from multinational companies.

Indonesian banking and services industries use information technology heavily according to one respondent, while a Chilean respondent suggested that mining is the heaviest user of information technology in Chile. The amount of Chilean small businesses using information technology to their advantage was estimated at over 50%, while one estimate for Indonesian small businesses was around 30%. An Indonesian respondent added the proviso that the number of SMEs in Indonesia is in the millions. The respondents estimated the percentage of sales done via e-commerce in each country at less than 10%. One Indonesian academic noted that most e-commerce currently occurring is by SMEs and very simple (via email), and business-to-business in nature. At the time of their responses (August 2001) a Chilean academic answered that their had not been an e-commerce crash similar to what the US and Australia had experienced, while an Indonesian academic answered that they had experienced such a crash.

In response to a question asking about special advantages in relation to information technology that their country possessed, several interesting responses were elicited. One Indonesian academic noted their use of simple technologies (for example 486

machines) to achieve real outcomes. Along with their use of Internet Café's and wireless Internet to avoid the set up cost of expensive hardware and the operational cost of ISPs and telephone companies. A Chilean academic suggested that their economic development has made it a safe country for investment. This echoes a comment by Shein: "Privatization in Latin America is occurring because the region is economically and politically stable for the first time in years, and that is giving United States carriers more incentive to build networks there…"[18]

The academics responses in this section were more factual than critical in nature, outlining for example where the demand for IT is, or whether they had experienced an e-commerce crash etc. From the survey as a whole however the respondents did not give the impression that their countries felt excluded from an information age, a strong theme within the literature. Indonesian and Chilean respondents highlighted the strong multinational activity in their respective countries, in line with many commentators' points within the literature. An Indonesian academic confirmed the importance of small business for their economy, but suggested only a small amount took advantage of IT, while a Chilean academic suggested the majority of small businesses in their country took advantage of IT. From the respondents it appears that while IT is an important and growing part of their economies (especially in Chile), it is not yet seen as a crucial competitive factor to the extent that the literature suggests.

[18] Shein, E. (1998) Telecom tango: telecom deregulation in Central and South America will encourage U.S. business emigration. *PC Week*, 15, 7, p 73.

Government and IT in Chile and Indonesia

Literature Summary

The role of the government in managing development is often emphasised in discussion on information technology and development, with an emphasis that information technology on its own is not the solution to everything and instead the role of the government is very important also. Nidumolu, Goodman, Vogel and Danowitz highlight the particular importance of government IT action in developing countries commenting, "In many LDCs, the state has a major role to play in the adoption of IT: it is usually the largest single user of computers and through its policies and regulations exerts the greatest influence on the diffusion of IT throughout the country."[19]

In the following paragraph Montealegre describes a common context for the role of government and business in developing countries:

"In LDCs, as compared with developed countries, government often exerts more influence over industries and organizations, controlling, for example, access to key resources and setting costs and prices. Innovation is limited by scarcity of managerial and technical personnel and capital, inadequate physical and information infrastructure, social and cultural diversity, and political barriers that modulate and distort market and competitive forces. A few companies, frequently with strong ties to the government or influential business groups, exercise disproportionate power, leading to implicit or explicit market-sharing arrangements and/or ruthless actions

[19] Nidumolu, S.R, Goodman, S.E, Vogel, D.R and Danowitz, A.K. (1996) Information technology for local administration support: the Governorates Project in Egypt. *MIS Quarterly*, 20, 2, p 197.

against competitors. The roles of the competitive game are often unclear and unstable, reflecting the underlying instability of the political and economic environments and the information imperfection of the markets. Finally, LDCs are generally more vulnerable to external economic shocks. Shifts in international prices of key exports or imports or access to primary export markets can dramatically affect competitive dynamics."[20]

The importance of the role of government is also mentioned by Woodall who comments, "IT is not a panacea that allows governments to avoid doing all the hard stuff, such as opening up markets to foreign trade and investment, liberalising telecommunications, protecting property rights, improving education, and ensuring an effective legal system and efficient financial markets."[21] This comment also contains an example of a common viewpoint within the literature, the need for developing countries need to deregulate their markets in order to allow IT to assist their development (and to develop their economy in general). This viewpoint is further championed by Woodall when she suggests that deregulation speeds up technology transfer, increases efficiency, and decreases costs of IT to businesses and individuals (for example through cheaper telecommunications through exposure of carriers to competition). Borrus and Cohen concisely represent what this viewpoint feels the results of regulation will be when they conclude "Countries that continue to pursue policies of promoting 'national champions' behind protected national boundaries will experience slower growth of IT activities while their domestic IT industries will be technological laggards compared to competitive ones operating in open markets."

[20] Montealegre, R. (1999) A case for more case study research in the implementation of Information Technology in less-developed countries. *Information Technology for Development*, 8, 4, p 199.
[21] Woodall, P. (2000) The new economy: Falling through the net? *The Economist*, 356, 8189, pp 34-39.

John Flemming cites Wade Warren, the telecommunications program manager for the United States Agency for International Development, who promotes the cause of deregulation in more simple terms, suggesting that "The cost required to rehabilitate the communications infrastructure in most developing countries can never be paid for by the public sector."[22]

Others suggest that the move toward deregulated markets is not the obvious solution to developing country's IT problems that is often put forward by commentators, for example Hamelink who comments that the World Trade Organisation's telecom agreement that "…requires signatory countries (68 countries that represent 98 per cent of the $600 billion telecom trade) to liberalize their markets to foreign competition…has seriously compromised the chances for universal network access as national policies may be considered anti-competitive if Governments intervene in the market to guarantee universal service." He goes further to suggest the need for "…the design of policies that leave the realization of ICT-potential not exclusively to market interests, a substantial allocation of public funding for the costs of accessing and using ICTs, and a massive effort in human resource training for the mastery of ICT-related skills."

Commentators sometimes see developed countries push for deregulation policies as a misleading ploy that disguises other motives. Hamelink suggests that "…the interests of industrial countries and transnational corporations are usually better served than the prospects for developing countries. A more adequate representation of all the parties affected by global governance needs to be attained if ICT advantages are to be

[22] Fleming, J. (1996) Poor nations leapfrog to future via new technologies. *Christian Science Monitor*, 88, 124, p 1.

equitably shared." Sanchez-Vegas echoes this in his interpretation of the commonly used terms 'globalisation' and 'interdependency': "it is more precise to state that the globalization and interdependency of the world economy is actually translated into an asymmetric interdependency that works primarily in the interest of the developed/information-rich nations."[23]

Regardless of the actual effect that policies based on deregulation or regulation might have, government room to effect changes in IT utilisation is often limited in developing countries as "…other urgent needs for education, economic and social development often have prior claims on limited national budgets." Indeed Woodall warns that there is a real danger that "…governments, businesses and aid agencies in emerging economies will get distracted by the Internet and concentrate all their efforts on getting wired, but fail to tackle deeper economic obstacles to development." As Woodall writes "There is little point in spending millions of dollars connecting villages to the Internet if most people cannot even read and write." More general challenges involved in changing IT utilisation are considerable with "…obstacles, among which are costs, the lack of technology base, inappropriate management and administrative structures, and a shortage of trained and knowledgeable personnel."[24]

Avgerou highlights the joint role of government and business in the utilisation of information technology for development purposes: "We find that economic and social theory converge to the suggestion that ICT diffusion and intensification of information activities do not lead deterministically to economic growth. Rather, they

[23] Sanchez-Vegas, S. (1995). David meets Goliath on the information superhighway: Venezuela in the context of the electronic communication networks. *Information Technology and Libraries*, 14, 1, p 32.
[24] Hayman, J. (1993) Bridging higher education's technology gap in Africa. *T H E Journal (Technological Horizons In Education)*, 20, 6, p 63.

provide a spur for change within organisations and economies. Organisations are faced with pressures to work out changes in the ways they do business or deliver their services, and policymakers must plan for a macro-economic environment that facilitates economic and social changes to the benefit of the country."[25]

Others make strong and perhaps hard to justify claims like those made in an UN Chronicle article that suggests "Developing nations can only benefit from information technology with the assistance of a trustworthy non-governmental organization (NGO). These NGOs, empowered with knowledge through information technology, pass the information along to those who need it."[26]

The role of the government can also be seen as one in opposition to the popular technological 'leapfrogging' notion, carefully adapting IT and IT policy to the circumstances of their country. Morales-Gomez and Melesse are proponents of this view, as they suggest "…country governments and international agencies: should undertake a more rigorous analysis of the social and cultural dimensions of ICTs in order to be able to design appropriate policies and programmes which will enable countries to harness ICTs for development.[27]

One area that gets a fair bit of attention in the literature is the intellectual property law of developing countries. Some authors suggest that weak intellectual property laws are a disincentive for multinational companies to invest in a country, for example

[25] Avgerou, C. (1998) How can IT enable economic growth in developing countries? *Information Technology for Development*, 8, 1, p 15.
[26] (1999) You cannot drop information technology like a bomb and run away. *UN Chronicle.*
[27] Morales-Gomez, D and Melesse, M. (1998) Utilising information and communication technologies for development: The social dimensions. *Information Technology for Development*, 8, 1, p 3.

India.[28] Other authors feel that current intellectual property laws disadvantage developing countries, setting prices for products (whether they be software, hardware, medicine, etc) too high for developing countries to legally take advantage of them.

[28] Tikku, A. (1998) Indian Inflow: the interplay of foreign investment and intellectual property. *Third World Quarterly*, 19, 1, p 87

Findings from Email Survey of Chilean and Indonesian Academics

Nearly all of the Indonesian respondents were unhappy with the priority given to information technology by their government, and none had anything positive to say. A Chilean respondent considered their government's approach as productive with the Chilean government seeing information technology "Increasing as a pivot for development". No Indonesian respondent reported any recent events that had heavily impacted on their information technology industry or their government's policy toward it, while a Chilean respondent noted that economic crisis in nearby countries (especially Argentina) had impacted negatively on the cost of computer technology.

Both Chilean and Indonesian respondents reported that their government has imposed no effective regulation of the communication possibilities that the Internet provides. One Indonesian respondent noted that some government officials speak about "e-government", and an emphasis of legislation toward "transparency rather than restriction, more autonomy and less centralization". This desire for information technology to enable more autonomy for the population is strongly shared by one Indonesian academic.

Knowledge of the outside influences on the development of information technology within Chile and Indonesia (eg NGOs, development aid) seems limited and confused based on the responses received to the email survey. Two Indonesian academics directly contradict themselves over whether any development aid is specifically directed toward their information technology infrastructure. Importantly one Indonesian academic says there are NGOs active in Indonesia, but they have no significant for the most of the population. This is in stark contrast to the UN Chronicle

article detailed in the previous literature summary section, suggesting that developing countries require NGOs to benefit from IT.

A common theme in the literature is the need for developing countries to strengthen their intellectual property laws in order to improve their information technology industry. Interestingly all of the respondents to the email survey answered that the strength of their intellectual property laws has not affected their information technology industry.

As can be seen in the literature summary the theme of deregulation and its effect on a developing country's information technology infrastructure and industry is also common, with the majority opinion of the literature in favour of deregulation. On this issue the respondents seem to agree with the majority of the literature, however one Indonesian academic felt that the issue required in depth analysis and did not commit to a position. Another Indonesian academic suggested that the prevailing Indonesian opinion agreed with the notion that deregulation has a "motivating" impact on the information technology industry.

A question that elicited an overwhelming affirmative response was "Do you think information technology is a positive or negative force in relation to your country's development?" One Indonesian academic stated, "Given the format of the country, nothing else can integrate it together…" Another suggested that information technology could help remove dependence on the government. A mixed response was received as to whether information technology created a dependence on highly developed countries, one Indonesian academic suggesting that dependence could be

avoided, and another suggesting that it didn't create dependence at all. A Chilean academic felt that there would be dependence until their country could generate its own technological solutions. A more cautious response was gained from a question asking how the respondent saw the future of information technology in their country. A Chilean academic felt that the state of IT in Chile would improve slowly over time. One Indonesian academic felt that after their economy had recovered the future of IT in Indonesia would be much rosier. Another Indonesian academic concluded with the statement "It is still a very very long way to go…"

Appendix A – Questions asked of Respondents (Chilean and Indonesian Academics in IT field)

For Indonesian respondents the references to Chile were changed to Indonesia.

Is there a lot of demand for information technology degrees? How does the demand compare with engineering degrees?

What percentage of new information technology workers would you estimate have a university degree?

How would you rate the computer resources of your university in comparison to a country like Australia?

What is the normal hardware and software that is being used in the average student computer lab?

What percentage of information technology students would you estimate find employment overseas? What percentage of these students would you estimate return to Chile to find work in their home information technology industry?

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How expensive would you estimate a 500 mhz Pentium III with a 10 gb hard drive would be in Chile? (in pesos).

What is the average cost charged by an Internet Service Provider for an hour of Internet time? What does a phone company charge per hour to access the Internet?

What sort of performance does the Internet have in Chile?

How popular are OS sites compared to Chilean sites for non-work related access?

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Who is the biggest employer of information technology workers, government or business? How has this demand changed over the last decade?

How much of the demand for information technology workers by business is from multinational businesses?

What local industries use information technology heavily?

What percentage of small businesses would you estimate use information technology to their advantage?

Has there been an e-commerce 'crash' in Chile similar to what US and Australia have experienced?

What percentage of sales made in Chile would you estimate are done via e-commerce?

Does Chile have any special advantages in relation to information technology?

What are the names of any Chilean companies producing a significant amount of hardware or software?

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What is your impression of the priority the Chilean government gives information technology within its industry policy?

Have any recent events impacted heavily on the information technology industry, or Chilean government policy toward information technology?

Are the communication possibilities that the Internet provides a concern for the Chilean government? Is there some sort of restrictive regulation imposed? Is it effective?

Is the military in Chile a large user of information technology? Does it drive the development of information technology within your country?

Is any development aid directed toward assisting local information technology infrastructure or conditional on some aspect of Chilean government information technology policy?

Are there any foreign non government organizations operating in Chile that have a particular interest in information technology?

Do you think that any regional organizations have affected the Chilean government's information technology policy?

Do you think the strength of Chile's intellectual property laws has affected your information technology industry?

How deregulated are the industries related to information technology in Chile? What impact do you think this has? What is the prevailing opinion?

Do you think information technology is a positive or negative force in relation to Chile's development? Why?

Do you think information technology creates a dependence on highly developed countries?

How do you see the future of information technology in Chile?