

**THE DICTATOR'S DILEMMA AND THE POLITICS OF  
TELECOMMUNICATIONS IN CUBA**  
A CASE STUDY

Master of Arts in Law and Diplomacy Thesis

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## *Abstract*

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The concept of the “dictator’s dilemma” refers to the balance between authoritarian governments’ use of information communication technology for economic development with their need to control the democratizing influences of this technology. This thesis explores this concept by conducting a case study of authoritarian Cuba. It applies a modified version of the “political replacement effect” – a theory that was initially developed by Daron Acemoglu and James A. Robinson (2006), which posits that rulers only adopt technological innovation if it does not threaten their political survival – as a theoretical framework. This study analyzes technology adoption indicators and the training of information technology professionals during three time periods in Cuba (1992-1997, 2000-2005, and 2006-2011) through the lens of this framework. These time periods differ in political and economic dimensions. This thesis finds some empirical support for this theoretical framework. However, it concludes by noting the need for further exploration of how the dictator’s dilemma relates to international political dynamics and the image authoritarian governments wish to project to other international actors.

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Within authoritarian regimes, the use of information communication technology (ICT) for economic development and commerce must be balanced by a need to control the democratizing influences of this technology, according to the view of many political scientists. This paradox is known as the “dictator’s dilemma” within the literature and among policymakers (Morozov 2011), and was invoked in a speech given by Secretary of State Hillary Clinton in 2010 that advocated the promotion of “Internet freedom” as a cornerstone of U.S. foreign policy.<sup>1</sup> According to the logic of the dictator’s dilemma, ICTs dramatically lower the costs of networked communication, favoring civil society over repressive governments. Dictators must eventually succumb to the technological change that may threaten their political control, lest they face economic stagnation. Another prominent view on this issue argues that, to the contrary, authoritarian regimes are finding increasingly sophisticated ways to counter the political impact of ICTs while simultaneously exploiting their commercial benefits.

The Cuban government, by restricting access to ICTs – requiring Communist party-sanctioned licenses for Internet access, developing a censored Cuban “intranet” that restricts access to external sites, and maintaining a telecommunications monopoly that makes prices for mobile phones prohibitively high for most Cubans – represents a particularly salient case of authoritarian control over citizen communications. At the same time, this government is also seeking to exploit the potential of ICTs for commercial purposes. Not only does the state-owned telecommunications enterprise

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<sup>1</sup> Within this speech, Secretary Clinton defines Internet freedom in four ways. This thesis will focus on the “freedom to connect,” which is based on “...the idea that governments should not prevent people from connecting to the internet, to Websites, or to each other” (Clinton, 2011).

Etecsa generate substantial profits for the cash-strapped regime, but Cuba has also made ambitious efforts to train a new generation of information technology professionals that can develop and export software to more developed markets. Conceptually, the dictator's dilemma falls short of fully explaining the Cuban Government's approach to ICT development.

This thesis will examine the paradox of the dictator's dilemma by using Cuba as a case study. We will specifically explore the training of information technology (IT) professionals and support for entrepreneurship within Cuba based on field research and historical data. We will interpret this data through the lens of a modified "political replacement effect" (PRE) framework, initially developed by Daron Acemoglu and James A. Robinson (2006). Under this framework, elites block technological innovation that erodes their incumbency advantage, increasing the likelihood that they will be replaced (Acemoglu and Robinson 2006, 115). Finally, we will draw conclusions from this study that can be applied to other cases and literature on this topic.

This thesis will begin with a review of existing literature and research on the dictator's dilemma in Chapter 2. To provide context on the Cuban government's approach to ICT development, in Chapter 3 we will provide a history of telecommunications in Cuba, and discuss the Cuban government's current strategy for restricting access to ICTs. Chapter 4 will summarize this study's primary research question, and Chapter 5 will introduce our theoretical framework. Chapter 6 will discuss the methodology used in this study, and Chapter 7 will include the analysis of the case. In Chapter 8 we will conclude this study and provide recommendations for further research.



## *Chapter 2: Literature Review*

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The treatment of the dictator's dilemma within political science literature is encompassed in the broader literature that examines the impact of ICTs on politics. Within this literature originated the idea that the Internet<sup>2</sup> could not be regulated by governments due to its relatively decentralized routing system. This system, initially developed by academics and government employees and financed by the U.S. Defense Department in the 1960s, was designed to carry messages from point-to-point even if intermediate communication exchanges were blocked, damaged, or destroyed due to an attack on U.S. infrastructure during wartime (Goldsmith and Wu 2006, 3). Because of its decentralized architecture, the relationship between the Internet and state power was subject to much theoretical debate and legal deliberation during the early years of its adoption.

### *2.1: The Internet and State Power*

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The Internet in its initial development was oriented very differently from, for instance, proprietary networks like AT&T's early phone network, which bundled services and controlled the access to and the development of hardware. Rather, the Internet's architects sought the modest goal of connecting anyone on the network to anyone else (Zittrain 2008, 27). Designing without consumer demand in mind, they exhibited "little concern for controlling the network or its users' behavior," and the design of the network

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<sup>2</sup> This thesis will follow the logic of Drezner (2005) in using "Internet" and ICTs interchangeably, even though the latter term incorporates additional means of communications, including mobile phones. As he states, "the predominant feature of the information society is the spread of the Internet," thus these terms will be alternated in use (1).

itself was publicly available and freely shared from the earliest phases of its development” (Zittrain 2008, 28). The Internet’s design was unprecedented because, as Goldsmith and Wu note, it was “*open, minimalist, and neutral*” (Goldsmith and Wu 2006, 23). It was open in that almost any computer or network could join it; it was minimalist because it required very little of the computers that wanted to join; and it was neutral between applications because it treated e-mail, downloads, and every other type of application the same (Goldsmith and Wu 2006, 23).

Given this initial design, the Internet functions under an assumption that information is transmitted equally; its protocols assume that all packets of data are intended to be delivered with equal urgency – or as Zittrain observes, an equal “lack of urgency” (33). In the early years of widespread Internet adoption (the 1990s), scholars and Internet activists spoke of the “electronic frontier” as a borderless “place” that could be protected and separated from territorial government, and especially from the U.S. government (Goldsmith and Wu 2006, 19). Embracing the decentralized design of the Internet – along with strains of American Libertarianism – they argued that the Internet would be inherently resistant to state control. For example, Internet activist John Perry Barlow, who authored “A Declaration of the Independence of Cyberspace,” declared that governments could not regulate the Internet despite their best efforts, and that it would wipe away traditional forms of state tyranny because “[the Internet] interprets censorship as damage and routes around it” (1996, 18 - 19). Similarly, Diamond argues that it is not merely the structure of the Internet, but the scale of content generated that makes censorship difficult if not impossible (2010, 74).

However, the regulation of the Internet has, over time, caught up with this new technology. From the early stages of Internet architecture management, government power was manifest. John Postel, an American computer scientist who administered the Internet Assigned Numbers Authority (IANA) until his death, attempted to challenge the U.S. government over its root authority<sup>3</sup> of the Internet in 1998 by emailing eight of the 12 operators of Internet's regional root servers and instructing them to change the root zone server. These operators complied with Postel, dividing control of the Internet naming authority between the U.S. government – represented by NASA, the U.S. military, the Ballistics Research Lab, and Network Solutions – and John Postel's computer at the University of Southern California (Goldsmith and Wu 2006, 45). In response, the U.S. government threatened Postel with legal force. He quickly restored full root authority to the servers under government control. This event demonstrated that the United States would consider any changes to the root file a criminal offense. Since then, presumptive root authority has remained in the hands of the U.S. government (Goldsmith and Wu 2006, 46). Thus, government power backed by the threat of legal force asserted itself in the management of a decentralized Internet.

Goldsmith and Wu (2006) also emphasize that, despite the early claims of Internet idealists, geographic borders have become highly relevant to the development of the Internet. This has not only been a result of authorizations by national governments, but rather an organic development from user demand, as “Internet users around the globe demanded different Internet experiences that corresponded to geography” (49). In particular, geolocation technology has allowed for very different user experiences of the

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<sup>3</sup> Root authority refers to management of global IP address allocation.

Internet in different countries. Cyril Houry, a software engineer, pioneered this technology with the realization that “the logic of the Internet [does] not point inexorably toward the flattening of frontiers,” but rather “people [will] pay for software that [takes] the boundaries of real space and [re-creates] them on the Internet” (Goldsmith and Wu 2006, 59).

Houry’s realization played a role in an illustrative case of the Internet’s transformation from a technology that resisted territorial law to one that facilitated its enforcement. In 2000, the American Internet company Yahoo! was sued by two French anti-racism groups demanding that Yahoo! France prevent French web users from accessing English-language auction sites offering Nazi memorabilia, in compliance with French law. Yahoo! argued in court that it was technically impossible to block only French web surfers from the site (Goldsmith and Wu 2006, 6). Houry testified on behalf of the plaintiff groups, demonstrating that geolocation technology could be used to block at least 90 percent of France-based users from accessing the offending Yahoo! sites (Goldsmith and Wu 2006, 7). The court ruled in favor of the plaintiffs and ordered Yahoo! to block French web users from accessing the unlawful content or face fines of \$13,000 per day (Goldsmith and Wu 2006, 8). Yahoo! swiftly complied with the ruling.

In 1999, Yahoo! also complied with the Chinese government’s demands to, as a condition of market access, filter materials that could have been construed as harmful or threatening to Communist Party rule (Goldsmith and Wu 2006, 9). Moreover, in the 2000 Internet defamation case of *Dow Jones Inc. v. Gutnick*, the High Court of Australia ruled in favor of the defamation plaintiff for the publication of false information about an Australian national – Joseph Gutnick – in the American newspaper *The Wall Street*

*Journal*. This decision effectively allowed plaintiffs in Australia to sue for defamation on the Internet against any defendant irrespective of their location (Goldsmith and Wu 2006, 148). Goldsmith and Wu note that “The Australian rule will chill speech in the United States and elsewhere, forcing newspapers around the world to bow to the most restrictive laws in the world” (148). Such rulings have taken their effect: presently, search engines such as Google routinely block links because of possible government action (Goldsmith and Wu 2006, 75). All of these instances show that companies comply with local laws in shaping Internet user experiences, regardless of the differences in the laws of the company’s country of origin.

Companies also rely on the legal authority of governments – backed by the threat of coercion or imprisonment – to maintain rule of law within Internet communities. Goldsmith and Wu (2006) note that the prevalence of fraud on the Internet auction site eBay in the late 1990s required the eventual involvement of criminal law enforcement. Despite the company’s best efforts to self-govern with user groups and mediation services, fraud within the rapidly growing eBay community required more significant and credible intervention. A federal report on the company in 2000 found more than \$4 million in losses from auction fraud alone, damaging eBay’s reputation as it faced class-action lawsuits (Goldsmith and Wu 2006, 133). In 1999, eBay took the important step of hiring a security team comprised of former law enforcement officials to work with law enforcement in criminal investigations (Goldsmith and Wu 2006, 135). By 2005, eBay employed a full-time security staff of 800 people (Goldsmith and Wu 2006, 135). The failure of voluntary self-regulation mechanisms on the site underscored the need for

services that only government can provide: public goods, including the enforcement of contracts and the power of legitimate physical coercion to deter criminal offenses.

Finally, the Internet's architecture of links has proven to be far less decentralized than initially believed because, in part, Internet access depends on physical connections which can be compromised to facilitate surveillance or censorship (Farrell 2011, 15). Price notes that control of information is possible if the state does not see the price of controlling it as a constraint, noting "The inevitability of crossborder data flow makes the task of controlling information... at the very least, very costly" (2002, 17). For authoritarian regimes intent on maintaining power, the cost of controlling information may be less of an issue than the need for maintaining political power.

## *2.2: The Internet and Democratization*

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Beyond the technical characteristics of Internet architecture and its relationship with state power, there is ample literature on the link between the Internet and democratization. There has long been a view – often romanticized – that technological developments, and especially communicative ones, are powerful instruments of democracy (Groshek 2010, 142-174; Dunham 1938, 77-79; Lerner 1958). Going back at least as far as the printing press, this literature recounts the impact of technological innovation on democratic movements of the past centuries (Schudson 2003, 49-60) in relation to conceptions of the public sphere (Habermas 1962) and the fourth estate (Jones 2000, 307-339 as cited by Meier 2011). As Meier notes, "Over the course of the past century, telegraphs, telephones, radios, and televisions were all introduced as new media, and each of these technologies were often ascribed broad potential for enhancing democratic development around the world" (Meier 2011, 24).

The literature on democratization and the Internet in particular tends to follow the argument that the Internet dramatically lowers the costs of networked communication, and therefore makes civil society groups more able to mobilize action and influence governments (Drezner 2010, 1). This literature recalls the decentralized nature of Internet architecture, emphasizing its unique properties that enhance collective action. Shirky (2009), for instance, argues that because of the Internet, activities that once required central coordination and hierarchy can now be carried out through much looser forms of coordination (as cited by Farrell 2011, 8). In a similar vein, Benkler (2006) argues that this kind of collective coordination is a generalizable form of production that is more efficient and has lower transaction costs than traditional market-based forms of exchange. Diamond goes further, lauding the “liberating” power of ICTs in the age of the Internet (2010). “Liberation technology,” as he calls it, “is any form of [ICT] that can expand political, social, and economic freedom” (Diamond 2010, 70). Echoing the views of many scholars, he emphasizes that liberation technology is unique in that it facilitates people-to-people or many-to-many communication, which is different from the top-down one-to-many forms communication that could be easily used for authoritarian state propaganda, including television and the printing press (Diamond 2010, 70).

Diamond’s view of liberation technology not only emphasizes the potential ICTs have for enhancing political mobilization, but also their potential for promoting economic well-being. By, for example, “conveying timely information about crop prices, facilitating microfinance for small entrepreneurs, mapping the outbreaks for epidemics, and putting primary healthcare providers in more efficient contact with rural areas,” it is clear that the benefits of the Internet – according to this logic – offer the potential for

major positive social spillovers (71). This claim is broad, but it must be noted that there is much empirical evidence to support the *economic* benefits of telecommunications penetration,<sup>4</sup> though its political benefits – in terms of its effect on democratization – have been more difficult to quantify.

The methodological approaches to examining the relationship between the Internet and democratization typically take two forms. As Howard explains,

[There is] a quantitative approach using large-N datasets and statistical tools that demonstrate how variation in democratic outcomes are correlated with variables that serve as proxies for theoretically interesting explanatory factors; [and] a qualitative and comparative approach using specific cases and narrative arguments that trace out causal connections in a more direct and nuanced manner. (2010, 23)

We will summarize the quantitative and qualitative research in this field, discussing the findings as well as gaps within this literature.

### *2.2.1: Quantitative Studies*

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Regarding quantitative approaches, Kedzie (1997) made the first attempt to quantify the relationship between the Internet and democracy by drawing on e-mail usage data in 1993 for 144 countries. He finds a strong correlation between countries' interconnectivity rankings and Freedom House measures of political and civil liberties (Kedzie 1997). However, Kedzie disavows any causal claim about whether democracy

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<sup>4</sup> For example, a recent World Bank study of 120 countries finds that for every 10 percentage point increase in the penetration of mobile phones, there is an increase in economic growth of 0.8 percentage points in developing countries (Zheng-Wei Qiang 2009, 9).



promotes interconnectivity or vice versa (Milner 2006, 179). Similarly, Eyck uses ordinary least squares (OLS) regressions to study the effect of ICTs on political protests in 86 countries and finds that ICTs can predict politically motivated collective behavior (2001, 147-160). Best and Wade use a variety of statistical techniques to assess the global effect of Internet on democracy for some 180 countries with largely inconclusive findings (2009, 255-271). Bailard uses fixed effects regression analysis of panel data at the country level from 1999 to 2006 to test whether the number of mobile phone subscribers has any influence on perceived levels of corruption (2009, 333-353 as cited in Meier 2011, 27), finding a “significant negative correlation between a country’s degree of mobile penetration and that country’s level of perceived corruption” (Bailard 2009, 333-353). However, Bailard does not answer whether or not this effect is more pronounced in countries with closed regimes. Groshek uses a multi-regression analysis and finds that the Internet is a weak but meaningful predictor of democratic regimes (2009, 115-136), but in a later study using time-series regression analysis finds no impact of the Internet on democratic growth (2010, 142-174). Miard uses negative binomial regression and finds that mobile phone subscribership has no impact on anti-government protests (Miard 2009). Finally, Howard uses fuzzy-set statistical methods and finds that ICT diffusion explains variations in democratization for a variety of countries with large Muslim populations (2010).

These quantitative analyses have made progress in explaining the relationship between the Internet and democratization, but their results are decidedly mixed. Some identify statistically significant relationships between technology and democratic movements, while others do not. More importantly, these studies tend to aggregate data

on democratic and authoritarian states and thus run the risk of not parsing out the more subtle differences between authoritarian and democratic regimes (Meier 2011, 79). Many of these studies also employ aggregate measures of democracy for their dependent variable, which limits the specificity of their conclusions. These shortcomings may also explain the often mixed findings of these studies; there is a need for qualitative studies of different regimes to better understand the relationship between the Internet and democratization.

### *2.2.2: Qualitative Studies*

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Qualitative studies in this field parse out the more complicated role that authoritarian regimes play in shaping the environment for democratization and, more specifically, civil resistance movements. For instance, recent research on civil resistance movements in post-communist countries demonstrate that states can actively sever the link between ICTs and participation. Nikolayenko notes: “In light of electoral revolutions in Serbia, Georgia, and Ukraine, the governments in Azerbaijan and Belarus have significantly raised the cost of political participation... [using] the coercive apparatus [to apply] violence to prevent the permanent occupation of the public space in the wake of fraudulent elections” (2009, 7). Similarly, in Burma the military regime has often dramatically increased the cost of SIM cards to mobile phones to prevent widespread peer-to-peer communication (Meier 2011, 44).

Other scholars have noted that ICTs enable activists to engage in new forms of contentious activities vis-à-vis repressive governments. This dynamic was also present in the past, as “the availability and mobility of print enabled by the printing press helped move protest from transient local direct action to more flexible and sustained national

contention” (Garner 1999, 29). However, these technologies were also adopted by coercive governments. As Ronfeldt and Varda note, “the printing press and later technologies, like the telephone and radio, did not prevent new and ever worse forms of autocracy from arising” (2001, 12). Notably, while these technologies initially undermined the power bases of old monarchies, these same technologies were later “turned into tools of propaganda, surveillance, and subjugation that enabled dictators to seize power and develop totalitarian regimes” (Ronfeldt and Varda 2001, 9).

Meier notes that repressive states also leverage new technologies – including the Internet – for tactical purposes, just as they utilized traditional communication technologies like the printing press, telephone, radio, and television (2011, 52). In her case study on former communist states, Nikolayenko finds that incumbent governments have responded to “the rise of reform-oriented and technologically savvy youth movements by setting up state-sponsored youth organizations and intensifying the use of modern technology to subvert youth mobilization” (2009, 6). Garrett also observes that “activists are not the only group capable of using technology to become more fluid and flexible” (2006, 219). Ronfeldt and Varda echo this point that the Internet empowers the state:

The state is online... promoting its own ideas and limiting what the average user can see and do. Innovations in communications technology provide people with new sources of information and new opportunities to share ideas, but they also empower governments to manipulate the conversation and to monitor what people are saying. (12)

Indeed, a major contribution of qualitative studies to this literature is their examination of the various means by which authoritarian regimes can subvert democratization while, at the same time, taking advantage of the commercial benefits of the Internet. We will explore this further in the following section.

### *2.3: Authoritarian Control*

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In reviewing this literature, we must note that democracies, due to political factors, may be better at adopting new technologies like the Internet than dictatorships. Many scholars have found evidence that regime type plays a key role determining Internet penetration rather than the reverse. Kalathil and Boas note that “states still call the shots,” and that authoritarian regimes are finding increasingly sophisticated ways to block Internet access while still exploiting its commercial benefits (2003, 137). In their study of eight authoritarian governments, Kalathil and Boas conclude that:

The state plays a crucial role in the development of the internet... and in conditioning the ways it is used by societal, economic, and political actors. Through proactive policies... authoritarian regimes can guide the development of the internet so that it serves state-defined goals and priorities. This may extend the reach of the state in significant ways. (2003, 136).

In this view, authoritarian governments may have little to fear from the Internet. Assuming governments have the capacity to enact policies that guide ICT development, they may be able to use new technologies to advance their political power.

Milner elucidates this argument by recounting eight policies that governments employ to control information, and more specifically, the democratizing aspects of Internet access:

1. Governments can use **firewalls**, employing proxy servers<sup>5</sup> to scan email for “offensive” or prohibited content and to review all web traffic by checking URLs against a constantly updated blacklist (Milner 2006, 185).
2. Governments can use **routers**; if there is too high a volume of web traffic with multiple Internet service providers (ISPs) providing access to the global Internet, the government can force the ISPs to monitor the web for them (Milner 2006, 185). Routers capable of blocking offensive Internet Protocol (IP) addresses and even filtering content therefore must be installed by the ISPs (Milner 2006, 185).
3. Governments can also use **software filters**, imposing censorship by using software to filter all e-mail and web traffic (Milner 2006, 186).  
  
Governments can also use their proxy servers or force ISPs to install these software filters.
4. Governments can also have **Internet police**, employing professionals to conduct surveillance and act as informants (Milner 2006, 186).
5. Governments can employ **coercion**, forcing ISPs to self-censor (Milner 2006, 186).
6. By using **restricted access**, governments can force all users to register with their ISP or government authority (Milner 2006, 186). Users, in

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<sup>5</sup> Proxy servers are computers that act as intermediaries between the global Internet and domestic users on private networks (Milner 2006, 185).

knowing the government can monitor their online activities, often inhibit their behavior. Some countries also restrict access to institutions, prohibiting individual users from accessing the Internet. By permitting access only in group situations, users – the governments hope – will be deterred from prohibited behavior because others can easily monitor them (Milner 2006, 186).

7. **High access prices** alone can also deter users from accessing the Internet. Three sets of costs matter for users: the prices of local telephone calls for making an ISP connection, the price users pay ISPs for access to the Internet, and the prices for ISPs to lease local lines (Milner 2006, 187).
8. Finally, governments to develop a **national intranet** that is controlled solely by the government and limits all contact with the global web (Milner 2006, 187).

Thus, governments can enact policies that both hinder the spread of the Internet, as well as blunt its democratizing influences. Goldsmith and Wu also observe governments do not have to do so by exerting direct power over citizens; they can limit Internet access and its democratizing influences quite effectively through “sources” (manufacturers) “intermediaries” (shops selling equipment or ISPs), and “targets” (purchasers) (2006, 69). Furthermore, “effective control over *any* of [these] three elements... permits the government to control conduct within its borders” (Goldsmith and Wu 2006, 69). This affords governments considerable flexibility in exerting control over Internet diffusion, while still allowing them to benefit from allowing certain commercial transactions online.

A shortcoming of the literature is that it remains unclear why some authoritarian governments allow Internet access and encourage the adoption of new technology while others are more hesitant to do so. Moreover, these studies do not adequately explain why some democratic governments exercise many of the policies above. For instance, India – the world’s most populous democracy – has over successive governments enacted policies that oppose Western or foreign broadcasting influences. During the 1999 conflict with Pakistan over incursions in Kashmir, for instance, Videsh Sanchar Nigam Limited (VSNL) - which at the time was virtually a monopoly ISP - removed access to *Dawn*, the Islamabad-based daily, from online distribution, probably at the behest of the government (Price 2002, 35). Thus, the specific relationship between regime type and Internet penetration needs further elucidation.

#### *2.4: Regime Type and Technology Adoption*

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Milner and others have attempted to more systematically define the relationship between Internet access and regime type. Milner posits that it is “political factors, especially domestic institutions”<sup>6</sup> that matter for the adoption of new technologies because they “affect the manner and the degree to which winners and losers from the technology can translate their preferences into influence” (2006, 178). Simply stated, groups that believe they will lose from the Internet will try to use political institutions to enact policies that block its spread (2006, 178).

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<sup>6</sup> In terms of institutions, we are referring to North’s definition of institutions as “the rules of the game in a society or, more formally, the humanly devised constraints that shape human interaction” (North 1990, 3). Economic institutions include property rights and entrance barriers, whereas political institutions include forms of government and constraints on politicians. North among others argues that the laws, regulations, subsidies, and taxes that governments choose to employ may substantially affect whether actors invest in new technology.

The Internet poses a threat to authoritarian governments in particular because “it promotes uncensored access to information, the wide sharing of that information, and the capacity to overcome collective goods problems, thus enhancing the public’s ability to organize against a regime” (Milner 2006, 184). Bueno de Mesquita and Smith also argue that “Highly educated people are a potential threat to autocrats, and so autocrats make sure to limit educational opportunity,” keeping workers just educated enough to have basic labor skills (2011, 109). Autocrats can then tax these workers, extracting revenue to pay off loyalists and ensure their political survival (Bueno de Mesquita and Smith 2011, 109). For autocrats this is crucial, as “Paying supporters, not good governance or representing the general will, is the essence of ruling” (Bueno de Mesquita and Smith 2011, 25). Authoritarian governments may also have more capacity to block technological change than democracies, both in terms of the control they exercise over state institutions and their lack of accountability to the broader population. In her econometric analysis, Milner shows that technology diffusion and the spread of the Internet are highly dependent on a country’s regime type, and democratic regimes are significantly correlated with increased rates of Internet users in a country (Milner 2006, 192).

Acemoglu and Robinson (2006) offer a slightly more nuanced interpretation of the relationship between regime type and technology adoption. In what they term the “political replacement effect” (PRE), political elites will block beneficial economic change brought about by new technologies when they are afraid that these changes will destabilize the existing system and make it more likely that they will lose political power and future rents (2006, 115). At the center of this theory is the idea that changes in



institutions or the introduction of new technologies often create turbulence, eroding the political advantages and future economic rents of incumbent elites (Acemoglu and Robinson 2006, 115). Alternatively, new technologies may enrich competing groups, increasing their threat to incumbents (Acemoglu and Robinson 2006, 115). This makes politically powerful groups fear losing power and oppose economic and political change, even when such change will benefit the society as a whole (Acemoglu and Robinson 2006, 115).

Acemoglu and Robinson also note that the PRE introduces a “tradeoff for elites between the likelihood of maintaining power and rents conditional on maintaining power, and may induce them to block [technological] change” (2006, 116). This tradeoff between maintaining political control and the commercial benefits of technological change conjures the literature on the dictator’s dilemma while offering a theory grounded in political dynamics. It thus moves beyond the assumed inevitability of dictators eventually succumbing to technology adoption due to the demands of globalization. This analysis will start with the PRE as a basis for our theoretical framework to better understand the Cuban government’s approach to ICT development.

### *Chapter 3: Cuba in Context*

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To give context on Cuba's approach to ICT development, we will provide a brief history of telecommunications in Cuba in relation to its turbulent political and economic history. Then, we will summarize the current state of mobile telephony and Internet access on the island.

#### *3.1: The Cuban Revolution and Fears of Foreign Domination*

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On the eve of the Cuban Revolution that led to the overthrow of the U.S.-backed Cuban President Fulgencio Batista, Cuba was a highly developed country by Latin American standards. However, as a result of transitioning from a former Spanish colony to economic dependence on the United States, Cuba lacked a real middle class and was riddled with social and economic inequality. Although pre-1959 Cuba had one of the highest per capita incomes in Latin America, the poorest forty percent of the population still only received 0.066 percent of the national income (Gallousis 2001, 89).

The 1959 revolution that brought Fidel Castro into power was, in many ways, a reaction to U.S. control and these many years of economic hardship and political instability. State-socialism not only offered a path to late development, but specifically provided mechanisms to overcome foreign-dominated economic structures and to consolidate the power of new regimes by expropriating the property of transnational companies and local elites (Hoffman 2004, 44). Thus, the nationalization of private property within months of Fidel Castro's guerilla army seizing control of Cuba was a reaction to these fears of foreign control and an assertion of Cuba's independent path to development.

### *3.2: A Shift in State Strategy for ICT Development*

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The Cuban Revolution dramatically changed the structure and function of all forms of media within Cuba. Before 1959, with one television set per 25 inhabitants and one newspaper edition per eight people, Cuba ranked first among all Latin American countries in the diffusion of mass media (Hoffman 2004, 183). After the Revolution, the Cuban Government expropriated all private media; independent media – including radio, TV, and print – were not allowed (Hoffman 2004, 183). The state-owned media was primarily used to secure the legitimacy of the revolutionary power and to promote the construction of a socialist society. Throughout the 1950s and 1960s, Cuba prioritized the build-up of mass media infrastructure, particularly TV and radio broadcasting, rather than telecommunications. This was because the government determined that telephones had less of a priority in its development purposes than mass media such as TV and radio. Rather, the regime saw telephones as a “luxury” good that did not reach a nationwide audience of all social backgrounds, which it saw as crucial to the process of nation-building (Hoffman 2004, 36).

The low priority given to telecommunications development in post-revolutionary Cuba is evident in how it developed its infrastructure. The number of main line telephones increased from 170,000 in 1959 to no more than 349,471 in 1994, giving Cuba the lowest growth rate in main line telephony in virtually all of Latin American and Caribbean countries (Hoffman 2004, 189-190). Moreover, up until the early 1990s, an estimated 40 percent of the telephone infrastructure consisted of U.S. technology installed before 1959 (Hoffman 2004, 190). Priority within the telecommunications infrastructure since the Cuban Revolution has been reserved for military and security

purposes; since the early days of the revolution through the present, an army general always headed the Ministry of Informatics and Communications (MIC).

### *3.3: Cuba's Economic Crisis*

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The United States broke diplomatic relations with Cuba in 1961 and in 1962 imposed a trade embargo, persuading all of Cuba's pre-revolution trading partners to sever their trade ties with the island.<sup>7</sup> With few other options, Cuba established trade relations with the Soviet Union and Eastern Europe in the 1960s. The Soviet Union was eager to fill this role given Cuba's geopolitical importance and subsidized its economy extensively. This relationship also dramatically transformed Cuba's domestic economy and international trade regime. While in 1958 about two-thirds of all Cuban trade was with the United States, only a few decades later approximately three quarters was with the Soviet Union (Nichols and Torres 1998, 21). Cuba essentially traded its dependency on one superpower for another.

Cuba's close ties to the Soviet Union also thrust it into the depths of the Cold War; the island served as a key battleground on which major geopolitical events played out between the United States and the Soviet Union. The United States conducted several unsuccessful operations to overthrow Castro, including Operation Mongoose and the Bay of Pigs invasion in 1961, which had calamitous political implications within the United States. More importantly, over thirteen days in October of 1962, the Cuban Missile Crisis placed the world on the brink of nuclear war in a confrontation over the Soviet deployment of medium-range and intermediate-range nuclear missiles (with the ability to

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<sup>7</sup> Almost all of these countries reestablished political and economic relations with Cuba during the subsequent three decades (Nichols and Torres 1998, 21).

strike the continental United States) within Cuba. Though the crisis ended with the Soviet Union's removal of their missile systems, the Kennedy-Kruschev Pact effectively strengthened Castro's position in Cuba by guaranteeing that the United States would not invade the island (Weldes 1999, 165-197).

The collapse of the Soviet Union in 1991 precipitated an extended period of economic crisis in Cuba known as the Special Period in Peacetime (or the Special Period). The crisis was defined by severe shortages of gasoline, diesel, and other petroleum derivatives due to the collapse of economic agreements between the petroleum-rich Soviet Union and Cuba. Having lost an estimated U.S. \$4 billion annually in Soviet subsidies, the gross domestic product of Cuba fell by nearly 50 percent between 1989 and 1993 (Nichols and Torres 1998, 21). The daily consumption of calories per capita plummeted from 2,845 in 1989 to 1,780 in 1993 (Nichols and Torres 1998, 23). The shortages of food and other basic necessities fueled popular discontent and increased political tension. New investments in the telecommunications sector nearly ended. In the face of instability, Cuba's political leadership had to generate the foreign currency needed to replace the lost Soviet petroleum via international markets.

In 1992, the Cuban Government amended its constitution to protect the property of foreign investors against expropriation, thus encouraging much-needed foreign investment. Facing the prospect that this investment was necessary to its financial survival but would be difficult to attract without a dependable telecommunications system, the Cuban Government sought a foreign partner to develop its infrastructure. In 1994 the state phone company EMTELCUBA was partially privatized; Grupo Doms, a

Mexican holding company, signed a U.S. \$1.1 billion joint-venture agreement to overhaul and operate the Cuban phone system (Nichols and Torres 1998, 27).

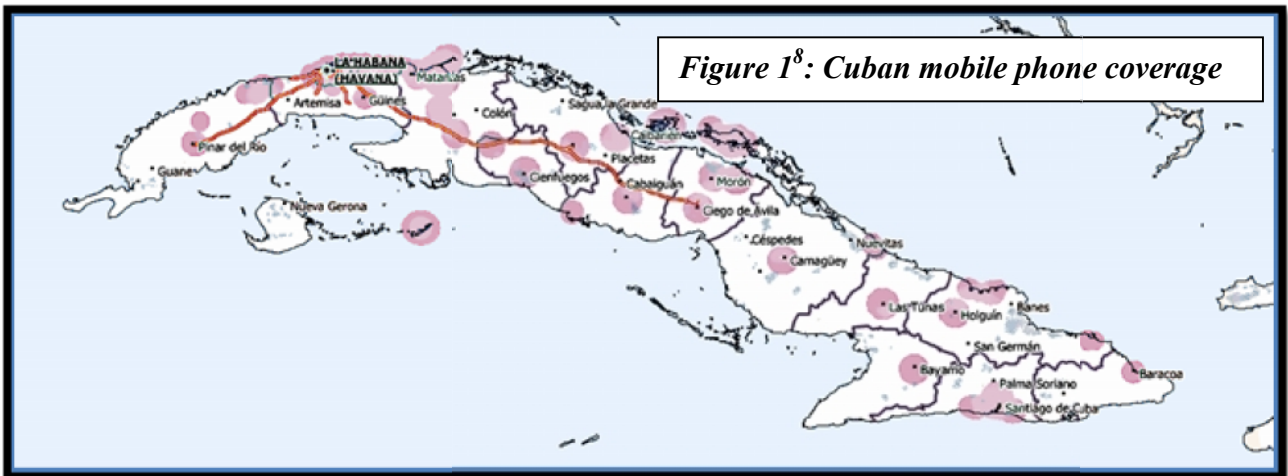
The investment and modernization policies underscored a strategic shift in the Cuban government's approach to telecommunications. As opposed to the state-socialist approach which gave low priority to the sector, in the face of economic collapse, Cuba's leadership approached telecommunications as an important element in the infrastructure necessary for reaching national development goals (Hoffman 2004, 194). Moreover, a revenue-sharing arrangement that came with the reestablishment of direct telephone traffic between Cuba and the United States became a substantial hard currency earner for the Cuban Government (Hoffman 2004, 192).

### *3.4: Mobile Telephony*

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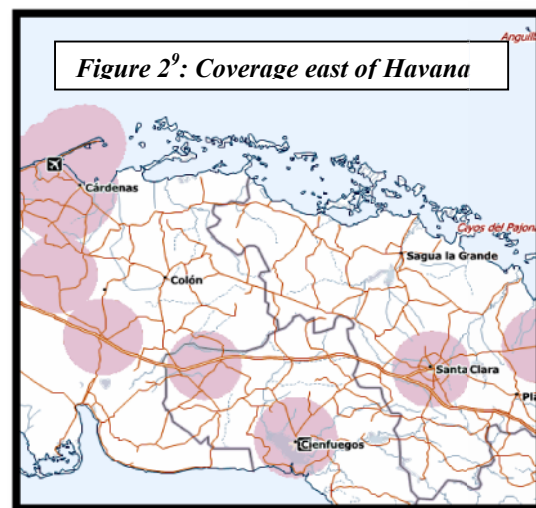
Relative to fixed-line telephony, Cuba's political leadership was more cautious in its approach to mobile telephony, which made a slow entry on the island. The country's mobile telephone company, Cubacel, was founded in December 1991 as a joint venture with 50 percent foreign capital (Hoffman 2004, 195). However, the government enacted a ban on mobile phones for consumer use in 2001, limiting usage to executives working for foreign companies and high-level Communist Party of Cuba (PCC) officials (Reardon 2008). Though there was large black market for mobile phones at the time (Huaimachi 2010), the ban itself reflected government fears of the potentially destabilizing effects of this form of communication.

Over time – and for reasons that this analysis will explore in depth in Chapter 7 – Cuba eased restrictions on mobile telephony. The government lifted the ban on mobile



phones in 2008 (Reardon 2008). While Cubacel held a monopoly position in mobile telephony for ten years on the island, in 2001 a second company, C-Com, began to offer mobile phone services and a third company, MoviTel, now offers paging services (Hoffman 2004, 196). Like fixed-line telephony, mobile phone revenues have become an important source of hard currency for the Cuban government, which likely influenced its decision to lift the ban.

Since lifting the ban on mobile phones, the growth of this market has skyrocketed. Today, the number of mobile phones in Cuba is believed to exceed 800,000, showing growth of more than 2,600 percent in just over three years (Cuba Study Group 2010, 5). Still, Cuba has the lowest penetration rate of mobile phones in Latin America and the Caribbean, even lagging



behind Haiti (ITU 2009, 101). Cuba's mobile network is also limited in its coverage and it is "second generation" technology, suited to voice conversation and texting, but not Internet applications (Press 2011, 11). **Figure 1**<sup>8</sup> and **Figure 2**<sup>9</sup> above show that mobile phone coverage is concentrated in major cities.

Moreover, the costs of talking on a mobile phone can be prohibitively expensive for most Cubans, whose average monthly salaries are U.S. \$20 (ITU 2009). To open a mobile phone account with the state telephone monopoly, Etecsa, a user must take a cell phone (the Nokia 1112 is being offered by the government for U.S. \$58) to one of the few offices in Havana, stand in line for an hour and then pay U.S. \$65 to activate the service (Booth 2009). At 17 cents a message, text messaging is more popular, and many Cubans have found innovative ways to use these devices. Cubans often use their cell phones as "beepers," returning text messages or missed calls on land-line phones, which are ubiquitous and cheap to use (Huaimachi 2010).

### *3.5: Internet Access*

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Like its approach to mobile phones, the Cuban Government has shown a similarly cautious approach to granting widespread Internet access on the island. Cuba has the lowest level of Internet penetration in the western hemisphere and one of the lowest in the world (Cuba Study Group 2010, 4). Cuba's National Statistics Office reports that only 2.9 percent of the population had used the Internet over a 12-month period, most through work or school (Rodriguez 2011), though international accounts report an even lower percentage (ITU 2009, 103). Appendix 1 shows Internet pervasiveness indicators from

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<sup>8</sup> [http://www.mobileworldlive.com/maps/network\\_info.php?nid=6927&org\\_id=6924&cid=3216](http://www.mobileworldlive.com/maps/network_info.php?nid=6927&org_id=6924&cid=3216).

<sup>9</sup> Ibid.



Latin America and the Caribbean. Cuba is last in fixed broadband Internet subscribers and secure Internet servers.<sup>10</sup> Only Belize, Bolivia, El Salvador, Haiti, Nicaragua and Suriname trail Cuba in Internet users per capita, and Cuba is far below the average for the region (Press 2011, 2). These limitations in Internet access are partially economic in nature; due to the U.S. trade embargo, access prices are high – the cost of public Internet access is approximately U.S. \$8 per hour, nearly half the average monthly wage in Cuba.<sup>11</sup> Cuba's policies also contribute to these limitations, as they routinely block or severely restrict Internet access.

Cuba first connected to the Internet in October 1996. Prior to this point, the nation was among the leaders in Caribbean information and communication technology (Press 2011, 11). However, at the time of its first Internet connection, Cuba's political leadership expressed concerns that NGOs could use the Internet in potentially subversive ways. Their primary concern was that NGOs in Cuba were often supported by the United States via the Cuba Democracy Act of 1992, which legalized electronic communication flows and financial support to anti-Castro civil society organizations (Boas 2003, 270). Commenting on these NGOs, at the Fifth Plenum Committee of the Communist Party of Cuba in 1997, Raúl Castro remarked that: "The glasnost which undermined the USSR and other socialist countries consisted in handing over the mass media, one by one, to the enemies of socialism" (Boas 2003, 270). Thus, when the direct Internet link was established, it was accompanied by a law that sought to establish strong, centralized control over Internet usage in the country (Boas 2003, 270). The law stated that use of the Internet would be selective and granted "in a regulated manner... giving priority to the

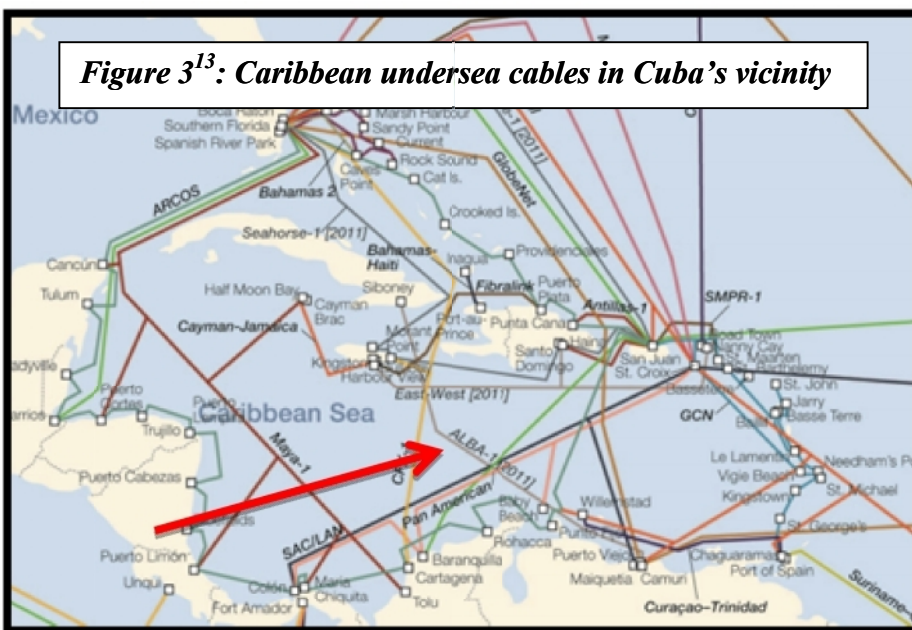
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<sup>10</sup> Secure Internet servers are an indicator of commercial activity and are rare in Cuba.

<sup>11</sup> Access prices as of July 2011, during author's field research.

entities and institutions most relevant to the country's life and development" (República de Cuba 1996, 423-424). Rather than allowing widespread, market-driven access and trying to control Internet content through censorship, the Cuban Government has promoted Internet access only where it directly benefits the regime and has restricted it everywhere else (Boas 2003, 271).

This strict government regulation over Internet access has significantly retarded its growth relative to the rest of the world. By 1998, Cuba had only a single 64-Kbps



satellite  
connection run  
by Sprint in  
Florida and  
allowed by an  
exception for

communications to the U.S. trade embargo (*OpenNet Initiative* 2007). Currently, Cuba still relies heavily on its satellite connection, with a 209 Mb/s upload bandwidth and a 379 Mb/s download bandwidth for the entire country.<sup>12</sup> To increase its connection capacity, in early 2011 Cuba completed the construction of a 1,550 kilometer, 640 Gb/s undersea fiber optic cable between La Guaira, Venezuela and Siboney in the eastern

<sup>12</sup> Cuba has 11 million people. To put this number into perspective, small universities in the United States serving approximately 10,000 people tend to have Internet connection speeds of 1 Gb/s, which is a higher capacity link than the entire nation of Cuba (Press, 2011, 7).

province of Santiago de Cuba. The project is labeled ALBA-1 in **Figure 3**.<sup>13</sup> The acronym ALBA refers to the eight-member Bolivarian Alliance for the Americas, established initially by Cuba and Venezuela (Press 2011, 8). The project was carried out by a joint venture between of Alcatel-Lucent Shanghai Bell and Telecomunicaciones Gran Caribe (TGC). TGC is itself a joint venture between the Venezuelan and Cuban governments; it is 60 percent owned by state-run Telecom Venezuela and 40 percent by Cuban Transbit (Press 2011, 8). Venezuelan President Hugo Chávez is said to have received a \$70 million loan from China for the project (Press 2011, 8).

The cable is expected to increase Internet speed 3,000-fold and be capable of handling about 80 million simultaneous phone calls (Rodriguez 2011). However, it is unlikely that faster Internet will be rolled out to all Cubans. For one, the Cuban government plans to continue operating current satellites, which implies that some organizations and networks will not be connected to the cable (Press 2011, 8). As of late 2011, connection speeds for users in Cuba remained low (Lazo 2011). It is likely that The Cuban Government will continue its past strategy of prioritizing who will receive the fiber optic connections. Many observers speculate that the government and military will receive the first connections to the cable, while special services and state business will also receive priority, including the highly profitable tourism sector (Frank 2011).

Indeed, the Cuban Government will likely use the connections to promote state business, as it has successfully in the past. The Internet has proved to be a boon for Cuba's tourism industry, both as a means to advertise through various government-

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<sup>13</sup> [http://www.telegeography.com/product-info/map\\_cable/downloads/2010\\_0629\\_CableMap\\_TeleGeography.jpg.zip](http://www.telegeography.com/product-info/map_cable/downloads/2010_0629_CableMap_TeleGeography.jpg.zip).

sponsored sites and as a vehicle to book reservations, check flight times, or support credit card authorization (Boas 2003, 271). Appendix 2, for example, shows the primary web page for Cubatur S.A., which is Cuba's state-owned tourism company. From this website, users can purchase airlines tickets, rent a car, and book a tour. A website for online money transfers also allows exiles to send funds to their Cuban relatives, which is another key source of foreign currency (Boas 2003, 271). The fiber optic connections may also benefit Cuba's small software industry (U.S. \$2 million a year) – which exports software to Canada (Frank 2011) – and its IT consulting services industry, which exports services to other developing countries (Ferrer 2011). Cuba has also long sought to be a scientific and technological power of the developing world, and has made use of the Internet to market its biotechnology industry (Boas 2003, 271).

Despite these commercial opportunities, the Cuban Government still actively restricts Internet access for a majority of its population. Until early 2008, computer purchases by private individuals were banned (*OpenNet Initiative* 2007). As noted, since the first Internet connection on the island, Decree-Law 209 required accreditation for Internet access and outlawed use that was considered to be “in violation of Cuban society's moral principles and the country's laws” as well as e-mail messages that could “jeopardize national security” (*OpenNet Initiative* 2007). All Internet access requires government authorization, and the MIC has overseen Internet and computer use since January 2000 (*OpenNet Initiative* 2007). Access for full Internet use is typically reserved for government-approved scientists, medical researchers, and government officials.

The Cuban Government also maintains control and oversight of all ISPs operating in the island. The Centro Nacional de Intercambio Automatizado de Información

(CENIAI) was the first Cuban ISP, but there are now others that, for instance, provide Internet service in tourist hotels or to foreigners operating joint ventures in Cuba (Frank 2011). CENIAI remains the only ISP licensed to provide personal Internet access to Cuban citizens (*OpenNet Initiative* 2007). All services, including ISPs, are subject to licensing (*OpenNet Initiative* 2007). The lack of private equipment for Internet access forces most Cubans to use public access points (*OpenNet Initiative* 2007). Not only can Cubans be easily monitored by state police at these sites, but they also generally require identification and registration, and many only access national e-mail and Cuban intranets, which restrict access to government-approved websites (*OpenNet Initiative* 2007). The government also limits use of most hotel and cybercafé Internet connections to foreign tourists (*OpenNet Initiative* 2007). Furthermore, all legal Cuban Internet traffic passes through state-run ISPs, which use software to detect politically dissident information (*OpenNet Initiative* 2007). This filtering includes the monitoring of e-mail messages prior to their having been sent or received (*OpenNet Initiative* 2007).

For people who gain Internet access and use it illegally, consequences are severe. Penalties for Internet violations include 20 years in prison for “counterrevolutionary” article writing and five years for connecting illegally (*OpenNet Initiative* 2007). Prominent Cuban bloggers who are critical of the regime with international readership – such that the government is more hesitant to throw them in jail – routinely face harassment and intimidation from the state police (Lazo 2011). In sum, restricted access, economic limitations, monitoring, and harsh penalties discourage the transfer of politically sensitive information in Cuba. In such an environment, self-censorship is pervasive.

#### Chapter 4: Research Question

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From the summary of Cuba's approach to ICT development discussed in Chapter 3, the Cuban Government has, over time, displayed a consistent strategy. Access limitations, high prices, and stiff penalties for political subversion keep most Cubans from accessing the Internet, much less using ICTs for political organization. However, the Cuban Government has lifted bans on mobile phones and personal purchases of computer equipment within the past decade. It has invested heavily in fiber optic connectivity and, as will be discussed in Chapter 5, training for IT professionals. It has also exploited some of the commercial benefits of the Internet by using it to market its tourism and biotechnology industries. The tension between ICT development for commercial purposes and the need to maintain political control thus plays a prominent role in this story. However, as discussed in Chapter 2, the dictator's dilemma does not sufficiently explain the Cuban Government's strategy for ICT development. The PRE, also discussed in Chapter 2, may shed more light on Cuba's approach to ICT development.

The remainder of this analysis will attempt to answer the following research question: *in balancing the needs of adopting the Internet for commercial purposes while curbing its democratizing effects, can the Cuban Government's approach to ICT development - including its training of IT professionals – be explained by the PRE?*

## *Chapter 5: Theoretical Framework and Key Concepts*

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As discussed in Chapter 2.4, the PRE, developed initially by Acemoglu and Robinson (2006), is one framework to structure our analysis of the Cuban Government's approach to ICT development. We will begin with the basic logic of the PRE as the foundation of our model, and then modify it, drawing from additional research on political survival. We will then define key concepts, and discuss how our theoretical framework can be applied to the case to answer our research question.

### *5.1: The PRE Framework*

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The PRE framework starts from the logic that political elites are less likely to be replaced when they adopt technologies and institutional changes that increase output because they will be more popular. Indeed, these changes will also benefit elites by increasing future output and their revenues. Therefore all else equal, elites prefer technological change. However, all else is not equal because such changes may erode their political advantages relative to other groups that are benefiting from the changes or weaken their ability to control political challenges. Thus, in certain circumstances, institutional and technological change will increase the likelihood that elites will lose power, creating the PRE (Acemoglu and Robinson 2006, 116).

Acemoglu and Robinson also posit that elites may behave differently based on the level of political competition that they face. With intense political competition, elites are more likely to innovate by adopting new technology because otherwise they are likely to be replaced (Acemoglu and Robinson 2006, 116). With a high degree of political entrenchment, incumbents are more willing to innovate because they are not afraid of

losing political power and they want to share in the gain of revenues brought about by technological innovation. Instead, Acemoglu and Robinson argue that it is elites that are somewhat entrenched but still fear replacement that will block innovation (2006, 116).

Human capital also plays a role in the model, as differences in the level of human capital may be important in shaping elites' attitudes towards certain technological advances. For instance, given the market for ICTs, certain levels of human capital – i.e. training in software development – are complementary to industrial activity, or the generation of a knowledge-intensive ICT sector. A high level of human capital – or more advanced training to a larger number of potential IT professionals – makes future gains from technology adoption larger relative to the rents from preserving the existing system, thus discouraging blocking by elites (Acemoglu and Robinson 2006, 116-117).

Acemoglu and Robinson also note that external threats are an important determinant of whether elites want to block technological and institutional change. More specifically, elites are less likely to block development when there is a severe external threat from a more developed country. This is because relatively backward technology increases the probability of foreign invasion. Therefore, the emergence of an external threat may induce innovation in a society that would otherwise block change (Acemoglu and Robinson 2006, 125).

In sum, what is crucial to elite perceptions towards change is not so much whether groups lose out economically or not, but rather their perceived ability to maintain political power.



## 5.2: A Modified Theoretical Framework

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Beginning with the basic logic that political elites will not adopt technological innovations that increase the likelihood that they will lose power, we can adopt the PRE framework to better fit the Cuban context. We assume that Cuba's leadership seeks to maximize its political survival. The trade-offs between the politically destabilizing aspects of ICTs and their potential for revenue-generation thus must be viewed in the light of the regime's desire to stay in power. This allows us to make the following initial hypothesis:

*Hypothesis 1: All else being equal, Cuba's leadership will block technological change that it perceives as a threat to its political survival.*

Next, we will expand the political dimensions of this model to better suit the context in Cuba. Drawing on selectorate theory, we posit that the political landscape can be broken down into two groups of people: the selectorate and the winning coalition (Bueno de Mesquita and Smith 2011, 4). The selectorate is a subset of the entire population that actually chooses who is in power, while the winning coalition is a subset of the selectorate whose support is essential if the leader is to survive in office (Bueno de Mesquita and Smith 2011, 5). In Cuba's case, the selectorate includes top PCC ministers and the military, while the winning coalition is made up of a much smaller circle of individuals close to Raúl Castro. According to selectorate theory, a leader has the greatest chance of political survival when the selectorate is large and the winning coalition is small, as in the case of an autocracy (Bueno de Mesquita and Smith 2011, 8-9). This is because those who are in a winning coalition can easily be replaced by other members of the selectorate who are not in the winning coalition. In the case of Cuba, of the twenty-

one ministers appointed by Fidel Castro in January 1959 immediately after the success of the revolution, 12 had resigned or had been ousted by the end of that year (Bueno de Mesquita and Smith 2011, 15). Four more were removed in 1960 as Castro further consolidated his power, showing that he kept his winning coalition small and loyal, easily replacing coalition members from the selectorate (Bueno de Mesquita and Smith 2011, 15). The loyalty of key backers is bought off with private goods or government revenue that is “spent on buying the loyalty of a few key cronies at the expense of general welfare” (Bueno de Mesquita and Smith 2011, 11). Maintaining this revenue is crucial, and is what gives incumbents their advantage. As Bueno de Mesquita and Smith note, “If a leader cannot find a reliable source of income, then it is only a matter of time until someone else will offer his supporters greater rewards than he can” (2011, 75). The need to maintain private rewards in an autocracy differs from the case of a democracy, which must provide public goods funded by government revenues to benefit a much larger selectorate – including all eligible voters – and a winning coalition that is a much larger subset of the selectorate.

Acemoglu and Robinson’s conception of political competition does not apply to the Cuban context; the totalitarian regime in Cuba has been firmly in power since the revolution, and has faced a neither strong nor organized opposition movement (Gershman 2009, 36-54). Thus, we posit a parallel “political threats” framework: in the face of credible threats to their power – including the potential loss of government revenues to buy off key supporters – political elites are more likely to innovate by adopting new technology to further their political survival. This allows us to make the following hypothesis:

*Hypothesis 2: Cuba's leadership will allow for technological innovation in an environment of greater political threats, with an emphasis on the perceived loss of future government revenues.*

In such a case, the potential loss of future revenues is perceived as more of a threat to political survival than the turbulence created by technological innovation.

To incorporate Acemoglu and Robinson's conception of human capital into our model, we must note that relative to other developing countries in Latin America, Cuba's population is highly educated (see Appendix 4). While Acemoglu and Robinson hypothesize that a higher level of human capital will make the benefits of technological innovation larger than the rents from preserving the existing system (2006, 116-117), Bueno de Mesquita and Smith propose that the payoffs of human capital development are also closely intertwined with the regime's need to generate revenue and provide private rewards to key supporters (2011, 109). More specifically, educated workers – when taxed – can generate revenue for the regime to buy loyalty. Nonetheless, there is little incentive for autocracies to educate their populations beyond maintaining a labor force productive enough to “pay taxes to line the pockets of rulers and their essential supporters” (Bueno de Mesquita and Smith 2011, 107). This is because, as noted Chapter 2.4, a highly educated population may be a threat to dictators, who “do no more for the people than is absolutely essential to prevent rebellion” (Bueno de Mesquita and Smith 2011, 108). Thus, we hypothesize that:

*Hypothesis 3: Higher levels of human capital in Cuba in the form of advanced training for IT professionals will coincide with periods in which Cuba's political leadership is in need of a means to generate revenue.*

Finally, Acemoglu and Robinson argue that external threats often make political elites more pro-innovation because falling behind technologically makes countries more vulnerable to foreign invasion (2006, 125). The concept of an external threat is relevant to the Cuban case, given the Cuban leadership's fear of foreign control (see Chapter 3.1) and the history of American invasion and meddling in Cuba's political affairs. Thus to incorporate this into our framework, we hypothesize that:

*Hypothesis 4: In periods in which Cuba's political leadership perceives a severe external threat, technological innovation will be allowed.*

### ***5.3: Key Concepts***

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Before proceeding with our analysis, we must more clearly operationalize the concepts of technological innovation, innovation blocking, and human capital in this context. The primary innovations we are concerned with are ICTs, or more specifically, the Internet and mobile telephony. In terms of innovation blocking, Milner's eight policies to control information apply (see Chapter 2.3). Human capital development requires further discussion.

The case of Cuba is unique in its level of totalitarian control over every aspect of society. In observing training for IT professionals and support for innovation in Cuba, one encounters different development models than those in market-based economies. We

will more clearly discuss those models here, as well as how we will interpret them within our theoretical framework.

### *5.3.1: Training for IT Professionals*

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Training for IT professionals in Cuba falls under the purview of the MIC. The MIC website lists its strategic goals for 2012, giving us some insight into its priorities:<sup>14</sup>

1. Obtaining external long and medium-term credit to finance capital investments and short-term credit for current trade;
2. Forming economic partnerships with foreigners to provide capital, technology and marketing distribution in selected areas;
3. Flexible handling of the global finance system to ensure good terms without undermining the National Economy;
4. Strengthening and expansion of strategic partnership with China and other countries that are sources of technology and political-economic integration in the framework of ALBA;
5. Ranking and assuring projects financially using the cyclic MIC system of research-production-marketing-technical services;<sup>15</sup>
6. Strengthening university and technological education related to the ICT sector and post-graduate training on the MIC system;
7. Fostering an atmosphere conducive to the development of ethical values and prevention of transgressions;
8. Developing work and salary systems that encourage high productivity;

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<sup>14</sup> <http://www.mic.gov.cu/sitiomic/servlet/hmicmision>.

<sup>15</sup> This cycle is further discussed in Chapter 5.2.2.

## 9. Reorganizing based on the MIC strategy.

Of these strategic goals, one should note that the first four have to do with global finance and foreign partnerships. Indeed, foreign investment to stimulate technology transfer is a key strategy for the Cuban Government in developing its ICT infrastructure, and thus will be an important component of our theoretical framework. Specifically, we will use any legislative changes in Cuba meant to stimulate foreign investment as an indicator of technology adoption or innovation.

In terms of technological training – its sixth strategic goal – the MIC oversees the Youth Computer Club (YCC) program, which is considered its “most important program” (Ferrer 2011). Aimed at familiarizing Cuban youth with computer skills, thirty-two YCCs were established in 1987 (Press 2011, 21). At the time of their establishment, these centers did not have Internet connectivity but rather offered computer games and classes on productivity software and programming (Press 2011, 21). In 2009, there were 607 YCCs throughout Cuba with 3,208 teachers and 8,626 computers (“www.Juvenclub.Cu: La Computadora De La Familia” 2009).

The primary function of these YCCs is user training: they offer classes aimed at users on Windows, Linux, Microsoft Office, Adobe Photoshop, web design, and introductory programming (Press 2011, 22). The YCCs currently offer access to a central YCC website (Appendix 3) that includes links to image and video collections, e-mail, an online library, software downloads, discussion boards, and a wiki which directs users to open source software downloads (2009). PC is the primary platform for developing and delivering applications at these centers rather than the Internet, which is now

characteristic of the offerings of U.S. junior colleges (Press 2011, 22). Access to the full Internet is not available at these centers. For the purposes of our analysis, these centers will be considered a form of human capital development; they are aimed at building the technical skills of Cuban youth.

Also of primary importance is the training of university-level Internet technicians. Cuba has a 100 percent literacy rate and their tertiary education expenditure and enrollment rates are the highest among the Latin American and Caribbean nations classified by the World Bank as upper-middle income (Appendix 4). Cuba has 65 universities, of which 17 offer specializations in information and communication technology (Oficina Nacional de Estadísticas 2010). There are also 25 technical schools that also offer similar specializations (Oficina Nacional de Estadísticas 2010). It must be noted, however, that none of these schools are reported to have Internet access. They rather allow users to access a limited Cuban intranet (Oficina Nacional de Estadísticas 2010).

The newest and most prominent of these programs is the specialized University of Informatics Science (UCI), referred to by locals as the “MIT of Cuba” (Ferrer 2011). UCI was founded in 2002 with 300 teachers and 2,008 students, and by 2007 it had over 10,000 students (Press 2011, 23). The UCI curriculum mixes coursework with practical experience; its goals are to educate professionals in the computer science field and to produce software and informatics services (Universidad de las Ciencias Informáticas 2011). They offer studies in undergraduate and graduate computer science and technology-based education. Very little course information – including syllabi and teaching material – is available on the university website (Universidad de las Ciencias

Informaticas 2011).<sup>16</sup> However, the website does include curriculum information, which is summarized in **Table 1**.<sup>17</sup> Compared to computer science curricula in the United

<b>Table 1: UCI Undergraduate Computer Science Curriculum</b>	
<b>Topic</b>	<b>Semesters</b>
Programming	3
Telecommunication	2
Software engineering	2
Computer architecture	2
Database Systems	1
Operating Systems	1
Computer Graphics	1
History of Computing	1
Computer Ethics	1
Artificial Intelligence	1
Computer Security	1
Management information systems	1
Electronic commerce	1
Professional Practice	10
Physical education	10
Mathematics	8
Foreign language	5
Economics, history, philosophy	5
Business, accounting and finance	3
Physics	2
Defense Preparedness	1
Social problems of ICT	1
Research Methodology	1
Teacher Training	1

States, Cuban students spend more time on foreign language (English), physical education, and professional practice (Press 2011, 24). U.S. students have a wider

<sup>16</sup> Also notably, the website's servers were often down at the time of writing.

<sup>17</sup> Ibid., 24.



assortment of humanities and social science electives to supplement their core curriculum (Press 2011, 25). Students at UCI are also expected to work on useful applications in education, health, sports, online government, writing software and building web portals and developing multimedia products (Universidad de las Ciencias Informaticas 2011). This practical experience is a valuable component of their education – however, in many cases the students will be learning technology that is outdated in other nations (Press 2011, 25). The computer science discipline has gone four generations of platforms for developing and delivering IT applications – batch processing, timesharing, personal computers, and the Internet. Cuba remains largely in the third generation – personal computer – while the rest of the world is increasingly using the Internet as a platform for developing and delivering applications (Press 2011, 25).

Because UCI students are engaged in software development and research and development (R&D),<sup>18</sup> the establishment of this university's programs will be considered a form human capital development and, to a lesser extent, technology adoption in our model. However, one must note that UCI graduates – and IT graduates in general throughout Cuba – are often being trained for nonexistent jobs, which is not uncommon in a command economy (Frank 2011).

### *5.3.2: Closed-Loop Development Process*

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Although the private sector has been nearly non-existent in Cuba since the revolution, at points of economic crisis – including the Special Period of the early 1990s, in 2008 at

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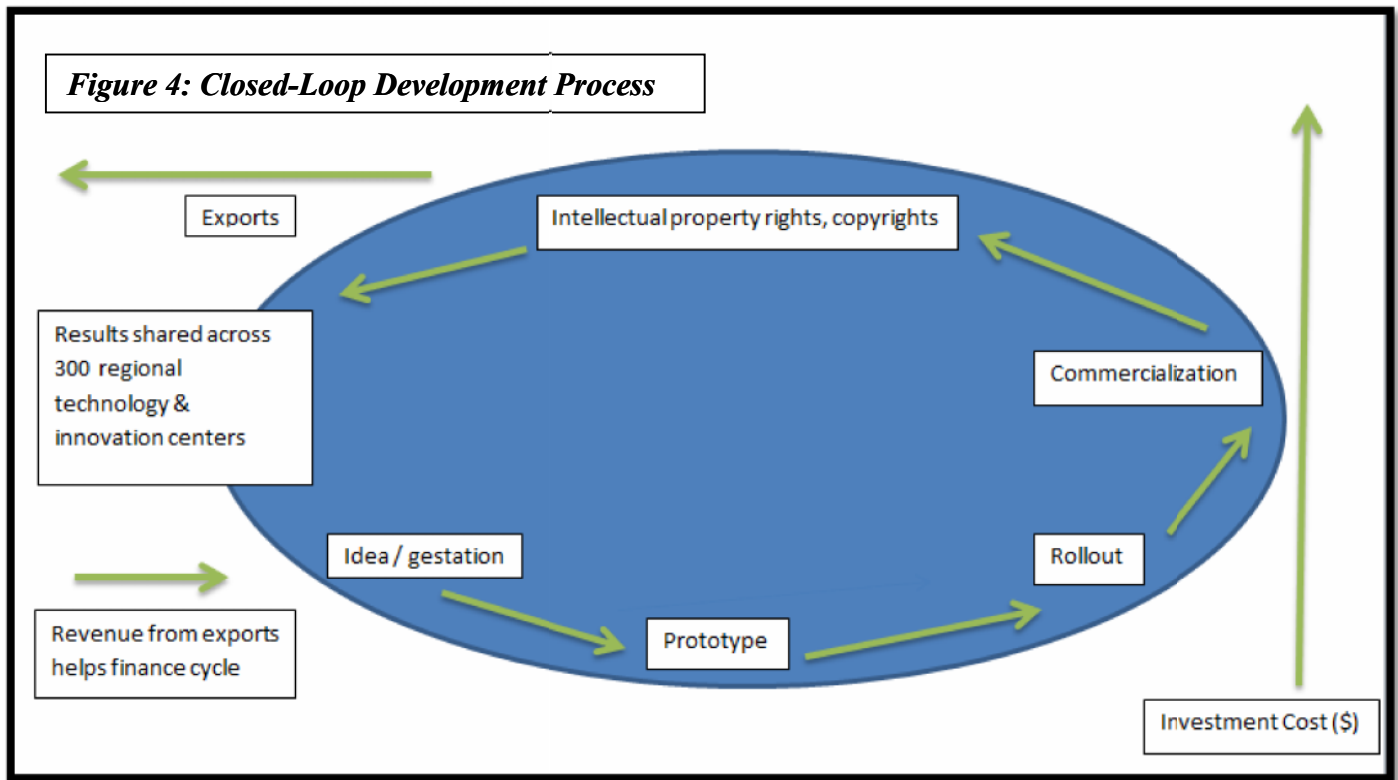
<sup>18</sup> According to the Organization for Economic Cooperation and Development (OECD), R&D is “creative work undertaken on a systematic basis in order to increase the stock of knowledge.” R&D is a term covering three basic activities: basic research, applied research, and experimental development (“Expenditure on R&D” 2012).

the onset of the global financial crisis, as well as more recently – the Cuban government has allowed limited private sector development by granting licenses for self-employment. However, this limited private sector is strictly regulated and taxed. The Cuban government further regulates the technological innovation process by making the innovation cycle itself – including the software development cycle – internal to the government.

The Institute of Scientific and Technological Innovation (IDICT), initially formed by a decree in 1963, is a government agency charged with “laying the foundation for the development of the Information Society within Cuba” (Ferrer 2011). It is also part of the MIC and spearheads the latter’s fifth strategic goal, as outlined in Chapter 5.3.1. With innovation centers, known as Centers for Information and Technology Management (CIGET) in each of Cuba’s 15 provinces, the IDICT provides advanced training to IT professionals in technology management and computer science. The CIGET branches also serve as incubators for technology development, developing computer software and computer science innovations on a small scale. All of the financing for these centers comes from the Cuban government. These technological innovations can be exported abroad, ultimately increasing financing for the cycle (Ferrer 2011).

In what IDICT Director of Organizational Development Ubaldo Socorras Ferrer terms the “closed-loop development process,” the entire development process – from the gestation phase of a new product, to its prototype, testing, rollout, commercialization, and finally to its intellectual property and licensing – are all internally administered and directed within the regional CIGET branches. This process is also illustrated in **Figure 4** below. According to Ferrer, the Finlay Institute – a leader in Cuba’s biotechnology

industry – utilized this same model to develop a meningitis B vaccine in the late 1980s.



This vaccine has been exported to 15 different countries, with a total of 55 million doses having been administered in Cuba and abroad (Fortner 2007). Thus, there is potential for successful technological innovations with this model, but because the government finances and directs the entire process, it has significant limitations.

The “closed-loop development process” is different from the technology development process in market-based economies primarily in terms of its financing; no private capital is invested in the process, nor is there access to any public equity markets. Moreover, any investments must serve a “social purpose” as determined by the Cuban government; in other words, the projects must reflect the needs of Cuban society as determined by its government (Ferrer 2011). The research performed by Cuban computer scientists in these programs is, from the point of view of the Castro regime, relatively

uncontroverial. A cursory review of the articles in a recent issue of *Ciencias de la Información* – a computer science research journal published by the IDICT – includes apolitical topics such managing digital libraries, the journalistic editorial process, and using different knowledge management systems (Basnuevo and others 2010; Buergo 2010; Herrera and others 2010; Morales and others 2010; Rivero and Diaz 2010; Sanchez and others 2010).

The lack of financing for the R&D process is no doubt detrimental to Cuba's ability to develop new technology. As shown in Appendix 5, ICT exports as a percent of total goods in Cuba lags behind the average rates of other Latin American and Caribbean nations with similar income classifications. Much empirical work on the R&D process provides evidence that, even in a freely competitive marketplace with access to private capital and public equity markets, there remains a chronic "funding gap" for R&D activities (Hall 2002, 35-51). The reasons for this funding gap are manifold, but have much to do with the uncertainty associated with R&D output (Hall 2002, 4). Even in highly developed economies – where the presence of venture capital, intellectual property systems, government support of R&D, and R&D tax incentives attempt to address this problem – underinvestment in R&D persists (Hall 2002, 3). Thus, although the Cuban government is attempting to encourage innovation through the IDICT, financial limitations as well as bureaucratic control prevent the Cuban ICT sector from being a meaningful contributor to Cuba's overall economy.

We will consider the IDICT-directed R&D process in Cuba to be a form of technology innovation and human capital development in our model. However, this analysis shows that the R&D process in Cuba is highly controlled by the government and

limited to a small and select group of elite computer scientists. Very few Cubans actually benefit from any ICT products developed in Cuba, as few of them actually own computers. We are primarily concerned with ICT indicators that show degrees of accessibility for the entire Cuban population; such include the number of Internet users, the number of secure Internet servers, and the number of mobile phone subscribers. Thus, these indicators will be of primary interest in determining technology adoption.

## *Chapter 6: Methodology*

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The literature review, background, and discussion of our theoretical framework and key concepts have laid the foundation for our case analysis. In Chapter 7, we will analyze ICT adoption in Cuba during three different periods of similar length (1992-1997, 2000-2005, and 2006-2011) and cross-reference these periods with our theoretical framework. The three periods are meant to differ along the environmental dimension of our theoretical framework – namely, we are interested in periods with different levels of political threats, revenue generation, and human capital. The overall research is qualitative, but when available, we will use relevant quantitative ICT indicators to support our argument.

Our methodology for this thesis included the case selection, data collection, and analytical tools as discussed below.

### *6.1: Case Selection*

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This research is not an exhaustive analysis of the dictator's dilemma in various authoritarian regimes; we are only interested in the strategy of the Cuban government. We chose Cuba because of the lack of data provided by the Cuban government, which contributes to a limited understanding of its policies in the academic community. Thus, this thesis seeks to generate more knowledge about the Cuban case, as well as unpack the assumptions behind the dictator's dilemma.

## 6.2: Data Collection

Throughout this study, we used a number of secondary data sources, primary resources – included Cuban laws and decrees, a combination of quantitative and qualitative data, and interviews. The elements of data collection are summarized below in

**Table 2.**

**Table 2: Summary of Research and Data Collection**

Methods	Details	
<b><u>Telephone Interviews</u></b>	<b><u>Duration</u></b>	<b><u>Occurrences</u></b>
Economist / Academic	30 minutes	1
Academic - Cuban blogosphere	1 hour	2
EU Representative, Havana	30 minutes	1
Commercial Representative, Italian Embassy Havana	30 minutes	1
Commercial Representative, Canadian Embassy Havana	30 minutes	1
<b><u>Email Correspondences</u></b>	<b><u>Sent</u></b>	<b><u>Received</u></b>
University of Havana Professor	6	6
Academic - IT engineering specialist	4	4
Former UK Ambassador to Cuba	10	9
Executive Director, Cuba Study Group	4	3
<b><u>In-Person Interviews</u></b>	<b><u>Duration</u></b>	<b><u>Occurrences</u></b>
University of Havana cultural liaison	1 hour	2
Commercial Representative, Japanese Embassy, Havana	1 hour	1
Cuban dissident blogger	2 hours	2
Cuban dissident blogger	2 hours	1
BBC journalist	2 hours	1
Reuters journalist	2 hours	1
Former UK Ambassador to Cuba	1 hour	5
Representative, US Interests Section, Havana	1.5 hours	1
IDICT Director of Organizational Development	1.5 hours	1
<i>Ciencias de la Información</i> Editor	1.5 hours	1
<b><u>Field Visits</u></b>	<b><u>Location</u></b>	<b><u>Duration</u></b>
Instituto de Información Científica y Tecnológica (IDICT)	Havana	2 hours
Youth Communist League Central	Havana	30 minutes
<b><u>Data Queries</u></b>	<b><u>Date</u></b>	
The World Bank (online databank)	January 1, 2012	
Cuban National Statistic Office	January 1, 2012	

### *6.3: Quantitative Indicators*

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All quantitative indicators were collected from various secondary sources. ICT indicators for the three time periods we examine were pulled from the World Bank's online databank. Data on education institutions in Cuba were pulled from the Cuban National Statistic Office.

### *6.4: Interviews*

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A number of government officials, researchers, journalists, and Cuban citizens were interviewed over the course of this research. Subjects were targeted for interviews based on their presumed knowledge of the research topic, which was often related to their profession or academic research interests. The interviews were informal and semi-structured; discussion questions included Internet and mobile phone accessibility as well as government policies pertaining to these technologies. The interviews were meant to be semi-structured to encourage the discussion of issues relevant to our research that we had not initially considered (e.g., this was how the discussion of Cuba's closed-loop development process came about, as discussed in Chapter 5.3.2). Additional sources were obtained by using the snowball sampling method.<sup>19</sup> The in-person interviews of Cuban citizens and site visits took place in August 2011 during our field research, while much of the contact with academic researchers took place over the phone or via email in early 2011.

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<sup>19</sup> This is a non-probability sampling technique where existing study subjects recruit future subjects from among their acquaintances.



## *Chapter 7: Case Analysis*

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In this section, we analyze three time periods in Cuba through our modified PRE framework. These periods were selected because they differ along the environment dimensions of our theoretical framework; the Special Period (1992-1997) is characterized by the collapse of Soviet subsidies resulting in more political threats, the Recovery Period (2000-2005) is characterized by economic recovery, and the Post-Fidel Transition Period (2006 – 2011) is characterized by political uncertainty as Fidel Castro transferred power to his brother, Raúl. For each of these periods, we will provide background information on what actually occurred, and then compare these to the predicted outcomes of our theoretical framework.

### *7.1.1: The Special Period (1992-1997)*

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As summarized in Chapter 3.3, the Special Period was an extended period of economic crisis in Cuba that began in 1991 after the dissolution of the Soviet Union. The collapse of the Soviet Union precipitated the fall of the Council for Mutual Economic Assistance (COMECON), an economic organization which, along with other subsidies, supplied natural gas to Cuba at below-market rates. With the loss of the annual U.S. \$4 billion Soviet subsidy which totaled 21 percent of Cuba's GNP, the Cuban economy went into a tailspin (Gershman 2009, 36). Moreover, Fidel Castro faced a crisis of legitimacy; the downfall of communism throughout Central Europe and the electoral defeat of the Sandinistas in Nicaragua reinforced a belief that the Castro regime was on the wrong side of history and faced an inevitable downfall (Gershman 2009, 36). In this environment, Cuba's leadership faced high political threats, as the guarantee of future revenues to pay off key supporters was not ensured.

Regarding the environment for foreign investment in Cuba, the government had issued its first piece of legislation permitting such investment in 1982, Decree-Law 50. This law authorized the formation of economic associations between foreign investors and state-owned enterprises, with a number of restrictions. There was for example, no provision allowing for the ownership of private property (Gallousis 2001, 92). Decree-Law 50 also limited foreign investment on joint ventures to forty-nine percent, diminishing the value of the investment itself by denying investors full ownership (Gallousis 2001, 92).

The Special Period marked the beginning of major legislative revisions to the foreign investment legal framework in Cuba. Coinciding with this economic crisis was the completion of the first project developed with foreign investment, nearly a decade after the promulgation of Decree-Law 50 (Travieso-Diaz and Trumbull IV 2003, 907). Foreign investment also grew slowly between 1991 and 1992. Approximately sixty new ventures were initiated during these years, mostly in the tourism sector by companies based in Spain and Germany (Travieso-Diaz and Trumbull IV 2003, 907). In August 1992, Cuba shifted its strategy in pursuit of longer lasting foreign investments by amending its 1976 constitution to alter the property regime, expressly authorizing foreign investors to own property (Travieso-Diaz and Trumbull IV 2003, 908). In October 1994, the Cuban government officially declared that all sectors of the economy were open to foreign investment except for public health, education, and the armed forces (Travieso-Diaz 2003, 1026). This spurred additional investment in the services sector, real estate, and telecommunications (Travieso-Diaz and Trumbull IV 2003, 908). In 1995 Cuba's National Assembly approved Law No. 77, which serves as the current legal framework

for foreign investment in the country. Though the law contains many restrictions and impediments to FDI, it does represent a somewhat liberalized investment regime in the country than that under Decree-Law 50 (Travieso-Diaz and Trumbull IV 2003, 908).

Levels of human capital in Cuba were high during this period. The IDICT had been established in the 1960s, and had expanded to regional CIGET branches in multiple provinces by 1976 (Ferrer 2011). In the 1990s the Center for Studies and Professional Development in Information Sciences (PROINFO) was also created, which was dedicated to developing professional skills in information sciences among Cuba's elite computer scientists (Ferrer 2011). Moreover, in 1996 Decree-Law 163 mandated the establishment of computer science training and working groups to "increase the role of science within the national culture" (Republic of Cuba 1996). This law also provided support to computer science research centers and publications (Republic of Cuba 1996).

In terms of computer networking, CENIAI began its networking activities in 1982 with connections to Soviet and European databases and very limited email (Press 2011, 14). By 1992, CENIAI was offering email (Press 2011, 14). By 1995, Cuba was among the networking leaders in the Caribbean (Press 2011, 14). CENIAI and three other networks with international UUCP links<sup>20</sup> were transferring over 60 Mbytes of international email and had nearly 2,600 users (**Table 3**).

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<sup>20</sup> UUCP is an abbreviation for Unix-to-Unix Copy. It refers to a suite of computer programs and protocols allowing for the remote execution of commands, file transfers, and email between computers (Kernighan and McIlroy 1979).

<b>Table 3: Monthly International Email Traffic in 1995<sup>21</sup></b>			
<b>Network</b>	<b>k bytes</b>	<b>Accounts</b>	<b>Users</b>
TinoRed	16,709	413	Youth Computer Clubs and NGOs
CENIAI	16,481	732	Several organizations
Infomed	14,000	500	National System of Health Information
CIGBnet	13,441	950	Center for Genetic Engineering and Biotechnology
<b>Total</b>	<b>60,631</b>	<b>2,595</b>	

Though there is limited data available during this period indicating ICT adoption rates, the data in **Table 4** do indicate an increase in the number of Internet users and mobile phone subscriptions.<sup>22</sup> However, one must note that mobile phones for personal use were banned during this period. Thus, any mobile phones were used by foreigners or PCC officials with explicit authorizations.

<b>Table 4: ICT Adoption Indicators in Cuba (1992 - 1997)<sup>23</sup></b>						
<b>Year</b>	1992	1993	1994	1995	1996	1997
<b>Internet users</b>	...	...	...	9.99	3,498	7,499
<b>Mobile cellular subscriptions</b>	234	500	1,152	1,939	2,427	2,994

Regarding the threat of foreign invasion during this period, the embarrassment suffered by the Kennedy administration during the Bay of Pigs Invasion in April 1961 strongly precluded future American administrations from invading the island. Instead, the United States was engaged in different means to undermine the Castro regime; the passage of the Cuba Democracy Act in 1992 dramatically aggravated economic sanctions against the island.

<sup>21</sup> Press, "The State of the Internet in Cuba," 14.

<sup>22</sup> Note that the Internet user data in Table 4 is contradicted by some of the data in Table 3. This can be attributed to the different sources and the generally poor data quality during this time period.

<sup>23</sup> "The World Bank DataBank," <http://databank.worldbank.org> (accessed April 14, 2012).

Tensions between the two countries did increase on February 24, 1996, when two Brothers to the Rescue<sup>24</sup> planes were shot down by the Cuban Air Force. As the Brothers to the Rescue pilots were unarmed, Cuba received international condemnation for the incident, and the United States Congress increased sanctions against the island with the passage of the Cuban Liberty and Democratic Solidarity (Libertad) Act of 1996. However, at other points tensions were eased between the two countries. In 1994, Cuba and the United States signed in agreement in which the United States would admit 20,000 Cubans a year in return for Cuba halting the exodus of refugees ("Timeline U.S.-Cuba Relations" 2011). Thus on the whole, relations between the two countries were tense but at times cooperative, and the threat of foreign invasion was low.

### *7.1.2: Theoretical Analysis*

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Returning to our theoretical framework outlined in Chapter 5.2, we find that much of the data supports our initial hypotheses during the Special Period. Indicators on changes in the foreign investment legal framework, growth in human capital development, and small growth in some ICT adoption rates show that the Cuban government allowed for innovation during this period.

Addressing each of our four hypotheses, we argue that *Hypothesis 1* applies to a limited degree during this time period. The substantial losses in GDP growth as well as the loss in government revenues due to a collapse of the preferential trade agreements with the Soviet Union constituted a severe threat to the Cuban government's political survival, thus innovation blocking was not a feasible strategy. That being said, Internet

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<sup>24</sup> Brothers to the Rescue is a Miami-based activist organization formed by Cuban exiles that is strongly opposed to the Castro regime.

and mobile phone adoption rates were still relatively low, especially when comparing Cuba to other Latin American and Caribbean countries (see Appendix 6 and Appendix 7). Thus, we can construe some innovation blocking during this period, but on the whole – especially given the significant changes in the legislative framework governing foreign investment – the Cuban government allowed for innovation. The prediction of *Hypothesis 2* is therefore corroborated by the data during this period; Cuba’s leadership did in fact allow for innovation due to their perception of greater political threats, with an emphasis on their perceived loss of future government revenues.

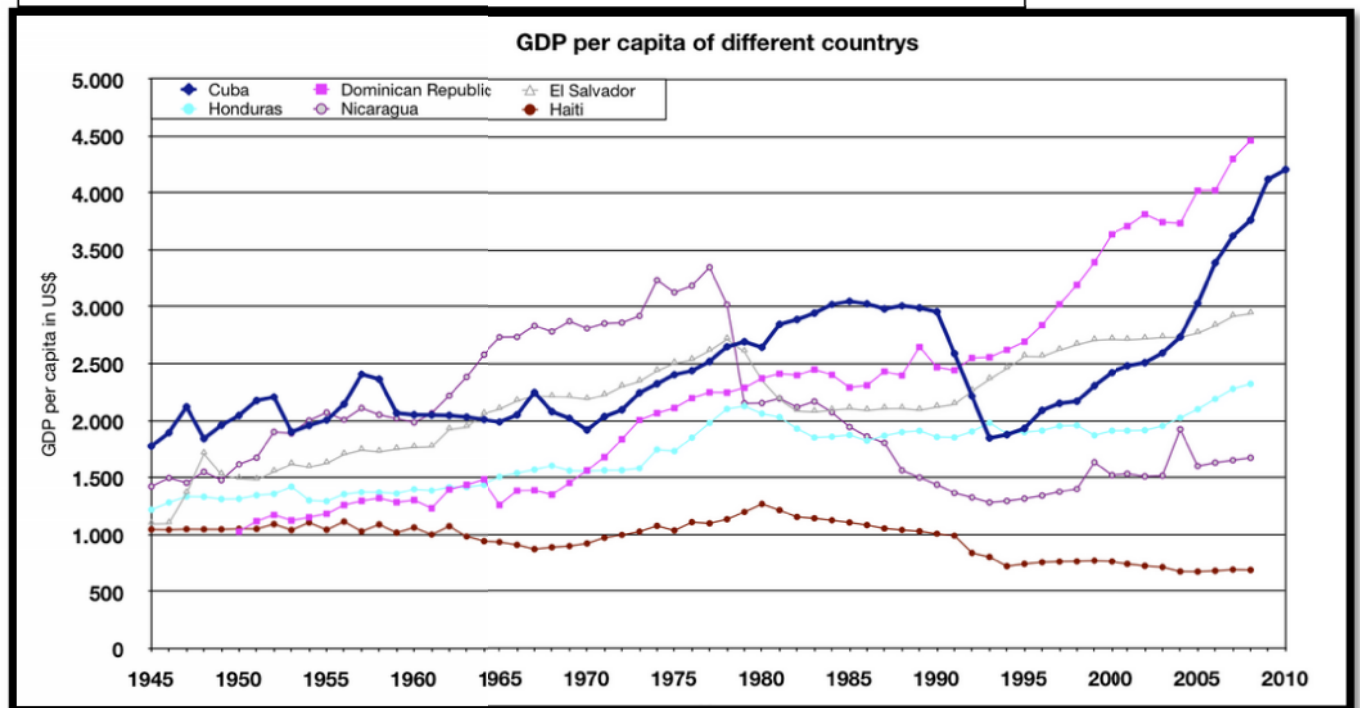
On the whole, we also interpret greater levels of human capital development in the form of advanced training for IT professionals. Given the loss in government revenues, one still sees investment in training programs for IT professionals. This is especially true given the establishment of PROINFO and the expansion of other regional training programs, including the opening of email accounts at YCCs (**Table 3**). This supports *Hypothesis 3*, as there was a higher level of human capital in the form of advanced training for IT professionals at a time in which the Cuban government was in need of a means to generate revenue.

Finally, we note that *Hypothesis 4* did not apply to the Special Period, as Cuba did not face a severe external threat of foreign invasion.

### 7.2.1: Recovery Period (2000-2005)

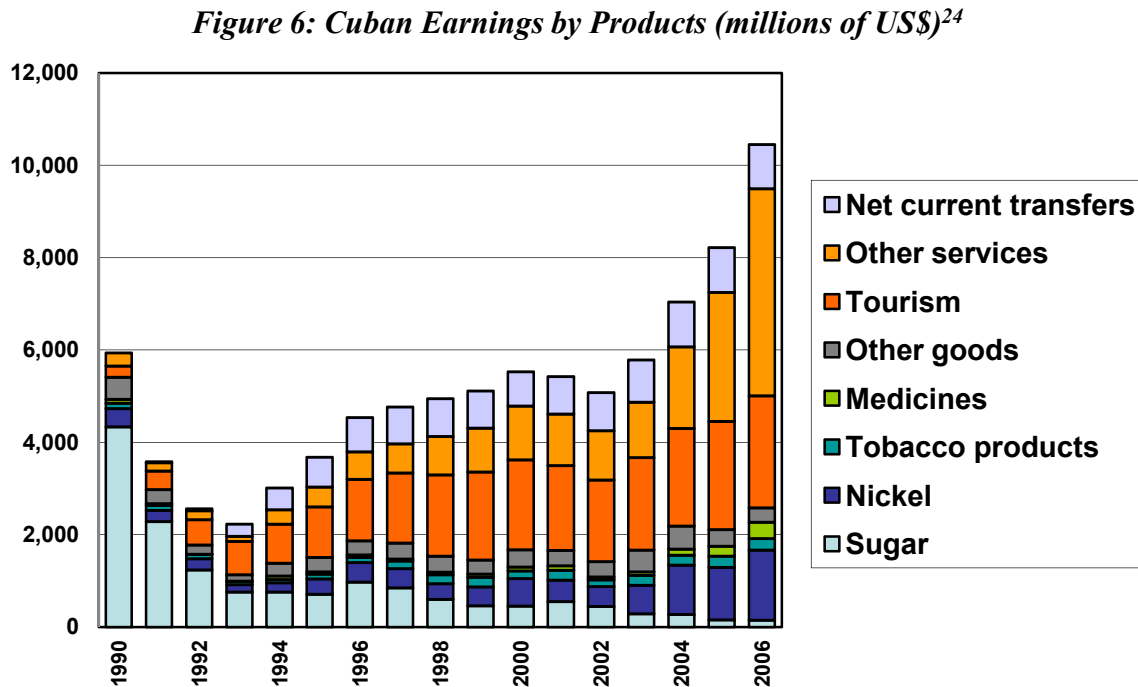
The Recovery Period of 2000 – 2005 was characterized by modest GDP growth after the Special Period in Cuba (see **Figure 5**<sup>25</sup>), primarily due to the growth of the tourism sector and other services. This growth began in 1999 with a 6.2 percent increase in GDP, significantly alleviating pressure on government finances ("Panorama Económico y Social: Cuba 2010" 2010).

**Figure 5: GDP per Capita, Cuba and other Latin American Countries<sup>23</sup>**



<sup>25</sup> ("Panorama Económico y Social: Cuba" 2010).

The Cuban economy both recovered in its earning capacity and composition; **Figure 6**<sup>26</sup> demonstrates that increased investments in other sectors aside from sugar,



which had traditionally dominated Cuban export earnings, also contributed to this recovery. Growth accelerated considerably in 2004 onwards through the increase in earnings from “other services,” which are mainly human capital services (primarily teachers and doctors), which were mostly generated by bilateral exchange agreements with Venezuela (Wilkinson 2010, 5).

Regarding the environment for foreign investment during the Recovery Period, there were no significant changes made to Cuba’s legal framework. Rather, Law 77 was retained from the Special Period as the primary rule governing such investments. The

<sup>26</sup> Emily Morris, *Futures for Cuba: The Economy* (London: Economist Intelligence Unit, (2007).



amount of FDI in Cuba remained relatively small and the rate of investment slowed (Travieso-Diaz 2003, 918). Most investors also brought in limited amounts of capital; in 2003, seventy-five percent of all investment was less than \$5 million (Travieso-Diaz 2003, 918). In 2000, the Cuban government also enacted a freeze on foreign investment in the property sector (IHS Global Insight 2010). Nonetheless, modest levels of foreign investment played a significant role in Cuba's growth during this period.

Levels of human capital development increased during this period. CIGET continued to grow and increase the scope of its activities in software development processes, as well as providing advanced training to computer scientists (Ferrer 2011). Most importantly, in 2002 UCI was founded, opening to its first class of 2,008 students with 300 teachers (Press 2011, 23). The university also grew substantially over the following few years (Press 2011, 23).

Regarding ICT adoption indicators during this period, **Table 5** shows that there was substantial growth in ICT goods exported from 2000 – 2005, providing an indication of the economic payoffs of advanced training for IT professionals. The number of Internet and mobile phone users also increased. Thus, ICT adoption rates were modest. Nonetheless – as noted in Chapter 3.4 – in 2001 the Cuban government enacted a ban on mobile phones for consumer use (Reardon 2008). Thus, the cellular subscriptions in **Table 5** represent executives working for foreign companies, high PCC officials with explicit authorizations, or black market use of mobile phones (Huaimachi 2010).

<b>Table 5: ICT Adoption Indicators in Cuba (2000 - 2005)<sup>27</sup></b>						
<b>Indicator</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
<b>ICT goods exports (% of total goods exports)</b>	0.15	0.50	0.71	2.07	1.73	4.37
<b>ICT goods imports (% total goods imports)</b>	5.33	6.45	6.33	6.10	6.45	4.58
<b>Internet users</b>	60,095	120,286	421,379	587,443	944,635	1,095,945
<b>Internet users (per 100 people)</b>	0.54	1.08	3.77	5.24	8.41	9.74
<b>Mobile cellular subscriptions</b>	6,536	8,579	17,851	35,356	75,797	135,534
<b>Mobile cellular subscriptions (per 100 people)</b>	0.06	0.08	0.16	0.32	0.67	1.20
<b>Secure Internet servers</b>	...	2	...	1	1	1
<b>Secure Internet servers (per 1 million people)</b>	...	0.18	...	0.09	0.09	0.09

Finally, in terms of the threat of a foreign invasion, relations between Cuba and the United States worsened considerably during this period, particularly after the election of George W. Bush as U.S. President in 2001. Under the Bush administration, the United States tightened embargo restrictions against Cuba (Perez Jr. 1995, 326). Though from a U.S. perspective the possibility of an invasion in Cuba was extremely low, that threat may have been higher from Fidel Castro's perspective. In a 2004 meeting with members of the Commission for Assistance to a Free Cuba, President Bush stated: "We're not waiting for the day of Cuban freedom; we are working for the day of freedom in Cuba" (Lobe 2004). Also, following his re-election in 2005, Bush declared Cuba to be one of the few "outposts of tyranny" remaining in the world (Perez-Stable 2005). Tensions were also heightened in 2005 when the Under Secretary of State for Arms Control and International Security Affairs John R. Bolton accused Cuba of maintaining a biological

<sup>27</sup> The World Bank Online DataBank.

weapons program (Eberhart 2005). Given that the United States had invaded Iraq in 2003 over its alleged possession of weapons of mass destruction, one could posit that this aggressive rhetoric and the enhanced sanctions against Cuba could have been interpreted as threatening to Cuba's leadership.

### *7.2.2: Theoretical Analysis*

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Cuba's economic recovery presents a very different situation of political threats than that in the Special Period. Given higher GDP growth and increased bilateral trade with Venezuela, Cuba was no longer on the verge of economic collapse. In this case, *Hypothesis 1* applies: we predict that Cuba's leadership will block technological innovations that it perceives to be a threat to its political survival.

The data from this period reveal a more complex picture. The Cuban government made significant investments in human capital development, with a focus on training IT professionals. The opening of an elite university devoted to this training – UCI – as well as a deepening of CIGET activities all point to high levels of innovation. That being said, ICT adoption rates in Cuba still lagged relative to other Latin American and Caribbean countries (see Appendix 8 and Appendix 9). There were also no significant efforts made by the Cuban government to increase foreign investment, and there was a reversal of many of the reforms made during the Special Period to stimulate private sector development (Travieso-Diaz and Trumbull IV 2003, 903). The Cuban government also enacted a ban on mobile phones for personal use in 2001, reflecting its fears of the use of ICTs by Cuban citizens. Technology adoption during this period was therefore focused on human capital development in the form of training programs; the Cuban government

only allowed innovations that it did not perceive as a threat to its political survival, supporting *Hypothesis 1*.

Given that the environment for political threats was much lower during this time period, *Hypothesis 2* does not apply. The Cuban government did make investments in human capital development in the form of advanced training for IT professionals, despite a lower level of political threats. This creates some confusion over the interpretation of *Hypothesis 3*, as one would assume a need to generate revenue via human capital development would also coincide with a high level of political threats. Yet given the increasing rates of ICT goods exports (**Table 5**) and the need of the Cuban government to defer more to services to diversify its industry and generate revenue (**Figure 6**), we can interpret this data as supporting *Hypothesis 3*; in order to ensure a future revenue stream and diversify its industry, the Cuban government increased its training of IT professionals to further develop its human capital potential.

Finally, the data during this period also support *Hypothesis 4*; as the Cuban government perceived a greater threat of foreign invasion from the United States, it allowed for some innovation. It primarily focused on human capital development by providing advanced training for IT professionals, with some growth in the number of Internet users and mobile phone subscriptions. However, ICT adoption indicators in Cuba during this period were still low compared to other Latin American and Caribbean countries, meaning the Cuban government still exercised much caution in providing access to ICTs, supporting *Hypothesis 1*.

### 7.3.1: Post-Fidel Transition Period (2006-2011)

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From 2006 – 2011, Cuba underwent some of the most significant political and economic changes since its revolution. Illness forced Fidel Castro to cede power in July 2006, passing along leadership to his younger brother, Raúl, while he underwent an emergency surgery. Raúl Castro formally took over as Cuba's president in February 2008 and as first secretary of the PCC in April 2011. Raúl moved slowly at first in implementing reforms, amid much factional fighting ("Revolution in Retreat" 2012). He also quietly discarded nearly all of Fidel's ministers and key aides, replacing them mostly with army officers ("Revolution in Retreat" 2012).

The Cuban economy slowed in early 2008 as Venezuelan aid was offset by devastating hurricanes and the effects of the global financial crisis on tourism and trade ("Revolution in Retreat" 2012). GDP expanded 4.3 percent in 2008, which was down from 7.3 percent in 2007 and from double-digit growth in 2006 (IHS Global Insight 2012). In September 2010, Cuba's leadership announced that it would initiate significant economic reforms that aimed to lay off 500,000 public sector workers over a six-month period, transferring them to a newly-legal private sector, in which the government would offer licenses to approved forms of self-employment (Darlington 2010). The economic reforms, set out in 313 *lineamientos* or "guidelines" that were approved by a PCC congress in April 2011, are being implemented slowly and with great caution ("Revolution in Retreat" 2012).

The first measures implemented granted 250,000 new licenses for approved forms of self-employment and authorized the outsourcing of labor (IHS Global Insight 2012). In addition, the Cuban central bank is exploring the possibility of giving microcredit or

small loans to new entrepreneurs. This will be a landmark in Cuba, as loans have been unheard of for decades (IHS Global Insight 2012). In addition, the newly-legalized small businesses will have to pay taxes, as the government seeks to implement a new “tax culture” (IHS Global Insight 2012). Cuban citizens have not paid taxes for more than 50 years.

In terms of the environment for foreign investment, a government decree announced in August 2011 authorized foreign investors to use state-owned land for up to 99 years instead of 50, as previously stipulated under Cuban law (IHS Global Insight 2012). The measure, which aims to boost the tourism industry, follows a law implemented on July 19, 2011 that allows foreign investment in Cuban luxury golf courses and luxury homes (IHS Global Insight 2012). So far, Cuban authorities have revealed that at least 16 golf development projects are being assessed and contract negotiations are likely to open up new opportunities in the tourist industry (IHS Global Insight 2012). Although these reforms are sector-specific, they do mark a move to increase the confidence of foreign investors.

Levels of human capital development also increased during this period. According to Cuba’s Office of National Statistics, by 2010 there were 606 public Internet access points at YCCs, 2,711 professors, and nearly 2.5 million Cubans had completed the course offerings at these centers since their founding (Oficina Nacional de Estadísticas 2011). By 2007, UCI had over 10,000 students (Press 2011, 23). This is a testament to the university’s considerable expansion since its founding in 2002, when it had only 2,008 students (Press 2011, 23). Finally, the IDICT – already having an accredited postgraduate center that offers courses on information technology – is, as of

late 2011, in the process of negotiating the founding of an additional center to grant masters degrees for computer scientists (Ferrer 2011).

In terms of ICT adoption during this period, there were a few significant milestones. As noted in Chapter 3.4, the Cuban government lifted its ban on mobile phones for personal use in 2008 (Reardon 2008), though prices remain too high for most Cubans to own and use them. Also in 2008, the government lifted a longstanding ban on the sale of consumer electronic goods, including personal computers, DVDs, video players, and others (Voss 2012). However, given that most desktop computers cost almost \$800 and the average wage in Cuba is around \$20 a month, the costs of these goods still remains prohibitive (Voss 2012). Perhaps most importantly, as a signal of its commitment to connect to the Internet, the Cuban government completed the construction of an undersea fiber optic cable in early 2011, which required significant up-front investments (see Chapter 3.5). Nonetheless, it remains doubtful that Cuban government will provide access to fiber-optic connections to its citizens for personal use (Huaimachi, 2010).

**Table 6** summarizes ICT adoption indicators from this period, during which limited data are available. There was modest growth in the number of Internet users and

<b>Table 6: ICT Adoption Indicators in Cuba (2001 - 2011)<sup>28</sup></b>						
<b>Indicator Name</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
<b>ICT goods exports (% of total goods exports)</b>	0.678	...	...	...	...	...
<b>ICT goods imports (% total goods imports)</b>	2.053	...	...	...	...	...
<b>Internet users</b>	1,257,143	1,317,310	1,457,938	1,613,935	1,790,019	...
<b>Internet users (per 100 people)</b>	11	12	13	14	16	...
<b>Mobile cellular subscriptions</b>	152,715	198,252	331,736	621,156	1,003,015	...
<b>Mobile cellular subscriptions (per 100 people)</b>	1.36	1.76	2.94	5.52	8.91	...
<b>Secure Internet servers</b>	1	1	1	...	1	...
<b>Secure Internet servers (per 1 million people)</b>	0.09	0.09	0.09	...	0.09	...

the number of mobile cellular subscriptions. It is more difficult to say whether or not there was growth percentage of ICT goods exports, and the number of secure internet servers remained the same. Similar to the past indicators, the ICT adoption indicators in Cuba during this period lagged relative to other Latin American and Caribbean countries (see Appendix 10 and Appendix 11).

Finally, regarding the threat of foreign invasion, relations between the United States and Cuba went from strained to somewhat improved. In 2006, a propaganda war broke out in Havana when Fidel Castro erected a monument to block a scrolling electronic billboard with messages about human rights abuses displayed on the top floor of the U.S. Interests Section in Havana ("Timeline U.S.-Cuba Relations" 2011). Delegations from the U.S. Congress – although isolated in past years – also began visiting the island in larger numbers to “launch a new era in U.S.-Cuban relations,”

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<sup>28</sup> Ibid.



although these groups were denied meetings with Fidel Castro ("Timeline U.S.-Cuba Relations" 2011). In April 2009, new U.S. President Barack Obama began implementing a less strict policy towards Cuba, stating that he was open to dialogue with the island, but would only lift the trade embargo if there was political change within Cuba ("Timeline U.S.-Cuba Relations 2011). In March 2009, President Obama signed into law a Congressional spending bill which eased some economic sanctions on the island and eased travel restrictions on Cuban Americans ("Timeline U.S.-Cuba Relations 2011). Relations strained in December 2009 when U.S. citizen Alan Gross was detained in Cuba and accused of spying on a U.S. Agency for International Development-funded contract ("Timeline U.S.-Cuba Relations 2011). Gross was prosecuted in 2011 after being accused of crimes against the Cuban state for bringing satellite phones and computer equipment to members of Cuba's Jewish community, and is currently serving a 15-year prison sentence. Although the Obama administration criticized Cuba for Gross' imprisonment, this was been coupled with an easing of the embargo restrictions, as noted. Moreover, the U.S. military's engagement in Iraq ended in 2011 while U.S. armed forces continue combat operations in Afghanistan. From the perspective of Cuba's leadership, the U.S. military is occupied and strained, and there is little popular domestic support in America for new wars. In sum, we posit that the threat of foreign invasion was low during this time period as perceived Cuban leadership.

### *7.3.2: Theoretical Analysis*

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The Post-Fidel Transition Period presents the most significant political and economic changes in Cuba of all the time periods in our analysis. The transition to power between brothers Fidel and Raúl presents a phenomenon that is not uncommon in

authoritarian regimes: to assure essential backers the continuity of private goods, when a leader is dying there is a need to assure the future flow of revenue, lest provoke an uprising (Bueno de Mesquita and Smith 2011, 26). Attempting to stave off defection by essential coalition members by passing on leadership through heirs – especially within the same family – who might keep the winning coalition intact sends a powerful message of continuity (Bueno de Mesquita and Smith 2011, 29).

Nonetheless, Raúl Castro's discarding of many of Fidel's key ministers and aids likely created much uncertainty within the PCC about its future. Moreover, Raúl's was 80 years old in 2011 when he took over as first secretary of the PCC. As many other political figures from the revolution are quickly becoming octogenarians, there remains a question of who will lead Cuba after Raúl Castro. This fact, coupled with the economic difficulties in Cuba after 2008, presented an environment of increasing political threats. This makes the prediction of *Hypothesis 1* less likely, as political threats were high. Thus, *Hypothesis 2* should apply: the Cuban government will allow for technological innovation. Indeed, much of the data from this period do support *Hypothesis 2* – in particular, the guarantees for foreign investors in the tourism industry and the increased levels of human capital in the form of advanced training for IT professionals. Perhaps more importantly, the Cuban government's lifting of its bans on mobile phones and computer equipment for consumer use – as well as its construction of an undersea fiber optic cable to enhance Internet connectivity – signal both an easing of regulatory rigidities that hinder innovation and a commitment to build the infrastructure required for Internet access.

That being said, access prices for mobile phones and computers still limit most Cubans from taking advantage of these devices. The completion of the ALBA-1 cable

also was not followed by enhanced Internet access. It is likely that select groups as deemed by the Cuban government will be the first to receive fiber optic connections – including important state industries and the army (Voss 2011). Thereafter, it remains doubtful that Cuban citizens will receive full Internet connections for personal use; it is rather more likely that they will receive access to a limited and highly censored Cuban intranet (Voss 2011).

In addition, the ICT adoption indicators from **Table 6** show very slow growth in the use of ICTs. Although the Cuban government showed a willingness to invest in training for IT professionals, a question remains regarding its willingness to enhance accessibility. If anything, many individuals are being trained in Cuba for non-existent jobs in the ICT sector. This dampens the empirical support for *Hypothesis 2*. It does, however, provide support for *Hypothesis 3*, as in this period there was both a need to generate revenue and an increased commitment by the Cuban government to train IT professions. However, data is needed on the amount on ICT goods as a percentage of total exports to further corroborate *Hypothesis 3*.

Final, because there was a lower threat of foreign invasion during this period, *Hypothesis 4* does not apply.

## Chapter 8: Conclusion

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This thesis sought to better understand the concept of the dictator's dilemma – or the balance between the authoritarian governments' use of ICT for economic development and commerce with their need to control the democratizing influences of this technology – within the context of Cuba. We chose Cuba because of the persistent lack of data provided by the Cuban government, and the generally limited understanding of Cuban government policies within the academic community.

To help structure our work, we adopted a theoretical framework that was initially put forth by Acemoglu and Robinson (2006) known as the PRE. The PRE posits that political leaders will only innovate if the turbulence of the technological innovation does not increase the chance that they will be replaced by another leader. We modified this framework by incorporating elements of selectorate theory, as outlined by Bueno de Mesquita and Smith (2011).

After our thorough research and analysis, our most significant findings from the Cuban case were:

- There was some support for *Hypothesis 1*, as Cuba's leadership did block technological change that it perceived to be a threat to its political survival.
- There was support for *Hypothesis 2*, as Cuba's leadership showed a willingness to allow foreign investment and ease certain restrictions on ICT access in periods of higher political threats.
- There was support for *Hypothesis 3*, as Cuba's leadership showed a consistent willingness to invest in the training of IT professionals at times that it needed to

generate revenue and diversify its economy. However, the efficiency of this strategy remains questionable, as the training of IT professionals occurred regardless of whether or not there existed an IT sector with jobs. Support for entrepreneurs in the form of capital is low to nonexistent, and the closed-loop development process ensures that the entire technology development cycle is internal to and controlled by the Cuban government.

- There was limited support for *Hypothesis 4* as Cuba did allow for innovation during one period in which there was a higher threat of foreign invasion (the Recovery Period). However, there were methodological issues with this hypothesis, which we will discuss further in Chapter 8.2.

In the following sections, we will observe the theoretical implications of our framework, the limitations of this research, and our recommendations for future research.

### *8.1: Theoretical Implications*

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Over the course of our research, we found that our theoretical framework did help to explain many of the changes in Cuban government policies over the course of the three time periods in our analysis. We also identified policies and events that our framework could not address.

The Cuban government showed a consistent willingness to build its human capital potential. It diversified and enhanced the means to build a workforce of IT professionals during every time period, yet a gap persisted between this investment in human capital and overall access to ICTs. There also remained a question – often corroborated by our interviewees – of whether or not the Cuban government was training people for

nonexistent jobs. Clearly, this aspect of the Cuban government's policy cannot adequately be explained by our theoretical framework; the gap between available skills and potentially nonexistent jobs creates a deadweight loss for the Cuban economy. It is thus a loss in revenues which could be given to key supporters of the regime. This challenges some of the assumptions behind our theoretical framework.

We posit that the key element missing from this theoretical framework is the Cuban government's concern for its own international image, or how it is perceived by other international actors. Many researchers have noted that the Cuban government is very sensitive to its international image and its desire for leadership amongst other developing countries (Hoffman 2004, Boas 2003). It is possible that Cuba's training of IT professionals – much like its training of doctors – plays a role in how it wishes other countries perceive it. Indeed, IDICT Director of Organizational Development Ubaldo Socorras Ferrer noted that Cuba currently hosts conferences for other developing nations on information technology (Ferrer 2011). It is possible that these conferences and the degree to which Cuba trains IT professionals has to do with the Cuban government's desire to be perceived as technologically progressive by other nations, regardless of whether or not these professionals are able to add value to the Cuban economy.

### *8.2: Limitations*

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There are several limitations to the research approach and design of this study. Some of these limitations stem from our theoretical framework, while others resulted from our research and data collection.

Regarding our theoretical framework, *Hypothesis 4* was difficult to apply in context. As posited initially by Acemoglu and Robinson (2006), there is an assumption that the political elites in question have perfect information about the will of the potential foreign invaders. Of course, such perfect information is not available in a real-life case, so we instead chose to examine the perceptions of Cuban leadership by analyzing the overall state of Cuba-U.S. relations. This approach would have been bolstered by any documentation showing the perceptions of Cuba's leadership and their concerns for foreign invasion, which we did not have.

There were also significant data limitations during each of the three periods, especially in terms of the growth in IT professional training programs and the ICT adoption indicators. Much of our knowledge of the training programs for IT professionals was gained from interviews and the very limited data provided by Cuba's Office of National Statistics. Though we relied on the World Bank's online databank for ICT adoption indicators, much of this data was missing, especially during the Special Period and the Post-Fidel Transition Period.

Finally, there were limitations in the way our field research was carried out. Though semi-structured interviews allowed for casual conversations that provided great insight into Cuban government policies, these interviews could have been considerably more systematic. We also could have targeted more government ministries for interviews. We were not able to obtain permits for a site visit of UCI, which would have provided significantly more insight into the training and job prospects for IT professionals in Cuba.

### *8.3: Future Research*

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Following the gaps in our theoretical framework discussed in Chapter 8.1, there were areas for future research that we identified over the course of this analysis. Firstly, there is a need to develop a theoretical framework that better incorporates the role of international perceptions or international political dynamics. From our case study, it was clear that key supporters are not the only party to which governments are beholden. The kind of power a government wishes to project abroad as well as the trade agreements it has with other international actors – especially Venezuela, in Cuba’s case – play a role in its decisions over resource allocation. We did not identify research on this topic and how it relates to the dictator’s dilemma over the course of our literature review, but we nonetheless believe it is relevant to the Cuban case, and perhaps others.

Finally, a more thorough study of Cuba’s training for IT professionals – one that is able to better track graduates of these programs and identify their post-graduation job prospects – could lend more insight into this case.



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*Appendix 1: Internet Pervasiveness Indicators from Latin American and the Caribbean<sup>29</sup>*

	Fixed broadband Internet subscribers (per 100 people)	Internet users (per 100 people)	Secure Internet servers (per 1 million people)
Antigua and Barbuda	14.5	75.0	646.4
Argentina	8.0	28.1	19.7
Aruba	17.4	22.8	356.7
Bahamas, The	10.1	31.5	263.4
Barbados	64.8	73.7	312.7
Belize	2.4	10.6	306.1
Bolivia	0.7	10.8	4.0
Brazil	5.3	37.5	25.9
Cayman Islands	..	42.4	1,364.1
Chile	8.5	32.5	39.1
Colombia	4.2	38.5	12.1
Costa Rica	2.4	32.3	98.3
Cuba	0.0	12.9	0.1
Dominica	14.1	37.6	203.8
Dominican Republic	2.3	21.6	14.2
Ecuador	0.3	28.8	12.0
El Salvador	2.0	10.6	11.8
Grenada	9.8	23.2	57.7
Guatemala	0.6	14.3	8.8
Guyana	0.3	26.9	7.9
Haiti	0.0	10.1	0.8
Honduras	0.0	13.1	7.1
Jamaica	3.6	57.3	35.6
Mexico	7.1	22.2	17.2
Netherlands Antilles	..	..	706.8
Nicaragua	0.6	3.3	6.3
Panama	5.8	27.5	85.7
Paraguay	1.4	14.3	5.7
Peru	2.5	24.7	10.5
Puerto Rico	5.4	25.3	61.5
St. Kitts and Nevis	22.6	32.5	1,199.4

<sup>29</sup> Data was downloaded from the World Bank indicators on January 1, 2012. Most of the data is from 2008 or 2009 with a few values from 2007.



<b>St. Lucia</b>	9.1	58.8	87.2
<b>St. Vincent &amp; the Grenadines</b>	8.6	60.5	100.7
<b>Suriname</b>	1.1	9.7	19.2
<b>Trinidad and Tobago</b>	4.6	17.0	46.3
<b>Turks and Caicos Islands</b>	..	..	..
<b>Uruguay</b>	7.3	40.2	35.6
<b>Venezuela, RB</b>	4.8	25.7	7.4
<b>Virgin Islands (U.S.)</b>	..	27.3	364.2
<b>Average</b>	7.2	29.2	172.7



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*Appendix 4: Education Indicators for Latin American and Caribbean Nations*  
*Classified by the World Bank as Upper-Middle Income<sup>32</sup>*

	Expenditure per student (% of GDP per capita)	Enrollment (% gross)	Enrollment, female (% gross)	Enrollment, male (% gross)
<b>Cuba</b>	58.8	121.5	153.7	91.2
<b>Argentina</b>	15.6	67.7	82.0	53.9
<b>Brazil</b>	30.4	34.4	38.9	30.1
<b>Chile</b>	11.5	52.1	52.3	51.9
<b>Colombia</b>	26.0	35.4	35.2	35.5
<b>Costa Rica</b>	35.9	25.3	28.3	22.5
<b>Dominican Republic</b>	..	33.3	40.8	25.7
<b>Jamaica</b>	42.4	24.2	33.4	15.1
<b>Mexico</b>	37.1	27.2	26.9	27.5
<b>Panama</b>	26.5	45.0	55.6	34.9
<b>Peru</b>	10.9	34.5	35.5	33.4
<b>St. Lucia</b>	..	14.8	20.4	9.1
<b>Suriname</b>	..	12.3	15.6	9.2
<b>Uruguay</b>	18.1	64.3	82.2	46.9
<b>Venezuela</b>	..	78.6	99.3	58.6

<sup>32</sup> Data from the World Bank online database, queried January 1, 2012. Enrollment rates are a percent of the 18-22 year old population.

*Appendix 5: Technology Exports for Latin American and Caribbean Nations  
Classified by the World Bank as Upper-Middle Income<sup>33</sup>*

ICT goods exports (% of total goods exports), 1996-2002							
	1996	1997	1998	1999	2000	2001	2002
<b>Cuba</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.22</b>	<b>0.15</b>	<b>0.50</b>	<b>0.71</b>
Argentina	0.51	0.61	0.54	0.57	0.69	0.79	0.67
Brazil	0.00	2.22	2.33	3.08	4.56	4.53	4.00
Chile	0.00	0.12	0.15	0.20	0.19	0.21	0.24
Colombia	0.11	0.11	0.12	0.12	0.15	0.21	0.29
Costa Rica	0.00	4.38	21.64	41.42	31.72	20.00	20.89
Dominican Republic	0.00	0.00	0.00	0.00	0.00	0.38	4.30
Jamaica	0.00	0.00	0.22	0.33	0.30	0.23	0.23
Mexico	17.17	18.51	21.03	22.33	23.04	24.03	22.56
Panama	0.00	0.00	0.00	0.00	0.00	0.08	0.53
Peru	0.00	0.00	0.13	0.21	0.36	0.19	0.17
St. Lucia	0.00	0.00	0.00	0.00	9.74	6.94	9.97
Suriname	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uruguay	0.00	0.08	0.12	0.15	0.18	0.12	0.13
Venezuela	0.05	0.05	0.05	0.04	0.07	0.07	0.16
<b>Region Average</b>	<b>1.19</b>	<b>1.74</b>	<b>3.09</b>	<b>4.58</b>	<b>4.74</b>	<b>3.89</b>	<b>4.32</b>

ICT goods exports (% of total goods exports), 2003-2009							
	2003	2004	2005	2006	2007	2008	2009
<b>Cuba</b>	<b>2.07</b>	<b>1.73</b>	<b>4.37</b>	<b>1.90</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Argentina	0.43	0.51	0.51	0.59	0.55	0.46	0.41
Brazil	3.19	2.37	3.41	3.19	1.97	1.82	1.76
Chile	0.17	0.12	0.13	0.10	0.14	0.16	0.16
Colombia	0.28	0.42	0.35	0.34	0.21	0.20	0.31
Costa Rica	26.56	22.13	24.58	29.40	28.35	23.80	18.65
Dominican Republic	3.96	6.08	7.72	5.35	6.49	6.00	3.64
Jamaica	0.33	0.34	0.19	0.13	0.23	0.31	0.80
Mexico	21.77	21.99	20.48	21.39	19.62	20.94	22.85
Panama	0.10	0.19	0.07	0.01	0.00	0.00	0.00
Peru	0.15	0.16	0.25	0.06	0.05	0.08	0.12
St. Lucia	12.89	8.43	6.35	8.90	9.59	5.72	0.00
Suriname	0.00	0.00	0.00	0.00	0.00	0.00	0.00

<sup>33</sup> Data from the World Bank online database, queried January 1, 2012.

<b>Uruguay</b>	0.14	0.14	0.18	0.13	0.18	0.15	0.14
<b>Venezuela</b>	0.14	0.11	0.06	0.04		0.05	0.05
<b>Region Average</b>	<b>4.81</b>	<b>4.31</b>	<b>4.58</b>	<b>4.77</b>	<b>4.81</b>	<b>3.98</b>	<b>3.26</b>

*Appendix 6: Internet Users for Latin American and Caribbean Nations (1992-1997)<sup>34</sup>*

Country	1992	1993	1994	1995	1996	1997
Antigua and Barbuda	...	...	...	1,511	2,014	2,517
Argentina	1,004	10,034	15,044	30,072	50,092	100,123
Aruba	...	...	...	...	2,300	...
Bahamas, The	...	...	...	2,686	4,956	3,915
Barbados	...	...	...	20	1,029	2,077
Belize	...	...	...	100	1,999	2,995
Bolivia	...	...	...	4,991	14,976	34,951
Brazil	20,013	40,029	60,050	170,164	740,838	1,311,724
Cayman Islands	...	0	0	1,295	...	...
Chile	4,999	9,999	19,999	49,998	99,998	156,873
Colombia	...	...	38,366	68,549	122,478	207,960
Costa Rica	36	2,693	9,474	14,459	29,917	59,840
Cuba	...	...	...	10	3,498	7,499
Dominica	...	...	...	392	830	...
Dominican Republic	...	...	...	1,364	6,040	11,687
Ecuador	549	1,796	3,892	4,990	9,981	12,977
El Salvador	...	...	...	...	5,003	15,004
Grenada	0	0	0	0	300	1,001
Guatemala	...	...	...	300	2,002	10,007
Guyana	...	...	...	...	480	962
Haiti	...	...	...	...	601	...
Honduras	...	...	...	2,050	2,494	9,979
Jamaica	...	...	898	2,695	14,688	20,016
Mexico	15,148	25,223	39,305	94,639	188,098	598,715
Nicaragua	...	...	597	1,393	3,980	9,950
Panama	...	...	200	1,502	6,010	15,025
Paraguay	...	...	...	...	999	4,993
Peru	...	...	1,990	7,961	59,708	99,515
Puerto Rico	...	...	1,000	5,001	10,009	50,085
St. Kitts and Nevis	...	...	...	...	850	1,001
St. Vincent and the Grenadines	...	...	...	139	522	1,000
Suriname	...	...	...	500	1,000	4,493
Trinidad and Tobago	...	...	...	1,995	4,988	14,963
Turks and Caicos Islands	...	...	...	...	...	...
Uruguay	...	...	1,999	9,997	59,978	109,954

<sup>34</sup> Ibid.

Venezuela, RB	2,493	8,776	11,968	26,930	55,857	89,773
Virgin Islands (U.S.)	...	...	1,000	2,999	4,998	7,497
Average	5,530	10,950	12,105	16,957	43,243	93,096



*Appendix 7: Mobile Cellular Subscriptions for Latin American and Caribbean Nations (1992-1997)<sup>35</sup>*

Country	1992	1993	1994	1995	1996	1997
Antigua and Barbuda	...	...	...	...	1,300	1,400
Argentina	46,590	112,000	241,163	405,395	667,020	2,009,073
Aruba	20	...	...	1,718	3,000	3,402
Bahamas, The	2,600	2,401	...	4,100	4,948	6,200
Barbados	796	1,560	2,967	4,614	6,283	8,013
Belize	0	400	832	1,547	2,184	2,544
Bolivia	1,551	2,659	4,056	7,229	33,400	118,433
Brazil	32,000	182,000	574,009	128,5533	2,498,154	4,550,000
Cayman Islands	988	1,260	1,813	2,534	...	4,109
Chile	64,438	85,186	115,691	197,314	319,474	409,740
Colombia	0	0	86,805	274,590	522,857	1,264,763
Costa Rica	3,008	4,533	6,985	18,750	46,531	64,387
Cuba	234	500	1,152	1,939	2,427	2,994
Dominica	0	0	0	0	461	556
Dominican Republic	7,190	10,364	20,990	55,979	82,547	141,592
Ecuador	0	0	18,920	54,380	59,779	126,505
El Salvador	0	1,632	4,868	13,475	23,270	40,163
Grenada	181	282	350	400	570	976
Guatemala	2,141	2,990	10,462	29,999	43,421	64,194
Guyana	841	1,029	1,251	1,243	1,200	1,400
Haiti	0	0	0	0	0	0
Honduras	0	0	0	0	2,311	14,427
Jamaica	7,628	15,221	26,106	45,138	54,640	65,995
Mexico	312,647	386,132	569,251	688,513	1,021,900	1,740,814
Nicaragua	0	324	2,183	4,400	5,100	7,560
Panama	0	0	0	0	7,000	23,474
Paraguay	1,500	3,390	7,660	15,807	32,860	84,240
Peru	21,550	36,300	52,200	73,543	200,972	421,814
Puerto Rico	60,000	95,000	175,000	287,000	329,000	367,000
St. Kitts and Nevis	...	...	...	...	300	205
St. Vincent and the Grenadines	70	83	150	215	280	346
Suriname	0	1,078	1,382	1,687	2,416	2,258
Trinidad and Tobago	1,277	1,679	2,599	6,353	9,534	17,140
Turks and Caicos Islands	...	...	...	...	...	...
Uruguay	1,712	4,969	6,825	39,904	78,601	99,235
Venezuela, RB	78,560	182,600	319,000	403,800	581,700	1,071,900

<sup>35</sup> Ibid.

<b>Virgin Islands (U.S.)</b>	...	...	...	...	...	16,000
<b>Average</b>	19,622	35,487	72,731	119,003	195,454	354,246

*Appendix 8: Internet Users (per 100 people) for Latin American and Caribbean Nations (2000-2005)<sup>36</sup>*

Country	2000	2001	2002	2003	2004	2005
Antigua and Barbuda	6	9	13	17	24	35
Argentina	7	10	11	12	16	18
Aruba	15	17	19	21	23	25
Bahamas, The	8	12	18	20	22	25
Barbados	4	12	28	40	50	56
Belize	6	...	6	...	6	9
Bolivia	1	2	3	4	4	5
Brazil	3	5	9	13	19	21
Cayman Islands	...	...	...	...	...	38
Chile	17	19	22	25	28	31
Colombia	2	3	5	7	9	11
Costa Rica	6	10	20	20	21	22
Cuba	1	1	4	5	8	10
Dominica	9	13	18	24	30	39
Dominican Republic	4	4	7	8	9	11
Ecuador	1	3	4	4	5	6
El Salvador	1	2	2	3	3	4
Grenada	4	5	15	19	20	20
Guatemala	1	2	3	5	5	6
Guyana	7	13	...	...	...	...
Haiti	0	0	1	2	5	6
Honduras	1	1	3	5	6	7
Jamaica	3	4	6	8	10	13
Mexico	5	7	12	13	14	17
Nicaragua	1	1	2	2	2	3
Panama	7	7	9	10	11	11
Paraguay	1	1	2	2	3	8
Peru	3	8	9	12	14	17
Puerto Rico	10	16	17	19	22	23
St. Kitts and Nevis	6	8	21	24	25	26
St. Vincent and the Grenadines	3	5	6	6	7	9
Suriname	3	3	4	5	6	6
Trinidad and Tobago	8	15	22	26	27	29
Turks and Caicos Islands	...	...	...	...	...	...
Uruguay	11	11	11	16	17	20
Venezuela, RB	3	5	5	8	8	13

<sup>36</sup> Ibid.

<b>Virgin Islands (U.S.)</b>	14	18	27	27	27	27
<b>Average</b>	5	7	11	13	15	18

*Appendix 9: Mobile Cellular Subscriptions (per 100 people) for Latin American and Caribbean Nations (2000-2005)<sup>37</sup>*

Country	2000	2001	2002	2003	2004	2005
Antigua and Barbuda	28	32	47	56	65	102
Argentina	18	18	17	21	35	57
Aruba	17	57	65	72	99	102
Bahamas, The	11	20	40	39	59	71
Barbados	11	20	36	52	74	76
Belize	7	15	20	22	27	33
Bolivia	7	9	12	15	20	26
Brazil	13	16	19	26	36	46
Cayman Islands	27	40	42	44	67	155
Chile	22	33	40	46	57	65
Colombia	6	8	11	15	25	51
Costa Rica	5	8	12	19	22	26
Cuba	0	0	0	0	1	1
Dominica	2	11	18	34	61	75
Dominican Republic	8	15	19	23	28	39
Ecuador	4	7	12	18	27	47
El Salvador	13	14	15	19	30	40
Grenada	4	6	7	41	42	46
Guatemala	8	10	13	17	26	35
Guyana	5	10	11	19	23	38
Haiti	1	1	2	4	4	5
Honduras	2	4	5	6	10	19
Jamaica	14	23	48	60	70	75
Mexico	14	21	25	29	37	44
Nicaragua	2	3	5	9	14	21
Panama	14	16	17	22	40	54
Paraguay	15	21	30	31	30	32
Peru	5	7	9	11	15	20
Puerto Rico	35	42	43	44	47	51
St. Kitts and Nevis	3	5	11	47	60	104
St. Vincent and the Grenadines	2	7	9	58	66	65
Suriname	9	18	23	35	43	47
Trinidad and Tobago	13	20	20	26	50	70
Turks and Caicos Islands	...	...	...	...	...	...
Uruguay	12	16	16	15	18	35
Venezuela, RB	22	26	26	27	32	47

<sup>37</sup> Ibid.

<b>Virgin Islands (U.S.)</b>	32	38	41	45	59	73
<b>Average</b>	11	17	22	30	39	53

*Appendix 10: Internet Users (per 100 people) for Latin American and Caribbean Nations (2000-2005)<sup>38</sup>*

Country Name	2006	2007	2008	2009	2010	2011
Antigua and Barbuda	63	70	75	74	81	...
Argentina	21	26	28	34	36	...
Aruba	28	31	34	38	42	...
Bahamas, The	26	27	32	34	43	...
Barbados	63	65	67	69	70	...
Belize	10	10	11	11	13	...
Bolivia	6	10	11	14	20	...
Brazil	28	31	34	39	41	...
Cayman Islands	45	52	61	65	66	...
Chile	34	36	37	39	45	...
Colombia	15	22	26	30	36	...
Costa Rica	25	28	32	34	36	...
Cuba	11	12	13	14	16	...
Dominica	39	40	41	42	47	...
Dominican Republic	15	18	21	28	40	...
Ecuador	7	11	19	25	29	...
El Salvador	6	6	10	12	16	...
Grenada	21	22	23	24	34	...
Guatemala	7	7	8	9	10	...
Guyana	...	...	18	24	30	...
Haiti	7	7	8	8	8	...
Honduras	8	9	10	10	11	...
Jamaica	17	21	24	25	26	...
Mexico	20	21	22	26	31	...
Nicaragua	3	4	5	7	10	...
Panama	17	22	34	39	43	...
Paraguay	8	11	14	19	20	...
Peru	21	25	31	31	34	...
Puerto Rico	24	27	36	39	43	...
St. Kitts and Nevis	49	52	60	69	77	...
St. Vincent and the Grenadines	32	52	60	70	...	...
Suriname	9	14	21	31	32	...
Trinidad and Tobago	30	32	35	44	49	...
Turks and Caicos Islands	...	...	...	...	...	...
Uruguay	30	34	39	42	48	...
Venezuela, RB	15	21	26	31	36	...

<sup>38</sup> Ibid.

<b>Virgin Islands (U.S.)</b>	27	27	27	27	...	...
<b>Average</b>	25	26	29	33	35	...



*Appendix 11: Mobile Cellular Subscriptions (per 100 people) for Latin American and Caribbean Nations (2006-2011)<sup>39</sup>*

Country	2006	2007	2008	2009	2010	2011
Antigua and Barbuda	130	131	157	154	191	...
Argentina	81	103	117	131	142	...
Aruba	106	109	114	120	122	...
Bahamas, The	78	114	107	106	125	...
Barbados	87	95	106	124	128	...
Belize	39	38	50	49	56	...
Bolivia	31	34	52	66	72	...
Brazil	53	64	79	90	104	...
Cayman Islands	172	186	178	195	178	...
Chile	76	84	88	97	116	...
Colombia	68	77	92	92	96	...
Costa Rica	33	34	42	42	65	...
Cuba	1	2	3	6	9	...
Dominica	104	130	135	140	155	...
Dominican Republic	49	58	75	88	90	...
Ecuador	62	72	83	93	102	...
El Salvador	63	101	113	123	124	...
Grenada	45	50	58	110	117	...
Guatemala	55	89	109	123	126	...
Guyana	53	72	60	68	74	...
Haiti	13	26	33	37	40	...
Honduras	32	58	85	113	125	...
Jamaica	85	100	101	110	118	...
Mexico	51	61	68	74	81	...
Nicaragua	33	45	55	56	65	...
Panama	66	90	115	175	185	...
Paraguay	54	77	93	89	92	...
Peru	33	55	74	86	100	...
Puerto Rico	56	62	64	68	74	...
St. Kitts and Nevis	102	128	146	146	154	...
St. Vincent and the Grenadines	80	101	119	111	121	...
Suriname	63	74	128	147	170	...
Trinidad and Tobago	115	114	136	138	141	...
Turks and Caicos Islands	...	...	...	...	...	...
Uruguay	70	90	105	123	132	...
Venezuela, RB	70	87	98	99	97	...

<sup>39</sup> Ibid.

<b>Virgin Islands (U.S.)</b>	...	...	...	...	...	...
<b>Average</b>	66	80	93	103	111	...