Industrial Policy Refraction:
How Corporate Strategy Shapes Development Outcomes in Brazil

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A thesis submitted for the degree of
Doctor of Philosophy

Hilary 2017

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This dissertation is motivated by a desire to understand why multinational firms respond to industrial policies in different ways, and how their responses shape development outcomes. From 18th-century United States to modern-day Brazil, governments have relied on tariff and non-tariff barriers to induce industrial development within their countries' borders. For states seeking to catch up, the acquisition and assimilation of frontier technology has always been paramount (Abramovitz, 1986).

Multinational firms based in industrialized countries have long been seen as sources of technology (Evans, 1979). Despite their importance in the process of economic development, they are often underspecified in the literature. Scholars of various disciplinary persuasions have examined industrial policy's antecedents (Dobbin, 1994; Breznitz, 2007) as well as its design principles (Rodrik, 2004; Sabel, 2009), but few have examined its *object*: the firm. My aim in this study is to explore how corporate strategy moderates the relationship between an industrial policy's aims and its outcomes.

I examine two multinational information and communication technology (ICT) firms, Samsung Electronics and Hewlett Packard Inc., explaining why they have responded to the Brazilian Informatics Law in different ways, and why these differences matter. On the basis of interviews, extended periods of observation and secondary materials, I develop a multilevel comparative case study that focuses on these firms and their Brazilian subsidiaries, as well as on their local research and development (R&D) partners and the teams of engineers that comprise them.

I introduce the inductively derived concept of *industrial policy refraction*, proposing that foreign firms respond to host countries' industrial policies in ways that are consonant with their corporate strategies; that centralized firms are less likely to comply with a host government's demands than are decentralized firms. Refraction is not categorical, but a matter of degree. My findings are brought to bear on three traditionally disparate bodies of research –industrial policy, corporate strategy and institutional theory – extending each and also bringing them into fruitful communion with one another.

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For my parents

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List of Acronyms

ANATEL	National Agency for Telecommunications
ANEEL	National Electricity Regulatory Agency
ANP	National Petroleum Association
CAPRE	Commission for the Coordination of Electronic Processing Activities
CATI	Committee for Information Technology
FDI	Foreign Direct Investment
FDS	Flexible Developmental State
FINEP	Funding Authority for Studies and Projects
GPT	General Purpose Technology
GVC	Global Value Chain
HBA	Home Base Augmenting
HBE	Home Base Exploiting
HTP	Horizontal Technology Policy
ICT	Information and Communication Technology
IPA	Investment Promotion Agency
IPI	Industrial Production Tax
ISI	Import Substitution Industrialization
MBO	Management by Objective
MCTI	Ministry of Science, Technology and Innovation
MDIC	Ministry of Development, Industry and Foreign Trade
MITI	Ministry of International Travel and Industry (Japan)
MNC	Multinational Corporation
NDA	Non-Disclosure Agreement
PBO	Project-Based Organization
PMO	Project Management Office
PPB	Basic Productive Process
R&D	Research and Development
RIB	Rapid Innovation Based (industry)
RFID	Radio Frequency Identification
SEI	Special Secretariat for Informatics
SEPIN	Secretariat for Informatics Policy
SUFRAMA	Superintendence of the Manaus Free Trade Zone
ZFM	Manaus Free Trade Zone

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1. INTRODUCTION

1.1. Background

Why do multinational firms respond to industrial policies in different ways? The short answer is that firms are different. Firms embody and reflect their founders' ideas and personality traits; they are shaped by the social norms and laws that envelop them; they are conditioned by fashionable ideas when they are young and impressionable. These endogenous and exogenous factors shape how firms formulate and reformulate their corporate strategies, the ways in which they manage their network of business units to create value in a given industry, or set of industries (Porter, 1987). And while firms, like people, are never quite done forming, they do eventually reach states of emulsion, when they achieve momentary and sometimes even permanent stasis despite their internal conflicts and contradictions. When firms leave the relative comfort of their home countries and enter new environments, they bring their luggage with them. But because the rules under which they have developed are not the same as the rules with which they are forced to interact, conflicts arise. My dissertation is an attempt to examine what happens when multinational firms enter new markets. Specifically, it is an attempt to understand what happens when they enter emerging markets with industrial policies aimed incentivizing them to do that which they would not do of their own volition.

Governments seeking to induce a transition away from agriculture and towards industry, or away from certain low-value segments of industry and into more attractive ones, have long used fiscal, credit and trade policies to achieve their aims (Hamilton, 1791; List, 1856). In many cases, these industrial policies have allowed once peripheral, underdeveloped countries to participate in the global economy on their own terms. By "getting prices wrong" and actively "governing the market" several countries in East

Asia were able to achieve and sustain rapid rates of growth, protecting nascent industrial sectors from global competition until they were able to stand on their own two feet (Amsden, 1989; Wade, 1990). There is a long tradition of scholarly examination into the contested process by which these industrial policy regimes emerge (Cardoso and Faletto, 1979; Dobbin, 1994; Breznitz, 2007). But while some scholars remain interested in understanding the political machinations and institutional arrangements that produce different sorts of policies, others have moved decidedly towards prescriptive analysis, outlining the general principles that should guide policymakers crafting industrial policies in today's globalized world (Rodrik, 2004; Sabel, 2009). Although the literature has evolved in various directions, it has done little to delve into the firm in any meaningful or systematic way.

The literature has long recognized that late industrialization "…is wholly a matter of imitation and importation of tried and tested processes" developed elsewhere (Hirschman, 1971, p. 92). In the early days, one way that late developers leveraged progress beyond their borders to accelerate their own processes of industrial development was through the importation of machinery and equipment (Gerschenkron, 1962). Another was through the inducement of foreign direct investment in local manufacturing facilities (Vernon, 1971). Much of the literature has focused on the ways in which technocrats strong-armed foreign firms into supporting their developmental aspirations; see Johnson's (1982) account of the MITI's role in encouraging technology transfer from abroad to domestic firms in Japan for an example. What these studies have in common is that they create a colorful portrait of the developmental state while reducing the multinational firms charged with transferring technology or investing in local production to little more than an uncooperative supporting cast – rebels without a cause. My research aims to unpack the multinational firm, examining how it responds to

a country's industrial policies, and why variation between different firms' responses matter for policy outcomes.

My key argument is that an industrial policy's aims and its outcomes are moderated by firms' corporate strategies. This dissertation introduces the concept of industrial policy *refraction*, a process by which a firm interprets an industrial policy and responds to it in a way that is consonant with its own corporate strategy, thus producing an outcome that diverges from what policymakers had expected and intended. Of course, the path between a policy's aims and its results is rarely straight and undisturbed. Policy formulation, implementation and evaluation are usually messy and contested processes. But what I posit here is that there are systematic and predictable reasons why a policy might fail to achieve what it sets out to do, and that these reasons can be uncovered by looking inside the policy's object, in this case, the multinational firm itself. This dissertation aims to imbue what has traditionally been an inert element in the study of industrial development with some degree of agency. It aims to enliven the conversation regarding the role of multinational firms in the process of industrial development, principally by assessing how differences in corporate strategy lead to predictable differences in firms' responses to industrial policies.

As this is an inductive study, I begin by poring through the empirical material. This study continues by threshing the data and fitting the most relevant bits into emergent constructs. These constructs and inchoate correlations between them are then brought into communion with existing scholarly work, eventually producing new theory in the guise of testable propositions. The body of scholarly work that I have found most useful for exploring the interplay between industrial policy and corporate strategy is institutional theory, in particular the work that has focused on strategic responses to conflicting institutional demands. My argument about industrial policy refraction is

developed through an examination of how firms, research institutes and teams within these institutes have responded to conflicting institutional demands – those emanating from the Brazilian government, and those emanating from their multinational parents – over time. The multi-level, longitudinal examination of strategic responses to institutional demands provides the foundation on which my central argument rests. Inserting corporate strategy between policy instruments and outcomes allows for a more nuanced understanding of why firms might respond to industrial policies in different ways, but also why in some cases, multinational subsidiaries actually do achieve some semblance of consonance with their host government's demands.

1.2. Study Scope and Key Terms

This study is ambitious in its aims, but limited in its scope. Its principal aim is to change the way that multinationals are conceived of in the economic development literature. The hope is that a more robust understanding of how corporate strategy shapes policy outcomes will lead to dialogue between management scholars and the sociologists, economists and political scientists concerned with the role of the state in the process of economic development. To be fair, there has been scholarly work on the ways that firms influence their operating environments. This includes work by organizational theorists concerned with how firms engage in corporate political action (Baron, 1995; Barley, 2010). However, generally speaking, these are two disparate scholarly communities that I believe have much to gain from dialogue. The challenge is encouraging a more complex view of the firm in relation to the state on the basis of a relatively narrow case study. What can the firms studied here tell us about firms in other industries? What can this narrow case study tell us about how industrial policy shapes the ways in which firms structure their R&D operations? What can the case of Brazil tell us about other emerging

economies with active industrial policy regimes? These questions are examined in greater depth in the chapters that follow, in particular, the chapter that outlines my methodology.

My dissertation has three distinct units of analysis. Firstly, it focuses the multinational firm, specifically on Samsung Electronics[1] and Hewlett Packard[2] (HP). It isolates corporate strategy as the key explanatory variable; these companies operate in the same industry, and in the context of Brazil, under the same industrial policy in the same country. Secondly, it examines four R&D institutes created by multinational firms in response to the legal requirements embedded in the Informatics Law, the industrial policy on which the analysis focuses. It focuses on the Samsung Informatics Development Institute (SIDI), the Eldorado Research Institute, the Venturus Institute (previously called Informat) and the Flextronics Institute of Technology (FIT). These institutes were created by Samsung, Motorola, Sony/Ericsson and Flextronics, respectively. For the sake of clarity, they are referred to as Institute S, Institute E, Institute V and Institute F from here on out. Finally, the unit of analysis becomes the teams of researchers at each of these institutes, as the aim becomes to understand how conflicts between multinational firms and host governments manifest at the intra-organizational level.

This dissertation is about how corporate strategy and industrial policy interact, and about how we discuss this interaction at the theoretical level. That being said, I believe that it is useful to define key terms from the outset, in order to ensure that the reader and I are on

[1] Samsung is a diversified multinational conglomerate. This study focuses specifically on Samsung Electronics, the group's flagship division. Unless otherwise stated, references to Samsung implicate Samsung Electronics, not the broader business group.

[2] When this study began, HP was a single firm comprised of two main divisions, one focused on consumers and another focused on businesses. In 2015, the company was divided into two separate, publicly traded firms. HP Inc. encapsulated the old printing and personal systems group while HP Enterprise became the new home for HP's old enterprise services group. Because much of the research was conducted prior to the split, the analysis refers to the two as groups rather than separate companies, for the most part, and focuses primarily on the consumer business (HP Inc.).

the same page moving forward. What is corporate strategy? Alfred D. Chandler (1962) defines strategy as "the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals" (p. 13). Firms formulate corporate strategies by taking stock of organizational strengths and weaknesses while appraising environmental threats and opportunities (Andrews, 1971). Porter (1987) suggests that corporate strategy is really about two fundamental and interrelated questions: what should the firm do? How should it manage its business units to achieve its goals?[3] Because this thesis focuses on firms in a single industry – although if one looks close enough the boundaries separating these two firms' markets come into view – the second element of strategy is where I focus the majority of my efforts. I take the fact that these firms operate in the consumer electronics space for granted, and focus on how they manage their vast networks of business units to achieve their goals.

What do I mean by industrial policy? I employ Rodrik's (2004) simple and elegant definition, which refers to industrial policies as those that "counteract the allocative effects that the existing markets would otherwise produce" in order to induce industrial development (p. 2). These policies need not be directed towards industry per se, although manufacturing has traditionally been their focus. Industrial policy has long been justified on the basis of the Prebisch-Singer thesis (1950), which postulates that if poor countries traded on the basis of Ricardian comparative advantage, they would remain poor indefinitely because of declining terms of trade for primary commodities. Dependency theorists pulled on this thread, arguing that the manner in which peripheral countries

[3] Here, I am putting forth a definition of corporate strategy that is associated with what Mintzberg (1990) describes as the "design school." There is disagreement about the degree to which corporate strategy is developed through a cool and collected process of planning by top executives. Important work on strategy and practice and strategy as process will be examined in the following chapter's broader discussion of corporate strategy.

were integrated into the global economy all but ensured their continued dependence on core, wealthy countries, and by extension, their continued state of underdevelopment (Furtado, 1964; Frank, 1966). In the second half of the 20th century, many countries engaged in import substitution industrialization (ISI), localizing production of goods previously imported. While these policies were successful in shifting the ways in which a number of East Asian countries articulated with the rest of the world, they largely failed in much of Latin America for reasons that have been oft debated and are beyond the scope of this thesis (Kay, 2002). What matters for our purposes is that despite being banished by the "Washington Consensus" in the late 1980s and for much for the 1990s, industrial development by way of import substitution has again become an important part of the policy agenda in many developing, emerging and even industrialized economies today (Wade, 2012).

In this dissertation, the interaction between corporate strategy and industrial policy is framed in terms associated with "new" institutional theory. How does this body of work define institutions? While I recognize that there are various definitions of institutions employed by different communities of scholars, here I adopt Scott's (1995) notion of institutions as the "cognitive, normative, and regulative structures and activities that provide stability and meaning to social behavior" (p. 33). Firms face certain difficulties when operating in institutional environments very different from the ones they operate under at home. Certain organizational practices that may be perfectly acceptable in one context may be unacceptable, or even illegal, in another. Some scholars frame variance in firms' capacity to navigate different institutional contexts with constructs such as institutional distance, which refers to the degree to which two institutional environments, including their cognitive, normative and regulative elements, differ (Kostova, 1999; Xu and Shenkar, 2002). Of course, corporate strategy can vary within a single institutional context, just as it can vary across contexts. In an effort to isolate the least common

denominator, I look at corporate strategy as the explanatory variable, not institutional distance. In this sense, my work is an extension of, and in some ways a challenge to, work by scholars like Oliver (1991), Edelman (1992) as well as Pache and Santos (2010), who broadly claim that firms' responses to institutional process vary, but for other reasons.

Finally, I wish to define the concept of refraction, as it appears throughout the dissertation and is eventually employed to formulate testable propositions. As it is employed in this thesis, refraction refers to the degree to which corporate strategy moderates the relationship between an industrial policy and its outcomes. For example, a government may set up a tariff on a certain final good and grant fiscal incentives to encourage firms to engage in local production. One firm may decide that said tariff makes the importation of said good impossible, and thus may decide to invest in local production. But while the aim of the policy may have been to create employment and value within the country's borders, the firm's strategy may preclude such a favorable response. The firm may respond by creating a highly automated final assembly plant and import complete knock down (CKD) kits, thus creating little local employment and adding little value in the country. But for another firm, the country may represent a significant market, or may offer advantages like low labor cost or a solid supply base. In this case, the firm may respond by localizing final assembly, encouraging their global suppliers to invest and engaging in local supplier development programs. Both firms invest in local production, but only one acts in accordance with both the letter and the spirit of the law. In the former case, the degree of policy refraction is high, while in the latter, it is low. Of course, it is difficult to quantify degree of refraction. This dissertation does not aim to create a means of quantifying the effect of strategy on the relationship between policy aims and outcomes. However, this could be a fruitful area for future research. In general, policy refraction can occur whenever foreign firms interact with industrial policies. This dissertation focuses specifically on industrial policies that apply to the R&D function. The

terms defined and discussed briefly here will be unpacked more thoroughly in the literature review.

1.3. Empirical Context

Given that our aim is to walk through how multinational firms have interacted with the Brazilian Informatics Law, here I wish to briefly summarize the law's origins and its evolution through the years, if only to introduce and justify the empirical context for this study. As I've already mentioned, this dissertation focuses on a small number of firms and R&D institutes operating in a single industry, in a single country and under a single industrial policy. Why this empirical context? Why the electronics industry in Brazil? A brief foray into the history of Brazil's industrial policy apparatus in general, and into the country's Informatics Law in particular, will help set the stage for an in-depth discussion in the chapters that follow. From the 1950s to the 1980s, Brazil engaged in import substitution industrialization, attracting multinational firms to produce durable consumer and capital goods locally. Among the many sectors targeted for localization was the electronics sector, which the government saw as paramount to the country's national security as well as its long-term development goals. The unlikely development of Brazil's home-grown computer industry in the 1970s was the result of converging interests on the part of key state and non-state actors, herded by a cadre of entrepreneurial technicians embracing and exploiting the nationalist sentiment of the times (Adler, 1986; Evans, 1986; Evans, 1995). Emanuel Adler (1986) describes these technicians as ideologically driven "pragmatic anti-dependency guerillas" who acknowledged the structural constraints faced by peripheral countries, but believed in the possibility of development through selective external technology absorption.

Their efforts to construct a national computer industry coincided with, and often incited, broader shifts in the military regime as well as a number of important national funding agencies and research bodies.[4] While national security was an important factor in the military's decision to encourage domestic computer development, there were other bureaucratic considerations as well. In one case, the Treasury Department's data processing subsidiary found itself unable to manage the growing number of federal tax returns coming in. It couldn't get a hold of American data processing equipment, so technicians began modifying machines to suit their needs, and even developing hardware of their own (Evans, 1986, p. 793). The government would establish the Commission for the Coordination of Electronic Processing Activities (CAPRE) in 1972 in order to collect the technical expertise necessary to advance government data processing needs. The new organization was tasked with keeping track of computer equipment in the country, advising the government on ways of supporting the development of new data processing technologies and training hardware and software engineers. It saw its mandate expand dramatically with the 1973 oil crisis, when Brazil came under serious balance-of-payments pressure. Computers made up a significant portion of Brazilian imports, and were therefore targeted for localization (Piragibe, 1985; Evans, 1995). In addition to its original mandate, CAPRE was now charged with regulating the importation of components on which local and multinational firms depended for their manufacturing and assembly operations.

[4] At this time, the Brazilian Navy was undergoing a process of modernization. It had purchased a number of advanced British warships in the late 1960s, but was wary of leaving the technology behind the ships' electronic control systems in the hands of the British. Therefore, it became sympathetic to calls for increasing domestic technological capabilities. The National Economic Development Bank (BNDE), led by José Pelúcio, saw the source of Brazil's underdevelopment as technological dependency (Adler, 1986). This view was supported by economists trained at Raul Prebisch's former pulpit, the Economic Commission for Latin America (CEPAL), many of whom now worked in various planning agencies, and by technicians that had taken up roles in the National Council for Research (CNPq), BNDE (later to be renamed BNDES) and the Funding Authority for Studies and Projects (FINEP). These funding bodies would provide the financial backing for these embryonic efforts to develop computers locally.

In 1976, CAPRE solicited proposals from local and foreign companies for the production of minicomputers in Brazil. Surprisingly, IBM was not granted permission. Its proposal for local minicomputer production did not include a local partner. This effectively created a market reserve, as Brazilian firms licensing foreign technologies were allowed to produce minicomputers while IBM and other foreign firms that had not found local partners were left out of the market segment (Evans, 1995). While CAPRE had been able to craft and enforce industrial policy because of the support it received from pockets within the federal government as well as the Navy, it wasn't long before those favoring market-oriented solutions ended their experiment. CAPRE was replaced by the Special Secretariat for Informatics (SEI) in 1979. But CAPRE had left behind a vibrant set of organizations eager to protect and expand Brazil's emergent informatics sector. Employees of the firms that had won the first minicompetition, as well as those employed by smaller computer manufacturers that had sprouted up since, lobbied to realize the vision that had first been put forth in the early 1970s. This vision would be enshrined in the National Informatics Law that was passed in 1984.

From the very beginning, SEI had found itself stuck between supporters of indigenous technology development and those who favored open access to global technology. It was difficult to protect budding national firms in a sector full of globally competitive multinationals like IBM and Burroughs. Large firms would often try to dip into the market reserve, and SEI found that it did not have the capacity to police the boundary effectively. Antonio Didier Vianna, then Director of the Brazilian Association for Computers and Peripheral Equipment Industries (ABICOMP), was livid knowing that SEI was consciously ceding market space to the multinationals. "In reality, what was ceded was a slice of our sovereignty…the approval of multinational projects in the medium segment constitutes an act of violence against the national conscience" (quoted

in Dantas, 1988). According to Evans (1995), it had become difficult to police the local firms as well. Many of the firms that had entered the market reserve in the 1970s had developed technology on their own, or through collaborations with local universities.[5] These firms felt betrayed when the 1984 super-minicompetition allowed foreign technology licensing to a greater extent than had been the case in the past. Furthermore, the industrial landscape changed. Instead of small entrepreneurial outfits, the winners of the 1984 competition included large financial groups like Itaú, Bradesco and Doca dos Santos, which licensed technology from foreign firms like DEC and Data General. These new circumstances dissuaded smaller firms from investing in costly R&D.

The shift away from indigenous technology development had resulted from pressure emanating from a range of domestic and foreign actors. Domestic users began to demand better products, market-oriented technocrats and politicians lobbied to have SEI shut down, the Superintendence of the Manaus Free Trade Zone (SUFRAMA), which oversaw the Manaus Free Trade Zone (ZFM), sought to consolidate its dominion of the budding electronics industry and foreign governments grew tired of state subsidies for Brazilian hardware exporters (Evans, 1995). Furthermore, informatics policy had always been restricted to the manufacture of computers. Over time, electronic components became ubiquitous in a range of industrial sectors from automobiles to household appliances. Thus, by the late 1980s, SEI found itself under-staffed for its increasingly complex and amorphous mandate. It couldn't police local or multinational firms effectively, it couldn't satisfy the needs of domestic consumers and it couldn't properly accommodate for the ubiquity of electronic components. This all occurred against a rapidly deteriorating

[5] The first Basic Plan for Scientific and Technological Development (PBDCT), passed in 1973, had indicated that hardware development would be concentrated at the Digital Systems Laboratory at the Polytechnic University of São Paulo and software development would take place at the Pontifical Catholic University of Rio de Janeiro (Silvia, 1980).

macroeconomic climate, as hyperinflation began to set in. What was once a solid edifice of nationalist pride had crumbled. This dramatic shift in course is evident if one compares the 1984 and 1991 informatics laws.

The 1991 Informatics Law was a radical departure from its predecessor, the 1984 National Informatics Law, which had focused on indigenous technology development as a solution to the dependency problem. The 1991 law sought to create an internationally competitive informatics sector, flouting the nationalist sentiment that had dictated informatics policies in the past. José Goldemberg, then Secretary of Science and Technology, stated that, "It is impossible to imagine a modern nation that does not have a strong informatics sector. For this reason, there has been a general exception in the general discourse. But the policy that I plan to pursue involves a gradual reduction in protection, placing the informatics sector at the same level as the others" (translated from quote in Tapia, 1992). This leveling was driven by both internal and external forces. Brazil's mounting debt problems and runaway hyperinflation had forced Fernando Collor de Mello, the first elected president of Brazil since the end of the military dictatorship, to reduce the size and reach of government. Outside Brazil, the so-called "Washington Consensus" had spread like wildfire, making swift work of protectionism in developing countries around the world (Williamson, 1993).

The Informatics Law of 1991 enshrined the ethos that has governed industry policy in Brazil's ICT sector to this day. It did away with SEI's competitions, effectively ending the market reserve and opening the market to foreign companies. The first law had established that for a company to be considered "national," 100 percent of its voting interest had to be held domestically. This was reduced to just 51 percent in 1991, prompting many multinational firms like Compaq and Acer to enter into joint ventures with Brazilian firms. However, while the market did open up nominally, the government

enacted a set of provisions to ensure that some productive activities would remain in Brazil. The government encouraged firms to manufacture locally through product-specific PPBs – "the minimum group of operations, within the industrial plan, which characterizes real industrialization of a certain product" (Egypto, 2012). The PPB, which exists to this day, is effectively a nationalization index; it outlines which electronic components and intermediate goods must be produced or assembled locally if a firm wishes to reduce its tax burden and avoid red tape.

In addition to component localization, the government encourages firms to conduct R&D locally. These R&D requirements were instituted as a means of mitigating the impact that the end of the market reserve had on local technical capacity. Firms were told to invest five percent of gross annual revenues on local R&D. The law stipulated that two percent had to be spent through Brazilian research centers and universities and that the rest could be spent internally. While firms were by no means obligated to localize production and R&D, the fiscal incentives made available to those who did were too attractive to pass up. Firms that applied for and received PPBs were granted significant reductions in Industrial Product Taxes (IPI) for final goods and an exemption from IPI for raw materials and components. In addition to these federal incentives, PPBs granted firms a reduction in ICMS (state VAT) in many states (Sales 2012). Between 1993 and 1998, companies were granted exemptions to the tune of R$2.3 billion (US$1.9 billion in 1998). During the same period of time, they invested R$2 billion in local R&D (US$1.7 billion); R$1.3 billion (US$1.1 billion) were spent internally, R$606 million (US$502 million) were spent in partnership with research institutes and universities and R$77 million (US$64 million) were spent on programs developed by the Ministry of Science and Technology (ANPAD, 2007). But as the policy's sunset provision threatened to phase out these incentives, beneficiaries began to lobby for an extension.

The 2001 Informatics Law clarified a few important areas of ambiguity, namely what was considered R&D, which organizations were eligible to access firms' external R&D spending quotas and how the relationships between firms and universities and research institutes would be structured. It wouldn't be long before the Informatics Law changed yet again, this time under the administration of newly elected President Luis Inácio Lula da Silva. During his election campaign, Lula had promised to extend the benefits granted to companies in the ZFM. He followed through shortly after he was elected, building political support in the Amazon region. But in order to extend the ZFMs benefits, Lula would need the support of former president Fernando Henrique Cardoso's Brazilian Social Democracy Party (PSDB). With its electoral base in the Southeast, the PSDB made its support for this move contingent upon the inclusion of an article that would ensure the extension of informatics incentives outside the ZFM for another ten years (Cukierman et al., 2012). The sunset provision was kicked further down the road with the passage of the 2014 Informatics Law; the Manaus Free Trade Zone was extended to 2050 and the IPI reduction for the rest of the country was extended to 2029.

Table 1.1: Informatics Law R&D Obligation

<table>
<tr><td colspan="3">Internal Expenditures (Can also be spent via third parties)</td><td>2.16%</td><td rowspan="5">4.00%</td></tr>
<tr><td rowspan="4">External Expenditures</td><td colspan="2">Agreement with CATI-certified science and technology institutes anywhere in Brazil</td><td>0.80%</td></tr>
<tr><td rowspan="2">Agreement with CATI-certified science and technology institutes in the North (except the ZFM), Northeast and Center West</td><td>Public or private entities</td><td>0.45%</td></tr>
<tr><td>Public entities only</td><td>0.19%</td></tr>
<tr><td colspan="2">Science and Technology Fund (FNDCT)</td><td>0.40%</td></tr>
</table>

Source: MCTI

Most importantly for the purposes of this dissertation, the R&D spending requirements first instituted as part of the 1991 Informatics Law remain in force today. Initially, the

government required that firms spend five percent of annual revenues on R&D in order to be eligible for certain fiscal incentives. The percentage required now stands at four percent, and will drop to three-and-a-half percent in 2019. But while the requirement for local R&D spending has come down over time, the requirement that firms outsource nearly half of the total has been in place since the modern law was first passed in 1991. Twenty percent of the total can be outsourced to a certified third party, whether it be a public university, a private university, a public R&D institute or a private R&D institute. Ten percent must be deposited in the government's science and technology fund. Finally, as of the law's 2001 renewal, 16 percent must be outsourced to a certified third party located in the North, Northeast or Center West of the country (See Table 1.1 for a full breakdown). MCTI officials confirm that the logic behind the outsourcing requirements instituted in 1991 was the creation of knowledge spillovers that would drive technological upgrading in local firms. While government officials interviewed did confirm that the government instituted outsourcing requirements to avoid creating knowledge enclaves, there doesn't seem to have been a great deal of analysis into how these outsourcing requirements would actually achieve their aims. Furthermore, the aims themselves were, and continue to be, woefully under articulated. This study unpacks how these R&D requirements and the largely multinational firms to which they apply have co-evolved.

Why Brazil? Why electronics? Why the Informatics Law? Brazil is a large and dynamic emerging market. The size of its domestic market makes it an attractive target for multinational firms seeking market opportunities. As such, the government has a great deal of latitude in crafting industrial policies; firms are simply willing to pay for access. The Brazilian electronics sector is particularly interesting because it is dominated by multinational firms. There are few globally competitive domestic lead firms or suppliers to speak of. The industry today is dominated by global lead firms like Samsung and HP

as well as contract manufacturers like Hon Hai Precision Industry (Foxconn), Flex (formerly Flextronics) and Jabil Circuit (Zylberberg, 2016). Other sectors like oil and gas and aerospace are dominated by national champions like Petrobras and Embraer, making them poor candidates for a study of how multinational firms respond to industrial policies. The Informatics Law itself is interesting, and a useful policy on which to focus this study, because it has been around, in one form or another, for more than 30 years. It was the first Brazilian industrial policy to prioritize the localization of R&D, and further, to require R&D outsourcing. Industrial policies in other areas, including automotive, oil and gas and electric utility, have been crafted using the Informatics Law as a template. They each require firms to spend a certain percentage of revenues on R&D and outsource a certain percentage to local third parties.

1.4. Dissertation Outline

This is an inductive comparative case study that follows the methodological steps outlined by various scholars including Glaser and Strauss (1967), Eisenhardt (1989), Yin (1994) and Gioia et al. (2012), among others. As such, this dissertation begins where the research ended, with the literature. Chapter Two examines the three bodies of work most relevant to this thesis, including the literature on industrial policy and the developmental state, on corporate strategy (focusing on technology strategy in particular) and on institutional theory. Early work on the developmental state focused on developing insights as to why certain states in East Asia had been able to spark and sustain high growth rates, driving the radical transformation of once agrarian economies into industrial powerhouses (Johnson, 1982; Amsden, 1989; Wade, 1990). The literature has since turned towards prescription, outlining the state structures (Ó Riain, 2002; Schneider, 2015), policy features (Hausman and Rodrik, 2002; Rodrik, 2004) and modes of global engagement (Sabel, 2009; Gereffi and Sturgeon, 2013) that are likely to work in

today's world. However, there has yet to be a discussion around how variation in corporate strategy leads to divergence in industrial policy outcomes. After all, industrial policy is really about firms. Firms trade; not states. Firms invest abroad while states do so rarely, at least directly. Thus, this dissertation opens up the possibility that differences at the firm level might have implications for industrial policy.

Chapter Two then moves to provide an overview of the literature on corporate strategy, focusing on work that relates to how firms set and execute their technology strategies. Specifically, it outlines the traditional drivers of R&D offshoring, which include wage arbitrage, market access and knowledge, as well as the recent trend towards R&D-related investments in emerging markets on the part of multinational firms (Howells, 2008). Further, it examines why firms might look beyond their boundaries for ideas and technologies, collaborating with universities, clients and competitors, and even outsourcing R&D to third-party service providers (Mowery, 1983; Powell, 1990; Chesbrough, 2003). The third body of work with which I engage is the literature on strategic responses to institutional demands. One of the goals I set out to achieve in writing this dissertation was to bring the conversation around varying strategic responses to a specific industrial policy to the level of theory, where my findings could be made useful across a broad range of settings. Institutional theory has given me the language to bring the particular to bear on the general, by conceptualizing corporate strategy, in part, as a response to institutional demands. However, I have also found that some of its propositions do not fit what I observed. Thus I have found opportunities to extend this body of literature. Specifically, I have sought to demonstrate how strategic responses by firms and institutional demands co-evolve over time.

Chapter Three outlines my research design and methodology, walking the reader through the process by which my study was designed, cases were selected and data were

collected and analyzed. As has been stated, this is an inductive study. It began with a strange empirical phenomenon that did not seem to conform with my expectations. I sought to explain why multinational firms erected independent R&D institutes in Brazil, and why they evolved differently over time. I designed a comparative case study in order to maximize the degree to which I would be able to generalize on the basis of my findings. Furthermore, the nature of the empirical phenomenon required me to investigate the subject matter at three different levels, each of which maps neatly onto the three empirical chapters that follow. I began my research by gaining access to three R&D institutes tied, to varying degrees, to multinational firms. I spent a considerable amount of time based at each of them, interviewing key managers and engineers, collecting observational data and poring through documents that my colleagues made available to me. I analyzed these data using the coding process outlined by Strauss and Corbin (1990) as well as Gioia and colleagues (2012), and then, on the basis of my findings, went off to collect more data, this time from the multinational firms themselves. This recursive process of data collection and analysis eventually brought me to a level of saturation, at which point I consulted the bodies of literature that I felt my findings spoke to most strongly, and began to test whether or not my findings coincided with what the scholarly community had to say. I end with a sober analysis of my study's limitations.

Chapter Four focuses on why multinational firms vary in their responses to industrial policy. It examines the origins of Samsung and HP's unique corporate strategies, delving into the internal and external factors that shaped the way they manage their increasingly global and complex networks of R&D centers. It focuses specifically on how these firms manage their foreign subsidiaries, and in particular their foreign R&D centers, in dramatically different ways. HP grants its subsidiaries a great deal of autonomy, which enables greater responsiveness to industrial policies in the firms' host countries. Samsung maintains tight control over its subsidiaries and centralizes the process of strategy

formulation, meaning that its foreign subsidiaries have relatively little control over how they respond to local policies. The main argument is that firms that decentralize the process of strategy formulation and, by extension, grant their foreign subsidiaries considerable autonomy in the way they interact with their surroundings, are more likely to act in accordance with their host countries' industrial policy regimes than those that centralize the process of strategy formulation and keep their foreign subsidiaries close to the chest. Thus refraction is likely to be highest when foreign firms are centralized and lowest when foreign firms are decentralized.

Chapter Five offers an account of how R&D institutes created as a result of the Informatics Law have managed conflicting demands over time, with their clients seeking to protect their intellectual property and to keep their ideas and technologies contained, and the Brazilian government seeking to leverage the existence of these nominally independent centers to create spillovers and push these technologies outward. By examining the evolution of these institutes vis-à-vis their clients and the Brazilian government over the course of three distinct periods, I am able to document how organizations bury incongruity deep within the organization to maintain legitimacy among conflicting actors. When they emerged, these institutes acted in accordance with the letter of the law, but not its spirit. Acting in accordance with the spirit of the law would have led to a loss in legitimacy with respect to their clients, on which the institutes depend for critical resources. But when the letter of the law changes to reduce ambiguity and bring the letter and the spirit of the law closer together, strategic responses become, in most cases, more elaborate forms of defiance. Some institutes remain captive to their principal benefactors while others diversify their base of clients. This should, in principle, encourage more knowledge mobility. However, in the end, it does not, for reasons explained in Chapter Six.

Chapter Six delves into the four institutes, focusing specifically on the three that have diversified considerably. These institutes engage in a process of *organizational balkanization*, separating teams of engineers so that for the most part, they work on behalf of a single client and do not have access to other clients' data. Thus they comply with the government's demands for client diversification, but because teams are separated along client lines, there is little difference between institutes that remain captive and those that diversify. In both cases, client-specific knowledge remains cloistered and spillovers are only incidental. At the end of the day, institutes are more dependent on their clients for resources than they are on the Brazilian government. Furthermore, the state's limited capacity to enforce its policies makes it relatively easy to feign compliance with its demands. Balkanization involves more than just the physical separation of people and servers. It manifests at the personal level, with engineers coming to identify principally with their main clients, thus prioritizing their aims and needs over those of the organizations for which they actually work. Managers work to bring engineers back to center, but are limited in their ability to move their staff throughout the organization. However, some institutes have found that through diversification into new sectors, they have been able to create more internal mobility. An electronics firm may not be too worried about the engineers working on its behalf spending some of their time working for a food processing firm, for example. Because there are so many sectors with industrial policies that stipulate local R&D spending and outsourcing, these institutes have been well placed to access these pools of funds. In the process, they have become what the state envisioned they would be to begin with, knowledge brokers.

Chapter Seven concludes. It brings the three preceding empirical chapters as well as the literature review together, outlining the work's major empirical and theoretical findings. Empirically, it outlines what is gained when policymakers consider corporate strategy while formulating industrial policies. Is there any appreciable difference in outcomes

between foreign investors that tend to delegate considerable autonomy to their subsidiaries and those that do not? What are the implications of these findings for emerging markets' foreign direct investment promotion efforts? This dissertation seeks to establish that corporate strategy *refracts* industrial policy. Firms interpret and respond to industrial policies in ways that are consonant with their corporate strategies, leading to variance in firm-level, and even aggregate policy outcomes. Theoretically, this dissertation seeks to advance the literature on institutional theory in international business (Kostova and Zaheer, 1999; Xu and Shenkar, 2002; Kostova et al., 2008) by proposing that corporate strategy affects a multinational firm's ability to adjust to new institutional settings and act in ways that are seen to be legitimate in host countries. The conclusion ends by proposing an agenda for further research into the interplay of corporate strategy and industrial policy.

2. LITERATURE REVIEW

2.1. Introduction

This thesis is an attempt to explain how corporate strategy and industrial policy interact. It would be irresponsible, if not impossible, to explain the empirical phenomena at hand without acknowledging streams of relevant scholarly work in the areas of management, political science, economics and sociology that collectively shed light on the questions on which this thesis focuses. This chapter outlines extant work on the developmental state and industrial policy and on corporate strategy and R&D management. Industrial policy is then examined as the articulation of a state's institutional demands and foreign firms' varying responses to said policies as their strategic responses to institutional processes. Thus the chapter includes an examination of relevant publications in the broad body of work on institutional theory as it relates to the multinational firm. In probing these three very different bodies of literature, this review reveals where the literature explains why things happen the ways they do, and where it falls short and needs further elaboration. It outlines the key contributions that this thesis seeks to make, and further, identifies places where these three disparate bodies of work may be brought into communion with one another to make theoretical headway towards a better understanding of the relationship between the state and the firm in the process of industrialization. More specifically, it seeks to build on the industrial policy and R&D management literatures using case material, and to bring them together at a higher level of abstraction, through the lens of institutional theory.

Many scholars have contributed to our understanding of the state's role in the process of industrialization. The aim of the first section is to examine the most impactful work to date, thereby exhuming the rich layers of empirical and theoretical sediment that afford

us firm ground on which to stand. It traces the genealogy of the developmental state, explaining how the state first came to actively direct the process of industrialization, and more recently, how it has adapted to remain relevant given the increased speed of technological development, the globalization of various facets of production and the creation of a more or less global system for governing trade in goods, and more recently, services. I argue that despite a great deal of scholarly work on the evolving role of the state in the process of industrial development, there has been little parsimonious theorizing about how industrial policy and corporate strategy interact. To be sure, scholars have long recognized that industrial policies incentivize *firms* to engage in certain activities over others, or to move into certain industries and not others. But one of the principal aims of this thesis is to provide a theoretically rigorous explanation for how corporate strategy shapes industrial policy outcomes.

In order to account for variation in policy outcomes, I examine the literature on corporate strategy, focusing specifically on technology strategy and R&D management. Because the empirical context involves the globalization of R&D on the part of multinational firms based in industrialized countries, I focus specifically on questions like why firms offshore R&D to emerging markets like Brazil, and why, in some cases, they outsource this core function as well. The case of the Brazilian Informatics Law demonstrates that the decision of whether or not to offshore or even outsource R&D activity may involve more than just a consideration of the other country's labor cost or technical competences. In this case, local spending on R&D, both through direct subsidiaries and through third parties, is the pound of flesh that the state exacts in exchange for access to the dynamic consumer market that it governs. I examine how this particular case challenges our understanding of what drives firms to offshore and outsource R&D, and further, what political offshoring and outsourcing imperatives mean for the content of R&D conducted in emerging markets enacting these local spending requirements. My second contribution

to this work is an exploration of how R&D services firms solve the problem of organizational balkanization, the creation of hermetically sealed spaces within the firm, in order to aggregate and mobilize knowledge acquired through contractual work.

The local subsidiary is often the stage on which the developmental state exerts its pressure. Indeed, it is one of the few places where it has the jurisdiction to enforce its particular rules directly on foreign firms, trade barriers notwithstanding. As such, Brazilian subsidiaries of multinational firms, as well as their local partners, become the foci of what I frame as a battle between conflicting views of what constitutes appropriate behavior. Herein lies the third body of work on which this thesis builds. Scholars in various fields have long sought to understand the rules that govern the social world that we both build and inhabit. This line of inquiry has followed various paths, often under the monikers of institutionalism or institutional theory. And while much of the literature has focused on why firms or professions come to look the same over time, many have recently sought to explain what happens when firms or individuals that operate in one sphere are transplanted into another, where the rules of the game may be different. I add to this heterogeneous body of work by providing an alternative explanation for why multinational subsidiaries operating in the same foreign context, under the same industrial policy regime, may act quite differently. I seek to contribute to this body of work on the basis of my empirical material, discussing where refinement may be theoretically useful and even necessary to account for my observations.

2.2. Industrial Policy and the Developmental State

2.2.1. The Origins and Evolution of the Developmental State

Although concern over the state's role in the process of industrial development spans nearly three centuries (Hamilton, 1791), the 'infant industry argument' only gained

traction in the second half of the 20th century, as scholars sought to explain the transformation of various East Asian economies. Chalmers Johnson's (1982) influential account of the Japanese 'miracle' launched an important body of work on the developmental state. In it, argued that the Japanese Ministry of International Trade and Industry (MITI) had driven industrial development by collaborating with the private sector to set and pursue the nation's industrial priorities. The developmental state became an oft-evoked trope after Johnson's book was published, with Alice Amsden (1989) and Robert Wade (1990) employing the concept to explain how Hong Kong, Singapore, South Korea and Taiwan – known collectively as the East Asian Tigers – had industrialized. Both strongly countered the mainstream narrative of the time: that these economies developed by getting the basics right, achieving macroeconomic stability and adhering to free market principles.

At the most basic level, what made these developmental states successful was their ability to establish and maintain highly effective, meritocratic bureaucracies that had the capacity to act with a certain degree of autonomy while remaining embedded in a network of social relations with private firms (Evans, 1995). Yes, the MITI was composed of elite, highly competent bureaucrats and yes, it exercised a great deal of discretion in how it chose to direct its authority. However, what made it a successful driver of industrial development was the fact that it remained pliable to the influence of the highest echelons of the private sector (Johnson, 1982). The developmental state could only succeed if the bureaucracy charged with directing economic development efforts was protected from societal interest groups so that it could set long-term industrial priorities in relative isolation. Autonomy prevented a descent into clientalism while embeddedness ensured relevance (Evans, 1995).

Successful developmental states were able to access and exploit foreign technology to increase productivity, to grow their industrial capacity and to eventually achieve competitiveness abroad. Alexander Gerschenkron (1962) first articulated the benefits of backwardness, arguing that industrialization was not a linear process from traditional society to an age of mass consumption, as Walt Whitman Rostow (1990) had previously claimed. He posited that backwardness was a state of high-potential energy. More backward states had the potential for higher rates of productivity growth than advanced states, in part because they could follow the blazed path. Moses Abramovitz (1986) extended the hypothesis, explaining that the ability to catch up depended not only on *access* to leading technologies, but also on the availability of social capabilities needed to *exploit* the technologies developed elsewhere.

In the case of Japan, the government strong-armed IBM into licensing its patents to local firms on favorable terms. Sahashi Shigeru, one of the MITI's most controversial vice-ministers, is quoted as telling company representatives, "We will take every measure possible to obstruct the success of your business unless you license IBM patents to Japanese firms and charge them no more than 5 percent royalty" (in Johnson, 1982, p. 247). Once many of the MITI's official powers had been stripped as a result of liberalization, the body resorted to *administrative guidance* to shape industrial structure.[6] It issued firms directives, requests, warnings, suggestions and encouragement (Chalmers, 1982, p. 265). In Taiwan, once the government began to target higher-value industries in the 1970s, it encouraged subcontracting to domestic firms as a means of encouraging technology transfer. Korea was far less open to FDI as a means of technology

[6] It relinquished its mandate to set import quotas and restrict FDI in a number of sectors. The revision of the Foreign Exchange Control Law in 1979-80 stripped its ability to support exporters as it had in the past. Finally, the MITI's role in setting Japan's trade policy was reduced dramatically following U.S. restrictions on Japanese imports. Japanese companies like Nissan were forced to set up assembly plants abroad to circumvent import restrictions (Vlasic, Tabuchi and Duhigg, 2012).

transfer, instead relying on capital goods imports, licensing, consulting and turnkey contracts (Lall, 2000). These economies prioritized access to foreign technology, and then made use of it by bolstering investments in tertiary education in science and engineering.

As many have noted, the state's ability to maneuver the process of industrial development was vastly diminished towards the end of the 20th century (Callon, 1995). Among the reasons for this decline were greater global integration, industry fragmentation, the spread of the 'Washington Consensus' agenda, a barrage of financial crises in the developing world and the shift from catch-up to frontier innovation in some countries. The rigidity of the East Asian developmental states became all too apparent in the late 1990s. In Korea, immense capital outlays on national champions became non-performing loans as the Asian financial crisis ripped through the region. The developmental state was a product of a specific time and place. With the end of the Cold War and the rise of the World Trade Organization (WTO), East Asian developmental states found that their space for intervention had been reduced considerably.

Furthermore, economic growth led to demands for greater democratization and openness, meaning that the political stability on which the state had depended to drive the process of industrialization had given way to a more pluralistic political reality (Wong, 2004). Wong (2011) claims that the developmental state "no longer has the corporate coherence and structural capacity to effectively coordinate the allocation of resources and stakeholders' activities, to lead and provide authoritative guidance from above," especially as it moves from catch-up to frontier, science-based innovation (p. 181). But as Mariana Mazzucato (2011) points out, frontier innovation does not preclude 'big' leadership (Wade, 1990). Indeed, it *requires* an entrepreneurial state willing to place bets, uncertainty notwithstanding. In sum, both exogenous and endogenous forces conspired to render previously coherent bureaucracies rigid and ill-suited to the new

world order. Nevertheless, various scholars have argued that the state still has a role to play in the process of industrial development.

2.2.2. Industrial Policy: Antecedents, Vectors and Design Principles

Industrial policy is one of the primary means by which developmental states have traditionally achieved their aims. After being banished to the wilderness by the 'Washington Consensus' in the 1980s, industrial policy has returned, supported by governments of varying ideological persuasions, and even by the international financial institutions that once frowned upon its use (Wade, 2012). In recent years, the literature has been taken in various directions, which scholars examining the structural determinants of successful development outcomes, the political determinants of industrial policy regimes, the proper vectors on which policies should intervene, and the design principles that underpin successful industrial policies. But few have critically assessed how organizational factors like corporate strategy determine the degree to which an industrial policy achieves its outcomes. In this section, I examine the various streams of literature broadly surrounding the issue of industrial policy in the modern age, and situate my own work alongside them.

Seán Ó Riain (2000) and others have explored how new structural configurations have allowed the state to remain an important actor in the development process today. Ó Riain argues that flexible developmental states (FDS) are more conducive to development in high-technology industries, which tend to be more reliant on global financial markets and global knowledge networks. These states are better equipped to implement 'open' industrial policies, which aim to forge relationships between domestic firms and global actors as a means of increasing domestic capabilities (Sabel, 2009). This invokes the image of the developmental state as a loosely coupled system rather than a unitary bureaucracy

(Weick, 1976; Ó Riain, 2004). But Daniel Breznitz (2007) and others argue against the notion that certain structural configurations will yield positive outcomes; that the state – bureaucracy or networked polity – is a unitary actor, and the process of industrialization is a binary outcome variable. He argues that we need to understand the *process* of embeddedness and the politics of industrialization, rather than take them for granted.

Politics does and always has mattered in the development process. But whereas before, the state's political and bureaucratic components were 'virtually fused' into one capable and relatively autonomous pilot agency, the proliferation of relevant actors today has complicated the politics of industrial development (Leftwich, 1995). As Thun (2006) demonstrates, there exists a "mosaic of local patterns within the national framework" (p. 9). Thus, systematic and enduring differences between localities produce varying approaches to the problem of industrial development. At the national level, Dobbin (1994) examines differences between countries' industrial policies, attributing them to differences between countries' rationalized meaning systems and the political institutions they inhabit. What these studies have in common is that they highlight the importance of understanding structure's antecedents in order to explain outcomes.

Rather than focusing on state structure, or industrial policy's antecedents, a number of scholars have sought to outline which sorts of policies might be employed to catalyze industrial development in today's day and age. There is a general consensus that, much like in the past, "...developing societies need to embed private initiative in a framework of public action that encourages restructuring, diversification, and technological dynamism beyond what market forces on their own would generate" (Rodrik, 2004, p. 1). But where these scholars differ is in the proper object on which industrial policies should focus: general activities, general purpose technologies (GPTs) or GVC niches.

Many have argued that states should craft horizontal, industry-agnostic policies rather than explicitly target specific sectors and firms so as to circumvent rent-seeking behavior. Hausmann and Rodrik (2002) argue that governments should only promote new activities, include sunset clauses in legislation, and support activities that create positive spillovers. This harkens back to Morris Teubal's (1996, 1997) notion of horizontal technology policies (HTPs). HTPs are a specific category of technology policies whose sole purpose is to advance broad-based technological development, irrespective of industry or technology area. But while various scholars make a strong case for industry- and technology-agnostic policies, others claim that they may be too broad.

Some scholars suggest that GPTs may be a more appropriate locus of intervention. GPTs are the least common denominators for innovation in a number of industries. They are pervasive, can be improved upon and lead to innovation across a range of downstream sectors through network externalities (Bresnahan and Trajtenberg, 1995; Helpman, 1998). The steam engine, the dynamo and the microprocessor are all examples of technologies that have accelerated the rate of technical change and increased productivity in a number of downstream sectors, although adoption and diffusion may have been sluggish in the first few decades after their introduction (David, 1990). Given that incentives to develop GPTs are minimal – it is difficult for any one firm to fully appropriate the gains associated with their development – governments have often stepped in to support their development (Teece, 1986).

The fragmentation of previously vertically integrated industries across national borders has created opportunities for participation and advancement by developing countries (Gereffi, Humphrey and Sturgeon, 2005). Rather than capturing entire industries, many developing countries now aim to insert themselves into and upgrade within global value chains (GVCs). Gereffi and Sturgeon (2013) explore what a GVC-oriented industrial

policy might look like. This type of industrial policy "...takes the interests, power, and reach of lead firms and global suppliers into account, accepts international (and increasingly regional) business networks as the appropriate field of play, and responds to pressures from international non-governmental organizations" (p. 446). In the age of 'compressed development,' developing countries leverage the global supply base, obviating the need to upgrade from the bottom of the ladder to the elusive top (Whittaker et al., 2010). This modular approach enjoins developing countries to find out what they do well, carve out a place in the global economy where they can be successful and engage with global suppliers to scale up and compete. States can no longer hope to build fully integrated, self-contained industries. Nor do they need to.

2.2.3. Gaps in the Literature and Key Contributions

As this review demonstrates, scholars interested in understanding the role of the state in shaping the process of industrial development have seldom unpacked the firm in a way that allows for parsimonious theorizing. There have been considerable efforts aimed at understanding why the East Asian Tigers developed so successfully, and conversely, why Latin America, generally speaking, did not (Dahlman and Frischtak, 1993; Hausmann and Rodrik, 2002). Recently, scholars have examined the structural determinants of success among modern developmental states, the political determinants of variation among industrial policy regimes, the proper locus on which policies should focus and the design principles that successful industrial policies share. Nevertheless, there has not been a serious attempt to understand how differences between organizations affect the outcomes associated with industrial policy. Otherwise stated, there has been considerable groundbreaking work on the antecedents of industrial policy, but little on its object.

Existing work does not give us the tools through which to understand variation at the firm level. The bulk of the literature on the developmental state focuses primarily on the national and sub-national policies and the political institutions that underpin them; the focus is the state, not the firm. The GVC approach gives us the language to describe why we might observe variation across industries, but it does not help us understand why we might observe two firms in the same industry, occupying the same GVC niche, responding to the same industrial policy in different ways. I believe that there is space for work that incorporates management theory into the rich body of work on industrial policy and the developmental state. This work is necessary and important if we are to understand the organizational determinants of industrial policies' outcomes. The following section outlines which parts of management theory I believe are useful for understanding differences between organizations' responses to industrial policy.

2.3. Corporate Strategy and R&D Management

2.3.1. Corporate Strategy: Origins and Working Definition

While the concept of strategy traces its origins to the military tactics first codified by Sun Tzu more than two thousand years ago, its extension into the world of business is relatively recent (Freedman, 2013). In one of the foundational texts of strategic management, *Strategy and Structure: Chapters in the History of the Industrial Enterprise* (1962), Alfred D. Chandler defines strategy as "the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals" (p. 13). Building on Selznik's (1957) early work, Andrews (1971) codifies what is still the central approach to corporate strategy, involving both an appraisal of environmental threats and opportunities with an appraisal of organizational strengths and weaknesses. Firms create

strategies on the basis of these external and internal appraisals, evaluate and choose among potential strategies, and then implement them throughout the organization.

To Mitzberg (1990) the space between strategy formulation and implementation must be more thoroughly examined, as the interface that separates the two sets of activities is less clear than many acknowledge. Indeed, "Strategy follows structure…as the left foot follows the right" (p. 183). Regardless of whether one sees the relationship between strategy and structure as causal and linear or mutually constitutive, it is important to acknowledge that they both have antecedents. As Heimer and Stinchcombe (1999, p. 25) argue in their reinterpretation of Cohen, March and Olsen's (1972) work on organizational choice, "garbage comes from somewhere and belongs to someone." Where people and their ideas come from has some causal impact on organizational choice. Organizations are products of specific times and places; they take on certain qualities and characteristics of their external environment (Stinchcombe, 1965; Hall and Soskice, 2001).

Within the broad literature on corporate strategy, I am interested in work on technology strategy, or the management of technological innovation. While work on corporate strategy and technological innovation were, at one point, conducted in parallel, there have been many efforts to spell out how technology management contributes to competitive advantage, and its sustainability (Schoen, 1969; Loveridge and Pitt, 1990; Dodgson, 2000). While there is much involved in the broad category of technology strategy, my interest is specifically in the area of R&D management, which includes questions regarding the extent to which the R&D function ought to be centralized or decentralized, domestic or international, incremental or radical. What follows is an examination of how the geography of R&D activity has evolved over time, how the

drivers of R&D offshoring and outsourcing have changed and what these trends mean for emerging markets seeking to attract higher-value activities from abroad.

2.3.2. Drivers and Geography of R&D Offshoring

Multinational firms have long offshored R&D by setting up captive centers in other industrialized countries. However, it wasn't until the 1980s that R&D took on a distinctly global flavor. This necessitated a shift from the traditional multi-domestic, hub-and-spoke structure to an intra-organizational network model (Cantwell, 1995; Reddy, 1997). Companies have traditionally offshored R&D services to meet local market demands, to access knowledge and talent or to engage in wage arbitrage. Kuemmerle (1999) helpfully classifies these drivers as either home base exploiting (HBE) or home base augmenting (HBA). While the impetus for offshoring has changed relatively little over the years, its geographic scope and consequences for organizational structure have evolved substantially. Today, emerging markets constitute a significant destination for new R&D investments (Howells, 2008). These centers are no longer distant and forgotten spokes, but integral nodes in increasingly global networks.

Consumers in foreign markets often have idiosyncratic needs. True, these markets will always have a small group of consumers that prefer global products – those designed to meet the needs of the company's home market. Apple's iPhone is a classic example. But once multinationals wish to penetrate the lower rungs of the market, they must begin to produce and market goods that conform to local tastes (Vernon, 1966; Kuemmerle, 1999; Khanna and Palepu, 2006). Mansfield and colleagues (1979) lend empirical support to this assertion, correlating percentage of sales derived from abroad and overseas R&D expenditures. They posit that R&D carried out overseas is aimed primarily at tailoring existing products to new markets. This has the dual effect of making goods more

palatable to new markets *and* ensuring that core technologies remain at home, where they can be better protected than in foreign locations.

Kuemmerle (1999) describes HBA investments as those made to tap into the host country's knowledge base. Firms offshore R&D to access established scientific communities and develop knowledge assets that can help them generate and sustain competitive advantage (Cantwell, 1989; Howells, 1990; Florida, 1997; Manning et al., 2008; Lewin et al., 2009). The competition for science and engineering talent at home has forced firms to look elsewhere for human capital. While lowering the cost of R&D was a primary consideration in the expansion of corporate R&D networks to developing countries in the 1990s (Reddy, 1997), the cost advantage of locating in these countries has declined. As the cost of hiring engineers in different countries continues to converge, opportunities for wage arbitrage may all but disappear.[7]

There is a direct relationship between the drivers of offshoring and new centers' mandates (Ronstadt, 1978; Håkanson and Nobel, 1993; Reddy, 1997). In the past, developing countries only succeeded in attracting units focused on product localization. "Firms' overseas R and D activities tend to focus on development rather than research, on product and process improvements rather than on new products and processes, and on relatively short-term, technically safe work" (Mansfield et al., 1979, p. 193). The

[7] While significant data inconsistencies make a detailed analysis of global engineering wages difficult, overall trends demonstrate a convergence in the cost of hiring engineers in places like China and Brazil and the cost of hiring engineers in industrialized countries. As of 2006, Chinese automotive engineers with 5-10 years of experience reported making less than $20,000 a year on average (Moavenzadeh, 2008). Chinese engineers in 2012 are making upwards of $50,000 a year. Brazilian engineers make $90,000 on average, and while Indian engineers are far behind, at $28,000, salaries have seen rapid growth in recent years. According to the 2012 SAE International Salary Survey, automotive engineers in the U.S. made just below $100,000 in 2006. Salaries increased marginally by 2012, reaching $103,400. This upward trend in developing countries, coupled with the relative stagnation of engineering wages in the U.S. and Western Europe, has made several firms question the long-term business case for offshoring engineering activities.

seminal literature in this space either explicitly or implicitly asserts that developing countries are places where companies pursue HBE strategies, and industrialized countries are where they enact HBA strategies. But empirical evidence shows that the geography of corporate R&D has shifted in recent years, as has the content of R&D conducted in these previously peripheral nodes.

The traditional – developed country to developed country – FDI route still accounts for a majority of new R&D investments. However, certain emerging markets have begun to capture a larger share of global spending in recent years. Three-fifths of new global R&D investments between 2002 and 2004 were made in developing counties (UNCTAD, 2005). China, India and Brazil are now among the leading destinations for new MNC R&D investments (Howells, 2008). Since 2010, companies have invested, or have committed to invest, $2.9 billion into new or existing R&D centers in Brazil. Many of these investments are oil and gas-related, including GE's new global R&D center and IBM's new center for natural resource analytics and computation. The second most important sector in terms of investment has been ICT, with firms like Samsung, Microsoft and Intel making high-profile investments in new R&D centers in the last few years (Zylberberg, 2016).

Moreover, sites in emerging markets have captured more important roles in their parents' global R&D networks in recent years. The literature on MNC subsidiary evolution is helpful in thinking about how emerging market subsidiaries might outgrow their competence-exploiting mandates and create new competence-creating roles within their parents' networks of R&D centers. Birkinshaw and Hood (1998) helpfully bring together different strands of literature on relationships within the MNC, creating an organizing framework for subsidiary evolution. Along with home-office assignment, they highlight subsidiary choice and local environment determinism as factors that determine how subsidiary roles change over time. Cantwell and Mudambi (2005) validate these

constructs through a quantitative analysis of R&D subsidiary mandates over time. This stream of literature is important because it injects some much-needed agency into the process of subsidiary evolution. Rather than a story about top-down directives, subsidiary evolution becomes a recursive feedback loop in which the subsidiary determines its role as much as the parent company does through administrative fiat.

My research builds on the notion that corporate R&D networks are fluid structures rather than static artifacts, and examines how emerging market centers upgrade from competence-exploitation to competence-creation. The literature tends to be pessimistic about this possibility. "While advice from advanced countries stresses R&D and frontier technologies, innovation in emerging markets mostly focuses on incremental changes to absorb and apply existing practices and technologies" (Corredoira and McDermott, 2014, p. 12). According to this view, innovation in developing countries tends to depend on non-R&D activities, on adapting foreign technologies to local environments (Pietrobelli and Rabellotti, 2011). Echoing Abramovitz (1986), these claims suggest that technology adoption from abroad is the only way for developing countries to innovate. But the expansion of corporate R&D activity to emerging markets, along with the possibility of subsidiary evolution, means that emerging market R&D centers can upgrade and become centers of excellence (Frost, 2002).

2.3.3. Innovation Across Firm Boundaries

It has long been recognized that internal R&D capabilities are important but alone insufficient means of developing new technologies (Mowery, 1983; Mowery and Rosenberg, 1993). The threat of technological obsolescence drives large, established firms to look beyond their boundaries for new products (Balakrishnan and Wernerfelt, 1986; Pisano, 1990). Firms in 'high-tech' industries rarely innovate in isolation. They must be

able to access, acquire, assimilate and exploit external knowledge to develop and sustain competitive advantage (Cohen and Levinthal, 1990; Zahra and George, 2002). "Many firms are no longer structured like medieval kingdoms, walled off and protected from hostile outside forces. Instead, we find companies involved in an intricate latticework of collaborative ventures with other firms, most of whom are ostensibly competitors" (Powell, 1990, p. 301). The literature on open innovation has highlighted the importance of reaching beyond firm boundaries to develop new products (Chesborough, 2003).

The literature has examined how firms acquire knowledge through relationships with lead firms in GVCs (Gereffi, 1999; Sturgeon, 2002), through spillovers (Audretsch and Feldman, 1996; Maskell, 2001; Breschi and Malerba, 2005) and through linkages to public and public-private knowledge brokers (McEvily and Zaheer, 1999; McDermott et al., 2009; Corredoira and McDermott, 2014). This study focuses specifically on private R&D service providers. Mowery (1983) finds evidence that between 1900 and 1940, firms outsourced R&D activities to independent research organizations when the subject matter was either generic in nature, or dealt with isolated one-off projects. Thus the least complex R&D projects were more likely to be conducted outside the firm, while the more valuable and strategically sensitive R&D projects were kept in-house.

Firms have long relied on universities for scientific breakthroughs that create opportunities for private profit downstream, especially diversified firms that can make use of said breakthroughs (Nelson, 1971). Some firms invest in basic research themselves, if only to familiarize themselves with the context surrounding their applied research initiatives (Rosenberg, 1990). This project focuses further downstream, on applied research and development, where value chain fragmentation and geographic dispersion

are more recent trends.[8] Advances in modern information technologies have allowed for the finer and finer slicing of GVCs (Mudambi and Venzin, 2010). The fragmentation of the R&D value chain has created new opportunities for firms in emerging markets. It has also created a new set of challenges, especially in the area of inter- and intra-organizational knowledge management.

This discussion about R&D outsourcing begins where discussions about firm boundaries must: in transaction cost theory. Constructed on the basis of Coase's (1937) observations on the nature of the firm, transaction cost economics (TCE) posits that properties underlying transactions, namely asset specificity, uncertainty, information complexity and frequency of interaction are important determinants of organizational form (Williamson, 1975; Shelanski & Klein, 1995; Godfrey & Hill, 1995). Contractual incompleteness – the inability to specify, *ex ante*, all potential outcomes associated with a given transaction – is a feature of all arms-length transactions. However, it is an especially salient issue in contracts for R&D services.

As Pisano (1990) explains, uncertainty cloaks the process of scientific discovery. At the onset of a contractual relationship, neither the supplier nor the buyer has a precise understanding of the quality and value of knowledge that will be produced. Moreover, accurate forecasting of a project's cost, duration and outcome is all but impossible. If we assume that firms invest in R&D to gain competitive advantage through proprietary access to new technologies, then it becomes clear that issues of appropriability are at the center of externally purchased R&D services (Pisano, 1990). As Arrow (1962) makes

[8] The U.S. National Science Foundation defines applied research as the 'systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met' and development as the 'systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.'

abundantly clear, "…no amount of legal protection can make a thoroughly appropriable commodity of something so intangible as information" (p. 615). This creates a potential hazard of expropriation by the R&D service provider, which may turn around and sell its newly acquired know-how to one of the sponsor's competitors. In fact, the tacit nature of knowledge generated may preclude the sponsor from knowing for certain if the R&D service provider has shared its knowledge with a competitor (Howells et al., 2008).

Internalization is one way to mitigate against the risk of knowledge expropriation. Another way to protect against this hazard is through the enforced erection of 'Chinese Walls' or 'Cones of Silence' in the R&D service provider. The concept of the Chinese wall was first developed to describe how financial services firms were able to eliminate the flow of client-specific knowledge where conflicts of interest could arise (Brewer and Nash, 1989; Sandhu, 1992). A firm would set up a digital wall to seal off one company dataset from another, so long as the two were situated in the same conflict of interest class (i.e. industry). Data could only be shared between companies if the firms were in different conflict of interest classes, or if the data were sanitized to eliminate the possibility of backward inference to uncover the source. This concept has been used in law firms as well, as client-specific information is sensitive and sharing it with lawyers working on behalf of clients in the same industry could lead to breaches in confidentiality and malfeasance (Moser, 1989).

The increased complexity of outsourced R&D projects and the expansion of their geographic footprint mean that the make-or-buy decision around R&D services is more complicated than it once was. These projects require more frequent and complex collaboration, sometimes across national borders, creating a situation in which asset ownership is disintegrated while task structure remains intricately interwoven (Sako, 2009). Open innovation is both a necessary and precarious feature of firms in high-

velocity industries. In relation to R&D outsourcing, purchasing services at arms-length allows firms to access external knowledge while also reducing time and cost of development. However, it may be difficult for firms to appropriate the benefits of outsourced R&D for a number of reasons. In cases where the risk of opportunism on the part of R&D service providers is particularly acute, firms may opt to internalize, or force their partners to erect Chinese walls.

2.3.4. Gaps in the Literature and Key Contributions

My dissertation makes three contributions to the existing body of work on technology strategy and R&D management. First, it lends empirical support to the notion that patterns and quality of R&D offshoring have changed in substantive ways in recent years. Much of the research discussing changing patterns and drivers of R&D offshoring tells a broad story about the reconfiguration of global R&D networks. My research delves into the multinational firm itself to understand, at a granular level, how global R&D management is different today than it was in the past. Whereas before, foreign R&D centers were largely charged with adapting and localizing technologies for local markets, today, many are seen to take on a range of capabilities critical to their parent companies' technology roadmaps. I discuss how subsidiaries push for charter change, and why some many have more success than others in doing so.

Second, it examines political drivers of R&D offshoring and outsourcing. Some emerging market governments require that companies spend a certain amount on local R&D in exchange for market access. Indeed, the attraction of multinational R&D investment has become a top priority for policymakers in emerging markets. What the quest for talent, the strategy of wage arbitrage and 'tropicalization' all have in common is that they are all driven by the firms' technology- or market-related needs. But as Gassman and von

Zedwitz (1998) suggest, firms may open up foreign R&D centers to access subsidies or to comply with legal requirements. While a great deal of empirical research has been done on the technology- or market-related drivers of R&D offshoring, there is relatively little on political drivers. Further, there have not been any studies, as far as I can tell, discussing legal drivers of R&D outsourcing. This is likely because it is a rarely observed empirical phenomenon. The study of knowledge spillover mandates allows us to develop a better understanding of how, in the most complex of circumstances, multinational firms manage their foreign R&D centers, and how these R&D centers evolve over time.

Third, this dissertation contributes to our understanding of the problem of knowledge aggregation in R&D services providers. The literature has not explored the implications of intra-organizational barriers to knowledge transfer in R&D services firms. This is partially the case because, as Pisano (1990) suggests, the presence of competitors for ideas generated through contract R&D will lead to internalization. But what if internalization is not possible, as is the case in Brazil's electronics sector? Legally mandated outsourcing lead to the creation of internal boundaries, which in turn require a different conceptualization of the firm. Some scholars have proposed that the firm should be understood not as a nexus of contracts, but as a social community organized for the efficient and expedient creation and transfer of explicit and tacit knowledge (Arrow, 1974; Kogut and Zander, 1992; Nonaka, 1994; Grant, 1996). But while this definition fits the matrix form, it fails to capture the organizational idiosyncrasies of the project-based organization (PBO).

In PBOs, "the knowledge, capabilities, and resources of the firm are built up through the execution of major projects" (Hobday, 2000, p. 874-875). Given that projects typically have a defined beginning and end, and that each project calls for a different configuration of personnel, it becomes difficult for these firms to build a coherent set of organizational

capabilities (Whitley, 2006). These structural barriers to intra-organizational knowledge transfer are not insurmountable in the long run, as teams are disbanded and reconstituted when old projects end and new projects begin. Over time, these firms develop organizational memories, which store knowledge from closed projects to be used with other clients at a later date (Hardagon and Sutton, 1997; Hargadon, 2002). But legal barriers to knowledge aggregation present project-based firms with a different set of problems. My main contribution here is to bring the literature on Chinese walls into communion with work on PBOs, knowledge brokers, and more broadly, innovation intermediaries, in order to explain how even in the most difficult conditions, organizations might find ways to overcome barriers to knowledge aggregation.

2.4. Agency and Institutions

Scholars have long endeavored to understand how institutions emerge and evolve; how they shape and are shaped by individual behavior. More recently, international business scholars have engaged in institutional analysis to study the complications that arise when multinational firms enter new markets characterized by different institutional profiles than their home countries. In these cases, companies can respond to institutional demands in a number of ways, especially when pressure emanates from various sources and pulls in different directions. This section provides an overview of the literature on strategic responses to institutional demands in order to set the stage for an in-depth examination of how multinational firms respond to institutional demands created by the Brazilian government's industrial policy surrounding their R&D management practices.

2.4.1. Defining Institutions

An extended genealogy of institutions, as understood by economists, political scientists and sociologists, is beyond the scope of this project. Nevertheless, it is important to

recognize that over the years, these communities of scholars have each developed important ideas regarding the structural features that shape individual action.[9] Douglass North (1991) defines institutions as "the humanly devised constraints that structure political, economic and social interaction" (p. 97). This definition has been generally supported by political scientists and economists, who tend to focus on the stable system of rules put forth by the state and conventions proffered by formal organizations. These scholars tend to separate out the cultural considerations that form an integral part of sociological institutionalism, which focuses on formal and informal rules in addition to the cognitive scripts and moral templates that underpin them (Hall and Taylor, 1996). Richard Scott's (1995) definition of institutions, which holds sway among many sociologists, and more recently, international business scholars, emphasizes the "cognitive, normative, and regulative structures and activities that provide stability and meaning to social behavior" (p. 33).

My research adopts this broader conception of institutions, allowing me to examine not only their legislative dimension, but the cultural attitudes and notions of appropriateness that underpin the rules of the game as well. The regulative dimension refers to the more explicit, either formal or informal, rules that govern society. It involves creating rules as well as monitoring compliance and sanctioning violators. The view of institutions as systems that create, monitor and enforce the formal and informal rules of the game receives support among a diverse array of scholars. The normative view of institutions highlights the values and norms that specify the appropriate means of pursuing particular goals. All action is rooted in a particular social structure that guides actors along the path of what is considered correct and moral. Finally, the cognitive pillar

[9] For an in-depth examination of these evolutionary paths, readers are encouraged to probe chapter two of Richard Scott's *Institutions and Organizations*.

includes the culture-specific constitutive rules through which we interpret reality. These are the rules we take for granted because they shape our field of vision in the first place.

2.4.2. Institutional Isomorphism

Formal organizations seek consonance with institutions not to increase the efficiency with which they pursue their daily tasks, but to achieve *legitimacy*, thereby increasing their likelihood of survival (Meyer and Rowan, 1977). DiMaggio and Powell (1983) follow this thread, claiming that in the past, the key driver of bureaucratization and rationalization was the need for greater efficiency in the face of competition. They argue that today, organizational change is driven not by some quest for greater efficiency, but by the isomorphic pressure created by the structuration of organizational fields. Isomorphism – the notion that organizations become homogenous in terms of structure, culture and output over time – has become one of the more compelling cornerstones of institutional theory. DiMaggio and Powell (1983) highlight three different forms of isomorphic pressure: coercive, mimetic and normative.

Coercive pressure is defined as the formal and informal pressures organizations face to conform to a reified model. This pressure can involve outright force, as is the case with a country's labor laws, or persuasion, which can come in the form of fiscal incentives exchanged for investments in local manufacturing. Mimesis is common when organizations face uncertainty in their external environment, and respond by modeling themselves after other organizations that they perceive to be legitimate or otherwise successful. Normative pressure stems from workforce professionalization, the process by which certain professional norms come to be diffused through a network of people that occupy similar roles in their respective organizations. This can occur through filtering, whereby employers look for a common set of attributes, like educational achievements at

certain universities, in their hires, leading all managers, accountants or lawyers to look, speak and act in a similar way to one another.

The idea that actors will act in accordance with collectively agreed upon rules regarding what is "true, reasonable, natural, right, and good" rather than some universal criteria for morality or efficiency is well captured by March and Olsen's "logic of appropriateness" (2004, p. 4). These rules of appropriateness are encoded lessons from the past that reflect behaviors associated with either success or survival. As Fligstein (1996, p. 662) puts it, "New rules follow the contours of old ones." But the link between rules (along with the institutions they comprise) and purposeful action is rarely linear. Individuals have multiple identities, defined by Stryker and Serpe (1982) as "internalized positional designations that represent the person's participation in structured role relationships" (p. 206). Each of these identities and related roles may implicate certain appropriate rules to follow. But there may still be ambiguity regarding what should be done, or an actor may know what should be done but may not have the capabilities necessary to follow through (March and Olsen, 2004). Institutional theorists have long understood that actors may not simply acquiesce to isomorphic pressure, or that they may be faced with different and conflicting institutional demands.

2.4.3. Strategic Responses to Institutional Demands

Christine Oliver (1991) argues that unlike resource dependence theory, which emphasizes the idea that firms can actively manage interdependencies with their environment and exercise strategic choice in how they elect to respond to external pressure, institutional theory has historically underplayed firms' ability to respond to institutional processes in ways beyond conformity. It is worth noting that Meyer and Rowan (1977) argue that actors can respond to institutional pressures in various ways,

including decoupling structure from day-to-day activities. Early institutional theorists understood the possibility that actors might resist or defy pressure to conform to some externally mandated process (Selznik, 1949). However, these early attempts to build managerial discretion into institutional theory underspecified the breadth and scope of viable strategic responses. Oliver argues that acquiescence, avoidance, compromise, defiance and manipulation are all viable strategies, and that each entails various tactics. For example, actors can avoid institutional demands by concealing nonconformity, loosening institutional attachments or escaping by changing goals.

But while Oliver's (1991) typology is a useful starting point, it does not account for the fact that individuals and organizations are often subject to demands emanating from multiple, sometimes contradictory sources, and that they change over time. A number of scholars have examined how organizations seek legitimacy in cases of institutional pluralism. Kraatz and Block (2008) argue that firms may seek to *eliminate* pluralism altogether by attacking the sources of what they deem to be illegitimate claims, *compartmentalize* by addressing various institutional demands sequentially, or concurrently through different departments, *balance* opposing institutional claims by easing the tension between them or *become institutions* in their own right, eliminating sources of tension by becoming social facts themselves. Organizational responses to institutional pluralism are conditioned by the sources of institutional pressure, the inner workings of the organization itself, the organization's location in a field and the structure of the field itself.

The amount of interpretive space afforded to managers is directly proportional to the degree of ambiguity in the institutional demand. The more ambiguous the institutional demand, the more likely that managers will respond symbolically and remain focused on action that supports operational efficiency (Edelman, 1992; Elsbach and Sutton, 1992;

Goodrick and Salancik, 1996). Furthermore, demands that articulate legitimate goals are often stronger than those that prescribe legitimate means, or ways of doing things (Pache and Santos, 2010). Conflicting demands over goals are more difficult to reconcile than conflicting demands over means. Firms often have a harder time managing institutional pluralism when the different sources of external pressure prescribe different goals that are appropriate to pursue.

Building on Greenwood and Hinings's (1996) discussion of employees' value commitments towards institutionalized templates, Pache and Santos (2010) draw the link between employees' commitments and their organizations' strategic responses to conflicting external demands. In some cases, an organization's functionaries may be unaligned with either side of an institutional conflict. But more commonly, the internal representation of a conflict is either one-sided or divided, with some employees identifying with one side and some with the other. The organizatio's strategic response varies in line with the relative power of each side. When internal representation is one-sided, the firm is likely to avoid or defy the unrepresented external demand. The same sorts of responses are likely when both sides are represented, and the more powerful coalition dictates the organizational response to the demand favored by the other, less powerful side.

Organizational responses to institutional pluralism depend on where the organization is situated in an organizational field, "a recognized area of institutional life" constituted by both market and non-market actors (DiMaggio and Powell, 1983, p. 148), as well as how centralized the field is to begin with (Pache and Santos, 2010). Organizations that are only loosely connected to central actors are both less likely to learn what constitutes appropriate behavior in a particular field and less likely to be coaxed into compliance. Peripheral organizations are less familiar with expectations, and are thus more likely to

engage in experimentation (Leblebici et al., 1991; Greenwood et al., 2011). Furthermore, peripheral organizations are less likely to receive resources or other advantages in a particular institutional context, and are thus more likely to have a great deal of discretion in terms of how they operate vis-à-vis external actors. The implications associated with being a central actor are far less clear. Greenwood and colleagues (2011) highlight the contradictory evidence, which on the one hand, states that size and status lead to media attention, intensifying institutional demands, and on the other, states that size and status are likely to grant an actor immunity from institutional pressure.

Finally, institutional pluralism has a stronger effect on organizations when the field is moderately centralized, when there are multiple misaligned and important actors that exert meaningful and conflicting demands on organizations. In highly centralized fields, there is usually a single constituent that sets legitimacy criteria and monitors responses. In decentralized fields, institutional demands, where they exist, are weak and easy to avoid (Pache and Santos, 2010). This can occur in emerging fields, where no single actor or set of actors has yet emerged, meaning that there are no clear and established criteria for legitimacy; no established rules of appropriateness. New markets are described by Fligstein (1996) as those in which "actors in different firms are trying to convince other firms to go along with their conception of the market. If they are powerful enough, they try to force their view" (p. 663). In these cases, there is no established and widely accepted *conception of control*, or collective identity that allows for the creation of a successful market.

2.4.4. Institutional Theory and the Multinational Firm

The literature on the multinational firm has long been concerned with the question of how to manage the tension between local adaptation and global integration (Doz et al.,

1981; Prahalad and Doz, 1987; Bartlett and Ghoshal, 1989). A number of scholars have conceptualized this conflict in institutional terms. The Varieties of Capitalism framework "predicts systematic differences in corporate strategy across nations..." (Hall and Soskice, 2001, pg. 15). But while the corporate strategies deemed to be legitimate might be clear for each individual country, or for each type of market economy, it becomes more difficult to assess what strategies might be construed as legitimate once a firm moves overseas and is exposed to different institutional environments. The question of how to achieve legitimacy becomes more complicated when a firm is exposed to an institutional environment with which it is not familiar.

For MNCs, the tacit nature of the cognitive and normative domains of each country's institutional profile make the quest for legitimacy particularly problematic. Furthermore, the sheer number of national institutions to which an MNC must be responsive complicates its ability to earn and maintain legitimacy in all of them, or at least in those that matter most. The *distance* between an organization's home country institutional profile and that of its host country affects its ability to attain legitimacy abroad (Kostova, 1996). Of course, the quest for legitimacy impacts organizational efficiency as well. Scholars have long understood that institutional distance makes the transfer of knowledge and organizational practices across national borders fraught with uncertainty (Kostova, 1999; Kostova and Zaheer, 1999; Xu and Shenkar, 2002).

Xu and Shenkar (2002) postulate that firms with global strategies are more likely to enter markets that are cognitively and normatively adjacent while those with multi-domestic strategies are more likely to enter markets that are cognitively and normatively distant. This proposition may not stand up to empirical scrutiny. After all, large MNCs are active in all sorts of countries regardless of their strategies. But the broader point might be that firms that devolve more autonomy to their subsidiaries have an easier time operating in

unfamiliar settings than do global companies. However, regardless of the strategy adopted, or the ways in which subsidiaries are managed, the literature predicts that MNCs should only conform to their host government's institutional demands in limited ways.

Kostova and colleagues (2008) argue that MNCs may acquiesce to institutional demands in host countries as long as they are regulatory in nature. MNCs resist institutional isomorphism along cognitive and normative lines vis-à-vis their host governments. This is because, as Kostova and colleagues (2008) explain, the traditional notion of a field does not apply to the MNC. Multinational subsidiaries in foreign environments might have a difficult time managing inter-organizational relations, which are critical to the process of structuration, and further, field formation. The intra-organizational environment is often more familiar, and more important. More often than not, multinational subsidiaries depend more on their parent companies than they do on their host governments for critical resources. But while Kostova and colleagues (2008) argue that local isomorphism is unnecessary and impossible, I posit that it is both necessary and complicated.

Host countries *do* exert institutional pressure beyond the regulatory sort. Laws are means through which to achieve desired ends. Thus pressure to conform to certain laws and regulations undergirds pressure to conform to certain ideas of what is and what isn't appropriate. An MNC subsidiary, then, often becomes the battlefield between conflicting institutional demands of the cognitive and normative variety. But a host government's capacity to enforce these institutional demands is limited by the fact that the intra-organizational institutional environment exerts stronger pressure than does the government. While Kostova and colleagues (2008) deem local isomorphism impossible, I argue that the degree to which MNC subsidiaries conform to local regulatory, as well as cognitive and normative, demands depends on corporate strategy.

2.4.5. Gaps in the Literature and Key Contributions

I make two main contributions to the heterogeneous body of work in the field of institutional theory, the first in relation to work on strategic responses to institutional demands, and the second in relation to work in the area of international business. The first contribution is a vignette that clarifies the co-evolutionary nature of strategic responses and institutional demands. Much of this work tends to treat strategic responses and institutional demands categorically rather than over time. Edelman (1992) and others provide a useful starting point for understanding how responses and demands might change as time passes. I extend this work by examining how different multinational subsidiaries and their R&D partners respond to government imperatives over time, in many cases creating more and more elaborate symbolic structures in response to more and more specific rules. Doz and colleagues (1981) acknowledge that host country demands are often ambiguous moving targets. My research delves into why this is the case, examining how strategic responses and institutional demands interact.

My second contribution in the area of institutional theory is an examination of the provocation put forth by Kostova and colleagues (2008), which states that multinational subsidiaries do not conform to local institutional demands beyond those regulatory in nature. At the organizational level, an MNC subsidiary faces two oft-conflicting sources of institutional pressure: the external environment in the host country and the internal environment within the MNC itself. How these pressures are felt depends in part on where the firm falls between being global – aggregating functions in one location to increase economies of scale – or multi-domestic – where national subsidiaries focus on local responsiveness (Prahalad and Doz, 1987; Bartlett and Ghoshal, 1989; Westney, 1993).

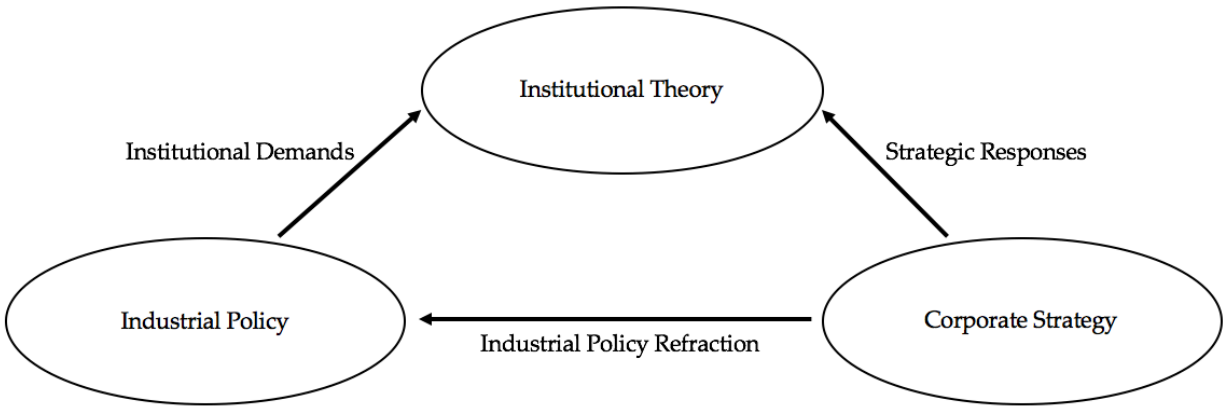
The literature on the multinational firm indicates that subsidiaries find themselves on a sliding scale between global integration and local responsiveness, and that where the subsidiary is situated depends on the local environment. In regards to the R&D function specifically, firms that do not require the capabilities present in a given country are unlikely to give that country's subsidiary much autonomy. But as more recent work on subsidiary evolution suggests, there are other factors at play in defining subsidiaries' charters (Birkinshaw and Hood, 1998; Zanfei, 2000). While work on subsidiary evolution is a step in the right direction, the traditional body of work on the multinational firm does not help us to answer the question of why two subsidiaries operating in the same industry and the same environment (that also see the environment in similar ways) might still operate in different ways.

I argue that viewing multinational subsidiaries as a collective, while important for parsimonious theorizing, misses important sources of variation between firms. Corporate strategy is one such source of variation, especially as it relates to subsidiary management. When corporate offices grant their subsidiaries more autonomy, it allows them to be more responsive to their host country's institutional demands without compromising their intra-organizational imperatives. On the other hand, when subsidiaries are kept on a tight leash, it becomes difficult for them to acquiesce to demands emanating from host country governments, elevating the risk of sanction. Degree of subsidiary autonomy is not exogenously given, but a result of the parent company's corporate strategy. This thesis explores how differences between firms' corporate strategies lead to varying degree of isomorphism by subsidiaries in foreign countries.

2.5. Discussion and Conclusion

These three bodies of work have overlapped relatively little to date. Their progress has been driven by scholarly communities with different compulsions, and ultimately, different aims. But that is not to say that there is no room for convergent work. This chapter traces some of the important and relevant work to date having to do, very broadly speaking, with industrial policy, with corporate strategy and with institutional theory. My aim in this undertaking, beyond filling gaps in each of these bodies of work, has been to reveal spaces where there *should* be conversation between them – not for the sake of conversation alone, but for the sake of furthering our understanding of how multinational firms and governments interact. Figure 2.1 illustrates the tri-partite conversation that this thesis seeks to facilitate.

Figure 2.1: Convergence of Three Bodies of Literature



I have demonstrated that the literature on the developmental state, and more recently, work on industrial policy, has not taken corporate strategy seriously. Industrial policies are internalized by firms, which must decide how they wish to respond to them. In the case of multinational firms, it is likely that industrial policy does not dovetail with strategic aims. I have argued that industrial policies encourage firms to do that which

they wouldn't do if left to their own devices. So if there is no convergence in the strategic aims of the state and those of the firm, what can we expect in terms of outcomes? I have proposed that we can conceptualize corporate strategy as a moderator that shapes policy outcomes. Firms respond to industrial policies in ways that rhyme with their corporate strategies. Thus we expect refraction. We expect the policy's outcomes to diverge from what the state envisioned when crafting them. But how can we better understand the degree of refraction? I suggest that adjusting the moderator can tell us a great deal about why some firms may act in closer alignment with a certain policy than others.

Referring again to Figure 2.1, we can conceptualize industrial policy as the embodiment of a government's demands on firms acting within its jurisdiction. We can conceive of these demands as being institutional in that they embody cognitive, normative and regulatory scripts and rules regarding which sorts of actions are legitimate, and should merit continued support, and which sorts of actions do not conform to the existing logic of appropriateness, and should merit sanction. Departing from the assumption that corporate strategies vary, even among firms in the same industry, I argue that strategic responses to external demands will vary as well. These strategic responses are conditioned by firms' broader corporate strategies. Otherwise stated, a firm responds to external pressure in a way that is consonant with the way in which it organizes itself to create value in a given industry. The *process* by which firms internalize and respond to industrial policies is conceptualized here is terms of co-evolving strategic responses and institutional demands. Concretely, Chapter Four inductively derives the concept of industrial policy refraction while Chapters Five and Six examine the process by which organizational responses and institutional demands co-evolve.

The empirical chapters that follow are informed by the three bodies of literature that have been outlined here. I use the lens of institutional theory, focusing on how firms respond

to conflicting institutional demands to argue that the literature on industrial policy should account for corporate strategy to explain variance in outcomes. Scholars have acknowledged that industrial policies vary in line with countries' idiosyncratic political institutions (Dobbin, 1994). There is no 'right' industrial policy regime. But while policies may vary significantly from one context to another, there seem to be certain design principles undergirding success cases. Successful developmental states pick industries (and firms within them), granting subsidies and market protection for a credibly limited period of time, after which point the umbrella is removed, and they either sink or swim. It is this combination of incentives and punitive measures that appears to separate the success cases of East Asia and the failures in Latin America, where subsidies were broad and often granted without credible sunset clauses (Hausmann and Rodrik, 2002).

While there has been a rich conversation about the degree to which industrial policies vary, and why they vary, there has been little work to date on how the fact that firms are different shapes policy outcomes. Much like garbage, firms come from somewhere. And their corporate strategies are shaped by those somewheres, whether they be periods of time or places in the world. Thus a government's ability to achieve its desired industrial policy outcomes – which in the case examined here includes inducing knowledge spillovers through the encouragement of partnerships with universities and research institutes – depends on how the firms to which the policy is being applied respond to it. In the case of foreign multinational firms, this implies a conflict between what the government wants and what the head office wants. Chapter Four examines how large multinational firms' histories shape their corporate strategies and, by extension, the ways in which their Brazilian subsidiaries respond to the Informatics Law in Brazil. Chapters Five and Six examine how these responses manifest at the organizational and intra-organizational levels over time.

3. METHODOLOGY

3.1. Introduction

This chapter constitutes a somewhat linear description of the decidedly non-linear process by which my doctoral thesis came to be. Rather than being the product of thoughtful and deliberate prefabrication, the design that gives this thesis structure was formalized with the research well underway. The inductive approach to theory building necessitates such flexibility. To be clear, I make the ontological assumption that the social world exists outside of myself as a researcher, and that I can uncover regularities and causal relations among its constituent elements (Burrell and Morgan, 1979; Johnson and Duberley, 2000). Of course, as a researcher I bring my baggage to the empirical material I choose to study. But I try to put my ideological preconceptions and theoretical commitments to one side when engaging in research, trying to see empirical phenomena for what they are, rather than what my ideas and reading tell me they should be. I am guided by Mintzberg's (1979) cautionary statement: "The greatest impediment to theory building in the study of organizations has been research that violates the organization, that forces it into abstract categories that have nothing to do with how it functions" (p. 585-586). Therefore, I have attempted through the course of this research to let the empirical data create the constructs, and eventually, theory.

This chapter begins with a discussion of the empirical phenomenon that set my doctoral research in motion. It continues with a discussion of my research design, explaining why I decided upon a comparative case study as the best means by which to answer my research question. Comparative research allows for the possibility of generalizable findings, and is seen to be a useful mechanism for theory building (Eisenhardt, 1989). I follow this by explaining my process of theoretical sampling. Theoretical sampling,

unlike random sampling, allows the researcher to select cases that further theory.[10] I then delve into the process of data collection, beginning with a description of the process by which I negotiated and attained access to the organizations in my sample and continuing with a description of the various sources of data on which my study relies, including semi-structured interviews, observational data and secondary written materials. I then describe how I moved from data collection to data analysis and back, creating a multi-level data structure that maps clearly onto the following chapters. I end by explaining how the hypothesis that emerged from my research extends and challenges extant theory.

3.2. Trigger to Theorizing

My approach to this project is informed and shaped by Merton's (1957) ideas regarding the role of empirical research in formulating theory. Merton posits that "empirical research goes far beyond the passive role of verifying and testing theory….it *initiates*, it *reformulates*, it *deflects* and it *clarifies* theory" (p. 98, italics in the original). To Merton, theories should be applicable to small tracts of data rather than seek to be all-inclusive, if they are to ultimately be useful. These middle-range theories occupy the space between minor hypotheses and master conceptual schemes. Glaser and Strauss (1967) pick up on Merton's work and attempt to close what they deem an "embarrassing gap between theory and empirical research" (p. vii), proposing a method of comparative analysis that allows a researcher to transform data obtained through social research into middle-range theory. Their methodological blueprint was relatively underspecified, and later elaborated by Eisenhardt (1989), who lays out a guide for building theory from case-study research. My research approach broadly follows the contours of Eisenhardt's (1989) codified process without adhering slavishly to its prescriptions. After all, researchers

[10] This is particularly useful when the researcher cannot control the circumstances surrounding his or her research subject(s), and when there are limitations on how large a sample can be selected.

must make a "creative leap" (Mintzberg, 1979) or "infer" (King et al., 1994) at some point to spin theory from empirical observation.

The process of inductive theory building begins with an anomaly, or as Weick (1989) calls it, a "trigger to theorizing." In this light, research takes on a probabilistic flavor. It is up to the researcher to find irregularities in the social world, and then, to explain them. To Merton (1957), data-driven research begins with serendipity, "…the fairly common experience of observing an *unanticipated, anomalous and strategic* datum which becomes the occasion for developing a new theory or for extending an existing theory" (p. 98, italics in the original). My trigger to theorizing was the discovery of what I found to be a peculiar organization. Between 2012 and 2013, I collaborated on a research project aimed at exploring Brazil's role in three global value chains (GVCs): medical devices, aerospace and electronics (Sturgeon et al., 2013). I led the research on Brazil's role in the electronics GVC, and following the philosophy of GVC research, I sought to understand not just how this particular industry was structured in Brazil, but how it was connected to the global flow of ideas, goods and services. Many of the largest firms in Brazil's electronics industry are in fact subsidiaries of foreign multinationals, so examining them without referencing their fellow subsidiaries or parent companies would have been a myopic exercise.

I conducted 14 interviews with local firms, subsidiaries of foreign firms and some of these foreign firms' home offices, as well as with several government agencies and non-governmental organizations. One of the non-governmental organizations we had a chance to interview was Institute F, whose very existence was strange. Flextronics, the firm that lends this institute its name, is one of the largest electronics contract manufacturers in the world; a global supplier to lead firms outsourcing a range of functions including component purchasing, production and final assembly as well as repair and reverse logistics (Sturgeon, 2002). That a Brazilian non-profit organization

bore this contract manufacturer's name was interesting. Flextronics is not a particularly R&D-intensive firm; furthermore, it generally does not offshore R&D, much less outsource it. I eventually found that Institute F was part of a larger cadre of anomalies: several large multinational firms had set up non-profit R&D centers in Brazil as a result of the country's longstanding industrial policy known as the Informatics Law. What made these institutes anomalies is that they were legally independent entities conducting R&D on behalf of large multinational firms. As the preceding review of research on R&D outsourcing makes clear, multinational firms rarely seek to engage with external partners in places that are known for having weak legal regimes of appropriability. Furthermore, it is highly uncommon for multinational firms to create legally independent R&D institutes in emerging markets, making these cases strange. So I embarked upon my DPhil with the aim of explaining their existence.

3.3. Comparative Case Study Approach

I began my project interested in understanding *why* multinational firms had set up non-profit R&D centers in Brazil and *how* these organizations had evolved in their 10+ years of existence. As Yin (1994) remarks, explanatory questions that begin with *why* and *how* lend themselves well to the case study approach. The case study approach is an in-depth form of empirical inquiry that examines a phenomenon as well as the milieu in which it is situated. I was interested in exploring an ongoing social phenomenon over which I could exercise no control, meaning that experiments and histories would have been inappropriate means of approaching my question. Furthermore, rather than being interested in the prevalence, incidence or frequency of a phenomenon, I was interested in understanding the very existence of what I perceived to be strange organizational forms. I was not conversant in management theory when I began this project, but was still able to identify these organizations as unique. While many organizational scholars have

argued that there is nothing wrong with having a sample size of one (Mintzberg, 1979; Kunda, 1992), I believe that multiple cases provide better fodder for robust theoretical insights, especially when the researcher hasn't the time or resources to engage in long-term ethnographic research (Creswell, 2003; Eisenhardt and Graebner, 2007).

By adopting a multiple-case design, I created the possibility of comparison. I found a set of organizations that appeared to be quite similar, and thus imagined that by adopting the replication logic, I would find more similarities than differences among them. Given the cases' extensive similarities – all centers were spin-offs from multinational firms in the electronics industry – the differences would appear all the more salient. I adopted a "most similar systems" design, which Przeworski and Teune (1970) describe as being based on the intuition that "systems as similar as possible with respect to as many features as possible constitute the optimal samples for comparative inquiry." They continue that, "If some important differences are found among otherwise similar countries, then the number of factors attributable to these differences will be sufficiently small to warrant explanation in terms of those differences alone" (p. 32). When I first selected the institutes that would constitute my sample, I could not see very many notable differences among them. It was only through the process of collecting and analyzing data that significant differences emerged, warranting explanations.

3.3.1. Sampling Procedure

The act of identifying this set of organizations allowed me to demarcate the boundaries of the population from which I would sample. The outer ring of this population included all of the organizations that had been identified by the Committee for the Area of Information Technology (CATI) as legitimate recipients of R&D funds associated with the Informatics Law. As of September 13, 2016, this population included 320 separate

entities, including public and private research institutes, university departments and incubators. Many universities and organizations had several certified units. For example, the University of São Paulo (USP) had 12 departments certified to use Informatics Law funds. Within this outer ring, I identified 170 unique organizations, counting USP once rather than twelve times. Because I was interested in research institutes in particular, I focused on the 55 research institutes nested within the broad group of 170 organizations, pulling the universities out of the sample. I began a process Glaser and Strauss (1967) call theoretical sampling, whereby the researcher selects groups to study on the basis of their potential value for creating theory. Given that inductive research is a process of developing rather than testing theory, random sampling is unlikely to create the theoretical constructs necessary to properly uncover meaningful relationships.

With a broad population of institutes defined, I began to isolate particular organizations on which to focus my pleas for access. When examining these institutes more closely, I became aware of the degree to which funding was concentrated in just a few of them. According to the Ministry of Science, Technology and Innovation, the ten largest recipients – including universities, institutes and incubators – accounted for 63 percent of all funding earmarked for R&D through this specific industrial policy. Seven of these recipients were private institutes and three were universities. I also noticed that the institutes that had spun off from multinational firms were consistently among the largest in terms of number and size of R&D contracts. In 2013, four of the five largest institutes in terms of funds received via the Informatics Law were organizations that had started out as MNC spin-offs.

These four institutes were similar in a number of ways. Firstly, they were the only ones spun off from multinational firms and located in the Southeast of Brazil. It is worth taking a moment here to note that Brazil's regions are extremely heterogeneous. The Southeast

has long been the country's economic engine, while the Northeast and Center West have traditionally been less developed. Since the creation of an industrial pole in the Amazon in the late 1950s, the region has attracted a number of industrial firms seeking to access a range of fiscal incentives that are made available in exchange for the localization of production. But these firms operate under a different regulatory regime, and respond to a different set of government institutions. By focusing on institutes in the Southeast, I was able to control for regulatory institutions as well as for other regional sources of variation, including level of economic development. Secondly, the four institutes identified all remained tied to the companies that had first created them in the late 1990s and early 2000s in response to the Informatics Law. This allowed me to monitor how their relationships with their multinational benefactors had evolved through the years. Lastly, the companies that had created the institutes in the first place remained leading firms in the global electronics industry when my study began, although some had gone through various ownership changes, including outright acquisition.

Thus my sample included this cadre of four private research institutes spun off from multinational firms. But I understood that examining these four relatively successful institutes that shared a number of characteristics might give me a skewed picture of what was happening more broadly among this large number of research institutes. So I also identified a number of other organizations that I would approach, if only to develop a more robust understanding of the context in which my core sample was operating. I selected cases that were spin-offs from universities, cases that were spin-offs from public laboratories and institutes that were formally public laboratories themselves. I also sought to imbue my sample with regional variance. I selected institutes in the Northeast that were offshoots of both private multinationals and public entities, and institutes in the South that were both private and public. Case selection followed a replication logic; I tried to create variation with predictable causes (Yin, 1994). The primary aim of

broadening the number of institutes I reached out to for interviews was not to draw definitive conclusions regarding the four institutes that formed the core of my sample, but to develop a more robust qualitative understanding of the environment in which the institutes under the microscope were operating.

3.3.2. Negotiating Access

I called each of the four institutes that constituted my sample, explaining to the receptionists in Portuguese that I was a doctoral student at the University of Oxford seeking to get in touch with an institute representative with whom I could discuss my project and perhaps negotiate access. In the case of Institute F, my previous connections to the organization allowed me to take a more direct approach. In the other three institutes, I was either given the name and e-mail address of the appropriate person to connect with, or was patched through and able to speak with them directly. I e-mailed each of the four organizations, outlining my research aims and sharing with them a publication that I had co-authored with colleagues on Brazil's role in GVCs to signal my previous experience conducting relevant research in the country (Sturgeon et al., 2013). I was eventually able to arrange preliminary meetings in the state of São Paulo between June 2 and 10, 2014. During this trip, I met with the superintendents of Institute F and Institute V, as well as with high-level managers of Institute S and Institute E. I also reached out to additional institutes in order to begin building out my understanding of the broader set of organizations of which the four institutes I was studying formed part.

In each meeting, I explained my project as an attempt to understand how state-supported innovation intermediaries in Brazil drove industrial upgrading. I asked for permission to spend between two and four weeks at each organization, interviewing managers and engineers, as well as participating in meetings. I followed up by sending each contact an

information sheet in Portuguese, which had been approved by the Saïd Business School's Departmental Research Ethics Committee (DREC). While the English version of the letter can be found in the appendix, here I highlight the section that outlines my request for access:

> *Research at Organization X will comprise of a 2-4 week visit by the principal researcher. The visit will take place between October 2014 and October 2015. During this visit, the researcher will spend 2-4 days per week at Organization X interviewing and observing technical, business development, government relations and managerial staff. The researcher will interview technical staff to understand how software developers collaborate within and across teams. These interviews will be complemented with observational data collected during technical meetings. The researcher will also interview business development and government relations staff to understand how relationships emerge, develop and evolve over time. Finally, the researcher will interview managers to understand Organization X's core competencies and future areas of strategic focus.*

I was granted extended access to three of the four organizations that I had initially approached: Institute S, Institute E and Institute F. Institute V did not grant me extended access because they were worried about the possibility that I would unwittingly share confidential information with their competitors. But management did allow me to schedule a follow-up interview with the superintendent as well as with another high-level manager. Each of the three organizations that granted me extended access did so on the condition that I would sign a non-disclosure agreement (NDA) precluding me from sharing any sensitive information received throughout the course of my research for a limited period of time. I signed each agreement and proceeded to schedule a period of time during which I could take my place as a resident researcher at each of these organizations.

I sought ethical clearance from the Saïd Business School's DREC before entering the field. This involved drafting an informed consent form in both English and Portuguese, and

going through various iterations with the DREC, which sought clarifications and suggested changes to ensure that my participants would understand my study's aims, as well as their role in helping me to achieve those aims. The form can be found in the appendix. I went through these forms at length with the gatekeepers to each of these organizations, and had them signed by personnel I interviewed as part of my study. Not all interviews were planned and formal. Some were little more than passing conversations or brief encounters that yielded interesting insights. I had made the institute superintendents and legal teams aware that my intention was not only to interview key personnel, but to spend time participating in meetings and observing the way their institutes operated. There was some flexibility built into the research protocol, and this flexibility was discussed openly and candidly with management. Where possible, I asked the person with whom I was speaking if I could include their comments in my research, without any sort of attribution. When I was not granted permission, the comments were redacted from my notes and excluded from the data analysis. Data were stored in accordance with the EU Data Protection Directive (95/46/EC), on which the Data Protection Act of 1998 in the UK and the Data Protection Law (forthcoming) in Brazil are based. All data collected was, and continues to be stored in secure physical and digital locations that can only be accessed by me, the sole researcher on this project.

3.3.3. Entering the Field

As both a researcher and research instrument, I needed to make sure that I had the language skills required to conduct in-depth qualitative research in Brazil. I prepared for my first round of fieldwork by taking Portuguese language classes in Oxford. I met with a Portuguese teacher once or twice a week for private lessons in the two months leading up to my trip. Upon my arrival in São Paulo, I participated in a week-long intensive language course at the Fast Forward Language and Cultural Institute. I then moved to a

room in a shared home in Campinas, where I would stay from mid-October to the end of December 2014. I began my research in earnest by spending two weeks, from the 20th to the 31st of October 2014 at Institute S. I followed that extended stay with a stay at Institute E from November 3rd to the 21st, and then with an extended stay at Institute F, from November 26th to December 19th. I thus began my research by spending two to four weeks at each of these institutes, interviewing superintendents, managers, directors and engineers, and collecting observational data by wandering around the spaces themselves and sitting in on classes, meetings and social gatherings.

On a few different occasions during this first stint in Brazil, I had the opportunity to interview superintendents and high-level managers of various other institutes as well as university professors collaborating with institutes and companies on R&D projects. Some were representatives of institutes that had emerged from public entities, and some led institutes situated in the Northeast. In conducting these interviews, I developed a better understanding of the whole ecosystem of certified R&D institutes in the country. But while these interviews did open up the possibility of using ownership or location as an independent variable, thus expanding my study's scope, I resisted. I decided to remain focused on the four institutes to which I had been granted access in part because, as a doctoral student, I wouldn't have had the time or resources to properly study many more institutes. I also kept to my original sample because real heterogeneity had begun to emerge among the four institutes I was studying.

I had found substantive differences in the ways in which Institute S, Institute E, Institute F and Institute V operated, and found these differences to be both interesting and complicated to explain. These institutes all had similar origin stories, yet operated very differently as instruments of the Brazilian industrial policy regime. Some were much more tightly bound to their original parent companies than others, and were thus more

responsive to their needs than to those emanating from the Brazilian government. Four multinational firms had responded to the Informatics Law by setting up nominally independent R&D centers, but these institutes' degrees of independence from their originators varied considerably. I became interested in explaining this variation, which led me to examine multinational firms and their R&D management practices. I began to interview these institutes' clients, both in Brazil and abroad.

3.3.4. Data Collection

Data collection for this study was a multifaceted process. I recognize that each means of data collection has its faults: interviews are flawed because respondents may answer questions in ways that they think will please the researcher; documents collected may be inauthentic, and even if they are authentic, will necessarily represent what one group believes to be important to document (Zinn, 1980); observation may yield inaccurate information if the researcher does not fully understand the cultural or organizational context that he or she is operating in (Creswell, 2003). But herein lies the power of *triangulation*. While the use of one method of data collection may yield flawed data, the use of various sources of data, collected in various ways, increases the validity of constructs that eventually emerge in the process of theory construction (Yin, 1994). As a researcher, I am more comfortable defending the veracity of my findings if they are confirmed, time and time again, by various people occupying various roles in various organizational settings. I am even more comfortable if the data I collect in multiple ways and from multiple sources point me in the same direction.

In this study, I opted for semi-structured, rather than structured, interviews for two main reasons. Firstly, they best corresponded with my selected research approach. Semi-structured interviews grant the researcher the flexibility to follow disparate trains of

thought, which are helpful for the process of inductive theory building. They avoid the rigidities of structured interviews while still allowing the researcher to ensure that some critical questions are addressed in all interviews (Bernard, 1988). Secondly, my respondents varied considerably in terms of their professional roles. Given that I interviewed superintendents, directors, managers and engineers, it was important to vary the interview format to suit their different perspectives and vocabularies (Barriball and While, 1994). I engaged in purposeful sampling within each institute, selecting respondents with disparate backgrounds in order to learn as much about each institute as I could (Lincoln and Guba, 1985). At institutes and universities to which I had not been granted extended access, I focused my data collection efforts on institute superintendents and directors, as well as on professors that had worked with these institutes on R&D projects.

The interview protocol was adjusted for each interview. The level of adjustment corresponded with the degree to which my respondents varied. For example, I asked superintendents across organizations similar questions because they personally worked on similar strategic problems. These individuals also tended to be among their institutes' longest tenured employees, making them useful targets for questions about their institutes' histories. The protocol changed significantly when I spoke with managers, as my questions related more to issues of day-to-day management, in particular to how they balanced their clients' demands and their own needs. Finally, interviews with engineers focused on collaboration with external partners and clients at the technical level.

Interviews lasted between 45 minutes and two hours. Some were conducted in English and some were conducted in Portuguese. The language in which the interviews were conducted depended on the respondents' level of comfort with English. If an interview began in English, but it became clear that language was a barrier to the respondent best

expressing himself or herself, I suggested that we speak in Portuguese instead. I recorded interviews with a recording device when permitted. These recordings were stored securely and transcribed in the language in which they were conducted by either myself or a paid third party. When I was not permitted to record the interviews, I took detailed notes and typed them up soon afterwards. In many cases, I circled back to certain respondents for follow-up interviews aimed at clarifying specific points. This was part of my earnest desire to ensure that my efforts to build theory didn't violate the reality I was observing and participating in.

Eugene Webb and colleagues (1966) first discussed using unobtrusive measures to collect data in the social sciences. While many of the measures they cited were unconventional, like exterior physical signs (e.g. hair and tattoos), in-situ conversations and expressive movements, they did provide useful insights into the possibility of using observational data as an unobtrusive measure. Many observational studies suggest that reactivity – how the presence of an observer affects the behavior of the observed – is common. However, Weick (1968) claims that people preoccupied with their everyday lives often assimilate an observer's presence into their routines. Reviewing a number of large-scale classroom studies, Croll (1986) lends support to this assertion, finding little evidence of reactivity among students to researchers in their midst. By spending two to four weeks in each organization, I had the opportunity to collect unobtrusive data to corroborate interview data. This element of the data collection process shares certain affinities with ethnography, as it involves studying inter-personal interaction in-situ, exploring locally produced phenomena, focusing on practices and artifacts and producing "thick description" (Geertz, 1973). My time in the field confirmed Weick (1968) and Croll's (1986) insights; within a short period of time, I became less visible and obtrusive.

To be clear, observational data were only collected at the three Brazilian institutes in which I was a resident, not at Institute V. Being present on a day-to-day basis allowed me to better understand the complexities associated with serving multiple competing clients concurrently. Turnstiles and keycard access doors were the most visible manifestations of the inertia managers operated under. I was not allowed entry to most clients' workspaces, interviewing managers and engineers in public meeting rooms instead. I was sometimes permitted to act as an observer in informal meetings with clients. On one occasion, a large client's project managers came to visit the institute in which I was based. I was invited to lunch, where client representatives, institute representatives, and university representatives interacted on an informal basis. Also present was a representative of the client's internal R&D operation in Brazil. As one manager made clear to me, this had caused some tension, as there was fear at the institute that the client wanted to take one of its core projects in-house. These sorts of observations strengthened my understanding of the ways in which these institutes operated.

Finally, I used secondary materials to support, enhance and sometimes contradict the findings generated through my interviews and observations. I was able to access institutional presentations, annual reports to the MCTI and other documents that gave me a more complete picture of how these institutes operated, how they liaised with clients and how they ensured that their work fit within the boundaries set by the Informatics Law. The three institutes in which I spent considerable time shared with me institutional presentations geared towards clients. These presentations allowed me to understand what superintendents and managers perceived to be their organizations' core competences and capabilities. This allowed me to verify what was being said in interviews, as these documents had not been prepared for researchers like myself. Each institute is required to submit an annual report to the MCTI, outlining what projects were completed at what cost and with what outcomes. The aim is to make sure that the money

being spent at these institutes is in fact being spent on R&D. Some institute managers shared policy briefs produced by industry associations in which they participated. One institute shared human resource allocation data, which allowed me to verify whether or not the construct of organizational balkanization had any basis in reality, or if it was just an imagined constraint in the minds of managers (discussed in Chapter Six). Documents were collected opportunistically. When interview respondents suggested that certain materials could be made available, I pushed for access. These documents allowed me to verify what I was seeing and hearing at each institute.

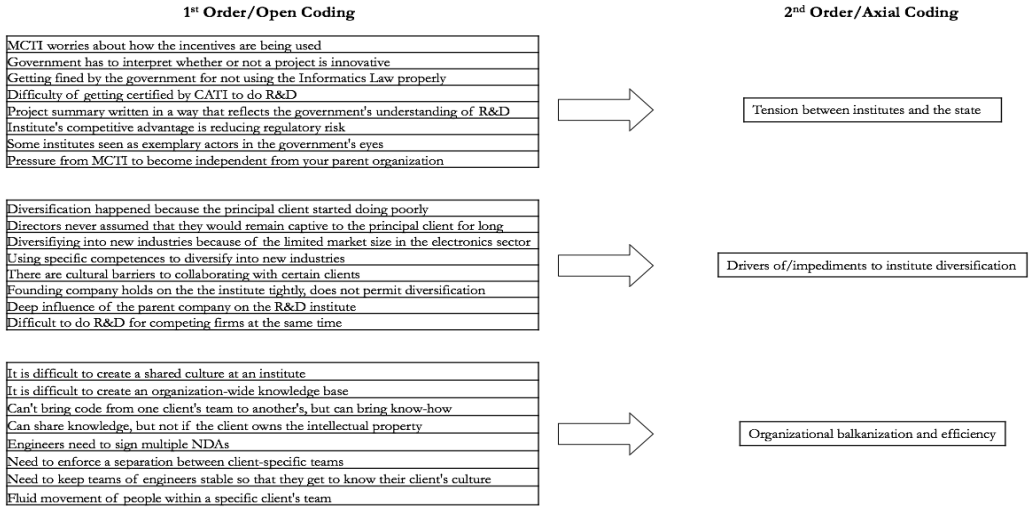
3.3.5. Data Analysis and Data Collection 2.0

I followed the process of constant comparison outlined by Glaser and Strauss (1967). Data collection and analysis were undertaken with some degree of overlap. This allowed me to make necessary adjustments to my instruments and protocols as new constructs emerged. I believe that case-study research is about the process of casing your research subject rather than demarcating rigid boundaries from the outset (Ragin and Becker, 1992; Piekkari et al., 2009). After completing my short periods of residency at each of the three institutes, I transcribed all of the interviews, and then read the transcripts as well as my interview notes. I began the analysis by examining data collected for each case individually. On the basis of my recollections, field notes, secondary materials collected and interview transcripts, I produced largely descriptive write-ups for each institute. These write-ups were by no means exhaustive. They were 2-3 page documents drafted with the aim of gathering my initial impressions and findings at each site. As Eisenhardt (1989) makes clear, the notes allow "the unique patterns of each case to emerge before investigators push to generalize patterns across cases" (p. 540). Once each of the three write-ups had been completed, I began to search for cross-case patterns, primarily

through a process of coding my interview transcripts and validating emergent patterns with the use of observational data and documents.

Interview data were analyzed along both descriptive and interpretive lines. Both of these steps were accomplished with the aid of NVivo, a software package well-suited to analyzing qualitative data. The process began with open coding to break down the data and create a thumbnail sketch of important themes, attempting to remain faithful to the terminology and lexicon utilized by my informants. I read through each of the interview transcripts and interview notes, and coded them generously. This process of open coding, or what Gioia and colleagues (2012) dub first order analysis, rendered more than 200 distinct categories. From there, I continued with axial coding, a means of selecting and connecting emergent categories to highlight specific themes and draw links between them (Corbin and Strauss, 1990). This process is similar to Gioia and colleagues' (2012) second order analysis, and involves stepping from the physical and specific to the general and theoretical. As Przeworski and Teune (1970) put it, "The bridge between historical observations and general theory is the substitution of variables for proper names of social systems in the course of comparative research" (p. 25). Indeed, this process rendered theoretical categories from the empirical material, which enabled me to create a data structure conducive to theory building. Figure 3.1 demonstrates the process of coding conducted at the three institutes that formed the core of my sample. It offers a small window into my data analysis, without going through each 1st and 2nd order code individually.

Figure 3.1: Data Analysis Examples

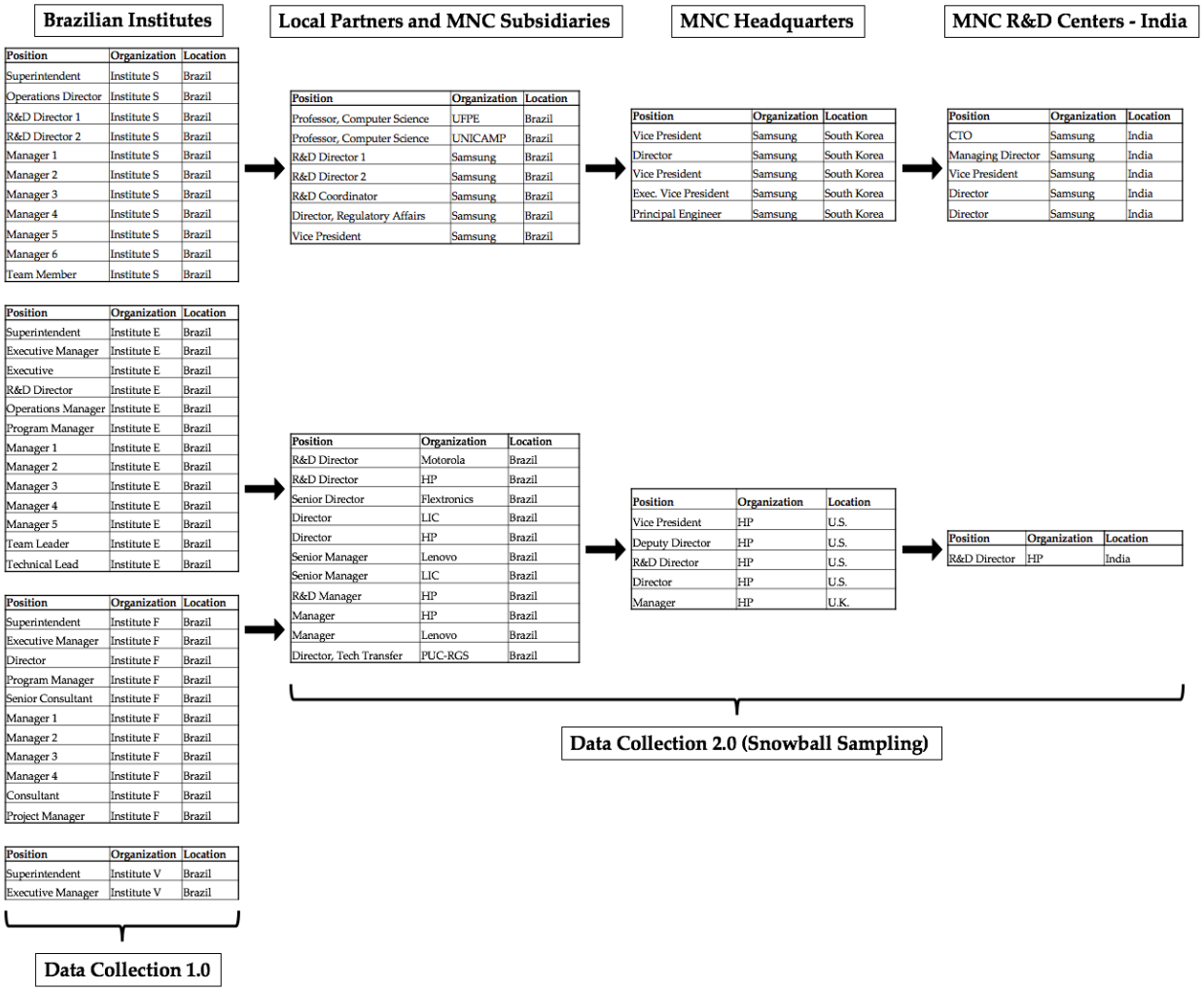


Note: Data analysis follows Strauss and Corbin (1990) and Gioia et al. (2012).

When clumped together and brought up to a theoretical plane, my codes revealed that the institutes were often subjected to conflicting demands. On the one hand, the Brazilian government pressured the institutes to separate from their principal benefactors, partly because it was worried that the R&D earmarks were being spent in a way that was not in the spirit of the Informatics Law. Institutes devoted considerable resources to framing projects in a way that would fit the government's definition of R&D. On the other hand, the institutes were subjected to considerable pressure from their primary clients, who wanted them to remain captive. Nevertheless, some institutes diversified and began serving multiple clients. Others did not. But even when institutes did diversify, the potential benefits associated with reaching a broader base of clients were rarely realized. This is because each individual client would require that the teams working on their behalf remain separated from teams working on behalf of others. So institutes dealt with pressure from the Brazilian government and from clients in different ways, giving me a great deal of heterogeneity to account for.

As I combed through data on what I had previously perceived to be three similar organizations, I became aware of the real differences between them, and strove to explain why these institutes had evolved in different ways. What was immediately apparent was that Institute S had remained captive to its benefactor while Institute E and Institute F had diversified considerably. The Brazilian government pressed for diversification at each of the institutes, while the multinational clients sought to keep them captive. Why had some institutes diversified while other remained captive? Was there any meaningful difference between remaining captive, and diversifying while erecting barriers to intra-organizational knowledge sharing? This round of data analysis raised a number of questions which I felt I could only answer by understanding both the perspective of the Brazilian government and the perspective of the multinational firms for which the institutes worked. I spoke with representatives of the MCTI and MDIC on numerous occasions, trying to better understand why the government was demanding that these institutes diversify in the first place.

Figure 3.2: Data Collection 1.0 and 2.0



Position	Organization	Location
Superintendent	Institute S	Brazil
Operations Director	Institute S	Brazil
R&D Director 1	Institute S	Brazil
R&D Director 2	Institute S	Brazil
Manager 1	Institute S	Brazil
Manager 2	Institute S	Brazil
Manager 3	Institute S	Brazil
Manager 4	Institute S	Brazil
Manager 5	Institute S	Brazil
Manager 6	Institute S	Brazil
Team Member	Institute S	Brazil

Position	Organization	Location
Professor, Computer Science	UFPE	Brazil
Professor, Computer Science	UNICAMP	Brazil
R&D Director 1	Samsung	Brazil
R&D Director 2	Samsung	Brazil
R&D Coordinator	Samsung	Brazil
Director, Regulatory Affairs	Samsung	Brazil
Vice President	Samsung	Brazil

Position	Organization	Location
Vice President	Samsung	South Korea
Director	Samsung	South Korea
Vice President	Samsung	South Korea
Exec. Vice President	Samsung	South Korea
Principal Engineer	Samsung	South Korea

Position	Organization	Location
CTO	Samsung	India
Managing Director	Samsung	India
Vice President	Samsung	India
Director	Samsung	India
Director	Samsung	India

Position	Organization	Location
Superintendent	Institute E	Brazil
Executive Manager	Institute E	Brazil
Executive	Institute E	Brazil
R&D Director	Institute E	Brazil
Operations Manager	Institute E	Brazil
Program Manager	Institute E	Brazil
Manager 1	Institute E	Brazil
Manager 2	Institute E	Brazil
Manager 3	Institute E	Brazil
Manager 4	Institute E	Brazil
Manager 5	Institute E	Brazil
Team Leader	Institute E	Brazil
Technical Lead	Institute E	Brazil

Position	Organization	Location
Superintendent	Institute F	Brazil
Executive Manager	Institute F	Brazil
Director	Institute F	Brazil
Program Manager	Institute F	Brazil
Senior Consultant	Institute F	Brazil
Manager 1	Institute F	Brazil
Manager 2	Institute F	Brazil
Manager 3	Institute F	Brazil
Manager 4	Institute F	Brazil
Consultant	Institute F	Brazil
Project Manager	Institute F	Brazil

Position	Organization	Location
Superintendent	Institute V	Brazil
Executive Manager	Institute V	Brazil

Position	Organization	Location
R&D Director	Motorola	Brazil
R&D Director	HP	Brazil
Senior Director	Flextronics	Brazil
Director	LIC	Brazil
Director	HP	Brazil
Senior Manager	Lenovo	Brazil
Senior Manager	LIC	Brazil
R&D Manager	HP	Brazil
Manager	HP	Brazil
Manager	Lenovo	Brazil
Director, Tech Transfer	PUC-RGS	Brazil

Position	Organization	Location
Vice President	HP	U.S.
Deputy Director	HP	U.S.
R&D Director	HP	U.S.
Director	HP	U.S.
Manager	HP	U.K.

Position	Organization	Location
R&D Director	HP	India

I asked the superintendents and directors of the institutes of which I was a resident to connect me with client representatives that were most familiar with their work as well as with their key local partners. Most of the time, this involved speaking with R&D managers and directors of multinational subsidiaries in Brazil, as well as with university professors and researchers in other Brazilian organizations. These interviews helped me to better understand my sample; in particular, the ways in which each institute interacted with external partners. Having had worked with the GVC framework for some time, I understood the value of looking beyond the multinational subsidiary and to its home

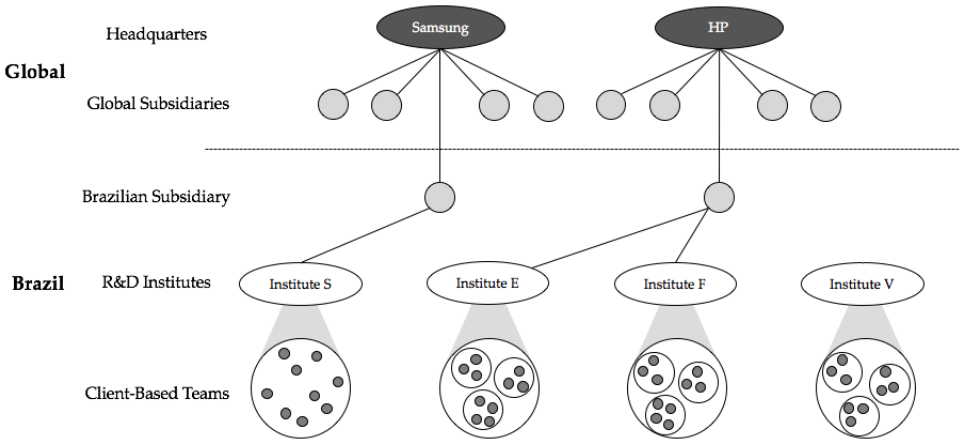
office in order to better understand how the single country I was examining formed part of a larger and more complex whole. So I asked subsidiary representatives to connect me with their counterparts or managers in their home offices (see Figure 3.2). When I was not able to gain access through my Brazilian contacts, I worked through alternate channels, including students and former students of the Saïd Business School that had connections to the firms that I wanted to study.

These interviews were conducted during various subsequent visits to Brazil, during a visit to South Korea in October of 2015 and during a visit to India in April of 2016. When visits were impractical, interviews were conducted over the phone or via Skype. This was the case for interviews with executives at HP based in the U.S. For interviews conducted with representatives of multinational corporations based in the U.S., Korea and India, interviews were conducted in English. In Korea, I was accompanied by an interpreter who assisted when respondents were unable to converse in English. During my third year in the doctoral program, I was presented with an opportunity to visit some of these firms' R&D centers in Bangalore, India. My interviews in India were opportunistic, as I was able to make the trip as an observer of a Saïd Business School EMBA module. These interviews allowed me to better understand how Samsung and HP structured and managed their R&D operations in another emerging market. Furthermore, they allowed me to isolate the effect of the Brazilian Informatics Law, as India did not have an industrial policy regime aimed at localizing foreign R&D and encouraging relations with local universities and institutions. All of the interviews conducted during the second phase of data collection were transcribed or written up if I was not granted permission to record. The data were analyzed separately from the data collected during my time in Brazil, as the material spoke to different questions: questions regarding how differences in corporate strategy could shape a firm's responses to an industrial policy.

3.3.6. Hypothesis Construction

Eventually, there were only marginal returns to additional data collection; I reached what Glaser and Strauss (1967) refer to as a point of *theoretical saturation*. Through the iterative processes of data collection and analysis, I had determined that the institutes at the center of my study were in fact loci of a conflict between multinational firms and the Brazilian government. And while data collection in Brazil did not yield a satisfactory explanation as to why institutes might respond to conflicting demands in different ways, the data collected outside the country did. Through snowball sampling, I had identified important clients for each of the three institutes I studied. The two clients that granted me access, Samsung and HP, provided me with a better understanding of why the institutes with which they worked in Brazil operated the way they did. In the end, my study was structured into three distinct levels.

Figure 3.3: Study Structure



The first was the global level, where I examined Samsung and HP. I examined these firms' corporate strategies, focusing specifically on how they managed their sprawling networks of R&D centers, especially those in Brazil and India. The second level was

Brazil. This is where I focused on how the four institutes selected had evolved over time in response to pressure emanating from the Brazilian government as well as from their multinational clients. The final level was the intra-organizational. Looking within the organizations allowed me to see how these institutes had, over time, achieved balance with respect to the conflicting demands placed on them. Each of these levels corresponds to a distinct unit of analysis: multinational firms, Brazilian R&D institutes and teams within each institute. What I observed in Brazil gave me a limited understanding of the dynamic forces governing these institutes' range of motion. Upon further examination of these institutes' main clients, I began to develop a hypothesis to explain why multinational firms' responses to an industrial policy might vary from one case to the next.

It became clear in my interviews, and through a great deal of secondary research, that Samsung and HP managed their operations in radically different ways. According to Porter (1987), "Corporate strategy concerns two different questions: what businesses the corporation should be in and how the corporate office should manage the array of business units" (p. 43). These firms, specifically Samsung Electronics and HP Inc., operate in the same consumer electronics sector, very broadly speaking. But they manage their network of business units, subsidiaries and affiliates in very different ways. I found that these corporate strategies affected how their Brazilian subsidiaries and partners responded to the country's industrial policy regime. The hypothesis that emerged from this study states that *an industrial policy's outcomes are mediated by firm-level corporate strategies.* Firms that grant their subsidiaries autonomy are likely to operate in accordance with a country's industrial policy regime while those that centralize control are less likely to operate in accordance with an industrial policy. Corporate strategy explains why firms respond differently to industrial policies, why Samsung created Institute S and SIDIA, and why HP has worked with a number of institutes like Institute E and Institute F

without creating a captive institute of its own. This process of theory building fashioned testable propositions, which are spelled out in the chapter that follows.

3.3.7. Enfolding Literature

The notion that a researcher can approach an empirical phenomenon with a theoretically untarnished mind is naïve. What was helpful in my case was that as a novitiate to the field of management, I simply wasn't well versed in the various strands of literature that comprised the field when I began this project. I had studied anthropology, sociology and development economics in the past, and recalled key works that I had read during those years while in the throes of my research. Work by scholars like James Scott (1985), Alice Amsden (1989), James Ferguson (1990) and Robert Wade (1990) certainly shaped my views regarding the role of the state in economic development. But I tried as best as I could to remain open to the data, and to put relevant literature to one side until I was prepared to engage with it.

Once I had completed the process of data analysis and had produced a hypothesis that both captured what I had observed, and could be tested in other similar situations, I went back to the literature to see if it accorded with my findings. I went first to the literature I knew best, the rich and extensive body of work on the developmental state. What I found was that corporate strategy was conspicuously absent. Foundational pieces of work like Chalmers Johnson's (1982) study of the MITI in Japan did discuss how the state interacted with the private sector, including foreign firms, to drive the process of industrial development. However, these descriptive accounts of how industrial development had played out in East Asia did not take the firm as their central unit of analysis. They focused on machinations within state bureaucracies and on the state's capacity to incent and punish private sector actors. But firms themselves were seen as little more than objects

with which these bureaucracies trifled. Part of this had to do with the fact that early work on the developmental state was descriptive in nature. People were wondering why certain East Asian economies had taken off while Latin America, as a whole, floundered. Only recently have scholars concerned with industrial development moved towards prescription. Given this shift, a more serious examination of how corporate strategy is likely to shape industrial policy outcomes is necessary.

Next, I focused on relevant literature in the area of R&D management. My study examined multinational firms from industrialized countries that had offshored and outsourced R&D activity to an emerging market. The literature has discussed why open innovation was important as firms sought to remain nimble and avoid technological obsolescence. But there had been little published on why firms might look beyond their boundaries in foreign countries with unfamiliar institutional arrangements. Furthermore, there had been little written on how regulatory drivers of R&D offshoring and outsourcing shaped the types of activities that would be undertaken in these locations, and how these R&D centers would articulate with the rest of the firms' R&D network. So I sought to extend work in the area of R&D management to cover cases in which firms are required to do R&D in places that they would not ordinarily do it: places without the low wages that would merit setting up a development center or the knowledge that would merit erecting a home base augmenting (HBA) center (Kummerle, 1999).

Finally, I found the literature on institutional theory to be useful for understanding how the institutes I was studying managed conflicting demands while focusing on operational efficiency. Meyer and Rowan (1977), who posited that organizations create ceremonial structures to conform to society's rationalized myths, gave me a lexicon through which to explain how these institutes were able to operate while conforming to the government's requirements through symbolic means. Further, the literature on strategic

responses to institutional demands allowed me to talk about variation between firms' responses to imperatives emanating from the government and from their clients. I found that my research extended certain elements of this body of work. While there have been efforts to explore how symbolic responses evolve, these efforts have been limited, and have not, in my estimation, captured the complex co-evolution of demands and responses. By examining these institutes and government policies spanning 10+ years, I was able to closely interrogate how unsatisfactory responses beget policy changes, and how these changes beget new responses, and how those unsatisfactory responses beget further policy changes, and so on and so forth. My research posits strategic responses to institutional demands as dynamic processes rather than single occurrences.

3.4. Limitations

This chapter would be incomplete without a sober examination of this research project's limitations. Firstly, and perhaps most obviously, my sample is small. I am examining two multinational firms and four Brazilian R&D institutes. As was stated earlier on in this chapter, the larger the sample, the more confident the researcher can be in generalizing on the basis of his or her findings. My limited resources, in terms of both time and finances, coupled with the research methods I chose to employ, made it difficult to increase my sample size. I built my theory on the basis of a small number of cases. Nevertheless, as explained previously, I don't believe that this issue negates the validity of my findings. Secondly, I alone carried out this study. Therefore, I did not have the benefit of alternate views, and did not have opportunities to discuss themes and ideas that emerged while conducting fieldwork. Yin (1994) introduces the idea of investigator triangulation – having multiple researchers looking at the same thing – as a useful means of building validity in case study research. The nature of this study precluded the inclusion of other researchers.

Finally, and perhaps most importantly, this study is limited because it requires a leap of faith on the part of the reader. Firstly, I am asking the reader to trust that I have the skills required to carry out research; that I have received the methodological training necessary to do the research I did, and to do it well. Secondly, I am asking the reader to trust that I have the wherewithal to acknowledge my biases, and to at least try to put them to the side when conducting research. The efficacy of grounded theory depends on the researcher approaching an empirical setting without any pre-fixed theoretical frames in mind. Of course, no one can quite live up to this standard, but I am asking the reader to trust that I did my best to ensure that the material spoke to me largely unobstructed by theoretical lenses. Finally, for my findings to be believable, the reader must trust that I have not knowingly manipulated my data to tell a compelling story. Replicability has long been the way to correct for this issue. But it is unlikely that another researcher will be able to follow the trail I've laid out in my methodology section and arrive at the same theory that I did. All I can hope is that researchers inspired by this work will take the theories developed here and apply them to other settings, where they can be validated or disproven. Furthermore, I hope that this study will prove to be a starting point for further theory work at the nexus of corporate strategy and industrial policy.

3.5. Conclusion

I believe that we live in a world full of tangible artifacts and structures, and that as a researcher, I can uncover relationships between the social world's constituent elements. My research approach has been informed and shaped by these ontological and epistemological stances. I began this project by setting a broad research question in my sights and allowing it to guide me through the case selection and data collection processes (Eisenhardt, 1989; Yin, 1994). My consulting work exposed me to the Brazilian

Informatics Law and to the variety of ways in which multinational firms responded to it. In my doctoral work, I set out to explain the heterogeneity in strategic responses. I began a process of theoretical sampling by first spending a week in Brazil interviewing superintendents and managers of various R&D institutes. Given that I was interested in how industrial policies shaped multinational firms' strategies, I selected centers that were offshoots of multinational firms.

Through a recursive process of theoretical sampling, I identified four R&D institutes that demonstrated significant variance in the degree to which they were independent from their multinational benefactors. The cases included Institute S, Institute E, Institute F and Institute V. These cases were selected to vary along certain parameters, which would grant the constructs produced greater external validity (Denzin, 1970). From the onset, I decided that my core unit of analysis would be the R&D institute. My selection of data collection methods was driven by my guiding question: why did I observe variance in strategic responses to industrial policy? Qualitative data are helpful for understanding the dynamics underpinning observed relationships (Eisenhardt, 1989). I was granted extensive access to three of the four institutes in my sample. While my study began as an analysis of the R&D institutes that emerged as a result of the Informatics Law, I soon found myself curious about different units of analysis as well. At the macro-level, I became interested in the effects of the industrial policy on multinational firms' global operations. At the micro-level, I became interested in knowledge management within the R&D institutes that had managed to diversify their client base.

Thus my doctoral project became a multilevel study focusing both on these R&D institutes' multinational parents as well as the client teams they were comprised of. I had collected the data necessary to examine these institutes at the team level through my interviews and periods of observation. I set out to understand how the Informatics Law

had shaped multinational firms' global technology strategies by first selecting two cases according to the logic of theoretical sampling, and then interviewing key corporate executives at each of the two firms that would comprise my comparative case study. The procedure for data collection and analysis followed the contours of my work at the level of the R&D institute. Much like I had previously, I first conducted within-case analysis followed by cross-case comparison to develop hypotheses that would explain the reasons for heterogeneity. I began largely agnostic regarding the theoretical hooks I would use to grapple with my guiding question, and over time, found the appropriate theoretical lenses through which to more thoroughly describe what I was observing (Glaser and Strauss, 1967). The three levels of analysis depicted in Figure 3.3 map onto the three chapters that follow.

4. INDUSTRIAL POLICY REFRACTION

4.1. Introduction

Although industrial policy fell out of fashion in the late 1980s and 1990s with the onset of several financial crises in the developing world coupled with the spread of the 'Washington Consensus,' it is clearly now back in vogue (Wade, 2012). But the world today is substantively different from the world in which countries like Singapore and South Korea first industrialized – countries today cannot realistically hope to build vertically integrated industries within their borders. Accounting for this new reality, scholars have sought to distill general design rules that states should follow to carve out higher-value roles in the global economy (Rodrik, 2004; Sabel, 2009; Gereffi and Sturgeon, 2013). But some have long argued that these structural accounts and prescriptive rules overlook the political orders that create the variation we see from one industrial policy regime to the next (Dobbin, 1994; Breznitz, 2007).

This chapter seeks to engage with the other side of the coin. Just as some have sought to uncover the sources of variation between countries' industrial policy regimes, this chapter seeks to answer the question of why firms respond to a country's industrial policies in different ways. I argue that firms *interpret* industrial policies in ways that are consonant with their corporate strategies, which are in turn products of specific times and places (Stinchcombe, 1965). Firms therefore *respond* to industrial policies in different ways, leading to varying degrees of industrial policy refraction. Refraction is especially apparent when policies are applied to multinational firms, which are less familiar with the institutional environment that produces the policy regime than are their domestic counterparts. As such, this chapter focuses specifically on foreign direct investment (FDI)-oriented industrial policies, answering the question of how and why multinational firms respond to them in different ways.

Above all else, FDI-oriented industrial policy is about encouraging foreign firms to do that which they would not necessarily do of their own volition, or to invest more than they would otherwise choose to invest. It is about meaningfully impacting the ways in which global firms make decisions and manage their operations. In the case of R&D investment promotion in particular, the state's aim is to maximize the value of an investment by inducing knowledge spillovers and encouraging the localization of complex R&D that yields patents and publications. The firm's aim, assuming that there are no discernible cost- or talent-related justifications for the investment, is to minimize the value of the investment, and to ensure that the R&D carried out is of marginal value, so as to reduce the risk of losing control of core technologies while operating under weak legal regimes of appropriability (Teece, 1986).

This chapter is about why differences between firms matter for policymakers. The empirical fodder for this chapter is the Brazilian Informatics Law, and the ways in which it shapes how two consumer electronics companies – Hewlett Packard[11] (henceforth HP) and Samsung Electronics[12] (henceforth Samsung, unless otherwise specified) – manage their R&D operations in Brazil and beyond. These firms are appropriate cases for the task at hand because they are both profitable global companies that operate in the same broad sector, that spend considerable sums on R&D, that manage globally distributed R&D networks and that have been conducting R&D in Brazil for similar periods of time, and have recently generated similar revenues in in the country, leading to similar R&D

[11] This chapter accounts for the company's division into HP Inc. (printers and computers) and HP Enterprise (servers, cloud infrastructure, IT services) in 2015. After 2015, it focuses primarily on HP Inc., unless otherwise stated.

[12] This chapter focuses on Samsung Electronics, one of the many affiliates that fall under the umbrella of the Samsung Group. While the chapter focuses on the electronics affiliate, it does discuss the group as well, especially with regard to the Office of the Chairman and the Samsung Advanced Institutes of Technology (SAIT), two divisions critical to electronics that serve the rest of the business group as well.

obligations and R&D employment levels. See Table 4.1 for descriptive statistics that speak to the aforementioned points.

Table 4.1: Comparing Samsung Electronics and HP, Globally and in Brazil

		Samsung Electronics	HP
Global (2014)	Total Revenues (USD Billion)	188.9	111.5
	Employment (Thousand)	307	302
	R&D Personnel (Thousand)	50	30
	R&D Spending (% of Sales)	7.3%	3.1%
Brazil (2012)	Revenues (USD Billion)	3.41	3.39
	R&D Obligation (USD Million)	136.4	135.6
	R&D Personnel (Internal/External)	2,000	1,400
	First R&D Center	2004	2003

Source: Company Annual Reports (2014), Brazilian Ministry of Science, Technology and Innovation (2012)

On the basis of interviews with executives, managers and engineers, as well as secondary materials, I find that these companies, while similar in many ways, respond to the Brazilian Informatics Law differently, each in a way that reflects its own corporate strategy, and by extension its organizational structure. Hewlett Packard grants its Brazilian subsidiary a great deal of autonomy, allowing it to interact with the local environment on its own terms. Samsung Electronics's Brazilian subsidiary operates in close coordination with headquarters, limiting the scope for local responsiveness. Thus, the degree of industrial policy refraction is greater in the case of Samsung than it is in the case of HP. The main lesson for policymakers is that FDI attraction should account for variation in firm level strategy when engaging in investment promotion efforts.

What follows is an overview of each case, beginning with an examination of each firm's history and how it manifests in their corporate strategies. Then I move to discuss how each firm manages its global R&D operations, and finally examine how the Brazilian Informatics Law has shaped these operations, both in Brazil and elsewhere. The purpose of the discussion is to demonstrate how an industrial policy's ability to achieve its desired outcomes is contingent upon a given firm's idiosyncratic corporate strategy. When multinational firms invest abroad, they bring their baggage – their ways of doing things – with them. They respond to industrial policies in ways that fit with their ways of doing things, regardless of what the policy's goals are. The link between an industrial policy's goals and its outcomes is rarely linear, and rarely uniform among companies targeted; it is refracted by distinct organizational features, leading to variation in outcomes.

4.2. The HP Way

HP has long valued autonomy. So much so, in fact, that it is the crux of the HP Way, the company's famed philosophy, which is perhaps best summarized as "give someone a job, set high expectations and clear objectives, and get out of the way" (House and Price, 2009, p. 217). In a 1995 memoir, David Packard recalls giving longtime engineer Charles House a medal for "extraordinary contempt and defiance beyond the normal call of engineering duty" in 1982 for pushing along what would turn out to be a highly successful display monitor project against his explicit orders. In fact, of the six major transformations that Charles House and Raymond Price (2009) identify in the company's history, only one was driven by Bill Hewett and all were resisted by David Packard. "The secret is that they backed people—often mavericks—and gave them enormous power to succeed if they could demonstrate positive results" (p. 33). These transformations were groundswells first championed by individuals inhabiting different nooks or crannies of the organization. It stands to reason that these transformations would not have come about

had the instigators not felt empowered to bring ideas to their managers, to their managers' managers, and so on and so forth.

As the company grew, scaling up and scaling out, its founders sought organizing frameworks that were consonant with their own ideas about management, specifically with regard to the role of individual employees in the process of strategy formulation and implementation. David Packard and Bill Hewitt were introduced to Peter Drucker's influential Management by Objective (MBO) philosophy, which first emerged in the management lexicon with the publication of Drucker's *The Practice of Management* in 1954, and gained popularity in the 1960s with his work and that of his student, George Odiorne. Drucker's ideas dovetailed well with the HP Way. They gave HP tools through which to formalize the decentralization of the organizational planning process, encouraging buy-in and commitment from employees at all levels of the corporation, both at home and abroad. David Packard went as far as saying that:

> *No operating policy has contributed more to Hewlett-Packard's success than the policy of 'management by objective.' Although the term is relatively new to the lexicon of business, management by objective has been a fundamental part of HP's operating philosophy since the very early days of the company…the antithesis of management by control…a tightly controlled system of management of the military type…Management by objectives, on the other hand, refers to a system in which overall objectives are clearly stated and agreed upon, and which gives people the flexibility to work toward those goals in ways they determine best for their own areas of responsibility (1995, p. 154)*

The company would later adopt elements of *Hoshin Kanri*, an MBO-inspired Japanese integrative management model that combined data-driven quality control with employee accountability for strategy implementation (Witcher and Butterworth, 1999). In fact, one of the first companies to implement *Hoshin Kanri* (under the name Hoshin Planning) was Yokogawa-Hewlett-Packard (YHP), a joint venture between HP and the Yokogawa

Electric Corporation, established in Japan in 1963. After years of mediocre results, David Packard handed YHP operations over to Kenzo Sasaoka, a Japanese manager who began implementing Hoshin Planning in 1977 (Packard, 1995). By 1982, YHP had become one of the company's most profitable divisions through dramatic improvements in quality, precipitating the rollout of the Hoshin methodology throughout the entire company in 1985 (Dahlgaard-Park, 2015). In Hoshin Planning much like in MBO, "…each unit within the organization is responsible for defining objectives, thus becoming a 'strategy owner'" (Feurer et al., 1995, p. 6).

As this case indicates, the company's penchant for individual autonomy carried to the rest of the organization, shaping the process of decentralization and internationalization that began in 1957, the year the company went public and partitioned itself into separate divisions. The organization was first split into four main product divisions: Audio-Video, Microwave and Signal Generator, Frequency and Time and Oscilloscopes. Unlike competitor DEC, which organized divisions according to function, HP divisions had their own marketing, manufacturing and R&D teams so that they could operate independently of the larger organization. In a way, each division became its own self-contained company with both the market knowledge and ordained discretion necessary to change course if needed. HP had begun to internationalize in the late 1950s and early 1960s as well, arranging joint ventures like YHP, making acquisitions, or setting up wholly owned subsidiaries, always ensuring "the greatest possible degree of local character and autonomy at the various international organizations" (HP Measure, 1973, p. 25).

But by the 1980s, various divisions had outgrown their britches, with some employing as many as 1,500 people across a number of locations, responsible for managing a range of products. As a result, the company started splintering these unwieldy divisions along product lines (Packard, 1995). HP adopted what can be best described as a cellular growth

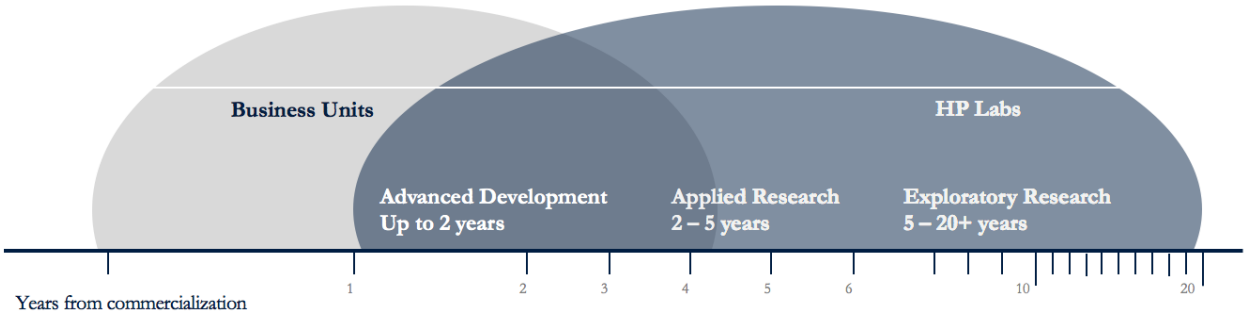
model, splitting business units when they grew too large to allow for hands-on management and regular face-to-face interaction among employees (Sieloff, 1999). Over time, the proliferation of independent divisions led the company to adopt a group structure, with related divisions brought under a group manager. Still, each business unit housed its own manufacturing, marketing and R&D teams locally to ensure that problems could be resolved swiftly, and market trends and technological advances could be quickly translated to commercial products. However, as the company continued to grow, the benefits of functional specialization and outsourcing became abundantly clear.

Given the company's strongly divisionalized structure, it had to aggregate internally along functional lines before it could engage in strategic outsourcing (Gospel and Sako, 2010). While the company had traditionally kept most activities in-house, it pioneered the outsourcing of "non-core" activities like production and IT services in the late 1980s and early 1990s. Production was first to go, for a variety of reasons. Sturgeon (2002) claims that the increased reliance on contract manufacturing on the part of American electronics firms was a result of increased capabilities and functional upgrading on the part of global suppliers, as well as increased market volatility, which made product scheduling difficult. HP now outsources its high-volume manufacturing to various global contract manufacturers, keeping high-value, low-volume manufacturing in-house (i.e. high-end servers). Furthermore, HP began offshoring IT services in the 1990s, a period during which various multinational firms took advantage of advances in ICTs to offshore routine business activities like back-office finance, accounting and document management services to low-cost locations like India (Fernandez-Stark et al., 2011). While most of this work was initially kept in-house, it was eventually handed off to one of many Indian outsourced service providers like Wipro and Infosys.

Apart from production and certain back-office functions, HP has seldom outsourced R&D in any meaningful way. In most cases, it remains the responsibility of the individual business units. Nevertheless, it was clear from the beginning that some degree of functional specialization would be necessary. HP Labs was formalized in 1966 to address two of the major R&D-related problems wrought by the company's split into autonomous divisions. The first was that the company's R&D personnel were now geographically divided, limiting opportunities for collaboration by individuals with different backgrounds or areas of dominion. The second was that having an R&D team in close communion with a commercial team meant that researchers focused more on divisional profit-and-loss statements than they did on research into new and transformative ideas (House and Price, 2009). Newly established divisions were quick to adjust to consumer demands, but did not have the incentive to preempt their demands, or to invest in emergent business areas.

HP Labs was created to be an engine of corporate renewal. The organization has kept this mission intact through the years, growing beyond the confines of a single site; it now employs more than 1,000 people in Palo Alto, USA, and Bristol, UK, among other locations worldwide. Furthermore, it orchestrates partnerships with universities around the world, often seeking out and engaging with professors with expertise in any area critical to the company's long-term vision, and sometimes soliciting proposals from university researchers, through the company's Innovation Research Program, for example. HP was originally divided into two global business groups, Printing and Personal Systems (PPS) and Enterprise. HP Labs served both. This is likely to remain the case despite HP's split into two separate companies, HP Inc. (printing and computer) and HP Enterprise (enterprise solutions, services and software).

Figure 4.1: HP's R&D Horizons



Source: Adapted from HP Presentation

According to one company executive, HP classifies R&D into three broad sets of activities: inventive creation, which is driven by HP Labs, prototyping and support and maintenance, which are undertaken at the business unit level. Individual business units are responsible for covering their divisional R&D budgets, hence the focus on activities closest to market (see Figure 4.1). Support and maintenance are the most labor-intensive activities in software R&D. Some printers have a seven-year life cycle, which means that they need to be compatible with various operating systems, security systems and network protocols. The labor-intensive nature of support and maintenance is what initially drove the company to seek out opportunities for wage arbitrage abroad. HP began to offshore R&D to India as early as 1988 to take advantage of the country's low-cost skilled labor. Today, it is the company's largest R&D operation outside the U.S.

India has become one of the company's horizontal R&D hubs, with two centers in Bangalore, one of which supports divisions under HP Inc. and another that supports those under HP Enterprise. The center that serves HP Inc. employs 850 people, directly and indirectly, as contractors. These jobs are funded directly by the Inkjet, Laserjet, Graphics Solutions (large-format printers) and Managed Print Solutions divisions. Given that India is a cost-competitive location for software development, many business units

fund the center for support and maintenance work as well as last-mile product and service development. As one longtime R&D manager makes clear, "Bill and Dave…did not give a product to India. We don't run a product out of India. This organization was built as a task-oriented organization." The center focuses on software R&D, specifically on three core activities: printer firmware, cloud solutions and quality and testing. Seventy percent of the work falls under the category of support and maintenance while 30 percent falls under prototyping and new product development.

HP's corporate strategy is conditioned by its founders' longstanding belief in autonomy, as codified in the HP Way and supported by consonant organizing frameworks such as MBO and *Hoshin Kanri*. This section has traced the effect of these organizational idiosyncrasies on the company's R&D management practices in particular, demonstrating that the early decision to divide R&D teams into business units limited space for collaboration, sacrificed long-term planning for short-term profitability and raised costs by reducing opportunities to scale labor-intensive R&D activities. But functional specialization allowed the company to create space for collaboration, both internal and external, to focus on its long-term technology strategy and to reduce the cost associated with support and maintenance. While both HP Labs and HP India serve a broad constituency, they do so for different reasons. HP Labs engages in applied research and advanced development before pushing a technology to its corresponding business unit(s). This corrects for the lack of incentive to invest in blue sky projects within business units. India is a transversal R&D center for cost-related reasons. It is less costly to do product maintenance – a relatively labor-intensive task – out of India than anywhere else. Unlike these two centers, the company's third horizontal R&D unit, located in Brazil, is a direct result of the country's Informatics Law. HP Brasil R&D will be discussed at length later in the chapter.

4.3. The Samsung Way

What is today known as the Samsung Group was founded while South Korea was a Japanese colony. The group has pursued a Japanese model of diversification and vertical integration since its inception: diversification through cross-subsidization between business areas, common for large conglomerates known in South Korea as *chaebol,* and vertical integration in terms of incorporating most, if not all, the functions necessary to bring a product or service to market. The group's history is deeply intertwined with that of South Korea, where the government stimulated catch-up growth by granting *chaebol* subsidies to encourage their entry into otherwise unattractive industries, and making said subsidies ruthlessly contingent upon performance (Amsden, 1989). Much like the Korean developmental state, the Samsung Group centralized strategy formulation and directed implementation at each of its affiliates and subsidiaries. It engaged in long-term planning through the Office of the Chairman, created in 1959 to manage Samsung's increasingly large and diverse network of affiliates, and to support the chairman's long-term planning (Lee and Lee, 2007). Quite unlike HP, which delegated considerable authority and discretion to individuals and subsidiaries, the Samsung Group maintained tight control over its subsidiaries, driving change and corporate renewal from the top.

Samsung got its start in 1938 as a trading company, and diversified through the years, often in lockstep with the Korean government's industrial policies. It made its first foray into the electronics industry in 1969, when it established Samsung-Sanyo Electronics, a joint venture between Samsung and Sanyo, which would become a wholly owned subsidiary (Samsung Electro-Mechanics) in 1975. It would begin by producing black-and-white TVs as well as white goods (air conditioners and washing machines) before it made one of its first big bets, on semiconductors. The Korean government selected semiconductors as one of its focus areas as part of a broader heavy and chemical

industries drive in the mid-1970s. The company moved quickly, acquiring a small semiconductor firm in 1974, and creating a semiconductor R&D lab in 1982, mostly to reverse engineer bipolar and metal oxide semiconductors (Kim, 1997). Shepherding funds from its profitable business areas, the Samsung Group upgraded to very large scale integrated (VLSI) circuits production – focusing on 64K direct random access memory (DRAM) – by licensing the technology from a few small U.S.-based semiconductor design firms, by building two small internal R&D teams, one in Silicon Valley and one in Korea, and by building a mass-production plant in just six months. Against all odds, Korea became the third country in the world to produce DRAM in 1983, behind the U.S. and Japan (Kim, 1997). Over time, it shifted away from licensing, instead depending on its own internal R&D teams to lead ensuing DRAM projects (256K, 1M, etc.). Samsung Electronics now holds upwards of 40 percent market share in the global DRAM market.

The group's diversification into semiconductors, as well as into other sectors like automobiles, was guided by the Office of the Chairman, the 'command tower' (Lee and Lee, 2007). However, the 1997 Asian financial crisis radically altered the organ's composition and orientation. Before the crisis, once the chairman decided to push in a certain direction and consensus was achieved in the 'Supreme Operation Committee,' especially from executives of more powerful affiliates that had to agree to bankroll these projects, the organization moved quickly to realize the new vision. But as Lee and Lee (2007) argue, the 1997 Asian financial crisis reduced the group's appetite for risk. The Office of the Chairman had long been anchored by two core teams, planning and finance. With the onset of the financial crisis, power was transferred from the planning team, which had long driven the process of industrial diversification, to the financial team, which had been charged with managing flow of capital between affiliates (Lee and Lee, 2007). Ambitious investments were largely off the table going forward, as the focus became efficiency at the affiliate level rather than growth through diversification. To

emphasize the point, the Office of the Chairman was renamed the Corporate Restructuring Headquarters in 1998. The shift away from planning and towards affiliate-level efficiency constituted a cultural shift. However, it wouldn't be long before the company set its sights on new ambitious projects.

The Corporate Restructuring Headquarters was renamed the Strategic Planning Office in 2006. This division's existence was short-lived, however, as a 2008 corruption scandal forced it to be disbanded. The command tower was revived in 2010 under the new moniker, the Future Strategy Office. However, a recent executive reshuffle has cast uncertainty over the office's future.[13] The Samsung Group has pushed into new industries in recent years. Today, the *chaebol* is the face of South Korea's foray into the biopharmaceutical industry, building enormous biosimilar manufacturing facilities and even pushing into innovative drug development (Wong, 2011). However, it appears that the command tower's shift away from long-term planning and towards affiliate-level efficiency may endure, changing the way the company formulates its corporate strategies, especially those aimed at developing and incubating new business segments.

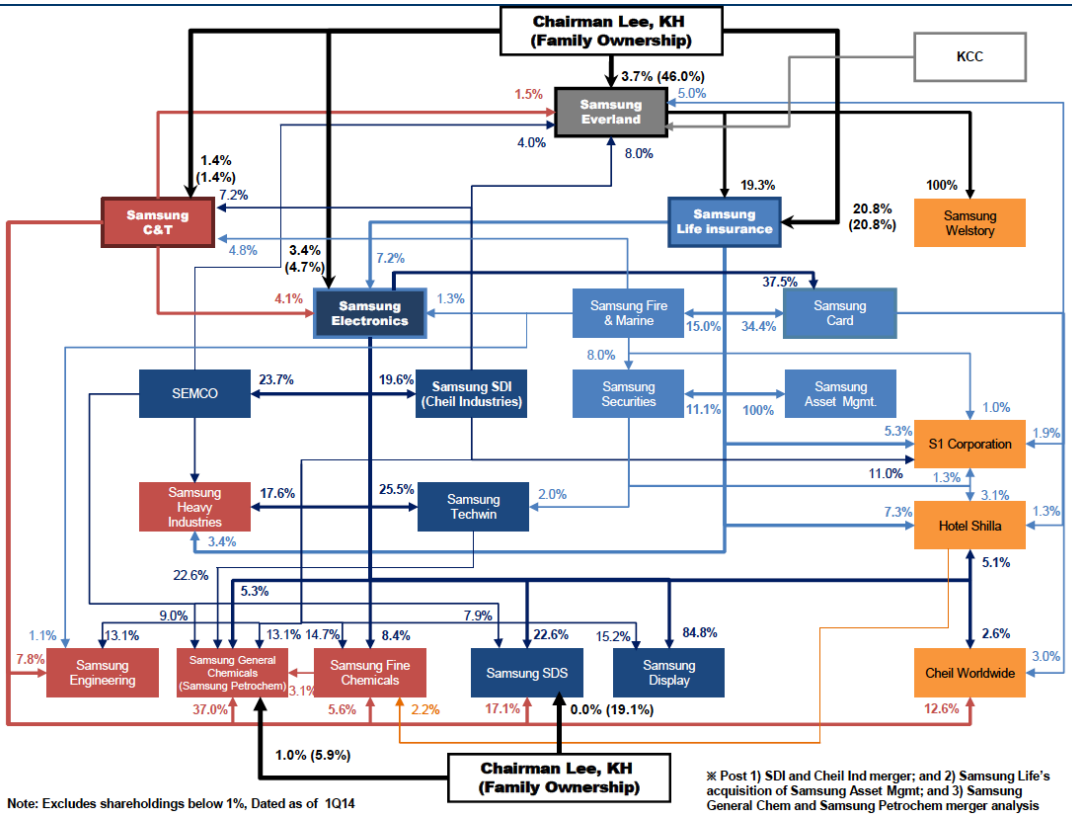
Beyond the Office of the Chairman, the firm began to appropriate Western management practices in the 1990s, focusing less on adopting foreign technologies as a catch-up strategy and more on product design, innovation and marketing. Chairman Lee's 'New Management Initiative' was announced in 1993, beginning a process of westernization that continues to this day. While the company began with the mantra of "contribution to the nation through business," the 1990s saw it change direction in an effort to become a "world-class company in the twenty-first century" (Song and Lee, 2014). Today, Samsung can be said to have a hybrid management system that combines Japanese practices of

[13] For a full account outlining the executive reshuffle and implications for the Future Strategy Office, see *Korea Times* article: http://www.koreatimes.co.kr/www/news/tech/2015/11/133_191303.html.

vertical integration and quality improvement with Western concepts of marketing and branding (Khanna et al., 2011). Increasing openness to outsiders and their ideas has allowed Samsung to expand dramatically, as growth is no longer as constrained by the availability of long-time insiders as it once was. However, as Khanna and colleagues (2011) remark, "Culture is a hard nut to crack." Few outsiders have been successfully incorporated into the firm, especially at the managerial level, and strategy formulation remains centralized and implemented by directive.

Even though the Samsung Group has globalized, decentralized and hired foreigners, it remains largely hierarchical and insular to this day. Much like the Korean developmental state, the group's strategy has been to place big bets, selecting an industry or business area, and focusing on it by redirecting resources tied up elsewhere in the organization; an internal "flying geese" pattern (Song and Lee, 2014). Indeed, one of the pillars of the Samsung Group's competitive advantage has been the ability to quickly reconfigure its internal competences in line with changing environmental conditions (Teece et al., 1997). But quick and centralized decision-making has meant that affiliates and subsidiaries have little agency to speak of; directives come from the top and are executed at the periphery. This centralized management style is made possible by the firm's complex ownership structure, and is evident upon closer examination of the company's R&D operations.

Figure 4.2: Samsung Group Ownership Structure



Source: Credit Suisse Equity Research, Kim et al. (2014)

The company's ownership structure affirms that it is an integral system rather than a loosely tied set of affiliates. While the group has yet to create a formal holding company, the Chairman and his family maintain control through direct holdings in Samsung Everland, Samsung Life (insurance), Samsung C&T (construction and trading) and Samsung Electronics, which gives them indirect control over other affiliates. Gil Kim and colleagues at Credit Suisse mapped out the group's complex ownership structure as of 2014, demonstrating how direct family ownership coupled with circular ownership between affiliates serves to keep the Chairman and his family in control (see Figure 4.2). This ownership structure is a reflection of the group's existence in the liminal space between Japanese and Western management; some of the group's affiliates, like Samsung Electronics and Samsung C&T, are publicly traded companies. Nevertheless, they remain

controlled by the chairman through holdings in other affiliates, as has been demonstrated by the high-profile attempt by U.S.-based hedge fund Elliott Associates LP to block the merger between two of the group's affiliates, Samsung C&T and Cheil Industries, which served to solidify the chairman's control of the company.[14]

Here, our discussion shifts away from the Samsung Group, and towards its flagship company, Samsung Electronics. Being a part of the larger Samsung Group has shaped Samsung Electronics' R&D management practices. An analysis of Samsung Electronics' global R&D network is vital if we are to examine how the firm has interacted with the Brazilian industrial policy regime. In the past, new product development was typically driven by strategic partnerships, technology licensing and reverse engineering, as the early days of Samsung Semiconductor demonstrate. As the company's technological capabilities grew, it began investing in R&D. Today, R&D is almost always conducted within the boundaries of the firm. While Samsung recently established an Open Innovation Center and touts its various programs aimed at building partnerships with universities, few would characterize the company as a prophet of the open innovation mantra. As Song and Lee (2014) remark:

> *…internal innovation has taken increasingly precedence as Samsung has grown into a global leader. While the company continues to incorporate external knowledge through its overseas research institutes and its pursuit of open innovation, Samsung's internal capabilities now push the frontiers of technology and create new product categories (p. 180).*

Samsung operates a global, layered network of R&D centers. At the top of its R&D structure is the Samsung Advanced Institute of Technology (SAIT), which was founded

[14] Although this attempt to weaken the founding family's hold on the company failed, Elliott Associates LP continues to press Samsung to simply its ownership structure. See Adam Lashinsky's (2016) article titled "Samsung Won't Cave Easily to Its Activist Investor" for more details on this story: http://fortune.com/2016/10/06/samsung-elliott-data-sheet.

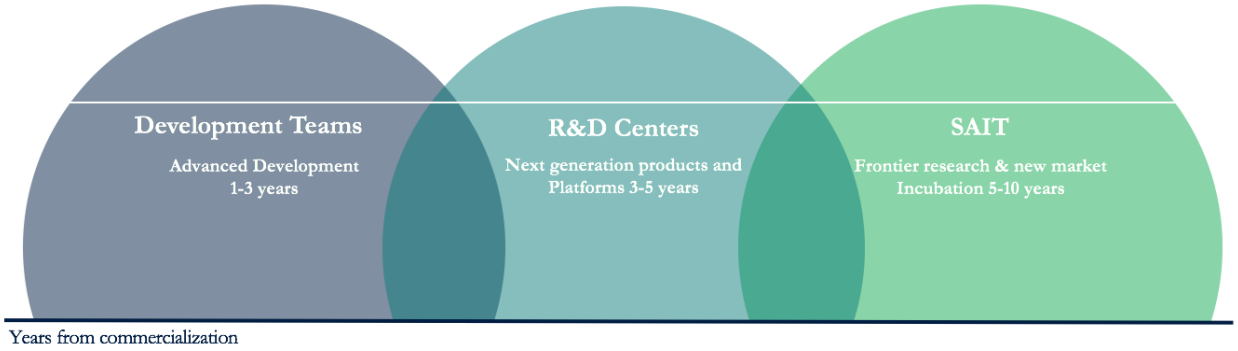
in 1987. This division focuses on long-term technology strategy, identifying future high-growth markets and procuring technology through patents and university partnerships, or through investments in internal R&D. It is important to note that SAIT works with the entire Samsung Group, not just with Samsung Electronics. Since Samsung Electronics did away with the position of Chief Technology Officer (CTO), SAIT has become the organ charged with formulating and implementing technology strategy through the development of ten-year roadmaps (Song and Lee, 2014). Thus, Samsung Electronics does not create its own technology strategy. It implements the technology strategy developed by SAIT and Samsung Group leadership via its broad network of R&D centers and development teams.

SAIT conducts research that is, if successful, pushed into relevant companies' and affiliates' pipelines for further development and commercialization. In the case of Samsung Electronics, SAIT pushes new technologies to the company's global R&D centers, of which there are now more than thirty in a number of countries around the world. These centers focus on both the development of next-generation products and platforms in broad thematic areas, sometimes on the basis of technologies developed at SAIT, and the localization of global products to their specific markets, working in close proximity with each country's commercial division. Whether a Samsung Electronics R&D center focuses on next-generation products and platforms or on localization depends, in large part, on the center's location.

Centers located in global technology centers tend to focus more on developing global products and services. For example, Samsung Research Japan (SRJ) – Yokohama works on core parts and components for global products. Centers located in large markets without clear and strategically important areas of technological expertise are often given competence-exploiting mandates, localizing global products. Samsung Research China

(SRC) Beijing focuses on telecommunications standardization and commercialization for the Chinese market. Of course, most centers occupy a place along the local-global R&D continuum. Closest to market in the Samsung R&D structure are the product development teams. These teams focus on technologies that are one to two years away from being commercially viable products. This layer of Samsung's R&D network is the most geographically dispersed, as these centers must collaborate with commercial branches in all major markets to understand local consumer demands. See Figure 4.3 for a depiction of Samsung's R&D system, organized by time to commercialization.

Figure 4.3: Samsung's R&D Horizons



Source: Author, based on interviews with R&D managers

Samsung Electronics does not organize its R&D teams along strict product lines. It manages its R&D network much like its parent company manages its network of affiliates, as integral and overlapping components of a closed and interconnected system. Each center focuses either on a set of core technologies, whether they be in semiconductors or mobile telecommunications, or on a geographic market, which is the case with some R&D centers in emerging markets. R&D managers interviewed for this study remark that it is common for headquarters to commission various R&D centers to work on the same problem; each brings its own expertise to the table and comes up with its own solutions. In the end, one solution is selected for further development and

eventually, commercialization. Much like the rest of the company, R&D is managed centrally by SAIT and by the Samsung Group leadership. Samsung Electronics' R&D centers largely execute based on directives, which are highly specified in a center's early stages, and broaden once competence trust has developed (Sako, 1992).

Samsung first began offshoring R&D in the 1990s, setting up centers in the United States and the United Kingdom to develop technologies, and a center in India to take on feature phone software development. Since its initial foray into India with the establishment of Samsung India Software Operations (SISO) in 1996, the company has expanded its R&D presence there dramatically. It operates one R&D center in Noida, which works on smart TVs, feature phones and low-end smartphones. This center focuses primarily on the local market. The company has a second R&D center in Bangalore, where it develops software for advanced smartphones, works on protocols for wired and wireless devices, and supports ongoing work in chipsets and printers. Most of this work is for the global market. Samsung Research India – Bangalore (SRIB) also runs research projects through its internal SAIT unit, which was created in 2009 to run digital technologies, materials simulation and bioinformatics projects.

An examination of Samsung's history reveals that the company's strategic management practices, far from being *deus ex machina*, are intimately linked to the Korean developmental state, to the founder and his family as well as the to the organization's command tower, the Office of the Chairman. These actors have all exerted considerable influence over the firm's strategic direction through the years, from its entry into semiconductors, to the management of its global R&D network. Samsung's R&D network operates as an integral whole, with purposefully blurry boundaries separating R&D centers, which work concurrently to solve company- rather than business unit-specific problems. There is little autonomy to be had at the level of individual subsidiaries. This

is especially apparent in the case of R&D. Some Brazilian engineers interviewed for this study claim that objectives often come from above with little in the way of technical or strategic explanation. The Chairman sets the Samsung Group's direction, often with the support of the command tower, and the strategy is executed at each of the affiliates, including Samsung Electronics. This chain of command explains Samsung's response to the Brazilian Informatics Law, which will be discussed at length in the pages that follow.

4.4. HP R&D in Brazil

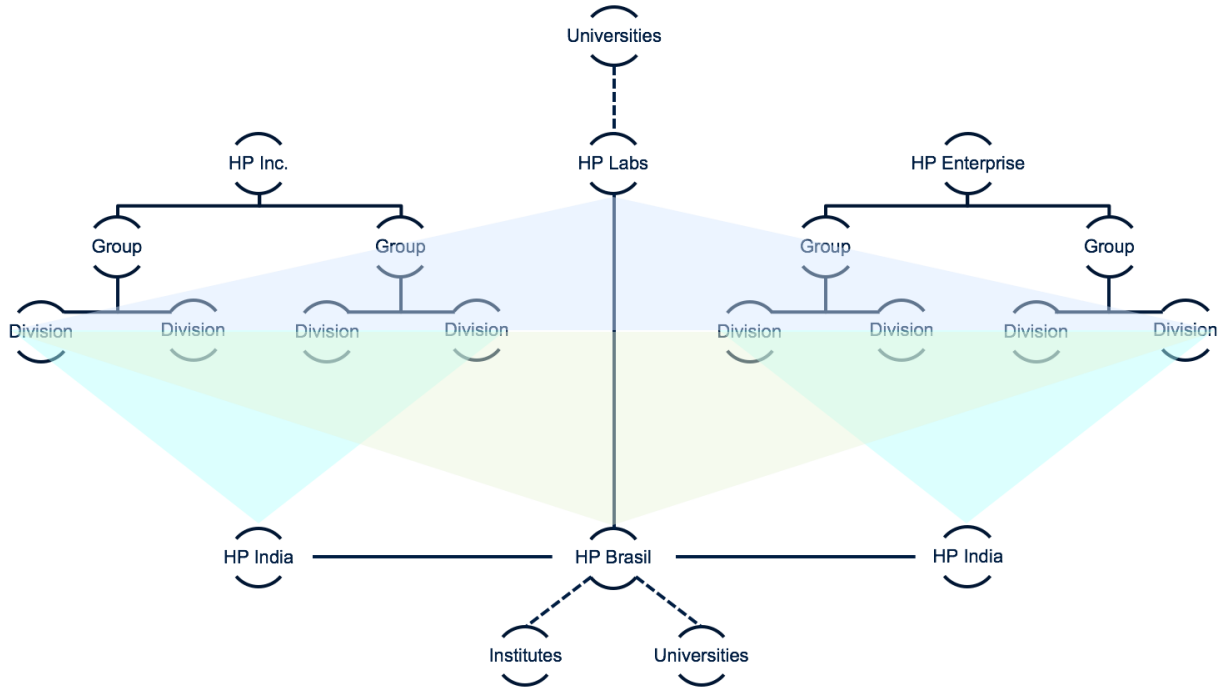
HP first set up a sales office in Brazil in 1967. Although it had started producing instruments and calculators locally as early as 1975, the establishment of the market reserve for informatics goods in 1984 restricted the firm's ability to access the local market. To continue operating in the country, it formed a joint venture with one of the various newly created national champions, Edisa Eletrônica Digital. Shortly after the market reserve ended and rules regarding foreign ownership of electronics firms were relaxed, HP bought out the Ioche Group's ownership stake in Edisa. And following the company's spin-off of Agilent Technologies in 1999, the newly consolidated HP Brasil narrowed its focus onto consumer electronics, namely printers and computers. In 2001, HP began conducting R&D in Brazil in accordance with the Informatics Law's requirements. The Porto Alegre R&D center was formally inaugurated in 2003, and remains the company's R&D hub in the country to this day.

As has been discussed, HP's R&D teams are attached to specific business units. The company's three horizontal R&D operations are Labs, India and Brazil. But while Labs was created for blue sky projects and India was an effort to engage in wage arbitrage, there was no obvious business case for R&D in Brazil. There was just no talent- or cost-related justification for a horizontal center in the country. Given that it was a product of

an idiosyncratic industrial policy that meant little to people outside the country, HP Brasil had no obvious home in the company's global R&D network. It had to search the global HP R&D network for business units that needed support. According to a local manager, the unit mapped out the company's global operations and decided to offer its services to Grenoble, France, where the Personal Systems (computers) group was based. The unit was quickly incorporated into the organization's R&D structure thereafter, coming under the direct management of the CTO's office. It has since co-defined its competences with the CTO's office, broadening its areas of focus to burrow itself into the core of HP's global R&D network.

According to the Informatics Law, fiscal incentives were granted (and R&D investments required) in exchange for local production of specific goods. Thus, given HP's divisional approach, each division producing in Brazil was responsible for spending a certain percentage of country revenues on local R&D. According to company directors, business units initially treated this R&D quota as a tax. The earmarked funds weren't used toward productive ends. Part of this had to do with their unfamiliarity with the Informatics Law, and part had to do with the relative importance of the Brazilian market. Over time, revenues and R&D earmarks rose in lockstep. Business units realized that they were paying out of pocket for R&D services that they weren't using to further develop their product lines. Eventually, HP made its Brazilian R&D operation a shared resource pool that served various business units as well as HP Labs on a competitive basis. Business units propose projects to be run through Brazil, and the CTO approves those that fit with the country's capabilities.

Figure 4.4: Configuration of HP's Global R&D Network

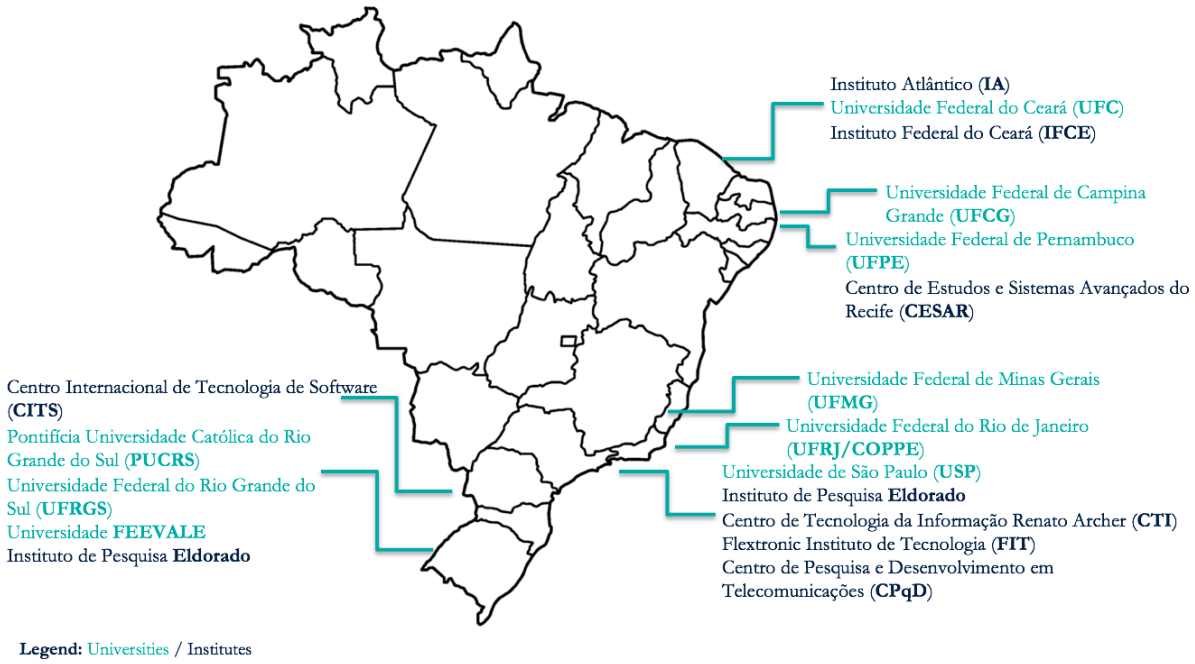


Source: Author, based on interviews with company executives and R&D directors

Figure 4.4 offers a sketch of HP's global R&D network, incorporating major transversal elements: HP Labs, HP India and HP Brasil, as well as some of their key external partners. While HP India operates two R&D centers, one for HP Inc. and one for HP Enterprise, HP Brasil, along with its partner institutes and universities, serves both. The Informatics Law does not allow companies to use earmarked R&D funds for last-mile development, de-bugging or what several executives refer to as ruggedization, which involves preparing a product for market. This takes place either in the corresponding business unit or in HP India. HP Brasil will often manage the tech transfer process to India, handing over projects once they are beyond regulatory coverage so that they can be completed in a more cost-effective location. Thus HP India works directly on behalf of various business units, but also receives last-mile development work from HP Brasil.

Today, 20 percent of the work in HP Brasil is for HP Labs and 80 percent is for business units in HP Inc. and HP Enterprise. Furthermore, the law has encouraged HP to set up a network of R&D service providers rather than opening up one large, captive R&D center. Only 40 percent of HP Brasil's R&D workforce is directly employed by the company. Of the 70 R&D programs that HP Brasil runs annually, 40 are in collaboration with partners, which include both universities and research centers certified to access earmarked funds. According to R&D managers in Brazil, each of these relationships is managed differently. Some partners prefer highly codified projects with clearly defined outputs while others prefer to have discretion over the project's design. Relationships with universities generally involve funding small, student-led projects that are of little immediate value to the company but serve to train students and perhaps add value long term.

Figure 4.5: HP's Brazilian R&D Partner Network



Source: Adapted from company presentation

Projects at HP Brasil are generally structured as follows. Each project has a champion in the larger organization, whether it be HP Labs or a business unit's R&D department. HP Brasil is the technical and managerial lead, and, when necessary, contracts an external partner to execute a discrete set of tasks (see Figure 4.5 for a map of HP Brasil's R&D partners). HP Brasil will prototype and develop a quasi-product before pushing it elsewhere to be ruggedized and finally commercialized. For example, in 2010, HP Labs brought HP Brasil a software-defined networking project, which HP Brasil worked on in collaboration with a Brazilian research institute called the Instituto Atlântico. While most of the work initially took place at the Instituto Atlântico, it was eventually brought into HP Brasil, which eventually pushed the product out to the responsible business unit for last-mile development and commercialization in 2014.

The Informatics Law has shaped the way that HP structures its R&D investments in Brazil, as well as the way it orchestrates its global R&D network. All company representatives interviewed state that without the law, HP would not have a substantial R&D presence in Brazil, much less a horizontal center critical to the functioning of the rest of the R&D apparatus. Brazil has wedged itself into HP's R&D system, working with HP Labs, HP India and individual business units to bring new ideas to market. According to one manager, the company has spent more than $200 million on R&D in Brazil in the last five years. The policy requires that HP not only invest in local R&D, but also collaborate with local universities and research institutes. The company does not engage in external collaboration on a systematic level anywhere else aside from HP Labs, which engages with various universities to access novel technologies. Finally, HP Brasil has carved out its own niche in its parent's global R&D network, actively crafting its own set of core competences to increase its global relevance.

4.5. Samsung R&D in Brazil

Samsung first entered the Brazilian market with a sales desk in 1986. It would establish its first factory in the country in 1998, in the Manaus Free Trade Zone (ZFM), to assemble hard disk drives (HDDs), computer displays and cell phones. It established its second factory in 2004, this time in the state of São Paulo, to gain access to the fiscal incentives made available through the Informatics Law. But while the company had agreed to localize production, it was reluctant to invest in R&D. Indeed, according to a Brazil-based company executive, Samsung fought the Informatics Law until 2002, at which point it realized that its efforts were futile, and that it would have to invest in R&D to avoid fines. The company began investing in R&D for mobile solutions and digital TV in Brazil in 2004. It did so through two nominally independent R&D centers, Institute S (São Paulo) and SIDIA (Amazon), although SIDIA remained largely dormant until 2013. The content of the work to be undertaken was a point of contention from the beginning, according to the same executive, with "the Koreans fighting to only do testing, and [the newly hired Brazilian R&D director] fighting to do research."

These institutes began as peripheral nodes in the company's global R&D network. They had no clear *raison d'être*. According to the same company executive:

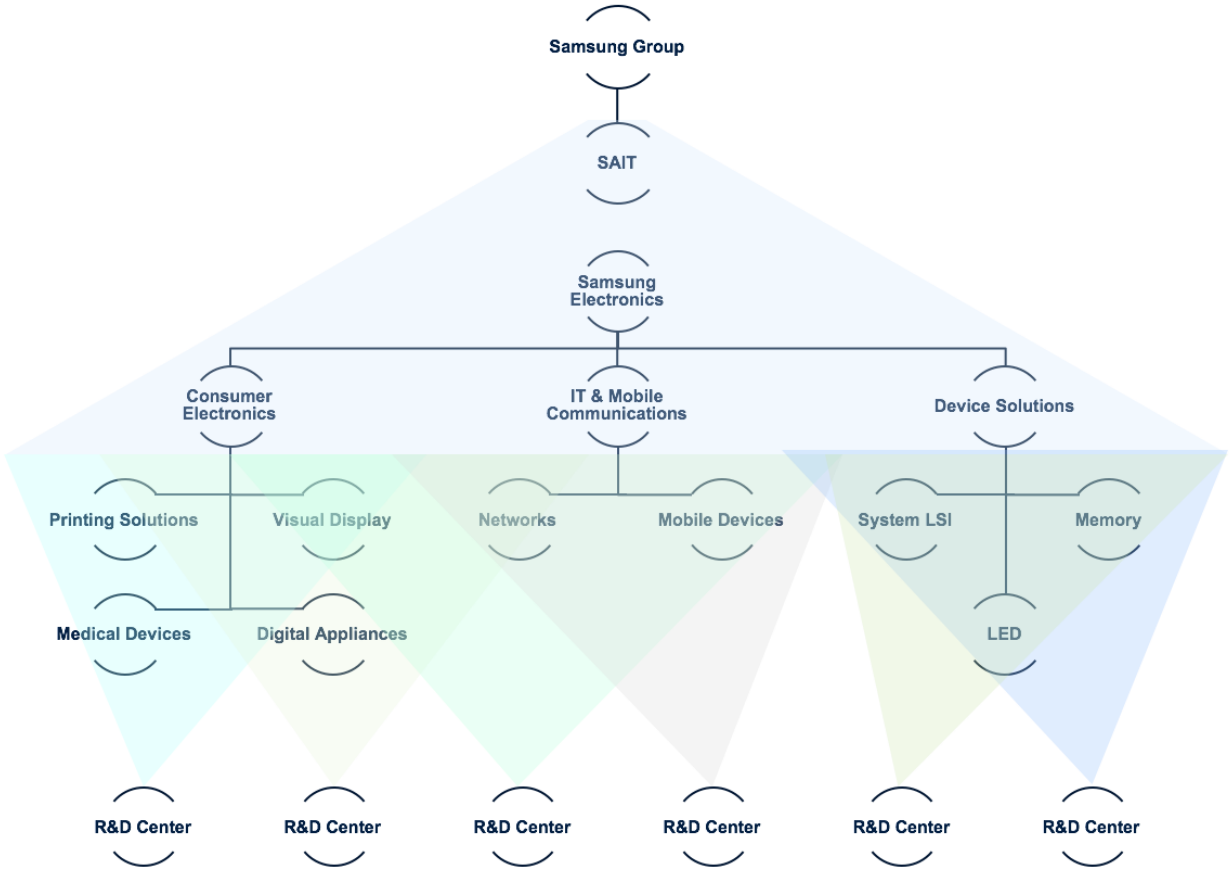
> *In other countries, you would create centers for some immediate reason. In Russia, it was an enormous volume of unemployed people that were experts in hardware. So an optics center was created there…In Israel, same thing, a center for software development. Same thing in India. The aim was to capture and encapsulate those qualities.*

The only reason Samsung had begun investing in R&D in Brazil was to avoid fines for non-compliance with the Informatics Law. Executives suggest that the Brazilian workforce was neither cost-effective or technically superb. But although Brazil was an

R&D backwater from the very beginning, it was still tightly articulated to company headquarters. As has previously been stated, Samsung R&D is a centrally managed, integral system. For the first five years of operation, Institute S only worked with Samsung Korea on projects around testing and development of mobile handsets for the Brazilian market. For example, Institute S worked with a local bank, Banco do Brasil, to develop a barcode reader for mobile payments, developing an algorithm that would enable the phone's relatively low-quality camera to capture and read printed barcodes.

Samsung's Brazilian R&D operation grew in size and scope in line with the company's growing in-country revenues, as was required by law. One Brazilian executive comments that once the annual R&D obligation surpassed $100 million, the firm had to find a way to restructure its operations and to work on more meaningful projects. While the company had long spent its R&D quota exclusively through its nominally independent partners, Institute S and SIDIA, it finally established an internal R&D lab in 2011 (SRBR). After all, the law allowed firms to spend half of their R&D funds internally. Furthermore, the large increase in the R&D obligation made it impossible to work on local testing and development projects alone. Thus, SRBR and Institute S began working on global platforms including security platforms and embedded software products. While the Brazilian operation has grown in size and scope, it remains relatively peripheral to the larger R&D network and focused primarily on the local market.

Figure 4.6: Configuration of Samsung's Global R&D Network



Brazil's insertion into the company's global R&D network does not appear to have radically transformed its R&D management practices. Samsung's R&D centers have broad and ever-changing mandates, which has allowed Brazil to enter the network without creating ripples outward. There is a great deal of overlap in the projects that these centers take on, especially between the company's consumer electronics and IT & mobile communications groups. See Figure 4.6 for a thumbnail sketch of Samsung's global R&D network. Unlike HP, where R&D teams are typically tethered to specific business groups, Samsung's R&D centers either develop technologies that serve various business units (i.e. semiconductors, software platforms) or develop a range of products for specific end markets. Global projects are typically executed at the company's competence-creating centers, those that hold dominion over a specific set of technologies, like the Samsung

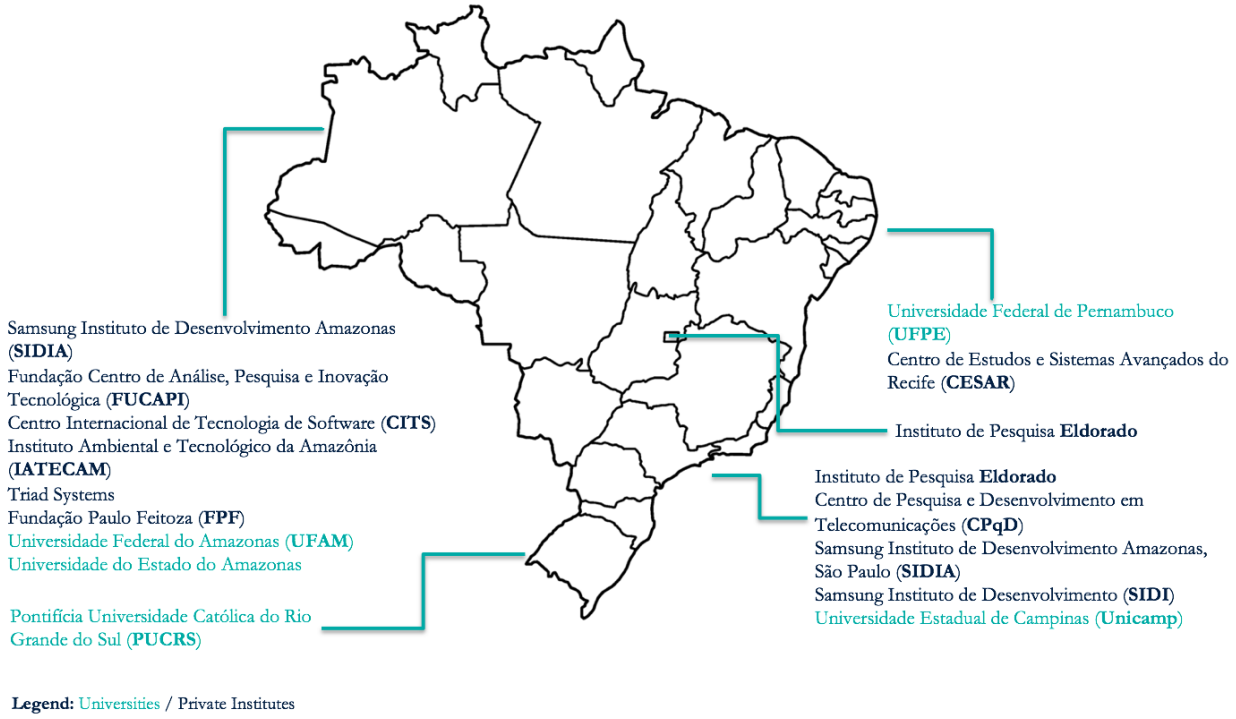
Semiconductor China R&D Center (SSCR) or the Samsung Semiconductor Israel R&D Center (SIRC). But they are also often allocated to various global R&D centers, which compete to produce the most effective solution. Local projects are typically incubated in the centers closest to market. Samsung Research India Bangalore (SRIB) has worked on products like the Tandoori microwave oven, Bike Mode (which blocks calls while the mobile device owner is driving a scooter) and Activwash technology, a feature that allows customers to wash shirt collars efficiently.

The evolution of Samsung Brasil's R&D operation required a shift in mentality at the top. The first director of SRBR came from the headquarters, from the finance division. This reflected both Samsung's need to control the periphery from the center, as well as its attitude towards Brazil in the company's R&D system. One Brazilian subsidiary manager argued that unlike most global multinationals, Samsung remained a Korean firm: "They don't let go." In the case of Brazil, the company sought to maintain a lid on costs and ensure that the minimum legal amount would be spent on projects in the country. As one executive claims, if the R&D obligation was $100 million, he would spend $80 million and vacillate with the remainder. The company's mentality towards R&D in Brazil began to shift in 2013, when a Korean-Brazilian researcher was appointed the new head of SRBR. The Brazilian R&D operation became less about cost control and legislative maneuvering and more about producing valuable knowledge inputs for the corporation. But while this shift did reflect Brazil's changing importance in the company's global R&D network, it did not lead to substantive change with respect to the subsidiary's autonomy.

Although Samsung was able to cover both the internal and external R&D earmarks through SRBR, Institute S and, more recently, SIDIA, the Informatics Law requires collaboration with universities as well. As a result, Samsung Brasil has engaged with professors on a number of projects through the years. But these partnerships are

commonly specified by the client from the outset. One professor who has worked with Samsung claims that "if it's on the road map, great. If it's not, it's out." A number of Brazilian university professors reflect that they are sometimes managed like outsourced business service providers rather than researchers. Samsung Brasil has long collaborated with research institutes as well. See Figure 4.7 for an overview of Samsung's Brazilian R&D network. The company outsources work to other institutes when it does not have the capabilities or the bandwidth necessary to execute specific projects internally. Demand volatility affects annual R&D earmarks, making it more attractive to maintain a small pool of personnel in other organizations. Samsung R&D managers state that these relationships typically have a narrow focus and are strictly managed. Samsung's relationships with external partners have been tightly controlled by SIDI, which serves as an intermediary between the partner and headquarters.

Figure 4.7: Samsung's Brazilian R&D Partner Network



Source: Author, based on interviews with company R&D managers

The Informatics Law has impacted how Samsung structures both its local and global R&D operations. Locally, it has forced the firm to collaborate with external partners, something that it does nowhere else below the SAIT level. Samsung's growing slice of the expanding Brazilian market for consumer electronics coupled with the law's presence over a long period of time has meant increasing R&D obligations. This has forced the company to increase spending in Brazil even as it reduces the amount of R&D offshored elsewhere. As interviews with Brazilian R&D managers and engineers demonstrate, increased funding has not meant increased autonomy and responsibility. The company's Brazilian R&D network remains tightly articulated with headquarters, leaving local managers with little interpretive space to respond to the industrial policy on their own terms. In this case, Samsung's strategy disrupts the policy from achieving its aim of localizing complex activity, and encouraging knowledge spillovers through external partnerships.

4.6. Discussion

The central argument in this chapter has been that firms respond to industrial policies in ways that are consonant with their corporate strategies, leading to significant variance in policy outcomes. The link between an industrial policy regime and its outcomes is mediated by organizational factors, which to date, have been underspecified by the literature. A firm's strategy and structure are conditioned by its founders, as well as by the external environment at specific periods in time, which include the time of founding and periods of radical change. Arthur Stinchcombe's (1965) insight that "organizations formed at one time typically have a different social structure from those formed at another time" (p. 154) has been elaborated through the years, and is known today as imprinting, "a process whereby, during a brief period of susceptibility, a focal entity develops characteristics that reflect prominent features of the environment, and these

characteristics continue to persist despite significant environmental changes in subsequent periods" (Marquis and Tilscik, 2013, p. 201). To summarize, corporate strategy is the result of internal and external factors at time of founding, or during subsequent periods of susceptibility.

Once an organization has congealed – once it has moved well beyond its establishment, and has achieved a certain level of stability – it becomes resistant to external pressure. By the time HP and Samsung came into contact with the Brazilian Informatics Law, their strategies had reached a level of stability that made them resistant to externally-mandated change. As Charles House and Raymond Price state early on in *The HP Phenomenon: Innovation and Business Transformation* (2009), once solidified, organizational characteristics are often obdurate and enduring:

> C*ompanies, like people, cannot change their stripes easily. Their style gets baked in, perpetuated, and inculcated so deeply that it becomes ingrained, patterned, and virtually innate. Indeed, if culture is something that becomes intrinsic and deep, it should be able to resist and repel even substantial challenges, to reassert its imprint and impact (p. 5).*

This explains why organizational responses to external demands may be limited, in general. Of course, firms typically acquiesce to regulatory demands, but they often resist normative and cognitive demands, especially when operating outside their home countries (Oliver, 1991; Scott, 1995; Kostova et al., 2008). Once a firm's style becomes deeply inculcated, it becomes difficult to shape, especially for an external actor on which the firm relies relatively little for resources or legitimacy, such as a foreign government regulating an MNC subsidiary.

Both of the firms examined in this chapter are products of specific people, times and places. Bill Hewlett and David Packard empowered individuals to help co-determine the

firm's strategic orientation from the very beginning. Individual empowerment remained the company mantra as it grew, influencing the company's early divisionalization along product lines. HP's decentralization and internationalization in the late 1950s and early 1960s constitutes what Marquis and Tilscik (2013) dub a "sensitive period," a time of change and upheaval during which an organization is receptive to influences from the external environment, leading to the incorporation of MBO and Hoshin Planning into the HP Way. Lee Byung-chul founded Samsung in 1938 and served as chairman until his death in 1987. His family continues to control the now sprawling Samsung Group through direct and indirect ownership in a number of key affiliates. Samsung has always been controlled from the center, with the Office of the Chairman managing the company's early diversification efforts in the 1960s and 1970s. The company's strategic orientation co-evolved with that of the Korean developmental state, as the case of Samsung Semiconductors demonstrates. The firm's practice of strategy implementation by directive has meant little autonomy for its subsidiaries.

These firms' varying strategies come into focus when examining the ways in which they manage and organize their R&D operations. HP has long separated R&D teams along product lines, aggregating only when necessary, as the cases of HP Labs, HP India and HP Brasil demonstrate. Each division manages its own R&D budget, accepting projects from HP Labs when appropriate, sending support and maintenance work to HP India when less costly and running projects out of HP Brasil if it manufactures goods there and needs to spend on local R&D as a result. Foreign subsidiaries like HP India and HP Brasil have varying degrees of discretion over the competencies they incubate and types projects they take on. Furthermore, they manage their local partners as they see fit. On the other hand, Samsung separates R&D from the specific product group. While R&D centers are sometimes linked directly to specific divisions – Samsung Semiconductor Israel R&D Center (SIRC) to the Device Solutions group, for example – they are often

granted amorphous mandates that cover a range of end markets, and vacillate between providing global and local solutions. Competencies to be incubated at each R&D center are often determined from the top, as are the projects each center works on.

Both HP and Samsung have set up and expanded R&D centers in Brazil in response to the country's Informatics Law. These firms have managed their Brazilian R&D centers in very different ways. HP Brasil has had to carve out a role in its parent company's global R&D network, and has been granted a great deal of autonomy with regard to what sorts of competencies it chooses to incubate and develop. The reason HP Labs gave the aforementioned software-defined networking project to HP Brasil is that the subsidiary had hired a researcher with expertise in the area. Country managers knew that HP Labs was prioritizing advanced development for software-defined networking, and hired this researcher to attract this work. Local managers have used their autonomy to focus on developing organizational capabilities that they see as being critical to HP worldwide. As one HP Labs executive puts it, "The team in Brazil has, over time, shifted to a position where they're better at the initial prototypes, and we tend to favor that function." Not the other way around. Executives and managers in the U.S. are intimately aware of the capabilities available in Brazil, and leverage the resource to support their business unit's R&D agenda. I argue that HP's longstanding practice of devolving authority to its subsidiaries has allowed its Brazilian operation to be more responsive to the country's industrial policy while still upgrading within the company's expansive R&D network. It has certainly allowed the subsidiary to manage its local partners on its own terms. HP Brasil has used the policy as an external resource to insert itself and expand within its parent's global R&D structure.

Contrary to HP, Samsung has long centralized decision-making, allowing it to adapt to changing circumstances quickly and decisively. This has meant relatively little autonomy

for its subsidiaries. The company's Brazilian R&D centers were given mandates by headquarters from the very beginning. They have focused primarily on advanced software development for a range of products particular to the Brazilian market, and have only recently begun to collaborate on global projects. Samsung executives in South Korea exhibit only a limited understanding of Samsung Brasil's R&D capabilities, much less the capabilities of its partners. One R&D manager in Brazil explained that over time, the country has become a more important node in Samsung's global R&D network. It has even developed an SAIT nucleus within SRBR. When I brought this up to Samsung executives in South Korea, they shuffled through their papers and told me bluntly that there was no SAIT in Brazil. This statement belies a lack of deep familiarity with organizational capabilities in Brazil, or perhaps wishful thinking on the part of local managers. But the lack of familiarity does not translate to a lack of control. Samsung has managed its subsidiary's strategic response to the Informatics Law, down to how it manages its external partnerships with Brazilian research institutes and universities.

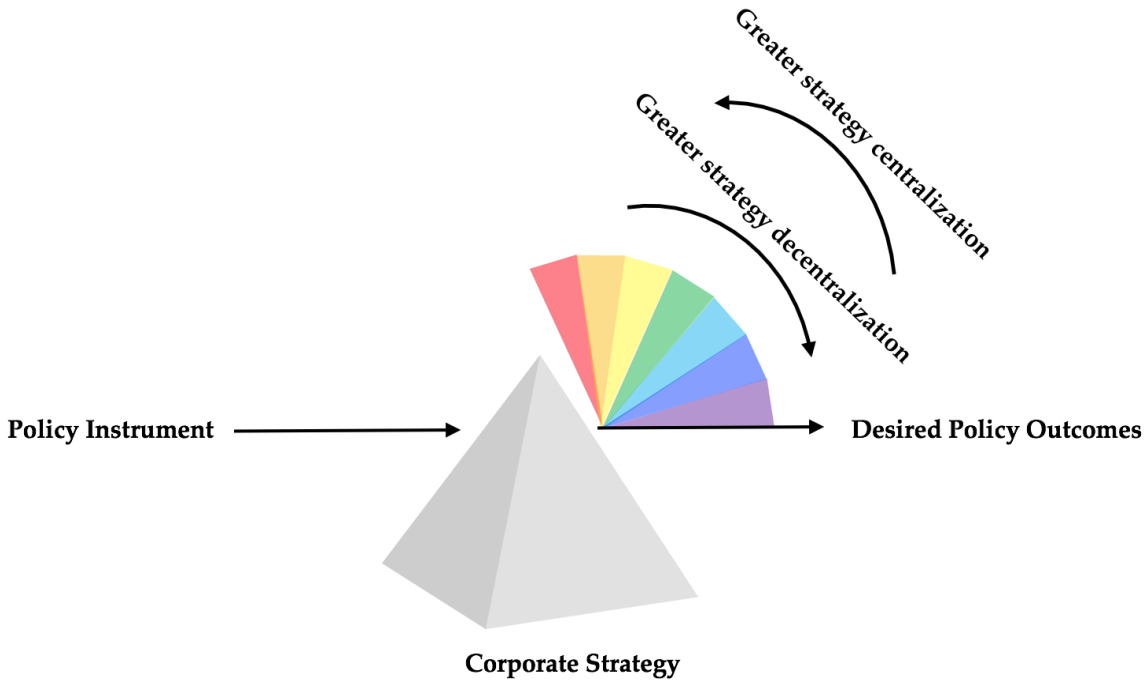
Given what we know about these firms, that they are large companies of a similar age that compete in the same broad industry and operate global R&D networks, we should expect them to respond to the Informatics Law in similar ways. But conversations with policymakers confirm that Samsung has been less aligned with the country's developmental agenda than has HP. One CATI official states that Samsung is "not doing anything illegal, let's put it that way. But we need to change this business as quickly as possible." Conversely, HP is seen as being well in line with the policy's intent. While some have argued that Samsung's ability to operate at the margins of what is considered legal is a direct result of its sheer size and importance for the broader market, the same could be said of HP. Then what distinguishes these two firms in terms of their responsiveness to the Informatics Law is the degree to which they grant their subsidiaries the autonomy needed to not only navigate the policy, but to leverage it as a resource.

As this chapter has demonstrated, HP and Samsung interpret and react to the Informatics Law in ways that are consistent with their unique corporate strategies. There are instances in which industrial policy and corporate strategy are more closely aligned, as is the case with HP, and there are those in which they are not, as is the case with Samsung. Recent work on industrial policy has focused on the design principles or structural considerations that produce desired outcomes. After years of in-depth empirical research on the developmental state, some scholars have shifted towards prescription, outlining design principles (Rodrik, 2004) and arguing for 'open' industrial policies (Sabel, 2009) or 'GVC-oriented' industrial policies (Gereffi and Sturgeon, 2013). Policy regimes that fit these molds are likely to succeed. Those that don't are not. On the whole, the industrial policy literature has tended to privilege the macro perspective, focusing on the broad brushstrokes that explain why a certain set of policies produce favorable outcomes. In doing so, it has forgone the arduous but necessary task of engaging with firm-level decision variables in a meaningful way. Industrial policy is often conceptualized as a funnel of sorts. Insert firms, shape preferences, await desired results.

Scholars like Daniel Breznitz (2007) have argued that these normative prescriptions depoliticize the process of industrial policy formulation and implementation. Industrial policies vary in line with national institutions (Dobbin, 1994). Similarly, strategic responses to industrial policies vary in line with organization-specific factors. Firms are different, and thus interpret and react to industrial policies in different ways. Accounting for firm heterogeneity can allow us to understand why a certain policy might work in some cases and not in others. My data demonstrate the contingent effect of organizational factors on an industrial policy's success. Industrial policy is here imagined not as a funnel that brings a heterogeneous set of actors to the same place, but as a prism through which firms pass when they enter new, protected markets. The effect of an industrial policy on

a firm is non-linear. There are cases in which the refraction is less pronounced than in others, as the case studies demonstrate. Figure 4.8 offers a caricature of how industrial policy's aims and its outcomes are mediated by firm strategy and structure. Firms can respond to industrial policy in many ways, only some of which align with the outcomes desired by the host government. There is likely to be greater alignment when some authority is devolved to the local subsidiary.

Figure 4.8: How Industrial Policy is Refracted by Corporate Strategy



Following the contours of the inductive approach, my aim now turns to distilling theory from these empirical findings. This process involves elevating industrial policy refraction from the empirical realm to the theoretical plane. What emerges is a series of testable propositions that depart from the assumption that achieving consonance between a multinational firm's corporate strategy and an industrial policy's desired goals results in better economic development outcomes than does dissonance between a multinational

firm's strategy and the host country's industrial policy regime. The first set of propositions refers to the effect of strategic fit on the existence or non-existence of refraction:

> *Proposition 1a: If an industrial policy is consonant with a company's corporate strategy, there will be no refraction; desired policy outcomes will be met*
>
> *Proposition 1b: If an industrial policy is dissonant with a company's corporate strategy, there will be refraction; desired policy outcomes will not be directly met*

The first set of propositions predicts when refraction will occur. If an industrial policy is consonant with its target firm's corporate strategy, then there will be no refraction. The firm will likely act in accordance with the industrial policy. This proposition does not have an empirical analogue in this study. I am suggesting that consonance between a multinational firm's strategy and a host government's industrial policy regime is unlikely. The second set of propositions departs from the assumption that an industrial policy regime is dissonant with a foreign firm's corporate strategy – they only apply if proposition 1b holds. This is the case for both firms examined in this chapter, as neither had a non-policy related reason for offshoring and outsourcing R&D to Brazil. These propositions aim to predict the degree of industrial policy refraction on the basis of a whether a company's corporate strategy is centralized or decentralized:

> *Proposition 2a: The more centralized a company's strategy, the greater the degree of ensuing policy refraction; actual policy outcomes will differ widely from desired policy outcomes*
>
> *Proposition 2b: The more decentralized a company's strategy, the lesser the degree of ensuing policy refraction; actual policy outcomes will differ little from desired policy outcomes*

What both sets of propositions suggest is that attracting firms with decentralized corporate strategies is likely to produce more favorable development outcomes than attracting firms for which corporate strategy is highly centralized. Decentralization implies greater latitude on the part of a subsidiary's managers to respond to an industrial policy in ways that are deemed to be legitimate by the host government. Greater responsiveness is not a manifestation of altruism, but a result of greater perceived or real dependence on the host government for critical resources. Subsidiary managers working for firms that formulate and implement strategy in a centralized fashion are less likely to respond to industrial policies in ways that the host government deems legitimate because they are, or believe they are, not highly dependent on the host government for resources.

Kostova and colleagues (2008) posit that multinational firms are not subject to normative or cognitive institutional pressure abroad, and more generally, that "isomorphism among MNCs is partly impossible and partly unnecessary" (p. 999). I argue that at least as far as regulatory pressure is concerned, isomorphism is likely if the threat of sanction is sufficiently high. Multinational firms tend to act in line with the Brazilian Informatics Law because not doing so would be costly. Where things get messy is with regard to the less visible normative and cognitive demands that industrial policies embody. By attracting firms that allow their subsidiaries a great deal of discretion with regard to how they operate in their surroundings, it becomes easier to achieve normative and cognitive isomorphism. These subsidiaries are more likely to be attuned to these demands, if only because of their real or perceived dependence on the host government for critical resources. The broader point is that there is variation in the degree to which multinational subsidiaries acquiesce to a host government's normative and cognitive demands.

The principal aim of this chapter has been to contribute to the ways in which scholars think about FDI-oriented industrial policies. Rather than seeing the objects of said policies

– firms – as a largely homogenous group, I aim to explore how firm heterogeneity matters for policymakers. I argue for a more nuanced understanding of industrial policy: one that sees its outcomes as being dependent on firms' unique organizational legacies as they manifest in their corporate strategies. I argue in this dissertation that industrial policies are not simply sets of regulations; they are legal documents that embody certain ideas regarding what is and what isn't appropriate behavior for firms to exhibit. But because a state cannot sanction a firm for failing to comply with it normative and cognitive demands, it may try to reshape the policy so that these subtler institutional demands are made obvious. It may engage in what Chalmers Johnson (1982) dubbed *administrative guidance*. The chapter that follows will explore the issue of heterogeneity in strategic responses in greater depth, exploring variation between Brazilian R&D institutes formed by multinational firms as a response to the Informatics Law. This chapter has been about exploring the existence of industrial policy refraction, and predicting the conditions under which we should observe it. The two chapters that follow are about how refraction occurs and evolves over time. In particular, it focuses on how a host government's normative and cognitive demands become more explicit over time through the reduction of legal ambiguity, and how organizations in Brazil continue to refract industrial policies in spite of these changes.

5. CO-EVOLUTION OF STRATEGIC RESPONSES & INSTITUTIONAL DEMANDS

5.1. Introduction

Samsung was not the only firm to create captive institutes in response to the Brazilian Informatics Law's R&D outsourcing requirements. In fact, a number of multinational firms established R&D institutes in the late 1990s and early 2000s to ensure that they were both in compliance with the law and could maintain full control over their R&D operations in the country. HP did not create a captive institute of its own. Instead, the firm has worked with a number of institutes, including Institute E and Institute F, both of which will be examined in this chapter. These institutes rely on their clients and their host governments for critical resources, and must therefore achieve legitimacy in the eyes of both. Institutions have regulative, normative and cognitive elements (Scott, 1995). This chapter focuses on these three elements, albeit to varying degrees, with the aim of exploring how conflicting demands have shaped these private R&D institutes over time.

It has long been acknowledged that organizations thrive, in part, because they are able to manage demands placed on them by external actors on which they depend for critical resources. In their seminal work on resource dependence theory, Pfeffer and Salancik (1978) argued that organizations could respond to demands by either adapting to their environment, or molding the environment to their liking. Bringing these ideas to bear on the 'new' sociological institutionalism, Christine Oliver (1991) argued that while resource dependency theory highlighted the need to actively manage interdependencies, and to avoid conformity at all costs, institutional theory proposed that the need for legitimacy would drive firms to conform, assuming that they were even aware of being coaxed into conformity in the first place. After all, some myths become so deeply engrained that we lose sight of them altogether (Meyer and Rowan, 1977; DiMaggio and Powell, 1983).

Fairly or not, Oliver (1991) argued that institutional theory left little room for agency, and thus created a typology of strategic responses to institutional processes to inject some vitality into a body of literature that she deemed bereft of managerial discretion.

Institutions are often ambiguous, leaving room for managers to interpret them and react in a way that suits them (Elsbach and Sutton, 1992). Meyer and Rowan (1977) argued that organizations might decouple structure from day-to-day activities, exude confidence, engender good faith and avoid inspection and evaluation in order to maintain legitimacy while remaining effective in their daily work. Oliver (1991) beefed up the menu of choices available, arguing that firms could actively defy institutional processes, or even manipulate them to meet their needs. This typology gave institutional theorists a way to conceive of strategic responses in a more robust way than they had in the past. Pache and Santos (2010) have sought to give Oliver's typology more predictive power, theorizing what conditions would lead firms to respond to conflicting institutional demands in one way or another. Two of their more important contributions include clearly distinguishing between institutional demands at the level of goals and those at the level of means, as well as identifying how responses might differ depending on whether one side or both sides of the institutional conflict are represented within an organization.

The previous chapter examined heterogeneity in strategic responses to industrial policy, arguing that firms that decentralize strategy formulation and implementation and thus grant their subsidiaries greater autonomy are more likely to operate in line with an industrial policy regime than are firms that centralize strategy formulation and implementation and keep subsidiaries on a tight leash. The unit of analysis was the multinational corporation. The chapter's focus was on understanding *why* industrial policy refraction occurs. This chapter moves away from the multinational corporation as the central unit of analysis, focusing instead on the private R&D institutes these firms

have created in Brazil. Its aim is to explain *how* industrial policy refraction plays out over time in the four Brazilian R&D institutes that constitute my sample. Theoretically, this chapter aims to address the paucity of literature examining how organizational responses to institutional demands change over time. As Greenwood and colleagues' (2011) put it, "the sustainability of organizational responses and their alteration and variability across time is a neglected but important theme that deserves serious attention" (p. 351).

The following section presents the case studies selected, and explains why they constitute an appropriate empirical setting for the study. The next three sections outline how institutional demands and strategic responses have co-evolved through three periods of time: the decade between the passage of the first modern Informatics Law in 1991 and its renewal in 2001, the years immediately following the law's renewal (2001-2008), during which time the government clarified its demands and elicited a shift in strategic responses, and the years leading up to the present day (2008-2014), where we begin to see some heterogeneity in strategic responses. The discussion section extrapolates from the case material to offer insights into the co-evolution of strategic responses and institutional demands over time.

5.2. Presenting the Sample: Four Case Studies

The following discussion centers on four cases that were selected on the basis of a recursive process of theoretical sampling (Glaser and Strauss, 1967).[15] These cases are all a subset of what the Brazilian government refers to as science and technology institutes

[15] Please refer to Chapter 3 for more details on the process of case selection.

(henceforth referred to as institutes) – those created by multinational firms.[16] Selecting private institutes created by firms as opposed to universities or public institutes allows me to argue that generally speaking, internal representation of conflicting demands is on the side of industry, not the government. As Pache and Santos (2010) make clear, where a firm's managers and employees' allegiances lie plays a role in determining whom they side with when engaging with different institutional actors. The directors, managers and engineers in the institutes that comprise my sample generally prioritize demands emanating from their clients over those emanating from the Brazilian government. As a result, these institutes embody "dramatic enactments of…rationalized myths" (Meyer and Rowan, 1977, p. 346), organizations created as simulacra of conformity with the Brazilian industrial policy regime.

The sample includes four independent R&D institutes that were created by multinational firms. As mentioned in the methodology chapter, I was granted extensive access to three institutes, including Institute S, Institute E and Institute F. While I was not granted extended access to Institute V, I was able to interview the superintendent on two occasions, and also had the opportunity to interview a high-level manager. Furthermore, as Figure 3.3 makes clear, this institute is not linked to either Samsung or HP. Nevertheless, I have included the relevant data I collected here, despite the fact that a thorough analysis of the institute is impossible given the limited access I was granted, and also despite the fact that the institute exists apart from the two multinational firms on which the previous chapter focused. Each case was developed on the basis of

[16] A number of public and formerly public bodies have spun off successful private R&D institutes. For example, the Federal University of Pernambuco created Cesar, which is now the third-largest CATI-certified institute in the country, and CPqD created the Atlantic Institute, which is among the 20 largest institutes by revenue. My treatment of these institutes is limited because the aim of this study is to examine the effect of the law on multinational corporate R&D strategy. As such, these institutes will be examined in less detail than the five central cases.

interviews with managers and engineers at these institutes, as well as short stays at institutes where extended access was granted. While my research at Institute V consisted of two short visits and interviews with key managers and engineers, I was granted the opportunity to spend between two and three weeks interviewing personnel, sitting in on client meetings and participating in activities at Institute E, Institute S and Institute F. The observational data collected allowed me to better understand how they are structured, how they liaise with clients and how they manage to balance conflicting institutional demands. Table 5.1 offers some descriptive statistics on the four selected cases.

Table 5.1: Summary Table for Four Selected Institutes, Data for 2013

Institute	Year Est.	Revenue (R$ Million)	Employees	Clients	Projects	Parent Country
Institute V	1995	46.3	226	10	49	Sweden
Institute E	1997	147.5	590	52	113	U.S.
Institute F	2003	35.4	158	7	27	U.S.
Institute S	2004	86.2	340	1	17	Korea

Source: MCTI, Institutional Presentations

As demonstrated, there is a great deal of variation from one institute to the next. Firstly, it is important to note that Institute E and Institute V emerged after the first modern Informatics Law was passed in 1991, but before it was renewed in 2001. The rest of the institutes emerged after the 2001 renewal. They also vary widely in size, measured in revenue and employment, the number of clients they serve and the number of projects they completed in 2013. Finally, they differ in terms of their principal clients' country of ownership. But these institutes are similar in ways that allow for meaningful comparison. Firstly, and perhaps most importantly, they were all established by multinational firms in response to the Informatics Law. They emerged as symbolic structures that satisfied

the government's poorly articulated demands (Edelman, 1992). Secondly, they are similar with regard to what sorts of projects they work on. A majority of projects conducted at each of these institutes are on the development end of the R&D spectrum, with very few projects venturing into applied or basic research.

5.3. Legal Ambiguity and the Emergence of Private R&D Institutes (1991-2001)

5.3.1. Institutional Demands: Legal Ambiguity

Companies from industrialized countries conducting R&D in the developing world typically keep activities in-house. While a number of developing countries have sought to attract multinational R&D centers, few have gone as far as mandating collaboration with external partners. What makes Brazil a compelling case is that the state attempts to shape both location *and* make-or-buy decisions around R&D. It is clear enough why a developing country might seek to attract R&D investments. Technology transfer has long been held as an important means by which developing countries can ignite economic growth (Abramovitz, 1986). It is less obvious why a developing country might require that multinational firms collaborate with local universities and research institutes. The reason is that, oftentimes, multinational firms' R&D operations in developing countries are walled off from the rest of the economy. They draw in some of the country's most highly qualified labor and leave very little beyond a few well-trained people. These centers often act as islands or enclaves with tenuous links to the host country's national innovation system, meaning that there are few (if any) knowledge spillovers associated with their activities (Gúimon, 2013). These types of policies aim to create a disjuncture between a firm's global and local technology strategies by reducing subsidiaries' responsiveness to demands from their parent companies, and increasing their responsiveness to the needs of their host governments.

The Informatics Law created a framework through which firms that received Basic Productive Processes (PPBs) – certifications ensuring that a good was produced domestically with a certain percentage of local content – could receive fiscal incentives so long as they agreed to invest in local R&D as well. Initially, the government required that firms spend five percent of their annual revenues in Brazil on local R&D in order to be eligible for certain fiscal incentives. The percentage required stands at four percent as of 2016, and will drop to three-and-a-half percent by 2019. But while the requirement for local R&D spending has come down over time, the requirement that firms outsource 46 percent of the total has been in place since the modern law was first passed in 1991. Twenty percent of the total can be outsourced to a certified third party, whether it be a public university, a private university, a public R&D institute or a private R&D institute. Ten percent must be deposited in the government's science and technology fund (FNDCT). Government officials interviewed confirm that the logic behind the outsourcing requirements instituted in 1991 was that they would allow for knowledge spillovers that would drive technological upgrading in local firms.

But the 1991 law was ambiguous with regard to *whom* firms could outsource their R&D quota to, *what* constituted R&D and *how* the exchange relationships would be structured. With regard to the question of *whom*, the law established that firms would need to outsource to 'research centers or institutes, or Brazilian educational entities, official or recognized, accredited by the committee…' (Law 8,248, Article 11, §1). The law called for the creation of a committee to certify which third parties would be eligible to receive funding. However, the composition of the Committee for the Area of Information Technology (CATI) was not decided until 2001, when Decree 3,800 established its composition and determined what its mandate would look like. I believe that there are two good reasons for this deferred action. The first is disagreement over the committee's proposed composition. Article 11, § 5 of the 1991 law had attempted to settle the issue of

the committee's membership; however, it was vetoed over disagreements regarding the constitutionality of its proposed structure. The issue was not revisited until the law came up for re-approval in 2001. The second reason is that when the 1991 law was passed, the only partners that firms could have conceivably relied on for R&D services were public research organizations and universities; therefore, there was no compelling reason to create a body to would determine which organizations could receive R&D funds associated with the law.

This brings us to the second incidence of ambiguity in the 1991 Informatics Law: there was no clear definition of R&D. Firms took advantage, often passing off operational expenses as technological development. By the time the law was re-approved in 2001, 52 companies had been found to have 'irregularities' in their accounts, and were forced to return more than R$3 billion in incentives (Cukierman et al., 2012). According to one multinational executive:

> *They [firms] mixed factory production with the institute. They threw factory costs in there. They threw human resources into the institute. They bought things for the institute that they didn't need to buy, things that weren't R&D. They would buy a car, or whatever. I knew about that stuff, but only through word of mouth. I don't have any proof.*

The third source of legal ambiguity deals with *how* exchange relationships between institutes and firms are structured. The Informatics Law states that firms engaging with these institutes must do so through *convênios* (agreements) rather than through contracts. While the law stated that firms must collaborate with institutes and universities through agreements, there was no clear definition of what an agreement entailed when the law was first passed. Thus relationships often took on a contractual flavor, which suited firms wary of sharing intellectual property with Brazilian counterparts.

As we have seen, the 1991 Informatics Law left a few important key areas underspecified, namely what it had meant by 'research institutes' and who would certify them, what would be considered R&D and what sorts of expenses would be permissible and how the relationships between firms and external partners would be structured. By 2001, the government had moved to create CATI and give it a clear mandate. It had devised a comprehensive definition of what constituted R&D and what expenses were appropriate for the execution of projects. The Federal Court of Accounts (TCU) had clearly distinguished contracts from agreements. But in the intervening decade, some firms had applied for and received product-specific incentives. In order to comply with the countervailing R&D outsourcing requirements, some of these firms had established nominally separate R&D institutes to retain full control of R&D operations in the country. The ambiguity of the Informatics Law allowed institutes to construct their own definition of compliance. It allowed them to achieve ceremonial consonance with the state's weakly articulated institutional demands without actually creating opportunities for knowledge spillover, which had been the government's goal since the law was established.

5.3.2. Strategic Responses: The Emergence of Private Institutes

According to one government official, when the law was passed in 1991, the government envisioned a model that replicated the industry-university partnerships that had existed in the U.S. for quite some time. And that was how it went for the first few years. But by the mid-1990s, firms had grown tired of being forced to work with Brazilian universities, especially foreign firms that were both unfamiliar with the Brazilian academy, and apprehensive about the quality of the work professors and their students were capable of. The R&D director of one multinational subsidiary claims that when his firm began conducting R&D in Brazil in the mid-1990s, he could only work with universities, which produced "next to nothing" in terms of commercially viable outputs. R&D productivity

was a concern for many companies; therefore, some decided to open up R&D centers of their own. After all, there was nothing stopping them from doing so. Ericsson created Informat (now Institute V) in 1995 and Motorola established Institute E in 1997. These institutes partook in a range of projects on behalf of their parent companies. Since there was no clear definition of what constituted R&D, firms were free to exercise discretion insofar as what projects they ran in collaboration with their new partners. Much of what was outsourced amounted to basic testing and development work.

For the first few years, these centers operated very much like internal divisions of their parent companies. This was despite the fact that the law had intended for them to be separate entities known as 'social organizations.' Following international norms set by the United Nations' Handbook on Nonprofit Institutions in the System of National Accounts, the Brazilian Institute for Geography and Statistics defines private foundations and non-profit associations (FASFIL) as private, not-for-profit legal entities that are independently managed (IBGE, 2002). Organizations that fall under the FASFIL category include social organizations, civil society organizations, private foundations and local branches of foreign private foundations or associations. As social organizations, the newly founded institutes were required to conform to FASFIL guidelines. This meant that their progenitors could not take an equity stake in them, that they had to have independent management and advisory boards and that they could not turn a profit. The institutes had to apply for a federal registration number through the national registry of legal entities (CNPJ); they could not use the number belonging to their parent firm.

Interviews with managers at Institute V and Institute E demonstrate how these nominally independent institutes were in fact fused with their multinational benefactors. One manager remembers being a young software engineer, and getting a job with Ericsson in 2000, or at least that's what he had been led to believe. Telebrás, the state-owned

telecommunications company, had just been privatized and Ericsson was on a hiring spree to keep up with demand emanating from a now accessible pool of potential customers for telecommunications equipment. He recalls being perplexed and disappointed on his first day when he received his identification badge. Instead of Ericsson, the badge read 'Informat.' When he asked the HR director for clarification, she said, "Don't worry, it's just a law here. It's the same thing." Informat was established in 1995, one of the country's first private, non-profit R&D institutes in the ICT sector. It was created in order to absorb the portion of the R&D quota that was earmarked to be spent externally. When this young engineer started, Informat was housed inside Ericsson's R&D center in the city of Indiaiatuba, in the state of São Paulo. The institute was run like an internal division of Ericsson for nearly ten years. While Informat did work with other clients on small projects, Ericsson commissioned nearly 100 percent of the work. Little changed after the merger with Sony in 2001. Work at Informat continued to focus on newly formed Sony Ericsson's 3G rollout in Brazil until the early 2000s.

Just down the road, in the city of Jaguariuna, Motorola was coming to terms with the fact that it would need to bolster its R&D presence in Brazil in order to develop commercially viable products for the local market. Motorola had partners in the Northeast, including the Federal University of Pernambuco and its spin-off, CESAR. However, it could not find an institute through which to fulfill its outsourcing obligations in the Southeast. Therefore, it established Institute E in 1997. Initial projects were geared towards education; Motorola was having trouble finding skilled human resources in Brazil at the time. Institute E's first project was the Technical Training Program (PCT), which was run through partner universities including the University of São Paulo (USP) and the State University of Campinas (Unicamp), among others. Once it had invested extensively in workforce training, Motorola began redirecting funds towards software and hardware development projects. Institute E had been formed as an association, which required

ownership by at least two legal entities. Motorola Services and Motorola Industrial would control the board for the first few years, leaving little room for meaningful participation by other firms that might be interested in engaging with the institute on R&D projects. Motorola had intended for Institute E to be an independent institute, but 90 percent of its revenues came from its unofficial parent company until 2008.

As Lauren Edelman (1992) convincingly argues, laws that are ambiguous, procedural in emphasis and difficult to enforce allow firms to create symbolic structures to achieve institutional consonance while actually privileging managerial interests. She finds that firms may incorporate largely symbolic equal employment opportunity offices and affirmative action policies without actually aiming to reduce discrimination in the workplace. Similarly, Olivier Boiral (2007) finds that Canadian firms with environmental management certification often decouple daily activities from the prescriptions set forth by the certifying body, rendering the standard little more than a 'rational myth.' These accounts of strategic responses to weakly articulated institutional demands prove a useful guide for understanding firms' initial responses to the Informatics Law. In the early years of the modern Informatics Law, firms erected symbolic structures in the form of independent institutes as a means of acquiescing with poorly articulated and largely procedural demands.

5.4. Resolution of Legal Ambiguity & Reproduction of Symbolic Forms (2001-2008)

5.4.1. Institutional Demands: Resolution of Legal Ambiguity

The government used the 2001 renewal as an opportunity to settle ambiguity around who could receive R&D funding through the law, what it meant by 'R&D' and how it wanted to see the relationships between firms and institutes managed. According to the then

Secretary for IT Policy at the Ministry of Science and Technology, Marcelo Lopes, "What we couldn't allow was for this joke to continue, where companies pretended to conduct research and the ministry pretended to control what they were doing" (translated by author from Cukierman et al., 2012). Decree 3,800 stated that CATI would be comprised of eight members: three from relevant ministries (science and technology, industry and trade and communications) one from a major research body (CNPq), one from each of the two major finance bodies (BNDES and FINEP), one from industry and one from the scientific community. The representative from the Secretariat for Informatics Policy (SEPIN) would chair the committee. Its mandate included developing criteria for the certification of science and technology institutes and universities that could receive Informatics Law funds, certifying and decertifying organizations, evaluating their annual reports and providing the national science and technology fund support by analyzing project proposals and evaluating results.

On top of outlining the structure and mandate of CATI, Decree 3,800 defined R&D and outlined which expenditures would be admissible. R&D consisted of:

> *I. Theoretical or experimental work undertaken systematically to acquire new knowledge, with a vision to reach a specific objective, discover new applications, or to obtain an ample and precise understanding of the underlying foundations of phenomena observed, without previous definition for the practical use of the results*
> *II. Systematic work using knowledge acquired through research or practical experience to develop new materials, products, devices or computer programs; to implement new processes, systems or services; or to perfect what is already produced or implemented, incorporating innovative characteristics*
> *III. Education and professional training at the undergraduate or graduate levels in information technology*
> *IV. Scientific and technological services in the form of advice, consultancies, studies, papers, metrology, standardization, technology management, invention and innovation promotion, management and control of intellectual property generated through research and development activities, establishment and*

> *operation of incubators in the area of information technology, provided that any associated activities fit under the rubric of I and II in this article*

The creation of a comprehensive definition of R&D provided firms with some guidance as to what sorts of projects would be approved by CATI. Decree 3,800 would go even further, outlining which expenses were appropriate given the new definition of R&D. Firms could spend their R&D quota on installing and using equipment, building and modernizing R&D labs, hiring direct and indirect human resources, accessing publications, traveling to see clients and attend conferences and purchasing consumable goods, training and technical services.

Finally, in the early 2000s the government created a clear definition of a *convênio*, and expressed how it differed from a contract (TCU, 2006):

> *…an agreement deals with the reciprocity of obligations (bilateralism). While in a contract, one party is obligated to give, to do, or to not do something by means of previously agreed payment, in an agreement, interests are jointly held, and a consideration of money does not need to exist. What one does is adjust the terms of mutual collaboration in order to reach a common goal.*

These clear definitions reduced the number of firms penalized for 'irregular' spending after 2001. However, this is not to say that firms responded to the resolution of legal ambiguity with acquiescence. One institute executive interviewed points out that even today, potential multinational clients approach him looking to purchase R&D services:

> *The client will come and want to sign a contract. We must inform them that this is against the spirit of the law. Something has to remain in Brazil aside from money. With a contract, you buy $100 worth of goods for $100. With a convênio, you put in $100 and get $80 back, with another part left behind by way of trained personnel and infrastructure.*

Since its initial passage, the Informatics Law has sought to encourage meaningful knowledge transfer by stipulating that relationships between firms and certified institutes and universities take the form of an agreement rather than a spot contract. But corporate insistence on contractual relationships highlights one of the ways that firms have evaded government directives. To summarize, while the renewal of the Informatics Law and the passage of Decree 3,800 clarified once ambiguous terms, firms continued to establish captive institutes and manage relationships with them and with universities through what amounted to little more than spot contracts for services.

5.4.2. Strategic Responses: Reproducing Symbolic Forms

While both Ericsson and Motorola acted to ensure legal compliance with the Informatics Law from the very beginning, Samsung chose to fight it. It had first established a production facility in Brazil in 1994. Nevertheless, it fought against the Informatics Law in the courts until 2002. One Brazilian executive hired in the early 2000s made it clear to Samsung that the fight was a lost cause: "The Informatics Law will continue to exist. Make no mistake, no one will win this. No one will win in the courts or out of the courts. Therefore, it is nonsense to keep fighting. Instead of fighting, we will settle and invest." It became clear that no corporate political strategy could sway the government to dismantle a law that had settled and ossified through the years. Samsung began to explore how to best structure its R&D investments in 2002, and finally established a CATI-certified institute in 2004. Institute S was originally co-located with the company's Campinas production site and only separated in 2012. In 2004, the firm also established an R&D institute in the Amazon to comply with the R&D requirements in the region, where its original production site was located. It had been able to outsource its entire R&D quota to these institutes until the obligation generated simply became too large to be executed by these two bodies alone.

The Informatics Law specifies that the manufacturer is ultimately responsible for the R&D quota. As such, it is often the contract manufacturers that are made responsible for R&D investments, not necessarily their clients. While there are a number of contract manufacturers in Brazil with R&D quotas, only one set up an R&D institute of its own. Institute F was set up in 2003, shortly after CATI had begun fulfilling its mandate. There was considerable disagreement within CATI regarding whether or not to continue certifying private institutes. According to one high-level executive involved in the negotiations, there were those on the committee concerned that, as companies continued to set up their own institutes, there would be little left over for universities and public research bodies. Furthermore, a number of private institutes had been sanctioned in the past for misuse of funds. However, after extensive discussions with each member of the regulatory committee, Institute F was granted CATI certification. But as one Flextronics executive recalls, the newly formed institute was put on notice. According to the same executive, the sentiment emanating from CATI was best summarized by the following comment made as the negotiations drew to a close: "Listen to the following. We will approve you. You will have to be totally independent…independent personnel, everything separate. I don't want you to be solely dependent on Flextronics as your client. You will have to dilute that over time." This would seem a relatively easy task for an institute borne of a contract manufacturer.

Around this time, most of the major private institutes began to set up regulatory affairs departments. These employees were tasked with translating client demands into legally permissible R&D projects. As one executive who spent time in government puts it:

> *Companies were obligated to and started doing R&D. R&D of the lame sort. The government here in Brazil does not have the power to monitor the implementation of its policies. There are too few people in government, in the Ministry [of Science,*

> *Technology and Innovation]. They don't have the people to monitor, therefore companies don't fulfill [the government's] requirements as they should. In the end, companies take care of their own necessities: services, customization…*

Indeed, an institute's ability to *enquadrar*, to frame a project so that it fits the law, has become an important source of competitive advantage. This is because having a completed project flagged as inappropriate carries significant negative financial implications for the project sponsor. Thus, firms will pay a premium to ensure that their projects meet the government's definition of R&D.

By the early 2000s, the government had begrudgingly acknowledged that firms would continue to establish these independent centers to avoid working with universities and public research institutes. It sought to manage the proliferation of private R&D institutes by requiring that they be accredited by the newly established certification committee if they were going to be using funds associated with the Informatics Law. It sought to reduce the possibility of malfeasance by clearly defining what it meant by R&D, and by laying out which expenses it deemed permissible. Finally, the government spilled a great deal of ink to clarify the distinction between an agreement and a contract, ensuring that firms knew how relationships with institutes were supposed to function. Institute S and Institute F Institutes were among the many newly established R&D centers granted CATI certification.[17] But while the 2001 law had reduced firms' degrees of freedom, newly established institutes modeled themselves after existing ones in an act of mimetic isomorphism. They continued to carry out their projects as they had in the past, but now

[17] Of course, centers not associated with any one company continued to grow in parallel. The Federal University of Pernambuco spun off Cesar and the Center for Research and Development in Telecommunications (CPqD) spun off the Atlantic Institute. Both quickly received CATI certification and began to use Informatics Law funds.

made sure that they were framed in a way that fit the newly established definition of R&D.

5.5. Beyond the Law: Informal Measures and Varieties of Resistance (2008-2014)

5.5.1. Institutional Demands: When Legal Measures Fail

Eventually, legal efforts were replaced by informal ones, much as was the case with MITI's shift away from direct control and towards *administrative guidance* (Johnson, 1982). A manager at one institute recalls CATI personnel coming for periodic inspections and making note of the fact that their institute was not sufficiently diversified. She revealed the sense of panic that ensued when the inspector disapprovingly made notes on official forms highlighting the fact that little effort had been expended to open up to external clients. Government officials realized that regardless of how explicitly they articulated their wishes in the Informatics Law, firms were going to continue enacting symbolic responses while creating few opportunities for knowledge transfer between local firms and entrepreneurs. As Meyer and Rowan (1977) clearly state, institutionalized organizations try to minimize inspections and evaluations because they are "public assertions of societal control which violate the assumption that everyone is acting with competence and in good faith" (p. 359). Failed inspections can seriously damage an organization's legitimacy, making it more difficult for organizations to receive resources on which they depend.

From the outset, the R&D requirements outlined in the Informatics Law had a clear purpose. They were established to not only encourage the localization of R&D activities, but also to induce knowledge spillover by requiring that firms collaborate with external partners. The establishment of captive third-party institutes meant that while R&D FDI

would indeed enter, the likelihood of spillover would be limited. As one CATI official interviewed for this study noted:

> *If you have a captive institute and apply [your R&D quota] in it, you are not sharing your technologies with society. I'm not saying that this is bad, that the projects are bad, of worse quality than the others. No, I'm not saying that. But it's not the concept. The concept is a socialization of the whole process. If this doesn't happen, the policy doesn't make sense. Why can't you have a private institute associated with a company? It's not that you can't, but according to the spirit of the Informatics Law, according to the concept of public policy, you are masquerading one thing as another. So everyone will set up their institute. Done. Is that what we want? Why oblige you to set up an institute in the first place?*

These institutes were designed to have a *social* purpose, and the bottling up of technology went against what they had been created to do. But having exhausted legal remedies, the government began to exert informal pressure to try to change R&D management practices. Inspections like the one mentioned above have been conducted periodically as a means of ensuring the visibility of the state at these private R&D institutes. CATI can also audit institutes if they believe that they are skirting the law's requirements. Finally, the government has engaged in public 'shaming' to push wayward institutes to open up and serve various clients. Conversely, it lauded diversified institutes.

For example, in October of 2014, SEPIN hosted a seminar titled "The Current and Future Role of R&D Institutes in the Context of the Extension of the Informatics Law." During his presentation, the head of SEPIN presented a slide showing how the top R&D institutes had fared in previous years (see Figure 5.1). While the institutes were anonymized, everyone knew that institute 'B' corresponded to Institute S (circled in red by the author). According to seminar participants, the Secretary used the occasion to emphasize that the government had intended for these institutes to be shared service providers and not captive R&D institutes. As the slide makes clear, Institute S is the only one working on

behalf of just one client. Indeed, Institute S has become the sacrificial lamb among private R&D institutes. As one long-time institute director claims, "Institute S is clearly what shouldn't be. For me it is a department of Samsung." This sentiment is echoed in interviews with other institute executives.

Figure 5.1: Slide from SEPIN presentation at October 2014 Seminar

Captação de Recursos de Investimentos em P&D

Valores em Mil Reais

Centros de P&D	2011	Número Empresas	Quant. Projetos	2012	Número Empresas	Quant. Projetos	2013	Número Empresas	Quant. Projetos	Total
A	92.728,00	44	90	82.266,00	32	104	147.471,00	52	113	322.464,00
B	71.366,00	1	31	83.371,00	1	22	86.159,00	1	17	240.896,00
C	38.696,00	24	59	44.668,00	27	52	59.931,00	30	63	143.295,00
D	24.822,00	7	38	32.046,00	7	37	46.308,00	10	49	103.175,00
E	34.268,00	13	55	25.966,00	12	50	32.831,00	9	44	93.066,00
F	21.093,00	6	38	22.604,00	7	30	35.389,00	7	27	79.087,00
G	13.985,00	4	5	16.944,00	4	6	25.880,00	7	11	56.809,00
H	16.388,00	26	59	19.403,00	24	55	18.669,00	31	61	54.460,00
I	7.675,00	15	23	9.548,00	14	26	12.940,00	14	24	30.164,00
J	8.327,00	13	30	6.600,00	12	36	10.779,00	18	45	25.706,00
K	7.862,00	3	6	6.159,00	4	7	4.472,00	9	11	18.493,00
L	4.789,00	3	6	6.871,00	4	7	2.940,00	5	5	14.600,00
Total Centros	341.999,00	----	440	376.204,00	----	432	483.768,00	---	470	1.182.213,00
TOTAL GERAL	476.810,00	----	858	510.390,00	----	924	623.630,00	----	968	1.610.830,00

Source: MCTI

Institute S has responded to informal pressure by establishing a business development branch to search for areas where it might be able to serve other clients without stepping on any toes in its most important client. It has focused on developing training modules, and identified potential clients. But these new programs are likely to be afterthoughts in the institute's day-to-day operation for quite some time. According to one of the center's directors, unless the government explicitly states that institutes must diversify or lose certification, there will be no appreciable change in the relationship between Samsung and its institute. As one SEPIN official puts it, "[Samsung] decided to establish its center

under the direct purview of its staff in South Korea. Is it illegal? No, it's not…but they could have done it like Institute V and Institute E." Some institute directors would like to see SEPIN issue a credible threat that it will revoke certification if institutes do not diversify over time. But the law does not support this sort of measure. There is no formal timeline, or date by which an institute must have expanded to serve multiple clients. So for the time being, informal pressure is the only means by which the government can try to shape institutes to act in accordance with its demands.

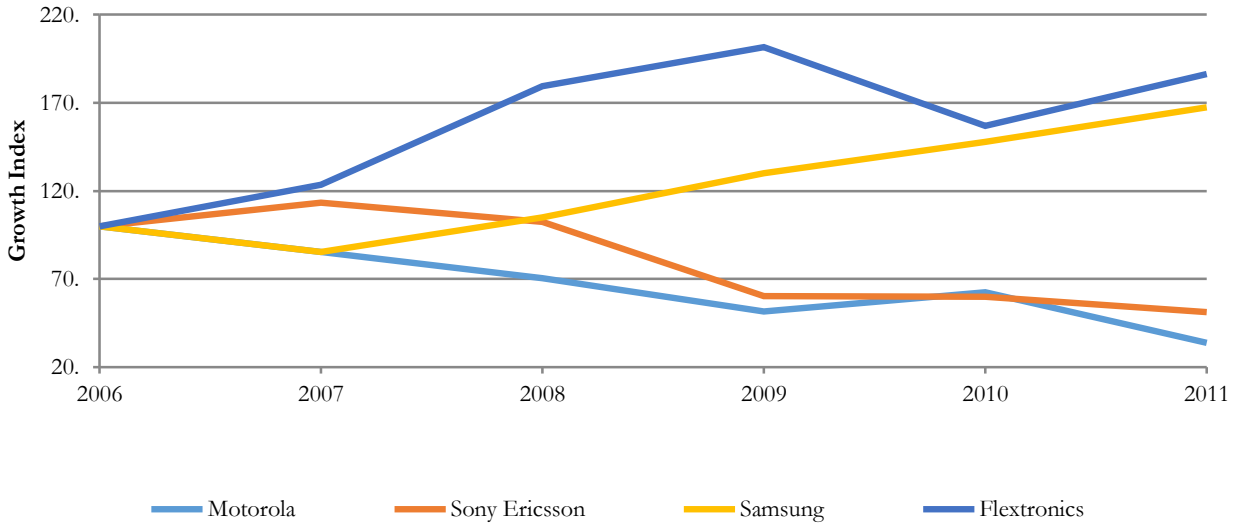
On the other end of the compliance spectrum, SEPIN has held certain institutes up as shining beacons, imploring others to emulate their example. At the same seminar mentioned above, three institute directors were invited to deliver presentations. They included directors of CESAR, of Institute F and of FITEC (another, much smaller private R&D institute). Furthermore, as the quote from a SEPIN official demonstrates, Institute V and Institute E are consistently lauded as manifestations of the government's vision. These public accolades, along with incidences of public shaming, are among the few tools the government has to ensure that institutes are acting in the spirit of the law. Inspections and evaluations are also employed to try to shape R&D management practices at institutes. However, as the preceding discussion has shown and as the following section will further demonstrate, these informal advances have yielded little in terms of changed practices.

5.5.2. Strategic Responses: Varieties of Resistance

Until the early 2000s, strategic responses to Brazil's industrial policy were relatively uniform across institutes. Legal ambiguity allowed Motorola and Ericsson to create fully captive institutes in the 1990s. Greater clarity after the 2001 renewal hardly influenced how newly emerged institutes were structured. Symbolic structures simply became more

detailed; the charade became even more elaborate. Finally, having exhausted legal recourses, CATI increased the rate of inspection and evaluation, audited firms they perceived to be skirting the law and even lauded and shamed 'good' institutes and 'bad' institutes, respectively. But what was it that brought some institutes in line with the Informatics Law's requirements and not others? Informal pressure appears to have done little to force Institute S to diversify its client portfolio. The same goes for the other institutes, which diversified largely for reasons having nothing to do with state pressure. There appear to be two principal reasons why some institutes diversified their base of clients. The first reason was a decline in their benefactors' fortunes. The second is the benefactor's role in the value chain. These two reasons will be examined in turn.

Figure 5.2: Revenue Growth Index of Institutes' Parent Firms, 2006-2011

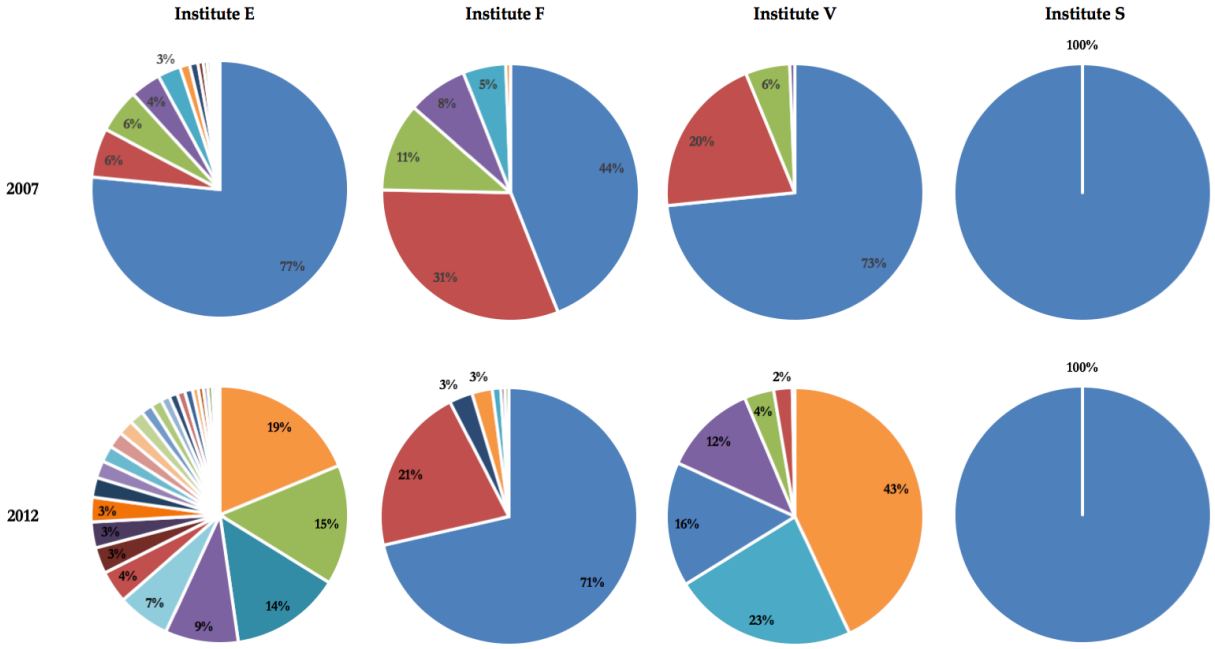


Notes: 2011 is the last year for which data is uniformly available. Sony Ericsson became Sony Mobile in 2012 and Google acquired Motorola Mobility in 2011. Revenue data for Motorola in 2010 and 2011 is a composite of Motorola Mobility and Motorola Solutions sales. Historical exchange rates acquired from Oanda.
Source: Company annual reports

Figure 5.2 compares the four institutes' main clients in terms of annual revenue between 2006 and 2011. Samsung and Flextronics fared well through the 2008-09 crisis relative to Motorola and Sony Ericsson, which saw their annual revenues drop by 27 percent and 41

percent, respectively, between 2008 and 2009. In the Brazilian market, Motorola's revenue dropped from $1.55 billion to $910 million from one year to the next. Sony Ericsson, which only published figures regionally, saw its revenues in the Americas drop to $1.22 billion in 2009, a 67 percent decline from 2008. Motorola's mobile division was acquired by Google in 2011, and then passed on to Lenovo in 2014 after a few years of poor performance both in Brazil and globally.[18] Sony acquired Ericsson's share in the joint venture in 2012. The precipitous drop in in-country revenue meant that R&D funds for their institutes dried up. As a result, they were forced to look elsewhere for clients.

Figure 5.3: Value of R&D Agreements at Each Institute, by Client, in 2007 and 2012



Source: MCTI, 2013

As late as 2005, Institute E still depended on Motorola for 90 to 95 percent of its revenue. The institute's directors understood this dependence to be risky, regardless of CATIs

[18] Only Motorola published sales figures for Brazil.

appeals for greater client diversity. The institute's director committed to reducing dependence on Motorola to 70 percent in five years. They would be forced to diversify sooner than expected as a result of Motorola's near-death experience in 2008-09. Institute E had generated R$32 million in revenue from Motorola in 2008. This figure dropped to R$14 million the following year, all of which came from previously approved projects. Motorola had stopped sending new projects altogether. One institute director sees 2008-09 as a watershed in the institute's brief history. It was at this point that Institute E had to establish a business development apparatus, seeking new clients to make up for the sudden drop in revenue. It bolstered its services division, which did not depend on Informatics Law money, and began to court Motorola's competitors for R&D projects. In 2012, it earned R$82 million in Informatics Law funding. It came from 32 different clients, none of which accounted for more than 25 percent of the total. See Figure 5.3 for a depiction of how Institute E and the other institutes in this sample evolved over time with respect to their revenue streams.

Pressure from CATI drove some reform at Informat. An extensive audit conducted in 2004 revealed to government officials just how beholden the center was to its parent. The audit concluded that Informat would need to move from Indiaiatuba and disentangle its technical teams and projects from those at Ericsson. It was at this point that the center's leadership decided to rename it Institute V. But apart from these changes, which ranged in intensity from the cosmetic to the outpatient, little changed in the client mix at Institute V for quite some time. In 2008, Institute V employed approximately 410 people. Of these, 380 worked for either Ericsson or Sony Ericsson. There was one team of 30 dedicated to serving all other clients. Institute V counted on seven clients in 2012. Three of them accounted for 95 percent of the firm's R&D expenditures. Sony bought out Ericsson's share in the joint venture in 2012, meaning that the newly formed Sony Mobile has become Institute V's new anchor client. Indeed, Institute V complied with CATI's

requests in 2004, moving to an independent site and disentangling its teams from those of its main client. But despite Sony Ericsson's struggles starting in 2008, the existence of a strong anchor in Sony Mobile stifled attempts at meaningful diversification. As one R&D institute director states, "You can disobey the law at several levels." Nevertheless, uncertainty following the takeover has driven Institute V to diversify its client base.

Despite the government's saber rattling, Institute S remains captive to its principal client, Samsung. While underhanded efforts to crack the institute open have been numerous and persistent, Institute S has continually shrugged off suggestions that it begin serving other clients. However, the institute has started to direct resources towards the identification of new markets where it could be successful. Market hegemony is but temporary, as the case of Motorola attests, and Institute S will eventually, if only out of economic necessity, need to consider other avenues of growth. It is beginning to develop general training programs, as this is one area where Samsung sees no conflict of interest. However, it is unlikely to be conducting R&D for another handset manufacturer anytime soon. In the absence of struggle by the anchor client – Samsung accounted for 36 percent of the Brazilian mobile handset market in 2012, and remains the market leader to this day – Institute S has remained fully captive. Beyond the lack of financial turmoil, the fact that Institute S has not diversified fits the theory of industrial policy refraction. Because the institute operates much like a local subsidiary and not a third party service provider, and because it is tied to a firm that centralizes strategy formulation and implementation, it is unlikely to operate in ways that are consonant with the industrial policy regime.

While Samsung Electronics is a leading electronics firm in Brazil, the country is marginal to Samsung's operations worldwide. According to the company's most recent annual report, the company's Brazilian subsidiary (SEDA) generated revenues of $7.3 billion in 2014. Since SEDA produces mostly for the local market, and the process of importing to

Brazil is complex, we can take this number as a relatively good estimate of the company's total sales in Brazil. This would amount to 12 percent of the company's sales in the Americas in 2014, and just four percent of global sales. The relatively marginal importance of Brazil to Samsung creates the credible threat of exit, perhaps blunting the degree to which the government is willing to push them to conform with local R&D spending requirements. But this argument, while plausible, is rendered implausible by the fact that Brazil is a nearly equally marginal market to firms like HP, which generated just three percent of its global revenue in Brazil in 2012, and Flextronics, which generated just six percent of its global revenue in Brazil in 2014. Yet both the local HP and Flextronics R&D operations are much more closely aligned with government demands than is Samsung's.

Institute F was open from the very beginning. In part, this had to do with resistance they faced from CATI, which by the early 2000s had come to see these private R&D institutes as acts of veiled defiance. Another significant reason that Institute F served various clients from the very beginning is that its parent company is a contract manufacturer. These turn-key suppliers house the generic manufacturing capabilities on which lead firms serving a range of end markets rely to produce final goods (Sturgeon, 2002). These firms master a few general processes to produce a large mix of final goods, including anything from mobile handsets to industrial equipment. As Figure 5.3 illustrates, 71 percent of Institute F's Informatics Law funding came from Flextronics in 2012. But while Flextronics is the legal carrier of the R&D quota, it seldom directs the nature of the R&D carried out on behalf of its clients. Their clients retain discretion over the projects without carrying the risks associated with a project that does not fit within the law. Thus Figure 5.3 obscures the true diversity of the institute's client base. Given Flextronics's position in the value chain, the institute never experienced the same informal pressure that other institutes beholden to lead firms did.

As the evolutionary trajectories of our four cases demonstrate, government-led efforts to open up private institutes have been largely unsuccessful. While CATI has succeeded in terms of forcing cosmetic changes, meaningful diversification has largely been a result of financial necessity rather than government pressure. In the absence of crisis or rapid loss in market share, institutes continue to work almost exclusively on behalf of their parents, as is the case with Institute S. The other institutes have garnered legitimacy from the Brazilian government for their efforts to open up and serve multiple clients.. But they also remain compliant with regard to their clients' demands for intellectual property protection. On the surface, these institutes have managed to achieve consonance with both their clients' and the Brazilian government's conflicting institutional demands. But theory suggests that this outcome is unlikely without resorting to compromise or hybridity (Battilana and Dorado, 2010). The ways in which these institutes have managed conflicting institutional demands emanating from the Brazilian government and from their clients will be addressed in the chapter that follows.

5.6. Discussion

This chapter builds on some notable pieces of scholarship that explain the plurality of ways in which firms respond to institutional processes (Oliver, 1991; Kraatz and Block, 2008; Pache and Santos, 2010). It makes a contribution to this body of work by examining how strategic responses and institutional demands co-evolve. Empirically, these cases give us a window into the *process* of industrial policy refraction. They show us how multinational firms respond to industrial policies in ways that are consonant with their strategies, not the Brazilian government's aims. In this chapter, I have argued that strategic responses are not singular acts. Rather, they are snapshots of the dynamic process by which organizations and institutional actors interact. If the institutional actors

exerting pressure on firms deem their responses to be inappropriate, then they may refine or reformulate their demands so that they are more clear and intelligible, and so that there might be less space for evasive maneuvering. The process of refining and reformulating demands may force firms to adjust their responses to retain legitimacy in the eyes of those on which they depend for resources. Then, institutional actors will react, and organizations will respond. And so on, and so forth.

The Brazilian government instituted local R&D spending requirements as part of the broader Informatics Law to ensure that the country's ICT sector would not be hollowed out following market liberalization. By requiring that some of the R&D quota be allocated to external partners, it sought to make sure that multinational firms conducting R&D locally would generate knowledge spillovers, that firms would not just set up innovative enclaves. However, the 1991 law did not clearly specify who could receive earmarked R&D funds, what was meant by R&D and how relationships with external R&D service providers would be managed. Ambiguous demands meant that multinational firms could acquiesce simply by creating legally separate entities through which they would funnel the external component of their R&D quota. Indeed, this is what both Motorola and Ericsson did by setting up Institute E and Informat. In the early years, Samsung fought the local R&D requirements in the Brazilian legal system, attacking the government's institutional demands head-on, trying to eliminate the source of pressure with which it was confronted (Kraatz and Block, 2008).

But while both Motorola and Ericsson had acquiesced to the government's demands by complying with the requirement to spend five percent of annual revenues on local R&D, some internally and some externally, they defied the spirit of the law, rejecting the notion that they should become lynchpins of the sectoral innovation system by driving industrial upgrading among local firms. The newly established institutes served their

principal benefactors alone, and were sometimes even located in the same building as their clients' local R&D centers. As Laura Edelman (1992) suggests, legal ambiguity allows firms to achieve consonance with institutional demands through simple alterations to organizational structure while simultaneously allowing them to forego acquiescing to the intentions driving those demands. These newly established institutes acquiesced to institutional demands emanating from their benefactors, which pushed them to remain captive so as to protect their intellectual property, while defying the Brazilian industrial policy's demands, which had been, up until that point, poorly articulated. Samsung sought to eliminate these demands altogether, fighting the law and refusing to even feign acquiescence for some time. It mounted a legal challenge against the Informatics Law until it became clear that no such political strategy would succeed in dismantling a policy assiduously sculpted over the course of many decades.

The government took the renewal of the Informatics Law in 2001 as an opportunity to clarify key points of ambiguity. Gaps and poorly defined requirements in the 1991 law had allowed firms like Motorola and Ericsson to acquiesce to legal demands while skirting the spirit of the law. By this point, Institute E and Informat had become referents for emerging institutes like Institute S and Institute F. This period of time was largely characterized by the reproduction of symbolic forms through mimetic isomorphism (DiMaggio and Powell, 1983). The fact that the government filled in the blanks with respect to who could serve as an external partner, what was considered R&D and how relationships would be managed simply meant that symbolic structures became more elaborate. Institutes got certified by CATI by mollifying the committees' fears that they would be little more than appendages of their principal clients. They continued conducting R&D that corresponded to their parent companies' needs, as they had before. The difference was that now, many of the institutes established regulatory affairs departments, whose aim was to ensure that projects fit the government's newly

established definition of R&D. Finally, firms did sign *convênios* with institutes, but the projects that fit under these broad umbrellas were run in a largely one-sided fashion, with clients retaining all rights to knowledge acquired through joint projects. Thus institutes acquiesced to the government's requirements by complying with now well-articulated regulations. Indeed, they set up separate institutes that conducted R&D through agreements with clients. However, none complied with the spirit of the law, which was that these institutes would become mechanisms for technology diffusion.

During the early 2000s, strategic responses looked fairly similar across our four institutes. All institutes complied with the legal rules set forth by the Informatics Law. At the same time, they defied the government's explicit requests that they begin to serve multiple clients. Acquiescence in form gave institutes the latitude to defy the government's implied aims. This resonates with Wesphal and Zajac's (1998) central finding, that when firms symbolically adopt long-term incentive plans (a concession to shareholders), shareholders let them off the hook from implementing changes that reduce CEO autonomy and increase board-monitoring capacity. Indeed, it reflects the broader line of research on symbolic management in corporate governance (Zajac and Westphal, 1994; Zajac and Westphal, 1995). But the question here is how long these symbolic structures hold, and what happens when institutional actors are no longer fooled.

Legal clarity did little to change the symbolic nature of firms' strategic responses to the Informatics Law. As such, the government began to apply informal pressure through inspections and evaluations, extensive audits and public shaming as well as public accolades. The aim of these efforts was to enjoin institutes to engage in meaningful diversification, to shift from simple development and productization to research and development and to demand that agreements with firms allow them to develop know-how that they could use elsewhere. In short, informal pressure was exerted to try to

nudge firms in the government's intended direction. Institute S stood by its ceremonial structures despite informal attacks. Now that legal ambiguity had been eliminated, avoidance was no longer a viable option. And so, it shifted towards outright defiance. On the other hand, Institute V, Institute E and Institute F opened up to serve other clients. This was largely a result of either their principal clients' changing fortunes globally and in Brazil, or their role in the value chain, with Flextronics operating its institute much like it did its own manufacturing business, on behalf of various clients. Crises facing their parent companies left Institute V and Institute E with hundreds of engineers that now had very little to do. Therefore, they both engaged in aggressive business development, going after firms with PPBs for R&D projects.

Institute V, Institute E and Institute F diversified and achieved legitimacy in the eyes of the Brazilian government. But they retained legitimacy in the eyes of their clients as well. Theory tells us that when firms are faced with two irreconcilable institutional demands, they will have to decide which audience deserves their full attention and which can be spared a kind glance. While some organizations are able to balance competing institutional logics and achieve sustainable hybridity (Battilana and Dorado, 2010), it is often one logic that gains ascendancy over others (Friedland and Alford, 1991; Heimer, 1999). But this is not the case here. The chapter that follows is dedicated to uncovering the sleight of hand that has seemingly allowed Institute V, Institute E and Institute F to achieve consonance with their now broad base of clients' as well as with the Brazilian government.

5.7. Conclusion

Institutional theorists have argued that organizations often erect symbolic structures to feign consonance with institutional pressures. These structures may be decoupled from

day-to-day activities if institutional demands seriously infringe upon the organization's ability to operate efficiently (Meyer and Rowan, 1977). But when organizations depend on various external actors for critical resources and face conflicting demands, they must somehow balance each party's requirements to retain legitimacy in multiple important spheres. Work in this space has often been categorical in the way it deals with strategic responses to institutional demands; certain types of pressure elicit specific responses. But these studies have seldom captured how demands and responses change over time. They assume that decoupled structures and avoidance strategies are sustainable, or that organizations can somehow balance two incongruent logics in perpetuity. But this is to assume that institutional actors do not see through symbolic structures, or that they are too meek or powerless to act.

Symbolic responses may satisfy institutional demands for a time, but institutional actors eventually sniff them out and re-apply pressure to try to force them into submission. They may do so by reducing legal ambiguity, forcing firms to either hide behind increasingly elaborate structures, or simply defy the state's demands. Some organizations create more and more detailed symbolic structures as pressure mounts. Symbolic structures are defined here as visible, formal organizational structures that reflect the myths of their institutional environment and mask the invisible, informal organizational structures that contour to the demands of everyday work (Meyer and Rowan, 1977; Edelman, 1992). The elimination of legal ambiguity lays bare the state's aims. Eventually, organizations must either choose outright defiance or find another way to achieve legitimacy in the eyes of two or more actors pulling the organization in different directions. Unlike previous work in this domain, this chapter treats strategic responses to institutional demands as moving parts in the process of conflict resolution, not as independent and singular events. In conclusion, this chapter has argued that thinking about strategic responses as isolated

events limits our ability to understand how they evolve over time; previous responses condition future ones.

So long as internal representation favors corporate headquarters and not the host government, degree of acquiescence with the state's demands will be limited (Kostova et al., 2008). The previous chapter introduced the concept of industrial policy refraction. It demonstrated that multinational firms respond to industrial policies in ways that make sense for them; in ways that are consonant with their corporate strategies. We see the same concept at work here. Although all institutes examined conform with the letter of the law, their degree of responsiveness to the Brazilian government's demands varies considerably. Institute S has defied the state's informal demands around client diversification. In large part, this has to do with the fact that the institute is closely tied to a firm that centralizes strategy formulation and implementation, and thus sees the institute as little more than an internal R&D lab to be managed from home. Thus, industrial policy refraction at the R&D institute level is highest for Institute S. The remaining institutes have diversified their base of clients, meaning a smaller degree of refraction. However, as the next chapter will make clear, diversification has not eliminated refraction.

Many countries around the world are crafting policies aimed at attracting foreign R&D centers as a means of technology transfer. It is important to know how these policies shape the relationship between corporate headquarters and subsidiaries. Multinational subsidiaries will often act in ways that keep them in the good graces of both their parent companies and their host governments (Kostova, 1999). Subsidiaries will erect symbolic structures in order to acquiesce to demands emanating from host governments while giving primacy to demands emanating from headquarters. But as time goes on, the government might act to clear up legal ambiguity, reducing the latitude that

organizations have to act in the interest of their parents. Organizations might respond by further elaborating their symbolic structures so that they are no longer thumbnail sketches but detailed illustrations. In some cases, these symbolic structures are so detailed that the host government rests, believing that its demands have been met. But in others, symbolic structures become insufficient in the eyes of the government, and avoidance becomes an untenable strategy.

This chapter's principal aim has been to show how strategic responses and institutional demands co-evolve, looking at how organizations change over time in response to increasingly detailed legal, normative and cognitive demands. As Greenwood and colleagues (2014) note, institutional theorists have done a great job of explaining institutional processes and institutional change at the field level, but have largely ceased to engage with the dependent variable, the organization, in a meaningful way. "Instead of looking at the organization through an institutional lens, we now seem to prefer to understand the institutions themselves, not the thing that they help us explain" (p. 1,209). So this chapter has taken the organization, the R&D institute, as its unit of analysis. Furthermore, this chapter has demonstrated the process of industrial policy refraction. As the previous chapter made clear, firms respond to industrial policies in ways that are consonant with their corporate strategies. Refraction is almost inevitable when policies are applied to foreign firms. But it varies in degree. Here, we saw Institute S defy the Brazilian government's demands, and Institutes E, F and V seemingly acquiesce. The following chapter delves more deeply into these three institutes to examine how they managed to satisfy both the government as well as their now broad base of clients.

6. COUNTERVAILING FORCES IN R&D SERVICES FIRMS

6.1. Introduction

The R&D outsourcing imperative embedded in the Brazilian Informatics Law was motivated by a desire, on the part of policymakers, to ensure that the benefits associated with increased spending would find their way out of some firms and into others, via universities or the emerging cadre of private institutes. It bears stating that the specific ways in which the Brazilian government had hoped to create spillovers were not spelled out in policy documents, and poorly articulated during interviews with government officials. The primary justification for the R&D outsourcing imperative in the law, according to policymakers interviewed, was that it would help create links with universities and other research organizations that could benefit from access to ideas and technologies that would otherwise remain cloistered within multinational firms. But as the previous chapter demonstrated, large multinational firms responded not by working with universities or existing research institutes, but by creating captive institutes of their own; some of these new private institutes were beholden to their benefactors – the companies that had created them – and thus made for poor knowledge conduits.

Efforts on the part of the government to minimize the law's ambiguity led to outright defiance on the part of one institute, and more elaborate avoidance tactics on the part of others. This reflects the idea that policy refraction will vary in line with firms' corporate strategies. Despite clearer and clearer legal language, and even informal pressure, Institute S remained captive to a single client. Others did comply with the increasingly clear letter of the law, but did little to meet the demands between the lines. These institutes were forced to diversify. However, this was largely a result of their principal clients' declining fortunes rather than government pressure. These newly diversified institutes reflected the government's structural vision; they served multiple firms

receiving incentives via the Informatics Law. But as the previous chapter suggested, compliance with the government's demands for diversification was just a more elaborate avoidance tactic. These institutes buried their defiance beyond the state's reach through a process of *organizational balkanization*, the purposeful creation of intra-organizational barriers to knowledge transfer. Of course, shared services providers often erect these barriers when working with various clients, some of which may indeed be competitors. But where this chapter breaks new ground is in examining these barriers in the context of R&D services, and in conceptualizing these barriers as ceremonial responses to institutional pressure. These institutes balkanized to maintain legitimacy vis-à-vis their clients, which sought to keep their outsourced R&D projects protected. Balkanization is here viewed as a purposeful means of avoiding host government demands.

This chapter examines the creation of barriers to intra-organizational knowledge transfer within three Brazilian R&D institutes, Institute V, Institute E and Institute F, as a means of understanding how conflicting institutional demands manifest *within* the organization over time. As Pache and Santos (2010) note, acquiescing to incompatible goal-oriented demands may compromise an organization's institutional support in one sphere or another. The reduction of ambiguity in the Informatics Law left little space for managers to act in a way that allowed them to retain legitimacy in the eyes of both the Brazilian government and their clients. Institute managers erected internal barriers to keep both their clients and the Brazilian government satisfied. But although these barriers allowed institutes to create a stable balance between conflicting demands, they also compromised their ability to build the organizational capabilities necessary to operate efficiently. Organizational balkanization complicated these institutes' ability to leverage knowledge developed while working for one client to solve problems for another.

It is not uncommon for the very existence of symbolic structures to infringe upon an organization's ability to operate efficiently. In order to begin leveraging organizational capabilities to solve problems on behalf of new clients, some institutes have sought a third path: employing the regulatory capabilities developed through years of navigating the complex Informatics Law to access pools of policy-generated R&D funds in other industries. These funds had been created using the Informatics Law as a template, meaning that these regulatory specialists were well-placed to support their organizations' efforts to use them. As previous chapters demonstrated, the difficulty and precarity of operating under the Informatics Law led all institutes studied here to create regulatory affairs departments. Industrial diversification has allowed some of these institutes to expand without breaching the internal barriers that allow them to retain legitimacy among the actors on which they depend for resources. These institutes have managed to achieve stasis between demands emanating from the state, as well as those emanating from their clients by adopting a knowledge brokerage model, leveraging existing knowledge to solve problems in new industries.

The following section provides a brief overview of the literature on project based firms (PBOs) and knowledge brokers. Next, it explores how these three institutes diversified their base of clients within the electronics industry and, in the process, created separate physical and digital spaces to comply with their demands. Data on human resource allocation, collected from one of the institutes examined, supports the assertion made by managers and engineers at each of these institutes, that the larger and more important the client, the more likely that the engineers allocated to their teams will be barred from working with other clients. It then describes how these separations became reinforced as employees relegated to spaces cordoned off from the rest of the organization came to identify with their principal clients rather than their institutes, privileging clients' interests over those of their own organizations. This, despite efforts on the part of

managers to reassert the importance of their identities as institute employees, as well as efforts to encourage the free flow of ideas within the organization. Finally, the chapter explores how some institutes diversified not just in terms of their base of clients, but in terms of the industries they came to serve, accessing new 'small worlds' by engaging with clients in the automotive, electric power and oil & gas industries, among others, and in the process, allowing for the possibility of knowledge brokerage.

This chapter is about how these institutes managed the tension associated with being the foci of conflicting institutional demands emanating from their various clients as well as the Brazilian government, and further, how they engaged in industrial diversification to expand without compromising institutional support. It explores the interplay between the centrifugal forces exerted by clients and the centripetal forces exerted by institute managers attempting to craft a set of core competences under significant constraints. Large multinational clients require intellectual property protection while the Brazilian government seeks to rupture the boundaries separating multinational subsidiaries from the Brazilian innovation system. These demands are incompatible with one another, and dampen the possibilities that organizational learning and knowledge brokerage might afford. In the end, some of these institutes became knowledge brokers, seeking out other pools of captive R&D funds to both reduce the risk associated with dependence on a single legal instrument, and to allow for the creation of intra-organizational channels for knowledge sharing. This became the only way for institutes to leverage their organizational capabilities to expand without compromising their legitimacy in two critical spheres.

6.2. Overview of Project Based Organizations (PBOs) and Knowledge Brokerage

As I have argued in previous chapters, organizational structure varies for historically contingent, path-dependent reasons. But organizations coagulate the way they do for other reasons as well, including the nature of the work they do. As Galbraith (1977) notes, organizations take on various forms along the spectrum from the multidivisional (M-form) to the project-based. Rather than being organized around divisional or functional lines, the pure PBO is organized in such a way that all key business functions are present in the team allocated to a specific project (Hobday, 2000; Gann and Salter, 2000). Here, the project is the key organizing principle; the needs of the project dictate the resources – both internal and external – allocated to it. But while the PBO has been seen as a remarkably effective means of organizing for project-based work, it raises a number of dilemmas as well. Principal among them is the issue of knowledge aggregation. As Sydow and colleagues (2004, p. 1476) put it, there is a perpetual tension between the "immediate task and performance demands of the project at hand versus the opportunities for learning and disseminating project practices that can be employed in subsequent projects." The problem of finding ways to induce organizational learning is endemic in organizations organized around projects.

The R&D institutes that have been studied here share certain characteristics with PBOs, but also differ in important ways. While they don't function like pure PBOs, these institutes do closely resemble what Hobday (2000) dubs 'project-led organizations.' In these organizations, some functional departments cut across project lines. Institute E, Institute F and Institute V all spread certain functions, like business development and regulatory compliance, across projects. But while these institutes are organized around the needs of specific projects, they are constricted in their ability to shift resources around freely because projects span multiple years and are executed in company-specific spaces.

This makes the issue of knowledge aggregation even more complicated than it is for PBOs. Of course, intra-organizational knowledge sharing can be impeded for a number of reasons. If an organization lacks the boundary spanning capabilities necessary to share ideas across project teams, knowledge will collect in pockets without spreading evenly across the firm (Tushman and Scanlan, 1981). Similarly, if an organization does not counteract the tendency for single business units (SBU) to become silos, it will be difficult to build core competences (Prahalad and Hamel, 1990). The relatedness of knowledge across business units is another factor in the efficacy of intra-organizational knowledge transmission (Hansen, 2002). But while there are many reasons why knowledge may not spread evenly throughout an organization, legally mandated boundaries have not been adequately addressed in the literature on R&D management.

In the organizations examined by Hobday (2000), the difficulties associated with knowledge aggregation have little to do with purposeful barriers. They have to do with the fact that channels for knowledge sharing between project teams were simply not created. "Lessons learned from particular projects were not shared formally because there were no structures or incentives for cross-project learning or communications" (p. 885). In the case of these institutes, the problem of knowledge sharing is tied to the fact that the project is not the key organizing principle, the client is. And most clients require that their teams be separated from the rest of the organization. As the literature on Chinese walls instructs, working with clients in the same industry makes it problematic to share knowledge between teams (Brewer and Nash, 1989). Diversifying into new industrial sectors allows for greater flexibility in human resource management. Working 'across conflict of interest classes' allows for the possibility that ideas developed on behalf of one client might be used in the service of another. It also opens up the possibility of knowledge brokerage.

Many organizations identified by Hargadon and Sutton (1997) to be knowledge brokers organize themselves around projects to some degree or another. Hargadon (2002) defines knowledge brokers as organizations that exploit "fragmented social structure by bridging multiple domains and moving ideas from where they are known to where they are not" (p. 44). The process of brokerage requires one to make two assumptions, one about the nature of innovation and another about the structure of the social world. For knowledge brokerage to yield new, commercially viable ideas, one must assume that innovation is recombinant in nature (Schumpeter, 1934). Furthermore, for knowledge brokerage to be possible, one must assume that the social world is divided into numerous isolated domains, or small worlds (Burt, 1992). Departing from these assumptions, Hargadon (2002) describes the process of knowledge brokerage as one that requires an actor to have access to multiple knowledge domains, gain access to multiple domains and bridge gaps, to learn about the problems and the existing resources in each of these domains, to link old knowledge with new problems and new knowledge with old problems and to finally build by introducing innovations into disparate domains. Emblematic examples of knowledge brokers include engineering design consulting firms like IDEO, and management consulting firms like McKinsey & Company.

So PBOs, much like the R&D institutes examined here, suffer from a certain inability to aggregate knowledge accrued through their project-based work. For PBOs, this issue can be resolved through the creation of spaces and mechanisms for knowledge sharing. For Brazilian R&D institutes, the solution is not so simple. Where the possibility of intra-organizational knowledge sharing is precluded by physical, digital and legal barriers, organizations must seek alternate routes. The route that has been explored by many of the institutes I studied is that of industrial diversification. A few years ago, these organizations couldn't share knowledge and resources across client teams because their clients operated in the same industry. By diversifying into new industrial sectors, they

broke down some of the walls to internal collaboration and created the possibility of knowledge brokerage. The capacity for brokerage depends on the ability to bring ideas from where they are *within the organization* to where they are not, through the cultivation of a cohesive organizational memory. By diversifying into new industries, these institutes create not only the possibility of intra-organizational knowledge sharing, but also the possibility of knowledge brokerage.

6.3. Accounting for Centrifugal Forces: Diversification and Balkanization

6.3.1. Early Client Diversification Efforts

Each of these three institutes broadened their base of clients in response to external pressure, which included government demands for diversification, financial difficulties on the part of their principal clients and their principal clients' role as suppliers in the value chain. While managers of these institutes may have always wanted to diversify, if only to hedge against the risk of overreliance on a single client, they, being independent organizations peripheral to their clients' technology roadmaps, had little leeway to do so. Case and point, the managers of Institute S express a desire to diversify, but are unable to do so because of their principal client's prohibition on them doing so. The Secretariat for Informatics Policy (SEPIN) conducted an extensive audit of Informat in 2004 driven by concerns that the institute was operating captive to its founder, Ericsson. At that point in time, the institute was physically located within Ericsson's internal R&D department in the state of São Paulo. Nearly all of its R&D was conducted on behalf of its principal benefactor, a few small spot contracts with local firms notwithstanding. As a result of the audit, Informat was forced to move out of Ericsson's R&D facility and was strongly encouraged to find new clients. But as the previous chapter explained, the audit did little to diversify the institute's client base; 93 percent of the institute's staff worked on behalf of Ericsson and Sony Ericsson as late as 2008. While it did move out of Ericsson's physical

space, and even rebranded itself by changing its name to Institute V, the institute did not engage in meaningful diversification until the financial issues facing its benefactor forced it to seek out other sources of revenue.

Institute V set up a business development unit in 2007 and began serving other clients in the ensuing years. Diversification efforts focused on clients operating outside of Sony Ericsson's main line of business, mobile handsets. For example, a Taiwan-based original design manufacturer (ODM), began manufacturing in Brazil in 2009 using incentives associated with the Informatics Law. It chose to allocate a significant portion of its R&D quota to Institute V, creating an embedded software lab to support its local tablet assembly operations. Institute V faced pushback when it sought to attract clients closer to Sony Ericsson's main line of business. For example, a Korean electronics company that assembles mobile handsets was also required to spend on local R&D, but did not have an institute of its own. Sony Ericsson allowed Institute V to take the firm on as a client only because the R&D it was planning to conduct applied solely to the company's computer monitor business, and not to its mobile handset business. While Institute V has diversified significantly through the years, Sony Mobile still exercises a great deal of power with regard to which clients the institute can take on and which ones it cannot. Like the institute's other clients, it insists on the separation of its team of engineers from the rest of the organization.

For Institute E, 2008-09 was a watershed period. It was the year that Motorola temporarily stopped sending projects as a result of the company's poor financial performance. In 2009, the institute brought in just one-third of the revenue it had generated during the previous fiscal year, according to one director interviewed. While the institute received an emergency loan from its board to stave off collapse, it soon became incumbent upon

management to seek out new sources of funding in order to avoid massive layoffs. As the institute's superintendent at the time put it:

> *We had been all Motorola; the board was Motorola; the director was Motorola…everything was Motorola. It was very difficult to approach other companies because they would say, 'How are you going to protect my IP?' So we decided to go into what I used to call a spiral model, in which we tried to find other niches with apparently no conflict, or less conflict with the Motorola name.*

The company approached an electronics contract manufacturer and various consumer electronics firms concentrated in the personal computer and printer product segments to gauge interest in allocating them their R&D earmarks. But in order to begin securing work from new clients, it became clear that the institute would need to dilute Motorola's role on the institute's board. Institute E had been formed as an association, with Motorola Industrial and Motorola Services as its two cofounders and sole board members. The institute's superintendent at the time was able to convince Motorola to grant new clients seats on the board. The two conditions were that Motorola would retain a majority and that the board seats would not be given to direct competitors. Eventually, the institute's spiral approach to diversification, coupled with the dilution of Motorola's role on the board, allowed it to approach Motorola competitors in search of an outlet for their R&D earmarks; the institute began serving other mobile handset manufacturers in the ensuing years.

As a spinoff of an electronics contract manufacturer, Institute F was better placed to diversify than either of the other two were. Given that many of Flextronics's global clients entering the Brazilian market were not familiar with the country's local R&D requirements, the firm was able to leverage its institute as a value-added service on top of the contract manufacturing services it was already providing. Because the PPB is granted to the manufacturer, not necessarily the branded firm, the responsibility for

meeting the government's requirements often falls to Flextronics. Only in some cases, under certain contractual arrangements, can the R&D obligation be transferred to the non-manufacturing client. This is why it appears that 71 percent of the projects at Institute F are conducted on behalf of one client (Flextronics). In reality, Flextronics remains responsible for the projects in the government's eyes, but the content of the work is typically directed by the individual clients. If this is taken into account, Institute F is one of the most diversified institutes in the country. It conducts R&D on behalf of many of its benefactor's clients, as well as its competitors; the institute works on behalf of various other global contract manufacturers without institutes of their own. Just like Institute V and Institute E, Institute F had to find ways to ensure that its broadening base of clients could rest assured that their intellectual property would be secure.

6.3.2. The Process of Organizational Balkanization

Organizations erect barriers to intra-organizational knowledge transfer when client-specific data needs to be protected. Financial services firms eliminate the flow of client-specific knowledge throughout the organization where conflicts of interest could arise. This involves a digital and physical separation of a bank's commercial lending and trust departments through what some have called 'Chinese walls' (Mendez-Peñate, 1976). Further, financial services firms must separate one client's dataset from another, so long as the two are situated in the same conflict of interest class, or industry. Data can only be shared between employees working on behalf of different companies if they are in different conflict of interest classes, or if the data has been sanitized to eliminate the possibility of backward inference to uncover the source (Brewer and Nash, 1989; Sandhu, 1992). These barriers have been studied in the context of law firms as well, as client-specific information is sensitive and sharing it with lawyers working on behalf of clients in the same industry could lead to breaches in confidentiality (Moser, 1989).

While the literature has not examined these barriers in the context of R&D services firms, their existence does limit their ability to leverage knowledge gained through work conducted on behalf of one client to solve a problem on behalf of another. Unlike project-based organizations (PBOs), these institutes collaborate with clients under agreements that span multiple projects, and are often renewed over the course of many years. Therefore, institutes will often build client-specific teams in order to make sure that the clients are working with engineers familiar with their needs, and that said engineers are not allocated to a team working on behalf of a competitor. Engineers sign non-disclosure agreements (NDA) with the institutes that employ them, and often, with the clients that they work for as well. Most large clients require that their dedicated teams work in segregated areas, both physical and digital. In this way, I conceive of Institute V, Institute E and Institute F as organizations comprised of balkanized spaces. The creation of segregated spaces allows these institutes to retain legitimacy in the eyes of their clients, which demand that their ideas be kept safe, especially when the institute is working with its competitors.

The degree of separation varies from one client team to the next. Smaller clients often have little say over where engineers allocated to their projects on a part-time basis spend the rest of their time. This gives institutes a great deal of flexibility regarding where to allocate resources. Institute employees working on behalf of a small client might have their desks clustered together in a larger space where other client teams are also present. In these cases, the teams are legally and digitally separated from others, but still share a physical space with their colleagues allocated to other clients. But this is not to say that information flows freely between these clients' teams. A team of three to five engineers at Institute E works on behalf of one large multinational ICT services firm. The project manager makes clear that despite the fact that his team works next to a team working on

behalf of another client, there is little interloping between the two. Employees working on behalf of smaller clients must still keep data and project details secure. Larger clients often insist on a strict separation between the work being conducted on their behalf and the work being done elsewhere in the organization, adding a physical layer to the existing legal and digital boundaries.

At most institutes, the first employees to connect with clients are the business development personnel, the program managers and the information technology (IT) specialists. Once it became clear that these institutes would need to diversify, they began constructing business development capabilities. The institutes had never had to go out and find work – it had always come from their principal benefactors. Some courted new clients with R&D earmarks by setting up new offices near their internal R&D facilities. Once the institute acquires new clients, it becomes the job of the project management office (PMO) to organize teams to suit their needs and manage their project pipeline. Institute F now has five program managers, each of which works on behalf of a different major client. Under these program managers are project managers, who manage the individual projects on a day-to-day basis. Program managers are often linked to a particular client, as are the project managers working under them.

Finally, the process of client diversification means new and complex requirements placed on institute IT specialists. They must be fluent in various network systems to achieve interoperability with each client's preferred software services providers. Infrastructure requirements can range from simple logical security – software controls that determine who is and who isn't allowed to enter certain digital spaces – to complete segregation. This might entail dedicating a specific room, with its own air conditioning unit and generator, to a certain client's servers. In some cases, institute superintendents don't even have access to their clients' servers. Some of Institute E's largest clients insist on having

separate server rooms with hard lines running directly to the rooms in which their engineers work. These spaces are often segregated from the rest of the organization through door-access control systems that are programmed to allow some engineers and high-level managers in, while keeping others out. In some extreme cases, cleaning staff have been barred from entering certain rooms if they have access to others.

The program managers, project managers and their teams come to be the main, and sometimes only, points of contact for clients. Part of the reason for this is that these relationships represent a significant investment. Compartmentalizing knowledge within a contained space can be seen as a means of tightening the regime of appropriability that governs who actually profits from the innovations that might emerge from work conducted by these teams (Teece, 1986). For many years, Institute F focused on R&D projects aimed at making its clients' assembly lines more productive. And while automation is still one of the institute's core competences, it has recently bolstered its software development capabilities as well. When Lenovo first entered the Brazilian market, it did so with Flextronics as its contract manufacturer. The company allocated its R&D quota to Institute F, partially because it was less costly than the other institutes, and partially because it allowed the firm to keep production and R&D under a single roof, eliminating the transaction costs associated with managing two separate partners.

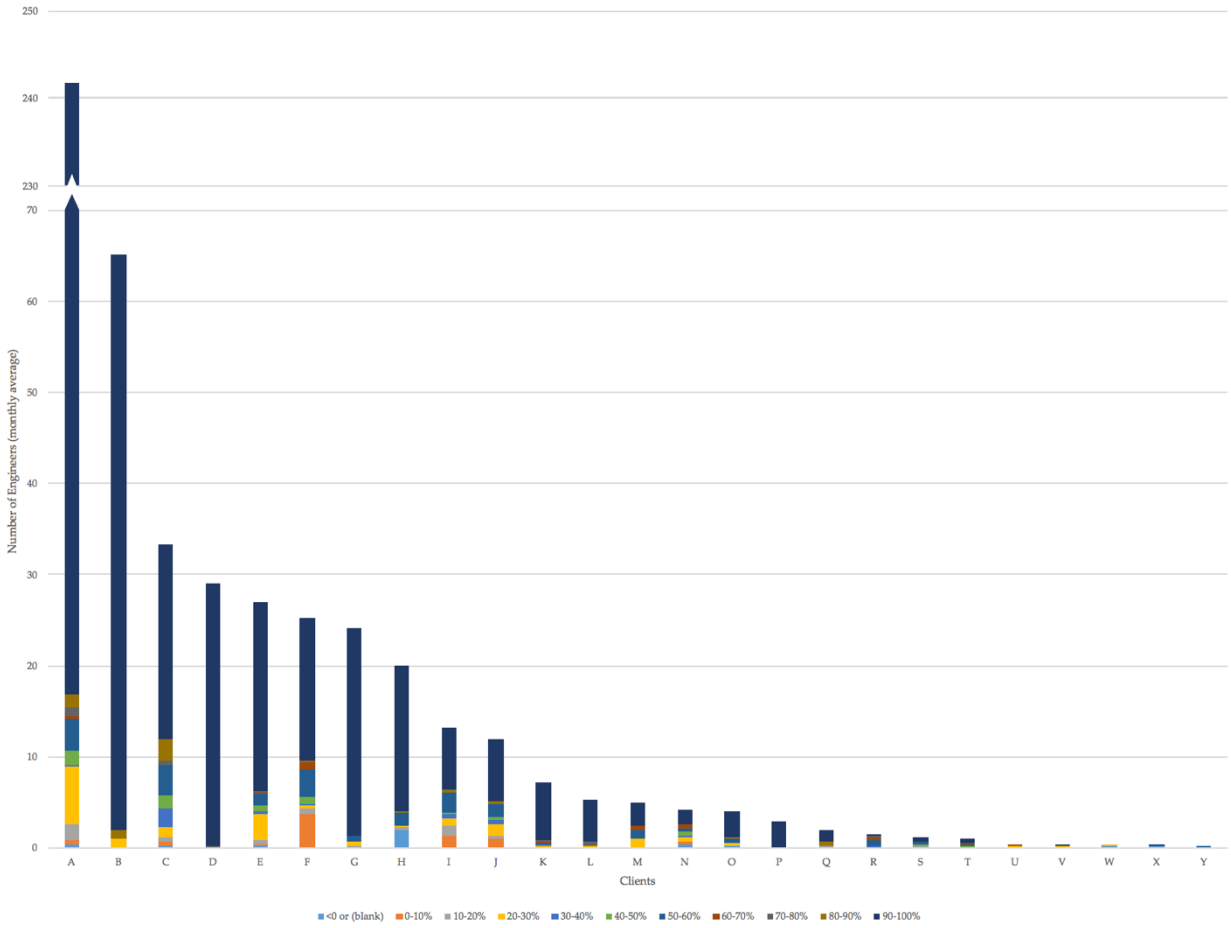
A U.S.-based senior manager for Lenovo described being in a meeting in China when the firm began to brainstorm ways to use the Brazilian R&D earmarks. Lenovo had long licensed its diagnostic software from a third-party software company, and had pushed the firm to develop the product to better suit its needs. But the fact that Lenovo wouldn't be able to appropriate all of the gains associated with the work it was putting into developing this product pushed it to invest in developing its own diagnostic software. The company was already working with Institute F in Brazil, and the two collaborated to

build a team with an understanding of the Unified Extensible Firmware Interface (UEFI), a specification that defines the interface between a computer's hardware and its operating system. The project has been ongoing for more than five years, with much of the technical work executed by a team of 33 engineers at Institute F and 20-30 researchers at the Federal University of Ceará in the northeast of the country, as well as Lenovo's own engineers in the U.S. and China. Institute F's team has been allocated a segregated office space, with limited access to the rest of the organization.

6.3.3. Evidence of Balkanization in Human Resource Allocation Data

Interviews and observation made clear that balkanization had indeed occurred at Institute E, Institute V and at Institute F. Most managers highlighted the fact that it is difficult to change the makeup of their teams, in large part because of the pressure exerted by their clients to keep their composition stable. Spending considerable time at Institute E and Institute F, and walking through Institute V on two different occasions, I got a clear sense of how balkanization manifested in each organization's floorplan. Walking through these institutes on my way to lunch or on my way to an interview, I would invariably come to a turnstile which would only let me through once my escort swiped their ID card. I would pass by locked doors with frosted glass windows every few paces, each of them with a keycard access point to the right of the doorway. Of course, engineers from different quarters were often seen sharing a coffee and chatting in common areas, whether they be lunch rooms or coffee machines. But work areas were neatly divided, especially in the case of large, important clients, which might have both their teams and their server rooms cordoned off.

Figure 6.1: Engineer Allocation by Client at Institute X, January to August, 2016



Data obtained from one of these institutes validated findings generated through my fieldwork. I was granted access to one institute's employee allocation database. It outlined where in the organization's engineers had been allocated, on a monthly basis, between January and August of 2016. Figure 6.1 lays out how engineers are allocated within Institute X (anonymized due to the sensitivity of this data). Along the X-axis are each of the clients with which it worked during these eight months, 25 in all. Each client has been coded with a letter to differentiate it from the others, going from the largest in terms of engineer allocation (A) to the smallest (Y). The Y-axis refers to the number of engineers allocated to each client's projects during the course of these eight months. The columns are segmented on the basis of much of the engineers' time was spent working

for that specific client. For example, 225 of the 242 engineers (93 percent) that worked for Client A between January and August of 2016 spent 90-100% of their time working for that client. Further, 97 percent of engineers that worked for Client B during the same period of time spent 90-100 percent of their time allocated to this client. Generally speaking, the smaller the client, in terms of engineers allocated, the more likely that the engineers working for it are not fully, or even mostly, dedicated to it. Conversely, the larger the client, the more likely it is that the engineers allocated to it are fully, or almost fully, dedicated.

We can draw an important but tenuous inference from these data. The higher the number of engineers working on behalf of a client, and by extension, the larger the pool of funds being allocated to the institute, the higher the likelihood that the R&D taking place is of moderate to high importance for the client. The smaller the number of engineers allocated to a client, and the smaller the pool of funds being directed towards the institute, the lower the likelihood that the R&D taking place is of moderate to high importance for the client. The intuition here is that the more money being directed to an institute as a result of the Informatics Law, the higher the volume of company sales in Brazil. Whether Brazil is an important market for a given multinational firm in absolute or relative terms is of little importance here. In either case, a client spending a great deal of money on R&D is more likely to be concerned about intellectual property theft than is a client spending relatively little. Thus, large clients spending a great deal of money on engineers conducting mission-critical, or at least moderately important R&D, are more likely to pressure institutes to place their people and projects in hermetically sealed spaces than are clients spending relatively little on R&D of relatively little importance.

These data reinforce the broad idea that employee mobility across client teams is an exception rather than a rule. Beyond this, if we look at specific clients more closely, we

see that engineer mobility across *projects* is also an exception rather than a rule. For example, if we examine this institute's largest client, the issue of cross-project mobility comes into starker relief. Forty-seven percent of the institute's engineers working on projects associated with the Informatics Law between January and August of 2016 worked on behalf of this client. During these months, Client A worked on 28 projects in collaboration with Institute X. In all but one of these projects, the majority of engineers spent 90-100 percent of their time of the particular project to which they were allocated. The largest projects, in terms of engineer allocation, are relatively stable over time. Furthermore, in the case of the largest projects, engineers tend to be wholly, or almost wholly allocated.

It is in the smaller projects that we see more mobility. For example, there are four projects that began in January and ended in either February or March of the same year. These were relatively small projects, with between four and eighteen engineers allocated during the months in which they were running. When these projects ended, the engineers were re-allocated to other projects under the same client. In many cases, the whole team was reallocated to a new project. The four to five engineers working on one project in January and February moved to a new project together in March, and stayed there until August. The 14-18 engineers working on another project between January and March were reallocated, together, to an existing project until August. When all of a given client's projects ended during the year, engineers were reallocated to other projects within the organization. However, this was only the case for smaller clients. In some cases, to avoid conflicts of interest, teams were moved from one client and placed on publically funded projects. For example, Client L's team of seven engineers was disbanded after June, and all of them were then allocated to a publically-funded project for July and August.

These institutes began as captive service providers to their respective benefactors. But over time, they constructed business development departments and diversified to serve other clients with R&D earmarks linked to the Informatics Law. To assure clients old and new that their intellectual property would remain secure, they erected internal barriers to knowledge sharing. Clients worked with program and project managers to build teams with the capabilities required to execute their projects. They cordoned these teams off from the rest of the organization. Legal instruments, segregated IT systems and separated physical spaces served to reassure clients wary of collaborating on R&D projects with shared services providers in a relatively unfamiliar institutional context. The data presented above serves as evidence of organizational balkanization, although it cannot capture its multidimensional nature. Interviews and observational data complement these human resource data to create a rich picture of intra-organizational fragmentation. The multidimensional separation outlined here eventually came to drive, and to be reinforced by changes in employee's identities.

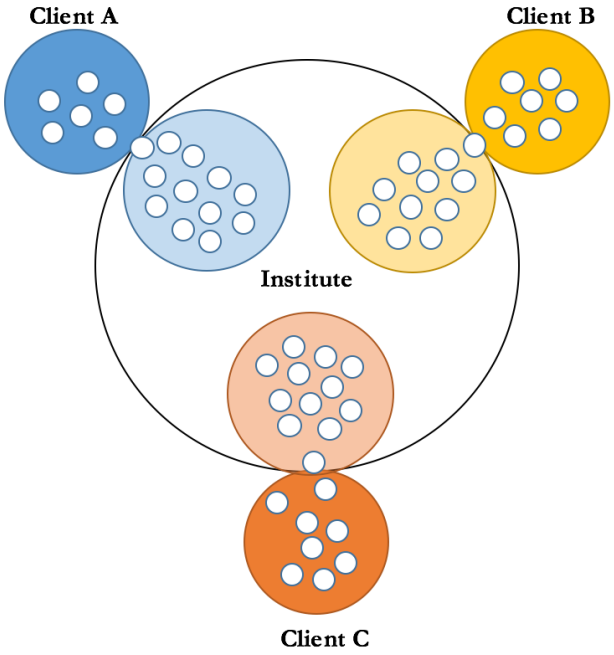
6.3.4. How Changing Employee Identities and Trust Reinforce Boundaries

Employees' institutional commitments shape the ways in which their organizations respond to conflicting demands. In the case of the Brazilian institutes studied here, commitments are often on the side of the client, rather than the state. When many of these institutes were formed as captive R&D centers, the internal representation of the institutional conflict was fairly clear. Institute S's employees' e-mail addresses used and continue to use the Samsung domain name. However, the process of client diversification changed these institutes' complexion. The creation of various client-based teams changed employees' allegiances. This shift – from institutional duality (the state and the benefactor) to institutional plurality (the state and the institute's diverse base of clients) – was particularly problematic for Institute V. As one executive manager notes, many managers retained the Ericsson mentality long after the institute was physically

separated from its client's R&D facilities and renamed. This may have been due to the fact that Informat was one of the first institutes created, meaning that rules and norms regarding diversification were not yet established as a result, employees identified with their principal client, which in turn made it made it difficult to attract new clients. He claims that to this day, there are a few managers that still identify with Sony Mobile more than they do with Institute V, much less other clients.

As time goes on, the separation of space comes to shape workers' identities, further ossifying existing, more cosmetic, intra-organizational divisions. Having a team work closely with a client has benefits, including the ability to understand the client's organizational culture, to know what sorts of projects are likely to dovetail with its technology roadmap and to create a clear division of labor between teams that allows for a relatively seamless handoff of work. The director of software development at Institute E doubles as the program manager for one of the institute's main clients. Both he and his counterpart on the client side made it clear that their teams work in an integrated fashion. The client takes on project management responsibilities while Institute E does the technical work. Teams operate across organizational boundaries, but their tasks and processes are interwoven (see Figure 6.2). This level of integration makes it difficult to see the boundary separating clients from the institutes they work with. In some instances, engineers working at an institute have access cards for their client's facilities, client e-mail addresses or client business cards. Many engineers often co-locate, spending time based within their clients' local subsidiaries. In some cases, they even spend considerable time at their clients' headquarters.

Figure 6.2: Institute Teams and Corresponding Clients



People have multiple identities, defined by Stryker and Serpe (1982) as "internalized positional designations that represent the person's participation in structured role relationships" (p. 206). They often organize these different identifies according to their *salience*, or the probability of their being enacted in response to a particular situation. An identity's salience in turn depends on a person's *commitment* to it, which depends on how important the people that require they occupy that identity are (Stryker, 1968). Engineers in these institutes operate in institutionally pluralistic environments that require they juggle between various identities. They identify as Motorola or Samsung staff, Institute E or Institute S employees or agents working on behalf of the Brazilian government – not to mention the other identities they bring in to work, or leave at the front door. Their relatively low level of interaction with the Brazilian government places their identity as agents of the state at the bottom of the totem pole. But the process of organizational

balkanization bolsters their identities as employees of their principal clients, rather than employees of the institutes on which they rely for their paychecks.

Eventually, the legal, physical and digital boundaries that clients insist upon early in their relationships with Brazilian research institutes become little more than relics, their value supplanted by the reordering of employee identities and emergence of trust between clients and their teams. Initially, boundaries are erected to safeguard against the possibility of opportunistic behavior on the part of a yet unknown R&D institute. Furthermore, they serve a symbolic purpose, as their existence allows multinational subsidiary managers employing these centers to telegraph to their paymasters back at headquarters that they understand the risks that outsourcing R&D in Brazil presents, and that they are doing everything in their power to ensure that intellectual property created there remains secure. But over the course of various agreements and the multitude of projects nested therein, trust emerges between the institute and its client, as well as the client's parent. Not only do clients come to trust that the institutes have the competences needed to complete projects, and that they will fulfill their contractual obligations to them; they come to build goodwill trust as well (Sako, 1992). Within the institutes, teams come to identify with their principal clients, creating a bond that in many ways obviates the need for more visible barriers.

Many institute managers often argue against their implementation in the first place. One institute's ex-superintendent argued quite bluntly that all these physical barriers do is raise the cost of their operations substantially in exchange for a veneer of security. "Many clients of ours still ask for locked doors, and I say, 'What is the point in that?' You put 'Restricted' on the door, but the guys go and have lunch together…It is not the lock that is going to promote anything." He continued by saying that that "companies say, 'I want a data center that is completely isolated.' What is the difference? You can put everything

in the same room!" A business development manager at Institute F stated that at the end of the day, engineers "have access, it's only that they don't use it." But the barriers are useful in that they create the possibility of identity reordering on the part of engineers, and that they create the veneer of safety that multinational firms and their subsidiaries need to outsource R&D under unknown legal regimes of appropriability. Over time, physical divisions become afterthoughts running in the background of day-to-day operations.

6.4. Accounting for Centripetal Forces: Knowledge Aggregation and Brokerage

6.4.1. Overcoming Barriers to Internal Knowledge Transfer

The forces causing Brazilian institutes to erect barriers to internal movement, and by extension, causing engineers to reorder their identities in the workplace, are often met by opposing, but not quite countervailing forces. Institute superintendents, directors and program managers all exert centripetal forces on their teams to try to bring them back from the institute's permeable membranes. These endogenous attempts to reframe employees' commitments are coupled with exogenous shocks that enable greater organizational integrity. But while these attempts on the part of managers as well as the effect of external shocks do create a sense of organizational cohesion despite obvious internal divisions, they are insufficient to counter the forces exerted by clients insistent upon the structural isolation of their teams.

Managers work to create a sense of organizational integrity by organizing events and creating shared spaces where people can come together, even employees who might well be working on behalf of competing clients. One manager at Institute E encouraged his employees to partake in the institute's annual photography competition, to participate in volunteer initiatives like teaching students with disabilities and to attend the regular

brown bag lunches in which colleagues present some of their work and garner feedback. To him, a manager was supposed to pull his or her employees away from their day-to-day client work so that they would remain mindful of the bigger picture. He claimed that he wanted his people to pick up their heads every now and again. At Institute V, architects and designers came together for monthly workshops in which they discussed problems they were having on certain projects, in the hopes that colleagues would share insights with one another. Institute F collaborated with a local university to provide employees with access to an onsite, part-time MBA program, providing a space to collaborate, learn and discuss ideas outside the workplace.

Managers also foster organizational integrity to increase employee satisfaction, and by extension, reduce turnover. As the human resource allocation data presented earlier shows, there is some mobility *within* these balkanized spaces. As a program manager at Institute F made clear, the client for which he was responsible might have 30 small projects running concurrently. He stated that, "When a fire starts in one place, I reallocate some resources to improve the situation, sometimes even to the detriment of others. It's the prioritization of projects." Having multiple concurrent projects helped to keep engineers motivated and engaged with the client. As one institute superintendent claimed, no engineer wants to be working on the same project for five years. In this vein, the ability to move them onto another project run by the same client is critical. But sometimes, a disgruntled employee might need more than a new project to stay motivated. As one project manager put it, "First step, always to the same client. Didn't work out? Then to another client." But as the data on human resource allocation for Institute X shows, even within a balkanized space, mobility is limited. Engineers often work on a single project for extended periods of time.

A number of managers often attempt to persuade their clients that bringing in engineers from other client teams can encourage 'outside-the-box' thinking. It undoubtedly serves their interests, as it ensures that their charges identify with the institute rather than their particular client. It also allows them to hold on to employees who are unhappy working for a particular client, and might leave the institute altogether. Managers argue that mobility serves the clients' interests as well, as it infuses their team with new and potentially useful ideas. But perhaps not surprisingly, clients are reluctant to buy this argument. Brazil is not a place where many foreign multinational firms go for outside the box thinking. They keep these sorts of projects at home. But if clients cannot appreciate the value of injecting vitality into settled teams by introducing engineers from elsewhere in the organization, they do understand the potential harm associated with losing a valuable engineer to the labor market. One institute manager reasoned:

> *Before we lose him to the market – because he can go straight to the competition where it would be completely out of our control – it is better to put him in another place where he is under our control, he will still abide by the NDA. It will also bring some new flash to another project. Keep this guy under our watch. It works.*

In these rare cases, engineers are swapped from one team to another. When this does happen, the preference is for exchanging people working for non-competitors. Engineers are instructed against transplanting lines of code from one client's projects to another's, or sharing prototypes developed for one client with the engineers working on behalf of another. However, it is difficult to halt the flow of know-how within the organization altogether. If know-how trading is common among competitors in certain industries and in certain associations (von Hippel, 1988; Sako, 1996), then it should hardly come as a surprise that it happens within an organization, regardless of how fragmented it is designed to be. This is a source of perpetual tension between clients and the institutes with which they work. Clients often want to keep all knowledge, including discarded

ideas, under wraps. But the institutes see the request to segregate know-how as unreasonable. As one Institute E Institute director put it, "If I learn how to write better throughout the course of a project, if my handwriting improves, does that mean I need to go back to having terrible handwriting?" A program manager for Institute F put it more explicitly:

> *What is spoken about with a client isn't used with another. That would be stupid…But you did research. You spent time. You reasoned. You saw what worked. You saw what didn't. When you go to another [project], that which you got wrong before is in your subconscious. 'Damn, I'm not going to do the same thing I did here, which proved to be incorrect. I'll do it differently.' So, in a way, you don't repeat your mistakes from one [project] to another.*

These opportunities for know-how trading are limited. They often arise when engineers are exchanged between teams, when clients hire an institute for just a few projects before ending the partnership or when clients experience a downturn in the Brazilian market. One of the few ways that institutes can unravel existing teams and redistribute resources as they deem necessary is if their clients' in-country sales drop considerably, bringing their R&D earmarks down to a level at which they cannot sustain the teams they have built. The case of Samsung is instructive here. The two major radio systems for mobile phones are CDMA (Code Division Multiple Access) and GSM (Global System for Mobiles). While most Brazilian operators had used GSM for quite some time, Vivo – the largest mobile operator in Brazil – was long tied to the CDMA system. But in 2006, the company announced that it would build a GSM network to run in parallel with its CDMA network. One R&D manager stated that the shift to GSM hit his company quite hard, as its strength had always been in CDMA. The company had long supported a team within an institute in the northeast of the country, and had long sought to keep the team isolated, as the institute counted Motorola among its largest clients. But the change in direction on the part of Vivo dramatically affected Samsung's sales in the country, forcing it to

relinquish control of said team, which was disbanded and spread throughout the rest of the aforementioned institute.

Given the volatility of demand in the Brazilian market, these events are not entirely uncommon, meaning that companies must sometimes release otherwise cloistered teams to work elsewhere in the organization, even for competitors. In other cases, the sum that a client invests in the institute is too small to justify cloistering any particular employee, much less creating a hermetically sealed space. These projects are typically small, and last a relatively short period of time. Thus know-how developed throughout the course of these projects easily makes its way around the organization. Internal barriers are rarely air tight. Managers often work to create space for collaboration, and try to circulate engineers throughout the organization. But the centripetal forces exerted through managerial efforts as well as demand volatility are infrequent and weak relative to the centrifugal forces exerted by clients keen to ensure that the knowledge produced through collaborative R&D projects is contained in a clearly defined space, among a clearly defined group of engineers. Given the friction associated with sharing knowledge across client teams, institutes have enacted alternative strategies for leveraging technical capabilities across client teams.

6.4.2. Knowledge Aggregation and Brokerage via Industrial Diversification

Although these institutes were borne of the Informatics Law, many of them found that remaining entirely dependent on a single policy left them in a precarious state. Furthermore, dependence on the Informatics Law meant serving a group of largely electronics firms that would always see one another as competitors, restricting their ability to leverage knowledge gained working for one client in the service of another. Through years of working with the Brazilian government, many of these institutes have

developed robust regulatory teams in order to ensure that their projects are admissible under the Informatics Law. Given their lack of familiarity with the law, many firms have traditionally been and continue to be risk-averse, asking institutes to do interesting and relevant work insofar as it fits neatly within the law's definition of what constitutes R&D. One manager often hears the refrain, "For the love of god, make an application that they won't reject!" The risk of a *glosa*, a fine for non-compliance, leads firms to prioritize safety over innovation.

The regulatory teams in each of these institutes work to ensure that projects are admissible under the R&D regulations in the Informatics Law. It was the regulatory capabilities developed through Informatics Law-related projects that allowed institutes to begin engaging with firms subject to similar industrial policies in other sectors. Each of the institutes in my sample has designated regulatory coordinators, or persons otherwise charged with managing institutional relationships, some of which involve regulatory bodies. Some of these regulatory specialists have narrow, operational job descriptions, for example, staying on top of ever-changing mobile device certification criteria established by the National Agency for Telecommunications (ANATEL). However, the specialists we are concerned with here are those charged with writing annual reports (RDAs) for the MCTI. While these personnel are sporadically hired away from the regulatory agencies themselves, more often than not, they learn on the job. These annual reports detail the institute's expenses for the year: how much was spent on project-related expenses, and how much was spent on each line item, as well as how much was spent on administration, including third party services, travel for conferences, equipment, etc. These reports are incredibly detailed, and are complicated to write. The regulatory specialists charged with collating information and writing these reports must do so in ways that minimize the risk of a *glosa*.

The Brazilian government modeled many of its industrial policies aimed at boosting R&D spending, and encouraging outsourcing, on the Informatics Law. Much like the Informatics Law, these new programs require that the third party service providers taking on projects provide detailed reports on how they made use of their funds. ANATEL, National Agency for Electric Energy (ANEEL) and National Petroleum Agency (ANP) have all recently begun to require that firms invest a certain percentage of their annual revenues on R&D. Telecommunications operators under ANATEL must spend three percent of net annual revenues on R&D. Under ANEEL's framework, electricity generators must spend 0.4 percent of net operating revenue on R&D, distributors are required to spend 0.3 percent and those in electricity transmission must spend 0.4 percent. ANP requires that operators spend one percent of net annual revenue generated from large oil fields on R&D. Up to half of the earmark can be spent internally, while at least half must be spent through universities and research institutes certified by ANP. Finally, the government established Inovar Auto in 2012 to incentivize innovation in the automotive industry by requiring that lead firms spend 0.5 percent of gross operating revenue on R&D (Zylberberg, 2016). One business development consultant working for an institute states that, "If you analyze the text for the ANEEL law, it was based on the text for the Informatics Law…same thing with Inovar Auto…They all have their roots in the Informatics Law."

Institute E and Institute F have both engaged in industrial diversification, while Institute V has ventured little beyond the Informatics Law. Through the Informatics Law, as well as through the incentive program for semiconductors and displays (PADIS) and the country's integrated circuit design program (IC Brasil), Institute E has built significant hardware development capabilities. One of the first companies that Institute E engaged with on the other side of Motorola's collapse in 2008-09 was a security company that wanted to develop a vehicle locator system to avoid truck theft. The product was

developed, but ultimately rejected by the client. Institute E was granted sole ownership of the intellectual property. It then stripped the product down and shopped it around to multinational automotive suppliers throughout Brazil. The product was eventually picked up by Magneti Marelli, an Italian first-tier automotive supplier with a long tradition of innovation in the Brazilian market. The firm had developed its Software Flexfuel Sensor in Brazil in 2003. The sensor calibrates the car's engine to operate efficiently regardless of the fuel – gasoline, alcohol or a mixture of the two – that the driver puts in the car. The sensor is now embedded in more than 10 million vehicles in Brazil, and is being exported around the world (Nascimento et al., 2009). The company now sits on Institute E's board and funds it to provide industrial design services for dashboard modules.

The institute has also made headway in gaining access to the R&D earmarks established by ANEEL. In particular, it engaged with the Companhia Paulista de Força e Luz (CPFL), part of CPFL Energia, the third-largest electric utility in the country, on a number of projects linked to the R&D quota for energy distributors. For example, it developed a smart energy meter that, through non-invasive measures, isolates a home's electricity consumption to test whether or not it is being served effectively by the grid. Because Institute E owns 50 percent of the intellectual property rights, it can profit by licensing the platform to other electric utilities. Institute E has worked on behalf of a number of other electric utilities on projects that range from data collection systems for energy grids to OLED lighting systems. Companies that generate, distribute and transmit electricity are obligated to spend a percentage of annual revenue on R&D. Institute E has positioned itself to access this pool of funds, diluting its dependence on the Informatics Law.

Institute F has targeted alternate funding schemes even more aggressively than has Institute E. While a number of private R&D institutes count on experts in radio frequency

identification (RFID), Institute F is perhaps the cognitive referent for clients seeking to complete R&D projects involving this technology. The institute developed its expertise in RFID in collaboration with HP, which decided to create an RFID Center of Excellence there in 2005. RFID systems involve the use of tags, active or passive chips that can store electronic information and are often affixed to a range of moving objects, from components on a production line to livestock roaming through pasture, as well as readers, active or passive devices that either transmit radio signals to passive tags or receive radio signals from active tags. HP initially directed some of its R&D funds towards creating an RFID center because country managers wanted to increase productivity on their production lines at Flextronics. Many projects have been executed through the years, for example, a reader portal – a metallic framework with a movable reader antenna through which pallets of tagged printers and cartridges pass – which has reduced time and minimized errors, contributing to the company's bottom line (Swedberg, 2014).

RFID is not a new technology. It has been around in one form or another for the better part of a half century. But RFID implementation requires a great deal of customization to the setting in which the system will be used. Institute F has leveraged its expertise in the technology to serve other Flextronics clients, as well as clients in other industries. Much like Institute E, the institute has sought to employ its technological capabilities to access new pools of earmarked R&D funds. It has worked with the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) to develop RFID tags for certain species of birds that are often captured and sold illegally. The institute has a number of other RFID projects in the works across a range of sectors. Two business development consultants have been brought on to examine opportunities for industrial diversification. The senior consultant reasons that:

> T*oday, agribusiness is the biggest market in Brazil, valued at $12-15 billion a year. Should I keep looking for business in electronics, which is worth $1-2 billion? We're going out to agribusiness. Now, agribusiness is something we don't know much about. Almost nothing. However, to enter agribusiness, we need to have something that we know how to do well: software development. That's what I'm trying to do.*

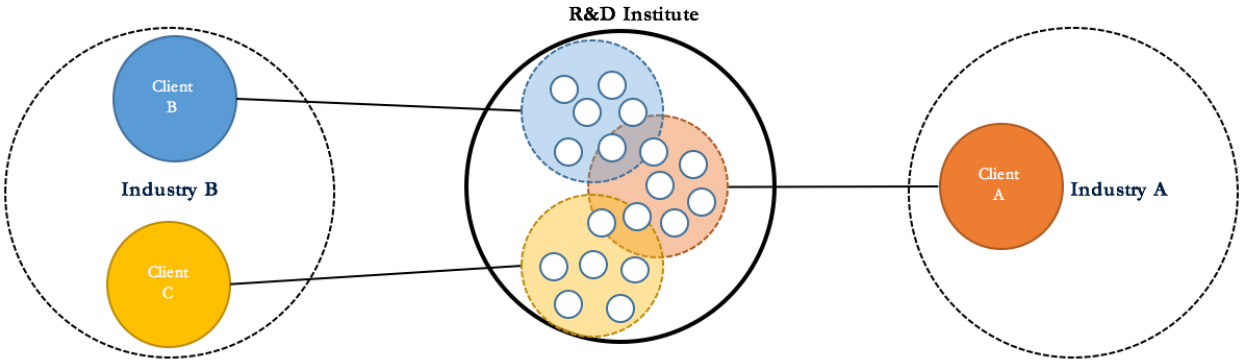
Specifically, they have engaged the Brazilian Agricultural Research Corporation (Embrapa), the Brazilian Development Bank (BNDES) as well as one of the largest orange juice suppliers in the world to develop an RFID system to monitor the productivity of its orange groves. The aim is to access funding through the Inova Agro program funded by BNDES and FINEP to drive innovation in the country's agricultural sector. Beyond agriculture, the institute is developing projects with a number of electric utilities with R&D earmarks created through ANEEL's program. For example, it has engaged with an electricity distributor in the south to develop active RFID chips powered by photovoltaic cells. Initially, the potential client said that RFID was not innovative, and that because it wasn't, the project wouldn't be eligible for funding through ANEEL's program.

Beyond having the technical capabilities required to successfully complete projects on behalf of clients in different industries, institutes must have the regulatory capabilities necessary to ensure that project proposals are written in a way that makes them eligible for funding under disparate industrial policy frameworks. In the case of Institute F and its pursuit of an electricity distributor, the business development consultant managing the account said that the potential client didn't see the project as being innovative. "We tried to prove, prove, prove [that it was]. They said, 'Ok, but RFID isn't innovative.' So what did we do? What was the idea? They hadn't yet understood the innovation." So he and the regulatory team worked to rewrite the project proposal in a way that fit under the ANEEL program. Institute E has similarly leveraged its familiarity with the country's

various industrial policy frameworks to frame projects in a way that makes them appropriate targets for R&D earmarks.

Organizations outsourcing their R&D earmarks to entities like Institute V, Institute E and Institute F are most concerned with slippage between clients in a single industry. Samsung does not want Motorola getting a hold of its ideas, and vice versa. But the pressure to maintain barriers to intra-organizational knowledge transfer becomes less intense when institutes reach into other industries for work. As such, clients might be more open to sharing an engineer with another client if they operate in an entirely different industry. For example, an engineer working in the HP-funded RFID Center for Excellence might face little pushback if he or she is moved to a project on behalf of an electric utility or an orange juice producer. Thus, the walls separating teams within these R&D institutes become softer and more permeable when a strategy of industrial diversification is enacted (see Figure 6.3).

Figure 6.3: R&D Institute Operating Across Industries



These institutes were never meant to diversify into other industrial sectors. The government initially envisioned that they would serve as a tool for drawing ideas out of multinational electronics firms that would have otherwise been content to keep them

within their captive laboratories. The data that the MCTI, and in particular SEPIN, collects and publishes on these institutes confirms that they were meant to be lynchpins of the sectoral innovation system, not knowledge brokers working with clients across industries. The only place where these institutes are publicly evaluated is in the MCTI and SEPIN's annual statistical report of the results of the Informatics Law. The report evaluates the institutes according to metrics such as the number of agreements they have signed with companies, including the aggregate value of those agreements, the number of projects conducted under them and the number of people that these institutes employ, as well as certain output measures like patents and publications generated as a result of the R&D earmarks. Because different ministries administer the other R&D programs – the Ministry of Mines and Energy (MME) oversees ANEEL and ANP, and the Ministry of Development, Industry, and Foreign Trade (MDIC) oversees Inovar Auto, for example – the government, on aggregate, has a limited view of how these institutes have evolved. Diversification beyond the Informatics Law takes place beyond the purview of the state.

6.5. Discussion

The MCTI's stated aim in creating an R&D outsourcing requirement, and inadvertently creating a cadre of certified organizations through which to dispense earmarked funds, was to ensure that the technology localized did not stay within a company's boundaries. The goal was to create an analogue of the industry-university partnerships common in the U.S. But in addition to spending some earmarked funds on university projects, a number of firms established their own captive R&D institutes. Over time, the government sought to force these institutes to open up and serve other clients, minimizing the refraction that had taken place in this initial period. But the fact that most of the potential clients were operating in the same industry, and in many cases, were direct competitors to the institute's original benefactors, meant that opportunities for knowledge spillovers

were few and far between. The institutes were forced to engage in a process of organizational balkanization to retain legitimacy vis-à-vis their base of clients.

The semi-permanent separation of engineers within the organization solved the problem of legitimacy. Satisfied that some institutes had expanded their base of clients, the government lauded their efforts and held them up as centers of excellence. Clients were also satisfied with the creation of internal boundaries, finding that the use of legal instruments like NDAs coupled with the creation of physical and digital barriers were sufficient means of ensuring that their intellectual property would remain safe. Beyond these very visible divisions, non-verbal alignment between institute and client engineering teams further reassured clients that their outsourced service providers were on their side. Over time, trust between these teams and their clients grew. With trust came a more important role in their multinational operations. Today, Institute E's Motorola and Dell teams collaborate not only with these firms' Brazilian subsidiaries, but with their other global R&D centers and their headquarters as well. The same can be said of the Sony Mobile team in Institute V and Lenovo team in Institute F. This brought Brazilian engineers into closer communion with their clients, adding another layer to the tug-of-war between clients and institutes over the identity of their employees.

Organizational balkanization can be understood as a special case of what Pratt and Foreman (2000) call compartmentalization, a means by which an organization preserves multiple identities without achieving synergy by bringing them together. It has long been understood that organizations decouple their formal structures from everyday practices to abide by externally imposed institutional demands while remaining operationally efficient (Meyer and Rowan, 1977; Boxenbaum and Jonsson, 2008). But when an organization is exposed to multiple conflicting demands, more elaborate organizational responses may be necessary. The literature generally describes compartmentalization as

being a largely voluntary process aimed at keeping the various identities within an organization segregated. For example, staff at a rehabilitation facility must balance two antithetical identities, one that engages in rehabilitation and another that offers patients acute care. Managers create a distinction by enforcing a dress code: street clothes for rehabilitation and scrubs for acute care (Pratt and Rafaeli, 1997). But here, compartmentalization is a legally mandated requirement that institutes must abide by.

The process described here has an analogue in the field of landscape ecology: habitat fragmentation. This refers to the creation, whether by natural or artificial means, of discontinuities in a population's environment. Habitat fragmentation often begets population fragmentation, which comes with its own set of pathologies including the attenuation of biodiversity, and eventually, ecosystem decay. These islands cannot support the same level of biodiversity that a contiguous space of the same size can (Forman, 1995). The same principle applies to balkanized organizations. The separation of an erstwhile contiguous organization creates perpetual divides. Client imperatives and peculiarities create divisions, but it is the ensuing reordering of identities on the part of engineers that make them relatively enduring. For this reason, managers concerned with the long-term survival of their institutes spend a great deal of time pushing their employees back to center, trying to remind them who they work for and whose interests it was their job to further. Engineers are thus subjected to countervailing forces of uneven strength. Physical, digital and legal barriers bring them to identify more closely with their clients rather than their employers. Despite their best efforts, managers cannot match these centrifugal forces. It is only through the pursuit of new opportunities in unrelated industries that managers are able to create communication channels within their organizations, as well as opportunities for knowledge brokerage.

Over time, many of these institutes developed strong regulatory capabilities. They were able to craft and frame R&D projects in a way that would be accepted by the Brazilian government. They also developed strong core technical competencies through long-standing agreements with leading multinational firms. But they faced barriers to intra-organizational knowledge sharing, limiting their ability to distribute these competencies evenly within their organizations, as well as their ability to leverage them to solve problems on behalf of other clients. Furthermore, recognizing the risk of being dependent on a single base of clients in a single industry, some institutes decided to pursue a strategy of industrial diversification in order to create new and less encumbered possibilities for knowledge sharing. This strategy did not negatively affect institutes' legitimacy vis-à-vis the Brazilian government, nor did it infringe upon their legitimacy vis-à-vis their clients, which were not as concerned about internal knowledge sharing if done on behalf of firms in completely different industries. A few institutes have been able to enact brokerage strategies by diversifying into new industries, leveraging their regulatory capabilities to access pools of R&D earmarks created by industrial policies aimed at automotive lead firms and suppliers, electric utilities, agro-industrial firms and oil and gas companies.

The point at the heart of this chapter, and more broadly, at the heart of this thesis, is that industrial policies are refracted by firms' corporate strategies, meaning that the outcomes of said policies often diverge from what the state anticipated when formulating and implementing them. This is especially apparent when studying multinational subsidiaries because they are more dependent on their parent companies than they are on the local government for critical resources. But even within this subset, there is variation. Organizations are different. They have different histories; different constitutions. And these differences matter when they enter new markets, and when they interpret and react to unfamiliar industrial policy regimes. For the institutes examined here, refraction is actually fairly uniform across cases. The government pushed all of

these institutes to diversify so that they would comply with the demand that they generate knowledge spillovers. In the case of Institute S, these demands fell on deaf ears, leading to a fairly radical degree of refraction. In the other cases, organizational balkanization ensured that knowledge would not flow freely within the institutes, and even less without. Thus the institutes internalized these requirements, but did with them what they wanted, or more precisely, what their clients demanded of them. Policy refraction did indeed occur in these cases as well, although not as acutely as it did in the case of Institute S.

Institute E, Institute V and Institute F all engaged in a process of organizational balkanization, limiting the possibility of knowledge sharing within and without their respective organizations to comply with their clients' demands for data security. But as Brewer and Nash (1989) note, data security becomes much less critical when moving across conflict of interest classes. In the end, these institutes, some more successfully than others, were able to diversify into new industrial sectors by leveraging their technical and regulatory capabilities. Gaining access to new small worlds that their existing clients were none too concerned about allowed them to create internal channels for knowledge sharing, and beyond that, allowed for the enactment of brokerage strategies. Ironically, these institutes did what the Brazilian government had wanted them to do all along. They became knowledge brokers capable of leveraging their know-how to solve problems in Brazilian industry. Thus, the link between policy aims and outcomes became a bit straighter, if for reasons that had nothing to do with state imperatives. This was one of the few ways in which institutes were able to further their own corporate aims while retaining legitimacy vis-à-vis the two main sources of institutional pressure, their clients and the Brazilian government. Neither the state nor the institute's clients pushed for industrial diversification. But they did not preclude this strategy either.

7. CONCLUSION

The central aim of this doctoral dissertation has been to introduce the concept of industrial policy refraction, and to demonstrate how it plays out at multiple levels, from the multinational firm down to the level of a specific team of engineers. Firms respond to industrial policies in ways that are consonant with their corporate strategies, which in the case of foreign firms, implies a certain degree of deviation from the government's desired goals. The notion that firms shape policy outcomes isn't a radical idea. What is new is the idea that subsidiaries of multinational firms respond to industrial policies in ways that are conditioned by their parents' corporate strategies, in particular, the way they manage their networks of business units, affiliates and subsidiaries. I have argued that firms that decentralize strategy formulation and implementation are more likely to act in line with a host government's industrial policy regime than are firms that centralize strategy formulation and implementation. Furthermore, I have demonstrated how this process of refraction plays out when examining these multinational firms' partners, as well as the teams of engineers that comprise them.

If the threat of sanction on the part of the host government is sufficiently high, firms must at least pay lip service to its industrial policies. But at the same time, these multinational subsidiaries are responsible, first and foremost, to their parent companies. This implies a certain degree of conflict. Host governments and parent companies rarely want the same things. Multinational subsidiaries, like most organizations, are often confronted with conflicting institutional demands. Because acting illegitimately carries a cost, they must operate in accordance, or at least feign operating in accordance, with the demands placed on them by all actors on which they depend for critical resources. This can prove to be impossible if institutional actors are pushing for truly incommensurable things. So firms may get creative about the ways they respond to pressure, feigning consonance with

demands emanating from the actors on which they depend least, and complying with demands emanating from actors on which they depend most. In the R&D institutes examined for this study, organizations feign consonance with industrial policy and acquiesce to demands emanating from multinational clients.

This chapter re-hashes the role of multinational firms in the process of industrialization, laying out why it is difficult in some cases for developmental states to get multinationals to conform to their demands. It then proposes that strategic responses and institutional demands co-evolve; there is a certain degree of path dependence in institutional actors' demands as well as in organizations' responses. Sometimes firms will feign conformity with a certain set of demands if conformity would cause a loss of legitimacy vis-à-vis another, more important institutional actor. Because institutional actors often sniff out non-conformity, no matter how well disguised, organizations are forced to burrow, placing their continued defiance beyond the reach of the state. In the end, organizations may reach a state of emulsion, even acquiescing to state demands in unanticipated ways, all the while maintaining conformity with demands coming from their multinational clients. The chapter ends with some parting thoughts regarding the subject matter that has consumed my thoughts for more than three years, the policy-related implications of this research as well as with a brief overview where this research might lead in the future.

7.1. Multinational Firms and Economic Development

Developmental states seek to achieve what their moniker implies.[19] But while these states' ultimate objectives may differ, the *means* by which they have traditionally been achieved varies remarkably little from one country to the next, and has changed little in the last few centuries. Industrialization has long been the most effective way for a country to increase its labor productivity, and hence achieve its desired development-related outcomes. Rodrik (2013, p. 166) provides compelling evidence, finding "a highly robust tendency toward convergence in labor productivity in manufacturing activities, regardless of geography, policies, or other country-level influences." All other things being equal, countries that enact policies aimed at driving structural change in favor of manufacturing industries tend to see convergence in labor productivity.[20] Since

[19] Development is defined slightly differently from one country to the next – after all, its conception must dovetail with a country's political institutions to be deemed legitimate. However, there are broad and widely accepted notions, or least common denominators, of what constitutes development. The UN's Millennium Development Goals (MDGs), and more recently, Sustainable Development Goals (SDGs), are manifestations of this relatively new global consensus regarding what goals should be pursued. All UN member states have agreed to pursue goals that include eradicating extreme poverty and hunger, providing universal primary education and achieving environmental sustainability, among others. These goals reflect a multidimensional understanding of development, which is perhaps best captured by Amartya Sen's (1999) notion of development as the expansion of substantive freedom. I recognize that by focusing strictly on industrial policy, this dissertation adopts a definition of development that centers on the increase of income and wealth in a specific population. While increased per capita income may not satisfy all countries' definitions of what constitutes development, it is often a necessary means by which to achieve some degree of progress, however it is defined. The limitations associated with this perspective are noted, but are accepted, given the limited scope of this doctoral work.

[20] Two comments must be made at this point. The first is that the very notion that manufacturing should be the object of industrial policies is not unproblematic. The boundaries separating manufacturing from services, for example, are more porous today than they have ever been. The very business models that many manufacturing industries have coalesced around for so long are changing before our eyes. Car ownership is giving way to car and ride sharing. Firms that used to sell software as a product are now selling it as a service. Some large businesses now sign lighting contracts rather than buying bulbs. As manufacturing and services continue to collapse, the objects on which industrial policies meditate will need to change. The second comment is that the manufacturing runway for developing countries, particularly those in Latin America, is getting shorter and shorter. In fact, many countries are experiencing premature deindustrialization, meaning limited room for manufacturing-led convergence in labor productivity, and further, limited opportunities for tried and tested means of pursuing economic development (Rodrik, 2016).

mechanized textile production first radiated outwards from Great Britain towards the end of the 18th century, many countries have relied on two things to induce industrialization within their borders. The first is government policy aimed at building industries that would, if left to market forces, never have a chance to take hold. The second is access to foreign technology, and perhaps more importantly, the capabilities necessary to use it.

Hamilton (1791) first articulated the infant industry argument, which states that a country's nascent industries do not have the economies of scale that their counterparts in more developed nations have, and thus require protection until they are able to compete at home and abroad. To this day, and perhaps even more so than in the past, countries have found ways to protect their local manufacturing industries though various means, including tariff and non-tariff barriers to foreign incursions. The general path has been to begin by supporting national industries though protection, thus allowing them to grow in a sheltered domestic market, and to then continue by removing the sources of protection and forcing them to compete on the global market (Gereffi and Wyman, 1990). But achieving scale in a protected market is not simply a matter of grit and brawn. In today's globalized world, it makes little sense for national industries, no matter how protected they are, to build everything from scratch. This is why foreign technology is, and has always been, vital to the catch up.

Simply stated, Gerschenkron's (1962) theory of economic backwardness postulates that the more 'backward' a country is relative to high-income, industrialized nations, the greater its potential energy; the more likely it is to grow quickly. Catch up depends, in part, on a country's ability to import the latest technologies from more developed nations, thus avoiding the costly experimentation endemic to the process of technological development. Unfortunately, this is a bit of a catch-22. As Hirschman (1971) puts it,

industrialization on the basis of foreign technology is necessarily hollow in certain respects. Specifically, it does not allow for the "sustained technological experimentation and concomitant training in innovation what are characteristic of pioneer industrial countries" (p. 94). Developing countries don't acquire the tacit knowledge that can only be assimilated through the time-consuming process of testing out various potential solutions to a problem and eventually stumbling upon one that works.

But because the stakes are so high and the needs so acute, developing countries cannot and should not spend time and resources experimenting where others have already toiled and found solutions. Thus, the next best thing to developing technology yourself is having the capabilities necessary to actually make use of foreign technology. Abramovitz (1986) argues that access to foreign technology alone is insufficient to spur catch-up, that countries need social capabilities to absorb and make sense of foreign technology. Indeed, access to British technology alone was not enough for Continental Europe to begin gaining ground on its referent. "Although [Western European countries] were able to study the new machines and engines almost from the start and indeed acquire them in spite of prohibitions on their export, they were generations in absorbing them and even longer in catching up to British practice" (Landes, 1969, p. 125). If knowledge must be acquired from abroad for the sake of expediency, then it becomes incumbent upon a country to develop the receptors for it.

Developing country governments have long seen multinational firms as means of tracing the technological progress achieved in their industrialized counterparts, thereby taking a shortcut on the road to economic prosperity. Domestic multinational firms can be useful in this regard when they engage in technology-seeking foreign investment in global technology centers. The case of Samsung's semiconductor push exemplifies this strategy (Kim, 1997). But more often than not, it is the foreign multinationals that are reified as

conduits of foreign technology. In countries with relatively underdeveloped industrial sectors, foreign firms become the fulcrums around which local firms begin to emerge and grow. This occurs by osmosis in some cases, as foreign firms hire local employees and sometimes work with local universities and suppliers. But it is much more likely to happen through deliberate policy mechanisms like local content requirements and local R&D requirements. The more attractive the local market, the more likely foreign firms are to seek entry, even if it entails some cost. This gives policymakers the space to craft policies aimed at extracting more value from foreign investors they would otherwise add.

Multinational firms do not always comply with local content requirements. Of course, firms will not disregard laws if the threat of sanction exists and is sufficiently high. But in many cases, the threat of sanction is simply not credible due to lacking state capacity, which Lindvall and Teorell (2016) define as "the strength of the causal relationship between policy instruments and the intended outcomes of public policies," (p. 18) mediated by the state's resources, namely, revenue, human capital and information. The relationship between instruments and outcomes is weak when the state doesn't have the money, people or information necessary to monitor whether or not firms are complying with the law. Evans (1995) describes the failings of the Special Secretariat for Informatics (SEI) in these terms; the group lacked the people and capabilities necessary to patrol the outer edges of the market reserve. Lindvall and Teorell's (2016) model assumes that the state's resources are the primary determinants of the strength of the causal relationship between policy instruments and outcomes. But as this study has demonstrated, even when the same policy, monitored by the same government agency, is applied to two different firms, policy outcomes still vary. This tells us that there is something more than just state resources mediating the relationship between instruments and outcomes. Indeed, my main argument has been that firms are different, and that these differences produce varying degrees of policy refraction.

If we assume for a moment that multinational firms do comply with legal requirements, does this mean that the state's desired outcomes are realized? Institutional theory has been a useful lens through which to peer into this question. Kostova and colleagues (2008) posit that multinational firms may comply with regulative institutional demands, but that conformity with regard to cognitive and normative demands is highly unlikely. Meeting legal requirements makes sense, if there is a reasonable chance that you will be caught and sanctioned for breaking the law. But these scholars propose that there is no way to require conformity along cognitive and normative lines. Foreign subsidiaries tend to be more dependent on their parent companies for critical resources than they are on their host country governments. As such, they will prioritize their parents' needs whenever possible. What does this actually mean in practice?

Developing country governments have long sought to attract foreign firms' R&D operations. Unlike production-related import substitution, the reasons for attracting R&D are less related to acute balance of payment issues, and more directly tied to technology diffusion. A government may require that a firm spend money on local R&D. But it cannot dictate what sort of R&D it conducts in its facility, or how critical the projects carried out there are for the company as a whole. Evans (1979) documented this issue in the Brazilian context:

> *Knowledge is hard to monopolize – harder if its production is not highly centralized. Multinationals have then every motivation to keep the innovative side of their businesses as close to home as possible. As long as they are free to make that choice, the industrialization of the periphery will remain partial. Facilities for the production of new knowledge will not be located there. New technology will continue to be generated by the center countries and later assimilated by the periphery (p. 37).*

The truth is that firms are relatively free to choose what sort of work they want to in each of their R&D centers. In public laboratories, the government sets the research agenda. However, in private firms, especially foreign ones, the government tends to have little say over what sorts of R&D should be conducted and what sorts should not. As long as projects don't break the law, there are few levers the state can pull to shape a firm's research agenda. The state can provide incentives for certain types of projects, for example, by incentivizing firms to address grand challenges. But generally speaking, there is no coercive mechanism for enforcing that certain kinds of projects are executed within a country's borders. However, my research finds that some firms may come closer to conforming to the state's subtler demands than others. As Evan's (1979) notes, "The history of nationalist pressure and multinational response in the area of research and development suggests…that the success of nationalist pressure will vary not only by industry but also issue by issue and firm by firm" (p. 191). To be clear, a firm conforming to nationalist pressure has nothing to do with altruism. It has to do with the fact that autonomy allows local subsidiaries to conform to local rules of appropriateness, which in turn grants them the legitimacy they need to access state resources. In large part, this dissertation has focused on uncovering why nationalist pressure is likely to affect firms differently, with some acquiescing and others defying demands.

As was proposed in Chapter Four, multinational subsidiaries that are granted greater degrees of freedom are more likely to act in accordance not just with the letter of the law, but with the spirit of the law as well, than are multinational subsidiaries that are granted relatively little autonomy. Furthermore, the degree to which appendages of the multinational corporation experience autonomy has a great deal to do with their parent company's history. Interviews with HP executives and secondary materials support the idea that the company values autonomy at the individual, business unit and subsidiary levels. As it divisionalized, it decomposed into fully functional units that could operate

autonomously. Each business unit was responsible for a specific line of business, and had the R&D, marketing and manufacturing capabilities necessary to operate largely independently of the larger organization. Strategy formulation was often decentralized, as the firm's incorporation of Hoshin Kanri into the HP Way suggests. In the case of Samsung, there was always a fair amount of overlap between business units, and strategy formulation was, and continues to be, fairly centralized. So in this interpretation, an industrial policy's instruments and its outcomes are mediated by organizational factors, namely corporate strategy. Corporate strategy refracts industrial policy, causing varying degrees of divergence from the state's desired outcomes.

Because HP's Brazilian subsidiary has a great deal of autonomy, it has more of an opportunity to conform to local institutional demands without compromising its legitimacy vis-à-vis its parent company. It can be more sensitive to local rules of appropriateness, which include not just what is legal, but what is "true, reasonable, natural, right, and good" (March and Olsen, 2004, p. 4). This makes it slightly more amenable to normative and cognitive demands. Conversely, Samsung's Brazilian subsidiary, having considerably less autonomy than HP's, cannot conform to local institutional demands without denting its legitimacy as a node in Samsung's global network of subsidiaries and affiliates. Thus it does conform to the legal requirements outlined in the Informatics Law for fear of sanction, but does not acquiesce to the cognitive and normative elements of the government's demands. Subsidiary autonomy shapes responses to industrial policy, but it also colors the type of work that takes place at the subsidiary. Birkinshaw and Hood's (1998) model of subsidiary evolution proposes that a subsidiary takes on more valuable roles in the company's network if the parent company grants it the charter to do so (head-office assignment), if the location has the resources and capabilities necessary to merit upgrading (local environment determinism) and if the subsidiary builds relevant capabilities (subsidiary choice).

Companies that grant their appendages greater autonomy are more likely to allow for subsidiary-driven charter change. In effect, the degree to which choice can shape a subsidiary's mandate depends on the firm's corporate strategy. There is a qualitative difference between R&D that is of low complexity and geared to the local market, and R&D that is complex and globally oriented. All subsidiary managers and engineers interviewed for this project, whether they were based in Brazil, India, Korea or the U.S., expressed an aspiration to do complex R&D that is globally relevant. Centers that are granted competence-creating mandates seem to have higher social standing within the firm. Furthermore, interviewees affirm that having more complex projects is correlated with lower employee turnover rates, which in itself leads to greater operational efficiency. Of course, investment promotion agencies (IPAs) seek to attract subsidiaries that have competence-creating mandates. These subsidiaries are more likely to file patents, collaborate with universities and engage in other activities that yield knowledge spillovers than subsidiaries with competence-exploiting mandates (Kummerle, 1999). But decisions regarding a subsidiary's mandate are largely beyond the state's control. Host governments can encourage the development of a local environment conducive to complex R&D, but are relatively limited in their ability to shape how firms assign capabilities within their global network of R&D centers. However, as this research has demonstrated, attracting firms that provide their subsidiaries more autonomy implies that local subsidiaries will have more discretion with regard to what capabilities they take on, and what their role is in their parents' networks.

7.2. Shifting Locus of Nationalist Pressure

What makes the Brazilian Informatics Law unique is that it stipulates that firms must direct a certain percentage of their R&D expenditures to third parties, including

universities, research institutes and a public research fund (FNDCT). The Noyes-Whitney equation establishes that the rate at which a solid object dissolves is positively correlated with the object's surface area; the greater the surface area, the higher the rate at which an object dissolves. A sugar cube dissolves more slowly than an equivalent amount of granulated sugar. By creating an outsourcing imperative, the Brazilian government sought to increase firms' level of exposure to the local environment. Forcing multinational firms to engage with third parties increased their points of contact with the national innovation system, creating more opportunities for knowledge diffusion than would have existed had they created R&D enclaves. But the nature of corporate responses to this outsourcing imperative has varied. Both multinational firms examined for this study were required to outsource some of their R&D budget to local partners. Samsung responded by first opposing these requirements, and then acquiescing, creating two nominally independent (but actually captive) R&D institutes. It then tasked these centers with managing its other local partners. HP responded by creating a fully-owned R&D center, and outsourcing, in accordance with the law, a certain percentage to third-party institutes like Institute E and Institute F.

A number of multinational firms created nominally independent R&D institutes in the late 1990s in response to the passage of the Informatics Law in 1991. But as was discussed in Chapter Five, the 1991 law was ambiguous with regard to *whom* firms could outsource their R&D quota to, *what* constituted R&D and *how* the exchange relationships would be structured. So firms created independent R&D institutes that were, in some cases, co-located with their internal R&D departments. There was no formal government body regulating these organizations, meaning that they often operated as extensions of their benefactors, and not as the non-profit, independent organizations they were envisioned to be. By creating independent, yet captive institutes, these firms were able to comply with the letter of the law, while ensuring that technologies developed there would remain

under their control. As Lauren Edelman (1992) convincingly argues, laws that are ambiguous, procedural in emphasis and difficult to enforce allow firms to create symbolic formal structures to achieve institutional consonance while privileging managerial interests.

The government came to see these institutes as little more than external, yet tightly coupled nodes of the organizations that had created them. The renewal of the Informatics Law in 2001 cleared up much of the legal ambiguity that had allowed firms to act in ways that did not necessarily fall in line with the law's intent. The new law outlined the structure of the Committee for the Area of Information Technology (CATI), which would be charged with certifying and monitoring the institutes created to receive R&D funds. and were thus seen as legitimate actors by the state. The government more clearly outlined what constituted R&D, and clarified the distinction between a contract and an agreement, which implied a relationship governed less by exchange and more by collaboration. But institutes responded to the tighter language by simply implementing more elaborate symbolic responses. For example, institutes continued to work on the same sorts of projects that they had in the past. The difference was that they now needed regulatory specialists that could write the project briefs in ways that fit the definition of R&D set forth by the government. All of the institutes studied for this project emphasized that one of their core competences was the ability to *enquadrar*, or make projects fit, the government's requirements. The nature of R&D conducted at these institutes changed little with the passage of the 2001 law. What changed was that institutes became more savvy in their maneuvers.

The government rightly concluded that its failure to make these institutes lynchpins of the sectorial innovation system was, in part, a result of their captivity. So CATI began to push these captive institutes to diversify and serve multiple clients. For incumbents, there

was limited leverage for driving diversification. For newly established institutes, achieving diversification became a prerequisite to certification. One executive recalls the stern words that followed the protracted certification process: "Listen to the following. We will approve you. You will have to be totally independent…independent personnel, everything separate. I don't want you to be solely dependent on Flextronics as your client. You will have to dilute that over time." The Ministry of Science, Technology and Innovation (MCTI) was either unable or unwilling to mandate that certified institutes diversify. Instead, pressure to serve various clients and cease operating as little more than appendages on certain firms' R&D departments was informal. It came in the form of increased inspections and public rebukes. The government's efforts to diversify these institutes have been relatively unproductive. Some have diversified, but only because their benefactors faced serious financial difficulties, limiting the extent to which they could continue funding the institutes they had created. In the case of Institute F, the fact that its parent was a contract manufacturer made diversification easier.

Some institutes have diversified and others haven't. For those that haven't, the threat of sanction is high, but has yet to be realized. Those that have diversified have been lauded by the government for their efforts. But is there any substantive difference between the two groups? This is the question that Chapter Six sought to answer. Institute S remains captive to a single client, and manages its external relationships with universities and research institutes tightly. But the three other institutes on which this study focuses – Institute E, Institute F and Institute V – have diversified for a range of reasons, and each now serves multiple clients. But the process of diversification at these institutes has proceeded hand-in-hand with a process of organizational balkanization. These institutes diversified out of necessity, or to preemptively minimize the financial risk associated with depending on a single client. But as they diversified, their new and existing clients began to clamor for more extensive restrictions on the movement of knowledge within

the organization. As a result, these institutes had to erect boundaries to intra-organizational knowledge sharing. Employees working for large clients were fully allocated to their projects in order to prevent the ideas and technologies developed on their behalf from making their way to engineers working on behalf of another firm.

Eventually, the legal, physical and digital boundaries that clients insisted upon early in their relationships with Brazilian research institutes became little more than relics, their value supplanted by the reordering of employee identities and emergence of trust between clients and their teams. As Pache and Santos (2010) note, where employees' allegiances lie has a direct effect on their organization's responses to conflicting institutional demands. In the institutes that diversified their base of clients, the government and the institute's managers sought the same thing, to allow for the free movement of knowledge and ideas within the organization. But engineers came to identify with the individual clients for which they worked, despite management's best efforts to remind them who they in fact worked for. Organizational balkanization became a means through which institutes could comply with institutional demands emanating from their clients, and bury nonconformity with government demands so deep that the state remained either unaware or unable to address the issue. The government sought to create a cadre of institutes that would siphon knowledge from their multinational clients, and then use it to drive innovation in Brazil's ICT sector, albeit in unspecified ways. But these institutes' dependence on their benefactors, and later on their diverse set of large clients, precluded them from being the conduits of knowledge that the state had hoped they might become.

Over time, some of the institutes studied were able to diversify by serving clients in a variety of industries. In the early to mid-2000s, the Brazilian government created various

policies aimed at increasing the level of private R&D spending in the country.[21] These policies were largely based on the Informatics Law, and applied to a range of sectors. Under these policies, firms in sectors including oil and gas and automotives could access a range of fiscal incentives if they spent specific percentages of their income on R&D, and a certain percentage of that percentage on projects with universities and research institutes. Some institutes that had previously focused primarily on ICT firms, like Institute E and Institute F, began to leverage their technical competencies and regulatory capabilities to access earmarks in other industries. One example is Institute F developing RFID-based solutions for energy providers and agricultural conglomerates. As the literature on Chinese walls suggests, knowledge sharing 'across conflict of interest classes' is far easier than within them (Brewer and Nash, 1989). In other words, it is easier to move knowledge within the organization if it is done between teams operating on behalf of non-competitors. A few of the institutes examined for this study were in fact able to begin sharing knowledge across client teams only when they began to serve clients in new industries unrelated to those in which their existing clients operated in.

The government had assumed that by creating an outsourcing requirement in its R&D policy, it could increase multinational firms' surface area in the country, leading to greater ease of technology diffusion. But while these policies did increase surface area, forcing multinational firms to interact with dozens of partners, they made for poor solvents. Part of the problem was, and remains, the internal fragmentation of these R&D services providers. Managers have tried to facilitate the free flow of people and knowledge to achieve greater operational efficiency. The fact is that an institute's annual revenue depends, in part, on how well its clients project they will do the next year – the

[21] Private sector spending on R&D is low in both relative and absolute terms, and has been for quite some time. The private sector spent 0.54 percent of GDP on R&D in 2005, 0.58 percent in 2008 and 0.59 percent in 2011, well below China, not to mention the U.S., Israel and South Korea (De Negri and Cavalcante, 2013).

amount to be directed towards R&D is established on the basis of revenue projections for the upcoming year – and in part on its ability to attract and retain clients, which can choose partners from more than a hundred institutes and university departments. Demand volatility and competition require a certain amount of organizational flexibility. Cloistering a set of engineers without a guarantee that there will be funds to cover their salaries in the coming year is difficult and leads to operational inefficiency.

Managers' quest for greater operational efficiency, as well as their desire to reduce reliance on a single industrial policy, led them to seek out other protected R&D markets. Industrial diversification allowed management to circulate engineers throughout the organization. But through diversification, these institutes were able to realize what the government had long sought to achieve. A few of these institutes became knowledge brokers in the sense that they connected disparate worlds by bringing solutions to problems from one realm to bear on problems with similar dimensions in another (Hargadon, 2002). As such, some of these institutes were able to achieve consonance with the state's aims of inducing knowledge diffusion by privileging organizational efficiency, which meant diversifying into new industries subject to different industrial policies. Thus industrial diversification has become a solution to the problems posed by organizational balkanization. Institutes that move to serve clients in industries unrelated to those in which their current clients operate find less resistance to internal mobility.

Chapters Five and Six demonstrated that strategic responses and institutional demands co-evolve. In the beginning, firms may respond to institutional pressure by erecting symbolic structures aimed at fooling the institutional actors into believing that they are compliant, when in fact, they are not (Meyer and Rowan, 1977; Edelman, 1992). But institutional actors are only fooled for so long. In some cases, they may stop pressuring firms into compliance once symbolic structures are erected because these structures are

all they need to satisfy their own overseers. Showing the Brazilian populace that multinational firms are investing in R&D at all might be enough. But in the case examined here, symbolic structures incite more pressure. The government may tighten the language in an industrial policy to make symbolic responses costlier. The locus of pressure may move within the organization itself. When an organization is subject to conflicting institutional demands, and finds that it must comply with those emanating from one actor to ensure the continued flow of critical resources, it responds to the other actor(s) symbolically, even at great cost to itself. The process of organizational balkanization is costly for the organization. However, it allows it to retain legitimacy vis-à-vis its clients while keeping the government at bay. Like a cat reaching and fumbling blindly into the hole in the wall in search of a mouse, the state cannot grasp what it cannot see, thus internal fragmentation becomes a semi-permanent solution for institutes facing conflicting institutional demands.

7.3. Policy Recommendations

The findings presented in this document have implications for policymakers concerned with driving industrial development in today's day and age. Here, I start with the particular, focusing on Brazil's Informatics Law, and more broadly on the country's industrial policy regime, and then move to the general, offering empirically-derived recommendations applicable across a range of settings. Brazil's Informatics Law was borne of a desire, on the part of the government, to ensure that efforts to develop local computer manufacturing capabilities in the 1970s and 1980s would continue, despite liberalization. The PPBs outlining a nationalization index for each product as well as the R&D requirements mandating collaboration with external partners exemplify the country's rule-based approach to industrial development. Each PPB details the degree to which each and every component of a given product, from the memory to the

motherboard, should be produced locally. These indices trend upwards over time, with firms being required to localize more and more of their supply base as the years wear on. The 2001 revision of the Informatics Law created highly specific rules regarding what constituted R&D, who could serve as an external partner and how the relationship between firms and local partners was to be governed. Thus, research institutes and university departments became more concerned with staying safe, delivering projects that fit the scope of the law, rather than pursuing projects that pushed the envelope.

What most, if not all, academic evaluations of the Informatics Law agree upon is that it has not spurred innovation (Garcia and Roselino, 2004; Sousa, 2011; Labrunie et al., 2013). This dissertation shows that the resolution of legal ambiguity regarding the law's R&D requirements has led, over time, to more and more elaborate symbolic responses on the part of firms and their partners. It has pushed firms towards risk mitigation and away from the embracing the uncertainty that research entails. Otherwise stated, a rules-based approach to innovation has left firms without the discretion that research and development inherently requires. It is worth noting here that this rules-based approach to industrial policy exists for a reason. Latin America has long mistrusted multinational firms. Dependency theorists have long argued that multinational firms benefit from market access and leave little of value behind; that they embody the imperial spirit that has made Latin America a peripheral and dependent actor in the global economy (Frank, 1967; Moran, 1978; Cardoso and Faletto, 1979). Therefore, it isn't surprising that parts of Brazil's industrial policy regime should overspecify the state's aims. Especially the laws overseen by the Ministry of Science, Development and Innovation (MCTI), where dependency theory still holds a great deal of sway.

So what we see in the Informatics Law is a rules-based approach to R&D localization and externalization. The state doesn't trust multinational firms to act in accordance with its

wishes, so it creates a highly detailed set of rules to all but ensure compliance. But what we see is that firms only feign compliance, and continue to act in ways that are consonant with their corporate strategies. Of course, refraction varies depending on the degree to which the firms decentralizes authority to its subsidiaries, but it exists to one degree or another in all multinational firms examined here. The dynamic witnessed here can perhaps best be characterized as a downward spiral. The state mistrusts multinational firms' intentions, thus creates highly specific rules. Firms, feeling constricted, further decouple ceremonial structures from day to day activities. As the rules get more and more specific, symbolic responses become more and more elaborate. All the while, the possibility of innovation gets more and more remote. In the end, it is the inadvertent resourcefulness of some institute managers that creates the possibility of innovation. Only by leveraging their technical and regulatory capabilities are some institutes able to diversify into other sectors, creating channels for intra-organizational knowledge sharing, and further, the possibility of knowledge brokerage. So these institutes find a way to innovate *despite* the state.

The policy recommendations for Brazil, as well as for other countries engaging with multinational firms for the purposes of driving industrial development, are twofold. Firstly, governments must consider corporate strategy when targeting potential investors. Multinational firms cannot be expected to act in full accordance with a host government's wishes. Their allegiances lie elsewhere. But the degree to which they act in accordance with an industrial policy depends on the degree to which firms decentralize authority to their subsidiaries. Specifically, firms that decentralize the process of strategy formulation and implementation will be more likely to act in ways that are consonant with a host government's industrial policy regime, leading to a relatively small degree of refraction. Those that are more centralized with respect to corporate strategy will be less likely to act in ways that are consonant with the local industrial policy regime, leading to

a greater degree of refraction. Investment promotion agencies should develop and house the capabilities necessary to examine potential investors, focusing their investment promotion efforts on those that are more likely to devolve discretion and authority to their local subsidiaries.

The second pertains to R&D promotion efforts in particular. Policymakers cannot force a firm to place a competence-creating R&D center in their country. Sometimes, a country's natural endowments or artificial advantages increase the likelihood of acquiring such an R&D center. But in the absence of any natural, pre-existing drivers of meaningful R&D offshoring, it becomes difficult to ensure that a given country becomes a valuable node in a multinational firm's global R&D network. Policies aimed at incentivizing R&D investments are important and valuable. But policies aimed at shaping firms' make-or-buy decisions around R&D, especially in foreign countries with unfamiliar institutional arrangements, are not likely to produce desired outcomes. They are more likely to produce ceremonial industry-university partnerships than they are to foster the creation of an R&D center integral to its parent company's global R&D operations. This is why rather than incentivizing external partnerships, policies should aim to attract R&D centers belonging to firms that tends to give their subsidiaries autonomy. If investment promotion efforts on the R&D front focus on these types of firms, and simultaneously work to improve the country's national innovation system by investing in training and education, improving research capacity at universities and at translational research institutes and creating a clear and coherent regime of appropriability, then it becomes more likely that the newly established R&D center will take on a competence creating charter over time. Policymakers must recognize that there are ways to elicit desired behavior, but that they cannot be coercive and foment mistrust. Otherwise, a downward spiral of mistrust and symbolism ensure.

7.4. Parting Thoughts and Future Research

Early efforts to develop Brazil's electronics industry came on the heels of the "Brazilian Miracle" (1967-1973), an era of rapid economic growth that in some ways validated the country's nascent nationalist economic and political agenda. The electronics industry, like many others, was deemed to be too vital to the country's economic fortunes and to its national security to be left in the hands of the multinationals. As Frank Bonilla (1963) puts it in his assessment of Brazil's emergent nationalist ideology, "the extension of political controls over the economy is…a means of bringing areas where collective interests are at stake back into the framework of responsible government action" (p. 243). The government charged the Commission for the Coordination of Electronic Processing Activities (CAPRE) and later the Special Secretariat for Informatics (SEI) with carving a space for budding Brazilian firms to take a shot at building minicomputers. Over time, the market reserve became difficult to monitor for illegal incursions and even more difficult to defend from those clamoring for access to frontier technology, which was being developed elsewhere (Evans, 1995). The 1991 Informatics Law opened up the market, albeit with certain caveats around local content and local R&D.

The Informatics Law has now been on the books in roughly the same form for nearly 30 years, despite the passage of various revised editions through the years. There are few competitive suppliers to speak of, and the aim of encouraging knowledge spillovers via foreign R&D centers has yet to be realized in any meaningful way. Many have deemed the policy to be a failure (Garcia and Roselino, 2004; Sousa, 2011; Labrunie et al., 2013). Yet it remains in place. Why? In his study of rural development in Lesotho, James Ferguson (1990) seeks an answer to the question of why development projects are implemented time and time again despite the fact that they fail, time and time again. The conclusion he reaches is that these projects persist because their primary purpose is not

necessarily to alleviate poverty, but to extend the reach of bureaucratic state power to previously unincorporated parts of the country through the pretext of poverty alleviation. During an interview, the director of one R&D institute explained why the Informatics Law remained on the books despite its obvious shortcomings. He took a marker and a sheet of paper and drew Brazil. He circled Manaus and circled Campinas. "The Informatics Law exists to support Campinas," he said. I heard this argument repeatedly during my fieldwork in Brazil, stated by both supporters and critics as a matter of fact rather than as a controversial idea.

The reasoning goes that the law has remained on the books to maintain a counterweight to the Manaus Free Trade Zone (ZFM), where most electronics manufacturing in the South would almost certainly flock if the law were to be abolished. Understood this way, the law exists to keep manufacturing jobs in the state of São Paulo, and away from the ZFM. The law counters what many politicians believe is an unfair advantage for Manaus. As the respondent describing the law's continued *raison d'être* notes, "Brazil is the only country in the world with an export processing zone that imports components and exports to the rest of the country." The conflict between Campinas and Manaus extends to R&D as well. Both require that firms spend locally on R&D. And while the efficacy of these R&D requirements has not properly been examined, especially in Manaus, the general consensus is that they have not been especially helpful in terms of bringing high-value projects to Brazil. This has been achieved by other means, including the discovery of the "pre-salt" oil reserves, which has driven a number of global oil and gas suppliers to set up R&D centers in the country.

To sum up, we understand that the law has failed in many regards, and that it remains on the books for reasons that have little to do with its efficacy. The discussion now turns to the question of why it has failed. In many ways, this is the question that this

dissertation has sought to answer. The passage of the 1991 Informatics Law marked a major cleavage in the history of the country's electronics industry. It ended the dream of creating national champions and embraced the fact that the sector would be populated by largely foreign firms. But as Frank Bonilla (1963) cautioned more than half a century ago, "…private enterprise, and especially *foreign* private enterprise, cannot be expected to formulate and even less to finance a well-coordinated plan for development" (p. 241, italics in original). This statement remains true today. It is part of the reason why the second coming of import substitution industrialization (ISI) has largely been seen as unsuccessful. As Kostova and colleagues (2008) put it, multinational firms will likely abide by regulatory demands, but be uncooperative with respect to local norms and cognitive imperatives. But as is often the case with blanket statements, certain things are left uncovered. Some multinational firms are more likely to conform to local norms and cognitive demands than others. The most cooperative firms are likely to be those that grant their subsidiaries the discretion to manage their surrounding environment on their own terms. These subsidiaries are given more slack in the ways that they choose to respond to industrial policies than are those that cannot respond to industrial policies on their own terms. By accounting for corporate strategy, we can better appreciate why firms' responses to industrial policy might vary.

This dissertation has sought to answer the question of why firms respond to industrial policies in different ways. In so doing, it has built upon and extended three discrete bodies of scholarly work. Firstly, it has sought to bring the concept of corporate strategy to bear on the economic development literature. While there has been interesting work published on the question of why industrial policies vary (Dobbin, 1994; Breznitz, 2007), there has not been equal treatment of the question of why firms' responses to industrial policies vary. Variation at the level of corporate strategy matters for policymakers, as some firms are more likely to be responsive to a country's industrial policy regime than

are others. This dissertation has introduced the notion of industrial policy refraction, and has presented propositions outlining the conditions under which refraction will occur, and when it is present, the conditions under which it will be most pronounced.

Secondly, it has sought to extend current work on R&D outsourcing by explaining how political outsourcing imperatives shape organizational boundaries and the nature of R&D conducted in emerging markets. There has been relatively little work to date outlining the political drivers of R&D outsourcing, which is no surprise, given the rarity of this empirical phenomenon. But the case of the Brazilian Informatics Law provides an empirical setting through which to observe how political forces shape the boundaries of the firm, specifically in the case of R&D. Thirdly, it has sought to engage with the sociological brand of institutional theory. The empirical material that constitutes the core of this study allows for an in-depth examination of how strategic responses and institutional demands co-evolve, with responses becoming more elaborate as institutional actors reduce ambiguity to lay their aims bare. History becomes an inefficient meander rather than a calculated, linear process (March and Olsen, 1998). Finally, this work extends current thinking in international business regarding isomorphism among multinational firms. It presents a nuanced argument regarding how the degree of isomorphism, especially with regard to cognitive and normative demands, depends on degree of subsidiary autonomy.

While this dissertation has sought to push various bodies of work in new directions, or further along clearly established lines of inquiry, I believe that it raises more questions than it answers. In my view, the notion that variations in corporate strategy have a direct and intelligible effect on industrial policy outcomes has been underexplored to date, and could be a fruitful direction for future studies that might cover a broader set of organizations, or different organizations in different industrial sectors. I have sought to

advance the idea that organizations have histories, and that those histories shape the ways in which they internationalize and interact with unfamiliar political orders. This matters if we truly care about policy outcomes. For this reason, I believe there needs to be more work that critically engages with the firm in the economic development literature. I believe that a quantitative assessment of the propositions outlined in Chapter Four would be useful in either validating or disproving the value of using corporate strategy as a moderator between policy aims and outcomes.

Continuing with the firm-level focus, this dissertation has sought to broaden the way that international business scholars think about how and why multinational firms engage with different countries in different ways. It has argued, in an underhanded way, that the construct of institutional distance may not be the most appropriate lens for understanding why firms operate differently when they enter different countries. Instead, it has proposed that one should look to corporate strategy as the explanatory variable. My contention is that institutional determinism is too blunt a tool and gives organizational history too little credit for its role in shaping firms' modes of engagement in foreign countries. I have demonstrated that firms respond to industrial policies in ways that reflect their corporate strategies. This idea might be further validated if two or more multinational firms from one country, or from different liberal market economies (LMEs) or coordinated market economies (CMEs), are examined insofar as their responses to a single industrial policy. Demonstrating variation in this context would lend my assertion that corporate strategy is a useful explanatory variable more support.

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Appendices

A. Informed Consent and Data Processing Statement

This project is being conducted by Ezequiel Zylberberg, a doctoral candidate at the Saïd Business School, University of Oxford. It is funded by Green Templeton College, the Saïd Business School Foundation and the Novak Druce Centre for Professional Service Firms and approved by University of Oxford Central University Research Ethics Committee.

You may withdraw from the study without penalty at any time by advising the researcher of this decision. To do so, please e-mail Ezequiel at ezequiel.zylberberg@sbs.ox.ac.uk. If you have concerns about any aspect of this project, please speak to Ezequiel Zylberberg (tel: +44(0)7462 727242) or to his supervisor Professor Mari Sako (tel: +44(0)1865 288925). Either will do his/her best to answer your query. The researcher should acknowledge your concern within 10 working days and give you an indication of how he intends to deal with it.

If you remain unhappy or wish to make a formal complaint, please contact the chair of the Research Ethics Committee at the University of Oxford (Chair, Social Sciences & Humanities Inter-Divisional Research Ethics Committee; Email: ethics@socsci.ox.ac.uk; Address: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD). The chair will seek to resolve the matter in a reasonably expeditious manner.

Data will be stored in accordance with the EU Data Protection Directive (95/46/EC), on which the Data Protection Act of 1998 in the UK and the Data Protection Law (forthcoming) in Brazil are based. All data collected will be stored in a secure physical location only accessible to the researcher. Digital data will be stored on password-protected devices only accessible to the researcher. Data collected may be processed manually and with the aid of computer software. Interviews and observational data will be recorded and transcribed by the researcher. A copy of your interview transcript will be provided, free of charge, upon request.

Please refer to the information sheet attached for more detail regarding the nature of the project. Below, please confirm that you have read the information sheet in its entirety, and consent to participating in this study.

□ I have read and understood the project information sheet, and consent to participate in this study

□ I have read and understood the project information sheet, and choose not to participate in this study

As outlined by the information sheet, data collected will be stored indefinitely in the Oxford University Research Archive. Please confirm that you agree with the terms of data storage outlined by checking the appropriate boxes below.

□ I agree to the data I provide being archived indefinitely at the Oxford University Research Archive

□ I understand that other genuine researchers will have access to this data only if they agree to preserve the confidentiality of the information

□ I understand that other genuine researchers may use the information I provide in publications, reports, web pages, and other research outputs only if they agree to preserve the confidentiality of the information

If you consent to participating in this study, please indicate, by ticking ONE of the boxes below, whether you are willing to be identified, and whether I may quote your words directly, in reports and publications arising from this research. Then please print and sign your name and date the form in the spaces provided.

□ I/my employer (delete which is not applicable) may be identified in reports made available outside the research teams and in publications. My words may be quoted and attributed to me

□ Neither I, nor my employer, may be identified in reports made available outside the research teams, nor in any publications. My words may be quoted provided that they are made anonymous

□ Neither I, nor my employer, may be identified in reports made available outside the research teams, nor in any publications. My words may not be quoted

Participant's name:...……....…….....
Participant's signature:……. Date:…….....
Researcher's name:...……....……...
Researcher's signature:……. Date:……

B. Project Information Sheet

Overview

The project is being conducted by Ezequiel Zylberberg, a doctoral candidate at the Saïd Business School, University of Oxford. It is funded by Green Templeton College, the Saïd Business School Foundation and the Novak Druce Centre for Professional Service Firms and approved by University of Oxford Central University Research Ethics Committee.

This study focuses on state-supported R&D service providers charged with conducting translational research in the area of informatics. Brazil has developed a number of public sector initiatives to support these organizations, which work with clients in a range of industries. The goals of this study are threefold: to examine how Brazilian industrial policy has changed to capture emerging opportunities in high-tech industry niches, to explore the means by which state-supported R&D service providers create and sustain client partnerships and to understand how these organizations leverage relationships with foreign and domestic firms to develop core competencies.

Research at Organization X

This study will be conducted through interviews and observational visits to state-supported R&D service providers in Brazil. The goal of these visits will be to understand both how these organizations are structured internally and how they engage with clients and government officials. Interviews aimed at understanding organizational structure will focus on how knowledge is developed and then shared across departments and project teams. Interviews aimed at understanding client relationships will focus on how organizations build their bases of clients, sustain existing partnerships and use their core competencies to diversify into different industry verticals. Interviews with government relations staff will focus on how organizations work within the frameworks set forth by relevant pieces of legislation (e.g. Lei de Informatica).

Research at Organization X will comprise of a 2-4 week visit by the principal researcher. The visit will take place between October 2014 and October 2015. During this visit, the researcher will spend 2-4 days per week at Organization X interviewing and observing technical, business development, government relations and managerial staff. The researcher will interview technical staff to understand how software developers collaborate within and across teams. These interviews will be complemented with observational data collected during technical meetings. The researcher will also interview business development and government relations staff to understand how relationships emerge, develop and evolve over time. Finally, the researcher will interview managers to understand Organization X's core competencies and future areas of strategic focus.

Data Collection and Processing Statement

Data collected during interviews and periods of observation will be stored in accordance with the EU Data Protection Directive (95/46/EC), on which the Data Protection Act of 1998 in the UK and the Data Protection Law (forthcoming) in Brazil are based. All physical data collected will be stored in a secure locker belonging to the principal researcher. Digital data will be stored on password-protected devices only accessible to the researcher. The names of individual informants and organizations will only be known to the principal researcher.

All personal and organizational data will be anonymized in all published and unpublished drafts of the final dissertation and ensuing publications to maintain informant confidentiality, unless otherwise directed. Data collected may be processed to glean more aggregated information useful for data analysis. For example, interview transcripts may be analyzed through NVivo software installed on the principal researcher's computer to draw out key themes. In accordance with the Data Protection Act of 1998, data collected will be stored indefinitely at the Oxford University Research Archive for research purposes alone, and will only be accessible to the principal researcher and other genuine researchers who agree to maintain confidentiality. Where appropriate, drafts of the principal researcher's work will be submitted to informants for approval.

Expected Outcomes

The researcher expects to gain a deep understanding of Organization X's organizational architecture, its core competencies and its role in the larger ecosystem of certified R&D service providers. He expects to have the opportunity to interview technical, business development and government relations staff as well as managers during his visit. The project would benefit greatly from the opportunity to partake in internal meetings, meetings with existing and potential clients and meetings with government officials. Interview schedule and meeting participation will be negotiated with managers as to not disrupt work activities.

The final deliverable will be a doctoral dissertation published by the University of Oxford. Data collected may be used for ensuing academic publications as well. In addition, the principal researcher will present his findings to managers and staff. The presentation will provide an overview of the researcher's findings, and provide feedback on Organization X's operations relative to operations examined elsewhere in the academic and industry literatures, as well as the ecosystem of certified R&D service providers. Interview transcripts, the final dissertation and related academic publications will all be made available to Organization X's managers upon request.

Questions and Concerns
You may withdraw from the study without penalty at any time by advising the researcher of this decision. To do so, please e-mail Ezequiel at ezequiel.zylberberg@sbs.ox.ac.uk. If you have a concern about any aspect of this project, please speak to Ezequiel Zylberberg (tel: +44(0)7462 727242) or to his supervisor Professor Mari Sako (tel: +44(0)1865 288925). Either will do his/her best to answer your query. The researcher should acknowledge your concern within 10 working days and give you an indication of how he intends to deal with it.

If you remain unhappy or wish to make a formal complaint, please contact the chair of the Research Ethics Committee at the University of Oxford (Chair, Social Sciences & Humanities Inter-Divisional Research Ethics Committee; Email: ethics@socsci.ox.ac.uk; Address: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD). The chair will seek to resolve the matter in a reasonably expeditious manner.

If you have any additional questions, or require further clarification on any of the information set out in this document, please feel free to reach out to the principal researcher. Thank you for your time and thoughtful consideration,

Sincerely,
Ezequiel Zylberberg

C. List of Interviews

#	Position	Organization	Location	Date
1	R&D Manager	Institute S	Brazil	20-Oct-14
2	Team Member	Institute S	Brazil	20-Oct-14
3	Director	Institute S	Brazil	20-Oct-14
4	Regulatory Coordinator	Institute S	Brazil	21-Oct-14
5	Director	Institute S	Brazil	21-Oct-14
6	Director	Institute S	Brazil	21-Oct-14
7	Manager	Institute S	Brazil	22-Oct-14
8	R&D Director	Samsung	Brazil	24-Oct-14
9	Manager, Regulatory Affairs	Institute S	Brazil	27-Oct-14
10	Manager	Institute S	Brazil	30-Oct-14
11	Manager	Institute S	Brazil	30-Oct-14
12	Superintendent	Institute S	Brazil	31-Oct-14
13	R&D Director	Institute E	Brazil	3-Nov-14
14	Technical Lead	Institute E	Brazil	3-Nov-14
15	Manager, Business Development	Institute E	Brazil	4-Nov-14
16	Manager	Institute E	Brazil	4-Nov-14
17	Executive Manager	Institute V	Brazil	5-Nov-14
18	Manager	Institute E	Brazil	6-Nov-14
19	Vice President	CPqD	Brazil	6-Nov-14
20	Director	CPqD	Brazil	6-Nov-14
21	Superintendent	Institute E	Brazil	13-Nov-14
22	Executive Manager, Business Development	Institute E	Brazil	13-Nov-14
23	Manager, Business Development	Institute E	Brazil	13-Nov-14
24	Manager	Institute E	Brazil	17-Nov-14
25	Program Manager	Institute E	Brazil	18-Nov-14
26	Team Leader	Institute E	Brazil	18-Nov-14
27	R&D Director	Motorola	Brazil	18-Nov-14
28	Professor, Computer Science and Engineering	UNICAMP	Brazil	19-Nov-14
29	Professor, Computer Science and Engineering	UNICAMP	Brazil	21-Nov-14
30	Superintendent	Institute V	Brazil	28-Nov-14

31	Superintendent	Instituto Atlantico	Brazil	28-Nov-14
32	General Manager	Instituto Atlantico	Brazil	28-Nov-14
33	Professor, Computer Science and Engineering	UNICAMP	Brazil	28-Nov-14
34	Executive Manager, Business Development	Institute F	Brazil	1-Dec-14
35	Manager, Business Development	Institute F	Brazil	1-Dec-14
36	Senior Consultant, Business Development	Institute F	Brazil	1-Dec-14
37	Innovation Manager	Institute F	Brazil	1-Dec-14
38	Manager	Institute F	Brazil	4-Dec-14
39	Professor, Center for Informatics	UFPE	Brazil	4-Dec-14
40	R&D Director	HP	Brazil	4-Dec-14
41	Manager	Institute F	Brazil	5-Dec-14
42	Director, Program Management Office	Institute F	Brazil	8-Dec-14
43	Program Manager	Institute F	Brazil	9-Dec-14
44	Superintendent	Institute F	Brazil	9-Dec-14
45	Consultant, Business Development	Institute F	Brazil	9-Dec-14
46	Senior Director, Government Relations	Flextronics	Brazil	9-Dec-14
47	Project Manager	Institute F	Brazil	10-Dec-14
48	Executive for Research and Innovation	Institute E	Brazil	11-Nov-14
49	Senior Manager	LIC	Brazil	29-Mar-15
50	Director	LIC	Brazil	30-Mar-15
51	Professor, Computer Science and Engineering	UNICAMP	Brazil	31-Mar-15
52	R&D Director	Samsung	Brazil	31-Mar-15
53	R&D Coordinator	Samsung	Brazil	31-Mar-15
54	General Coordinator of Informatics Policy	SEPIN, MCTI	Brazil	7-Apr-15
55	Director, Regulatory Affairs	Samsung	Brazil	7-Apr-15
56	Vice President	Samsung	Brazil	7-Apr-15
57	Superintendent	INDT	Brazil	8-Apr-15
58	Chief Operations Officer	INDT	Brazil	8-Apr-15
59	Director, Business Development	FPF Tech	Brazil	10-Apr-15
60	Manager	Institute E	Brazil	14-Apr-15
61	Manager	HP	Brazil	14-Apr-15
62	R&D Manager	HP	Brazil	14-Apr-15
63	Director, Tech Transfer Agency	PUC-RGS	Brazil	14-Apr-15

64	Secretary for Informatics Policy	SEPIN, MCTI	Brazil	28-Apr-15
65	Chief Scientist and Founder	CESAR	Brazil	1-Feb-16
66	Director, Center for Informatics	UFPE	Brazil	2-Feb-16
67	Professor, Center for Informatics	UFPE	Brazil	2-Feb-16
68	Chief Business Officer	CESAR	Brazil	17-Feb-16
69	Director, Government Relations	HP	Brazil	12-May-16
70	Senior Manager	Lenovo	Brazil	10-Dec-14
71	Manager	Lenovo	Brazil	10-Dec-14
72	Vice President	HP	U.S.	22-Apr-15
73	Deputy Director	HP	U.S.	3-Sep-15
74	R&D Director	HP	U.S.	26-Aug-15
75	Director of Engineering	HP	U.S.	31-Aug-15
76	Engineering Manager	HPE	U.K.	20-Jul-16
77	Chief Technology Officer	Samsung	India	6-Apr-16
78	Managing Director	Samsung	India	6-Apr-16
79	Vice President	Samsung	India	6-Apr-16
80	R&D Director	Samsung	India	6-Apr-16
81	R&D Director	Samsung	India	7-Apr-16
82	R&D Director	HP	India	5-Apr-16
83	Vice President	Samsung	South Korea	16-Oct-15
84	R&D Director	Samsung	South Korea	16-Oct-15
85	Vice President	Samsung	South Korea	16-Oct-15
86	Executive Vice President	Samsung	South Korea	16-Oct-15
87	Principal Engineer	Samsung	South Korea	16-Oct-15