A RESOURCE DEPENDENCE PERSPECTIVE ON STATEWIDE HEALTH INFORMATION EXCHANGES

A Dissertation in
Information Sciences and Technology

by

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ABSTRACT

In 2009, $550 Million was disbursed through a Federal program, the State Health Information Exchange Cooperative Agreement Program (SHIECAP), to facilitate and expand the exchange of patient health data among healthcare organizations. This program created concurrent efforts in each state that recruited leadership and drafted strategy to surmount the sociotechnical barriers to offering patient data exchange. SHIECAP aimed to alleviate these barriers through a combination of funding and guidance. As of 2016, there has been growing interest in the local counterparts of SHIECAP, the Health Information Exchanges (HIEs), but there has been little research on the performance of the statewide SHIECAP organizations. This investigation applies Resource Dependence Theory to fill this gap, focusing on the relationship between the boards of directors and strategy of these organizations as they influence performance.

Resource Dependence Theory argues that organizations recruit directors to their boards to gain access to critical resources necessary for their strategy. As resources required and strategies employed vary across contexts so do their boards. To study these boards within this data exchange context, this study uses mixed methods within an embedded case research design. In this design, quantitative analyses of 44 SHIECAP organizations provide evidence to test the predicted relationships between boards, strategy and performance. An in-depth qualitative investigation of North Carolina is used to augment this analysis by capturing the mechanisms driving these predicted relationships.

This work finds a strong relationship of board size and composition predicting performance of SHIECAP Organizations, but does not find a similar relationship between strategy and performance, though this is partially expected due to the lack of alignment between boards and strategy in this context. The North Carolina Case offers further explanation of these results showing (1) performance is mediated by the actions of several organizations, (2) a
weakness in the SHIECAP Strategy labels applied by ONC, and (3) the mechanism that drives performance of these organizations.

This melded approach provides three main contributions to Resource Dependence Theory. These are (1) a conceptual understanding of how boards and strategy relate to performance within the context of data exchange organizations, (2) a demonstration of a link between boards of directors and exchange use, and (3) an approach to categorizing compositions of board members in data exchange organizations.
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## Acronym List

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<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARRA</td>
<td>American Recovery and Reinvestment Act of 2009</td>
</tr>
<tr>
<td>CCHIE</td>
<td>Coastal Connect Health Information Exchange</td>
</tr>
<tr>
<td>CHINS</td>
<td>Community Health Information Networks</td>
</tr>
<tr>
<td>CHMIS</td>
<td>Community Health Management Information Systems</td>
</tr>
<tr>
<td>EHR</td>
<td>Electronic Health Record</td>
</tr>
<tr>
<td>HIEs</td>
<td>Health Information Exchanges</td>
</tr>
<tr>
<td>HIPAA</td>
<td>Health Insurance Portability and Accountability Act</td>
</tr>
<tr>
<td>HIT</td>
<td>Health Information Technology</td>
</tr>
<tr>
<td>HITECH Act</td>
<td>Health Information Technology for Economic and Clinical Health Act</td>
</tr>
<tr>
<td>NCHICA</td>
<td>North Carolina Health Information &amp; Communications Alliance</td>
</tr>
<tr>
<td>NCHIE</td>
<td>North Carolina Health Information Exchange</td>
</tr>
<tr>
<td>ONC</td>
<td>Office of the National Coordinator for Health Information Technology</td>
</tr>
<tr>
<td>REC</td>
<td>Regional Extension Center</td>
</tr>
<tr>
<td>SHIECAP</td>
<td>State Health Information Exchange Cooperative Agreement Program</td>
</tr>
<tr>
<td>WNC Datalink</td>
<td>Western North Carolina Datalink</td>
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Chapter 1: Introduction

This work applies the concept from Resource Dependence Theory (Pfeffer and Salancik 1978; Pfeffer 1973) that boards of directors and their strategy effect an organization’s performance (Pearce and Zahra 1992) to the State Health Information Exchange Cooperative Agreement Program (SHIECAPP) organizations (Blumenthal, 2010). This work further extends the theory into collaborative IT organizations, providing insight into the relationship between boards, strategy and performance in this context, while also describing the considerations that must be made to capture this relationship effectively. The method used in this dissertation is an embedded case study employing mixed methods (Yin 1989) where the quantitative results of a comparative analysis of 44 State organizations are further illuminated by qualitative study of a single State’s organization. This chapter provides an introduction to this study, focusing first on the problem in practice that makes this study timely and interesting in application. The second section describes the study’s motivation from Resource Dependence Theory. The third section introduces the research questions, that give structure to this inquiry. The fourth section discusses the contributions garnered from investigation of those questions. Finally, this chapter concludes in the fifth section with a discussion of the overall structure of this dissertation.

1.1 Problem Statement

Health Information Exchanges (HIEs) are organizations that offer systems for the electronic exchange of patient health data across organizational boundaries. Prior to SHIECAPP, most of these organizations were focused on serving the needs of sub-state regions, but SHIECAPP has shifted this focus to establishing statewide data exchange. The purposes of this exchange are as varied as the needs of the differing organizations that share or receive this information. While
healthcare providers require data to effectively treat patients, less obvious stakeholders of these exchanges are public health organizations that require data to track the appearance and spread of illnesses, and payors that require data to establish claims eligibility. Despite the widespread need for data sharing, HIEs have struggled to attain viability and sustainability. Healthcare providers are reticent to share data with non-affiliated providers (Furukawa et al. 2014; Korst et al. 2011), and each exchanging organization has differing and potentially conflicting requirements that the HIEs need to navigate (Adler-Milstein et al. 2010). These specific challenges caused the failure of two prior nation-wide efforts to promote data exchange organizations in the 1990’s (Vest and Gamm 2010). To surmount these challenges, the Office of the National Coordinator for Health IT (ONC) created SHIECAP with $550 million in allocated funds. SHIECAP was created to promote State efforts to establish statewide HIE services. Using these funds, each State recruited a board of directors and created an organization to develop and enact an HIE-promoting strategy. SHIECAP also created an opportunity for HIEs to succeed by placing significant political pressure on healthcare providers to share data, and alleviating the fiscal challenges of navigating stakeholders’ differing social and technical requirements. This has created an excellent research opportunity to capture the mechanisms of this performance, while also providing an opportunity to explore the implications of theory. SHIECAP is described in more detail in Chapter 2.

1.2 Study Motivation

Resource Dependence Theory argues that organizational success is determined by the appropriate management of environmental interdependencies (Boyd 1990; Drees and Heugens 2013; Hillman et al. 2009; Ulrich and Barney 1984; Zona et al. 2015). This argument has been extended and tested often, especially within the healthcare industry (Kuntz et al. 2016; Mannion et al. 2015; Ozcan et al. 1997; Pfeffer 1973; Provan 1991). Organizations have been shown to
manage their dependence on others by adapting internal structures and practices to limit that dependence, while also gaining access to key financial, informational, political and material resources (Boeker and Goodstein 1991; Ulrich and Barney 1984). For the HIEs that SHIECAP promotes, these interorganizational interdependencies are complex, as data exchange services require agreement and collaboration not only between, but among external organizations. This dependence on the network of external organizations removes much of the control that would be held by the HIE boards over their own performance.

While Mergers, Joint Ventures, Executive Succession and Political action by organizations have been shown to clearly follow Resource Dependence Theory’s principles, this work uses the Theory’s focus on Boards of Directors (Hillman et al. 2000; Jones et al. 2008; Kroll et al. 2007; Pearce and Zahra 1992; Pfeffer 1972). This research specifically extends the interplay between boards of directors and strategy; it predicts performance in the context of SHIECAP organizations, and examines how this alignment affects the performance of statewide HIEs. Due to the lessened control over their own performance and ONC’s funding of the organizations, SHIECAP organizations are a particularly interesting focus to explore the effectiveness of boards in developing collaboration in the environment and in garnering non-financial resources.

SHIECAP provides a unique opportunity to study the development of data exchange organizations as they become embedded in the healthcare industry. This Federal program offers multiple iterations through which to capture the predicted relationships from Resource Dependence Theory between boards, strategy and performance. Further discussion of Resource Dependence Theory and HIEs is included in Chapter 3.
1.3 Research Questions

This dissertation studies how a board of director’s size and composition aligns with their organization’s overall strategy, and how these boards and their strategies influence performance. In Resource Dependence Theory boards are often described in terms of “size,” a count of the total number of individuals who serve on the board of directors, and “composition,” the proportion of the board comprised of individuals who offer access to key resources in the organization’s environment. Both of these measures indicate different relationships linking the organization to its environment. In the case of SHIECAP organization strategy, the ONC created a typology of four general models for fostering statewide HIE based on early applications to SHIECAP, and these are used as my strategy variable (each strategy is further elaborated in Chapters 2 and 4). The six research questions of this dissertation exploring the relationships between board characteristics (size and composition), strategy and performance are depicted in Figure 1.1.

Figure 1.1: Depiction of Research Questions

The specific research questions are best described in two sets. First are Research Questions 1-5 that investigate discrete relationships between boards, strategy and performance. These research questions use quantitative methods to analyze the relationships, which are further analyzed by a later stage of qualitative analysis. Research Questions 1 and 2 focus on the alignment between boards and strategy, and seek to identify whether different strategies are enacted by boards of differing sizes, or if particular strategies are enacted by boards with large proportions of different types of directors. The texts of those questions are as follows:
1. Is there a relation between SHIECAP Organization Strategy and board size?

2. Is there a relation between SHIECAP Organization Strategy and board composition?

Research Questions 3, 4 and 5 focus on the predictive power of boards and strategy on performance. These questions help investigate whether size or composition of the board had an effect on performance, and the direction of that effect, while also identifying if a specific strategy helped determine performance.

3. Does board size predict SHIECAP Organization performance?

4. Does board composition predict SHIECAP Organization performance?

5. Does SHIECAP Organization Strategy have an effect on SHIECAP Organization performance?

The second set includes a single research question that focuses on concepts that are not readily captured quantitatively, and the investigation of this question helps to inform the results of the five prior questions. As the relationship between boards, strategy and performance are all moderated by numerous contextual mechanisms, without qualitative inquiry it would be difficult to capture what these mechanisms are and how they affected the results of the first five research questions. The text of this final question is as follows.

6. What other unmeasured variables influenced the relationship between boards, strategy, and performance?

The development of these questions are discussed in detail in Chapter 3, and their operationalization is discussed in Chapter 4.
1.4 Significance and Contributions of the Study

This research is significant as it captures a rare moment in the development of an industry and provides a unique opportunity to investigate the implications of Resource Dependence Theory for HIEs. Aside from the raw results of this study, the main contributions of this work are threefold: (1) a conceptual understanding of how boards and strategy relate to performance within the context of data exchange organizations, (2) a demonstration of a link between boards of directors and exchange use, and (3) an approach to categorizing compositions of board members in data exchange organizations.

First, the concept of “performance” is challenging for IT organizations as often the benefit of a given technology is diffused across an organization’s workflows. This is further complicated as the strategies employed by boards of directors each impacts performance variables differently. In this study, I investigate how a board and its strategy for implementing IT systems impact the resulting use of those systems. While it is very tempting to identify implementation as a measure of performance, the pitfall of this approach is that the desired benefits of Health IT require that technology be used. This is the core sentiment behind Meaningful Use (described in Chapter 2), and this study follows a similar approach. This contribution is discussed in more detail in Chapters 5 and 6.

Second, this work finds a significant relationship between boards of directors and one of several measures of data exchange performance: query use. In this study, I identify a link between the structure of the SHIECAP organization, the use of those organization’s services, and the mechanism that creates that use. As no link is found regarding SHIECAP organizational strategy, this relationship is particularly interesting. Through qualitative analysis, this result was further investigated to identify mechanisms that confounded this relationship. These provide valuable insights to the application of Resource Dependence theory to data exchange contexts.
Third, in Resource Dependence Theory, labels of board composition are inconsistently applied across studies (Daily et al. 1999), and this study provides both a method and a model for applying labels for board composition. This allows for follow-on and reproduced studies to develop similar measures of board compositions and allows for greater transferability of results.

1.5 Dissertation Organization

This dissertation is separated into six chapters and several appendices. This chapter has introduced the major concepts and relations that will be repeated and further detailed in later chapters. Chapter 2, Background, defines HIE by illustrating the organizational context that they operate in, describing the differing methods of data exchange and reviewing the strategies employed during SHIECAP. Chapter 3, Literature Review, introduces the general tenets of Resource Dependence Theory, and focuses on the investigation of boards of directors in the Healthcare context. Chapter 3 melds this investigation with research on HIEs to develop the research questions shown in Section 1.3. Chapter 4, Methods, describes the embedded case design of this study, including the operationalization of the research questions into concrete methods and measures of boards, strategy, and performance. Chapter 5, Results, discusses the results of the analyses detailed in Chapter 4, with specific attention paid to the evidence that these results offer to the research questions. Chapter 6, Discussion, provides the broader implications of these results both for Resource Dependence Theory and for practice. Chapter 6 concludes with a discussion of the limitations of this approach as well as potential for future work.
Chapter 2: Context of Health Information Exchanges (HIEs)

This chapter describes Health Information Exchanges (HIEs) and the developmental challenges that necessitated the State HIE Cooperative Agreement Program (SHIECAP). The purpose of this chapter is to provide background on both HIEs and SHIECAP that is relevant for later discussions about their boards of directors, strategies and performance. To aid in these later discussions, this chapter provides a brief definition of HIEs, the service they offer, an overview of pertinent Federal regulation that constrains the operations of these organizations, and an overview of States’ participation in SHIECAP. These are presented in five sections. The first section imparts a common understanding of what HIEs are, and describes the need for data exchange in the Healthcare Industry. The second section describes the national environment of HIEs, focusing on the regulations applicable to HIEs and complementary health IT-promoting programs funded by the American Recovery and Reinvestment Act (ARRA). The third section introduces SHIECAP, focusing on the participation requirements enforced by the Office of the National Coordinator for Health IT (ONC). The fourth section focuses on the strategies developed by the States in their plans for SHIECAP. The fifth and concluding section discusses how SHIECAP has changed HIE’s adoption and use nationally.

2.1 What are HIEs?

HIEs are organizations that offer systems for the electronic sharing of patient health records across organizational boundaries. The purposes of this data sharing are as varied as the needs of the differing organizations that share or receive this information. The most common concept of this service is the sharing of data between primary care physicians and emergency room personnel, but HIEs offer this service on a broader scope, fulfilling a necessary role
supporting data exchange between many different stakeholders of the Healthcare Industry. Examples of stakeholders in this data sharing include public health organizations, payor organizations, patients, and provider trade organizations.

Prior to the widespread adoption of Electronic Health Records (EHR), this sharing could only be done via fax or by paper, if sharing occurred at all. HIEs facilitate data sharing through patient query and directed-messaging systems and through electronic prescribing systems (also known as “eprescribing,”). Performance metrics on each of these methods were sent to ONC from the SHIECAP-participating States to capture the performance of the State organizations. These methods for data exchange are described in the bullets below.

• **Query** – Based on a query by a user, these systems aggregate data from multiple participating organizations to provide a more-complete view of a patient’s medical history. These systems are often complemented with directed-messaging. Out of the 44 States included in this study, 27 states reported query transaction data.

• **Directed-Messaging** – Emulating existing paper-based methods of data sharing, these systems allow for point-to-point transactions in which the sender can select information to share and with whom. Out of the 44 States included in this study, 39 States reported directed-messaging transaction data.

• **ePrescribing** – A specialized sub-set of directed-messaging, these systems are centered on pharmacy operations. Currently, Surescripts has 95% of the market share in these systems. In contrast to the other two methods of data exchange, ePrescribing data is reported by Surescripts for all states. This data is presented as the total number of individuals actively using the system; transaction data was not available.
The fundamental need for these data sharing services stem from patients’ health records that are fragmented across multiple organizations. This fragmentation results in duplicated tests, overutilization of care, and decreased quality of care. These records are fragmented as patient care is spread across multiple organizations and there are significant technical, social, and organizational barriers that block the data sharing necessary to unify these records (Vest and Gamm 2010). These challenges are compounded because EHR systems are not uniformly adopted, and paper records continue to persist (Dykstra et al. 2009).

Without HIEs, the problems arising from fragmented patient health records persist even when EHR systems are fully implemented and adopted within an organization. For example, when patients develop certain symptoms, a report is made to Public Health organizations to aid in the identification and tracking of health risks. A study of these reports found that 10% of patients had duplicate reports and about 20% of these duplicate reports originate from multiple healthcare providers (Gichoya et al. 2012). Similar problems are experienced by patients with chronic conditions; fragmentation results in their records being incomplete for roughly a third of their medical visits (Grinspan et al. 2013). While some efforts are underway to decrease fragmentation within organizations (Ong et al. 2013), HIEs are a clear solution to unify these fragmented records (Dixon et al. 2011).

Despite this, HIEs still experience significant pushback. Healthcare providers are concerned with HIEs’ costs and value as they switch IT systems (Lammers and Zheng 2011), balk at enterprise approaches to data sharing (Olsen and Baisch 2014), and debate the “best” model for health record storage (Lapsia et al. 2012; Wilcox et al. 2006). The concerns about cost and value are very salient, but are mitigated by broader participation in HIEs that drive down the costs. This broader participation increases the amount of shared information on HIE systems, which clarifies the benefits (Solomon 2007). To increase participation, there is a clear need for relationship building with both leadership and staff.
2.2 Regulation of Health Data Exchange

SHIECAP and HIEs are shaped from the Federal level by two complementary regulations: the Health Insurance Portability and Accountability Act of 1996 (HIPAA), and the Health Information Technology for Economic and Clinical Health Act (HITECH Act). HIPAA required the development of stringent guidelines for protecting private patient data, and the HITECH Act expanded HIPAA’s regulations and provided $25.9B for the promotion and adoption of health information technology. The HITECH Act also introduced “Meaningful Use” of EHRs, and created a legislative mandate for ONC to promote HIE adoption and use. Although the implications of these regulations are not central to the focus of this work, they have fundamentally effected how data sharing is conducted in Healthcare. The regulations have provided many of the necessary conditions for SHIECAP organizations to succeed where prior efforts to promote data exchange in this context have failed. The most important of these conditions is the widespread adoption of EHRs and motivation for their use. The following sections provide a brief overview of the provisions of these Acts and clarify how they created these conditions for the interorganizational foundation of SHIECAP organizations.

2.2.1 HIPAA

Title II of HIPAA charged the US Department of Health and Human Services (HHS) to develop five rules regarding Administrative Simplification (AS). They are referred to as the Privacy Rule, the Transactions and Code Sets Rule, the Unique Identifiers Rule, the Security Rule, and the Enforcement Rule.

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1 The Patient Protection and Affordable Care Act of 2010 (PPACA) or “Obamacare” is often discussed in social contexts as regulating HIE, but this is often due to conflating HIE as it is used in this
2 See Appendix A for a review of these previous efforts
The Privacy Rule defines “protected health information” as “individually identifiable health information” and strikes a balance between patients’ privacy and the efficient transit of health data for providing healthcare. The rule further defined approved recipients of this information, and how it could be shared.

The Transactions and Code Sets Rule standardized the methods that governed electronic data interchange, specifically regarding common transactions with payors such as claims statuses and transactions. The Unique Identifiers Rule was complementary to this rule as it mandated the adoption of standard identifiers that would be common across all health plans, healthcare providers and employers.

The Security Rule defined security protections regarding electronic protected health information across three conceptual domains: administrative, physical and technical. First, administrative safeguards pertained to the policies and procedures implemented to demonstrate compliance with HIPAA. These included internal privacy/audit procedures, employee access, and privacy training. Second, physical safeguards pertained to controlling physical access to protected data to guard against inappropriate use. These included facility security plans, maintenance records, escorts and placing workstations out of high-traffic areas where unapproved personnel and the public can view data on the screen. Third, technical safeguards pertained to cyber security threats to protected data. These included encryption for open networks (encryption on closed networks is optional), data corroboration, authenticating trading partners and risk analysis/management programs in use.

Passed in 2009, ARRA’s Title XIII: the HITECH Act expanded HIPAA’s Enforcement Rule making data breach reporting mandatory. HIPAA sets civil monetary penalties for these violations and enacts procedures for their investigation and prosecution. Common violations include misuse/disclosures of protected health information, lack of health data protections, patients unable to access their health data, and over-disclosure of patient health data.
2.2.2 Health IT for Economic and Clinical Health Act (HITECH Act)

The HITECH Act included significant regulatory changes for healthcare and funding for the modernization of the nation’s health information technology systems. These changes introduced “Meaningful Use,” and impelled the ONC to create the Health Information Technology Extension Program and the SHIECAP. As the Enforcement Rule and SHIECAP are discussed elsewhere in this chapter, this section will focus on Meaningful Use and the Health Information Technology Extension Program.

2.2.2.1 Meaningful Use

Meaningful Use was a response to healthcare providers that implemented an EHR but neglected to use their systems. To foster this adoption and use, EHR incentive programs from Medicare and Medicaid were made available to healthcare providers that could demonstrate specific stages of Meaningful Use. Stage 1 (2010-2012) focused on data capture and sharing in standardized formats. This data was to be used to track patient conditions and quality of care within organizations, while also sharing that data with others for care coordination, engaging patients in their care and reporting measures of public health. Stage 2 (2012-2014) built upon this foundation and required increased eprescribing and lab reporting, sharing of data over multiple organizational settings, and more patient controlled data. Currently, Stage 3 (2014-2016+) focuses on improved health outcomes, decision support for national emergencies, patient access to self-management tools, and patient-centered HIEs. It is important to note that at the time of this writing, Meaningful Use Stage 3 has yet to be fully specified.
2.2.2.2 The Health Information Technology Extension Program

The purpose of the Health Information Technology Extension Program was the development of Regional Extension Centers (RECs). The purpose of these centers was to provide education, outreach, and technical assistance to healthcare providers to support their implementation and meaningful use of an EHR. RECs also guided healthcare providers in their selection of HIEs developed in line with SHIECAP. The RECs were complementary organizations to SHIECAP organizations, providing operational support to many healthcare providers that needed financial and technical assistance to participate.

2.3 State Health Information Exchange Cooperative Agreement Program (SHIECAP)

Charged by the HITECH Act, ONC developed SHIECAP for States to facilitate and expand HIEs among organizations to assure statewide data-exchange coverage that was aligned to national HIE standards (Blumenthal 2010). ONC allocated $550M to fund these participating organizations between 2010 and 2014. To join, each state submitted a Strategic and Operational Plan introducing the organization that would lead and implement their strategy, describing in significant detail a plan to develop or expand data exchange services statewide. In contrast to the constrained regional and technological perspective of prior efforts, SHIECAP focused on statewide services agnostic of specific technological solutions. This infused capital into HIEs in these states, and allowed for broad comparisons across all of these organizations, which would be otherwise impossible.

The leadership of these proposed organizations varied from new organizations created solely to offer data exchange services, like the Alabama HIE, to collaborative healthcare agencies that were already in operation in the State, like the Texas Health Services Authority and the
Rhode Island Quality Institute. In all of these leadership organizations, a multi-stakeholder board was recruited to oversee and advise the organization in its approach to promoting data exchange.

These Strategic and Operational plans also documented State’s HIE readiness, barriers to statewide exchange services and strategy for developing those services to assure both transparency of process and concern for the security and privacy of patient data. These plans were required by ONC to specifically detail the State’s approach to enable eprescribing, lab reporting, and the sharing of patient data between unaffiliated organizations. The precise method for accomplishing this was left to the discretion of the states. This allowed for significant variation in approach and outcome across SHIECAP organizations. Each applicant State was allocated funds after a period of revisions incorporating ONC feedback into their plan prior to approval. Figure 2.1 shows that state population strongly determined the resulting funding level.

![Figure 2.1: SHIECAP funding trends closely to population of grantee State](image)

It is important to note that these plans were not all approved at the same time. Each state progressed through the development of the Strategic and Operational Plans differently. To assist
those States that did not yet have an approved plan, as well as to assist industry analysts and individual organizations in States with approved plans, ONC reviewed the initial set of 28 approved plans and developed 4 “models” that captured the common practices and approaches described in those plans. The models were offered to help in plan development and refinement, and ONC reflected that few States exhibited all elements of any given model, and many states exhibited qualities of multiple models. For this study, I use these models as proxies for SHIECAP Organization Strategy. These strategies are the topic of the next section.

2.4 State Strategies applied during SHIECAP

The four strategies identified by ONC are Elevator, Capacity Builder, Orchestator, and Public Utility. Elevator strategies focused on rapidly enabling directed-messaging through adoption and development of basic infrastructure among healthcare providers. Capacity Builder strategies bolstered existing HIEs through financial and technical support without connecting them to statewide services. Orchestator strategies deployed “thin-layer” state-level architectures providing interoperability and shared services to existing local HIEs, but not to physicians and patients. Public Utility strategies developed a robust statewide agency that offered data exchange services primarily to end-users of HIEs, but also could link to existing HIEs. Many States exhibited a mix of two of these strategies (Tripathi and Hyatt 2011). Elevator strategies, for example, complement Public Utility strategies as Elevator’s develop the basic infrastructures for data transfer between healthcare providers that enables those healthcare providers’ participation in more complex data exchange solutions developed in Public Utility. Public Utility strategies, in turn, help those healthcare providers meet the evolving definition of Meaningful Use, which Elevators may not sufficiently meet. These strategies are discussed in more depth in Chapter 4.
2.5 Salient Changes to the National HIE Landscape after SHIECAP

At the close of SHIECAP in 2014, EHR adoption and data exchange use has increased across the US, though this adoption and use is significantly variable across States. By requiring that each SHIECAP Organization provide a plan to offer statewide data exchange services in coordination with RECs, Public Health organizations, lab/radiology facilities, pharmacies and payor organizations, each State approached the leadership of their SHIECAP Organization differently, shaped both by the needs of the State and the State’s prior experience with HIEs (Dullabh et al. 2011). In most States, this created durable statewide HIEs, but the leadership of these organizations seems to follow predictable patterns of care provider, payor and public health participation. The link between these groups’ inclusion, strategy employed and the success of their organizations is the focus of the research questions proposed in Chapter 3.
Chapter 3: Literature Review

This dissertation examines the relationships between the boards, strategy and performance of State Health Information Exchange Cooperative Agreement Program (SHIECAP) organizations through the lens of Resource Dependence Theory. In this Chapter, several research questions are developed from the synthesis of a top-down review of Resource Dependence Theory’s focus on boards of directors with a bottom-up review of empirical research on Health Information Exchanges (HIEs). The first section discusses the selection of Resource Dependence Theory over Population Ecology, Institutional Theory and Agency Theory. The second section reviews Resource Dependency Theory’s focus on boards of directors, and the connection between boards and strategy. The third section reviews research specifically targeting the boards of healthcare organizations to develop a clearer understanding of the impact on performance by boards and strategies in the healthcare industry. At this point, the discussion shifts focus from theory to context, as the fourth section reviews empirical research on HIEs with implications for SHIECAP organizations. The fifth section argues the value for further extending Resource Dependence Theory by comparing SHIECAP organizations to the healthcare organizations discussed in section three. The sixth section concludes this comparison by presenting research questions and discussing the implications of applying Resource Dependence Theory’s focus on boards of directors to the boards that led SHIECAP organizations.

3.1 Resource Dependence Theory in Contrast to Other Theories

The selection of Resource Dependence Theory was made over complementary theories that explain the sociology of industrial action. These theories include Population Ecology (Hannan and Freeman 1977), Institutional Theory (DiMaggio and Powell 2007), and Agency
Theory (Eisenhardt 1989a). Population Ecology and Institutional Theory both approach organizational adaptation and survival from open-systems perspectives, but differ in their focus as to how best practices are spread through the community (Lawrence and Lorsch 1967). Population Ecology uses environmental imperative to maintain the flow of resources to drive the variation, selection and retention of organization structures (Aldrich and Ruef 2009), and tempers this view with an understanding that strong structural inertia constrains this variation (Hannan and Freeman 1984). In contrast, Institutional Theory uses social and political norms to spread organizational structures (DiMaggio and Powell 2007) as adherence to those norms increases the organization’s legitimacy and therefore increases its access to resources (Baum and Oliver 1991). Both of these theories assume broad diffusion of information and the presence of similar environments for the organizations under study, without a clear understanding of the variation within the task environment. Research is growing within Institutional Theory to better understand the role of IT and collaboration in shaping industries (DiMaggio 1998; Sawyer et al. 2005), but these studies stop short of studying the organizations that foster IT collaboration and intermediation. Grounded studies of these organizations are currently developing similar understandings of Ecological and Institutional pressures but strong links to these theories have yet to be made (Hellmann et al. 2016; Tapia et al. 2012).

Resource Dependence Theory was selected over these theories due to the closer tie to the task environment of the organization, and clearer focus on the role of boards of directors within organizations (Hillman et al. 2009; Pfeffer 1972). SHIECAP provides a particularly interesting context for investigating Resource Dependence Theory, as the ability of the board to influence performance is diminished by the organization’s dependence on others to perform, and the portfolio of resources the board needs to access are fundamentally different from non-state-sponsored organizations. However, Resource Dependence Theory is not the only theory to focus on boards of directors, Agency Theory (Eisenhardt 1989a) also has a strong research stream
focused on boards of directors as they relate to the organizations they monitor. As this research is often overlapped with Resource Dependence, the Agency perspective is discussed below.

In contrast to the three theories discussed above, Resource Dependence Theory argues that organizational success is contingent on the management of environmental dependencies (Boyd 1990; Drees and Heugens 2013; Hillman et al. 2009; Ulrich and Barney 1984; Zona et al. 2015), and is frequently applied to healthcare organizations (Kuntz et al. 2016; Mannion et al. 2015; Ozcan et al. 1997; Pfeffer 1973; Provan 1991). As predicted by this theory, organizations manage their dependence on others by adapting internal structures and practices to gain necessary financial, informational, political and material resources from their environment (Boeker and Goodstein 1991). These actions are designed to limit dependence on external organizations while increasing the organizations’ dependence on the actor (Ulrich and Barney 1984). This dependence management develops an organization’s power and legitimacy (Selznick 1943, 1957; Weber 1978). Pfeffer and Salancik (1978) further developed these concepts in their seminal book *The External Control of Organizations*, which identified five organizational behaviors that more clearly exhibit this concept. Those behaviors were Mergers, Joint Ventures, Executive Succession, Political Action and Board Membership. For analysis of SHIECAP organization, this work focuses on board membership as the collaborative nature of SHIECAP’s goals provide an interesting context to study the effectiveness of boards and their alignment to strategy.

### 3.2 Perspectives on Boards of Directors in Resource Dependence Theory

Board membership is a weaker link to resources than the overt pooling of resources found in Mergers and Joint Ventures. In contrast, board membership does not create clear terms or binding roles for board members. Instead, members of boards of directors represent *assumed* access to financial, informational, social and material resources in trade for increased external
influence on decision-making and access to the board’s information (Pfeffer and Salancik 1978). Due to this ambiguity, boards are frequently evaluated according to their relationship to (1) the organization’s top management (Fama and Jensen 1983), (2) external organization’s boards (Boyd 1990), and (3) the organization’s environment (Pfeffer 1972).

In Resource Dependence Theory, the three board relationships described above are termed board independence, board interlocks, and board size/composition. Board independence evaluates decision-making agency (Fama and Jensen 1983) by focusing on the board’s relationship with the organization’s top management, in which the resource is decision making power. This relation is established by board members that are drawn from or appointed by the organization’s top management (Daily et al. 1999). Board interlocks evaluates a network of organizations by focusing on the co-membership of individuals across multiple boards (Boyd 1990) in which the resource is information access and social capital. In contrast to the previous theories, size and composition of boards evaluates the relations to other organizations in the environment irrespective of the external leadership positions held by board members (Pfeffer 1972). The resource in question here is rarely limited to a single resource (Hillman et al. 2000), and often is more concerned with alignment between the organization’s requirements and its environment (Gales and Kesner 1994; Hillman et al. 2000). The last of these relationships is the focus of this work; this selection is discussed in more detail in the following section.

3.2.1 Board Independence

The first approach draws from Agency Theory (Eisenhardt 1989a) to better understand how boards align the interests of the top management team with stakeholders. The central focus of this approach is the “independence” of board decisions from the influence of the top management team, measured by the proportion of the board affiliated with top management
An independent board can more effectively mitigate principle-agent problems by assuring that top management does not enrich themselves at the expense of shareholders (Fama and Jensen 1983; Jensen and Meckling 1976; Nguyen et al. 2015). This perspective does not take into account the ability of the board to access external resources, and instead focuses on the decision-making power of board members.

A weakness of this approach is that no strong operationalization of board membership has been found to create a consistent measure of board independence (Daily et al. 1999; Zahra and Pearce 1989). In essence, this approach attempts to use a measure of board composition as a proxy for board neutrality, and this neutrality is then used as a predictor of the board’s ability to curb the top management team’s potentially deleterious actions. Despite this disconnect of using affiliation as a proxy for action, the board’s role of control and oversight continues to be a common topic in the study of the composition of boards (Hendry and Kiel 2004; Hillman and Dalziel 2003; Zona et al. 2015). These studies tend to avoid the topic of board composition and instead explore the mechanisms the board uses to align their interests (Bezemer et al. 2007; Zahra and Pearce 1989).

### 3.2.2 Board Interlocks

The second approach shifts focus from an organization’s internal structure to it’s external structure defined by the organizational network created by board interlocks (Mizruchi 1996). These interlocks are created when an individual board member links multiple organizations by being a member of each of their boards; these links have been found to be conduits for organizational power and control (Mizruchi 1996), and also for the diffusion of practices and information (Davis and Greve 1997; Davis 1991; Shropshire 2010). These networks assume that the effect of boards is more dependent on the individual’s social capital (Kim and Cannella 2008).
than on which organizations they specifically link, and does not fully explain the recruitment of non-interlocked individuals onto boards of directors.

3.2.3 Board Size and Composition

Board size and composition is one of the foundational elements of Resource Dependence Theory. Pfeffer (1972, 1973) identified board size as an indicator of the resources needed by the organization while board compositions varied predictably with performance measures (Pfeffer 1972, 1973). This echoed Lawrence and Lorsch’s (1967) earlier finding that organizations with internal structures that did not align with the requirements of their environment performed poorly when compared to better-aligned competitors (Lawrence and Lorsch 1967). Further research has cemented this result, showing that boards do change in size and composition in response to the changing needs of the organization (Callen et al. 2010; Young 1996), and that boards that fail to change result in lower performance levels (Mueller and Barker 1997).

Board size is a marker of the organization’s overall size, whether that is defined by sales (Pfeffer 1972), number of interdependent organizations (de Andres-Alonso et al. 2009), or the complexity of its operations (Coles et al. 2008). Linking board size to performance however is more difficult, as the effect appears to be industry-specific. Board size, in general, is positively associated with performance in nonprofit industries (Dalton et al. 1999; Pearce and Zahra 1992; Provan et al. 1980); while Fortune 500 firms show no association (Gales and Kesner 1994).

The downside for organizations with increased board size include increased costs (Young et al. 1992), and difficulty in building consensus (Goodstein et al. 1994). This partially explains the difficulty of enacting strategic change in organizations with large boards of directors (Alexander et al. 2006). While many researchers are quick to question the simplistic answer
provided by board size, it has proven to be a powerful predictor of firm action, given a firm’s strategy and past performance (Hendry and Kiel 2004; Pearce and Zahra 1992).

In contrast to the varying perspectives on size, the composition of the board focuses explicitly on the resources board members bring to the organization. Pfeffer and Salancik (1978) identify that board members are drawn from the management of the organization (insiders) and from external organizations (outsiders), and that these members are selected for their advice and counsel, access to information critical to the firm, preferential access to resources, and legitimacy. This insider/outsider distinction has been used across board research from board independence (Garrett 2007; Hillman et al. 2000), and the board’s actions and strategy (Alexander et al. 2006; Davis 1991; Hendry and Kiel 2004; Pearce and Zahra 1992; Pugliese et al. 2009; Young et al. 1992), to the effect of the board on operations (Young 1996). While the Insiders on the board receive more attention (Daily et al. 1999), there is sporadic research into outsider sub-groups that serve as a conduit for specific resources, such as regulatory expertise (Johnson et al. 2013), stakeholder involvement (Hillman et al. 2001) and financial resources (Bernstein et al. 2015). In contrast to organizational and profession-based access to resources, there is a growing interest in the demographics of board members and diversity of the overall board as a link to resources (Hillman et al. 2007, 2002; Portes and Sensenbrenner 1993). Of these, this work focuses on the organizational affiliation of board members.

There is growing use of a taxonomy of board members developed by Hillman et al. (2000) that uses these organizational affiliations and can be generalized across organizational contexts. This taxonomy was developed by the synthesis of existing theory on the Resource Dependence roles of Directors; it was applied to airline firms undergoing deregulation, and identified changes in the alignment of the board of directors. Since that initial publication, this taxonomy has been used to study emergent and family firms to better understand the resource dependence role of these boards (Jones et al. 2008; Kroll et al. 2007). This taxonomy includes
insiders, but breaks up the outsider label to better categorize members by the resources they provide. These categories are “Business Experts” who are experienced in the market or competitive environment the firm faces; “Support Specialists” who provide links to specific areas of expertise, but do not form the foundation of firm strategy; and “Community Influentials” who provide links to relevant groups beyond the firms competitor and suppliers for political and social support (Hillman et al. 2000). Table 3.1 gives a review of this taxonomy.

<table>
<thead>
<tr>
<th>Director Label</th>
<th>Resource needs provided</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Insiders</td>
<td>Expertise on the firm itself, as well as general strategy and direction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specific knowledge in areas such as finance and law</td>
<td></td>
</tr>
<tr>
<td>Business Experts</td>
<td>Expertise on competition, decision making and problem solving for firms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serve as sounding boards for ideas, provide alternative points of view</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Channels of communication between firms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Legitimacy</td>
<td></td>
</tr>
<tr>
<td>Support Specialists</td>
<td>Provide specialized expertise on law, banking insurance and public relations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide channels of communication to large and powerful suppliers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ease access to vital resources such as capital and legal support</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Legitimacy</td>
<td></td>
</tr>
<tr>
<td>Community Influentials</td>
<td>Provide non-business perspective on issues, problems and ideas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expertise about and influence with powerful groups in the community</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Representation of interests outside of main competitive interests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Legitimacy</td>
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</tr>
</tbody>
</table>

Table 3.1: The resource dependence roles of directors from Hillman et al. (2000)

Hillman et al.’s (2000) taxonomy has been used to show that high rates of insider membership on the boards of very young organizations predict post-IPO success (Kroll et al. 2007), and that business expert and support specialists influence the adoption of successful diversification strategies among family firms (Jones et al. 2008). Both Kroll (2007) and Jones (2008) show that, at pivotal moments in an organization’s lifecycle, a misalignment of the board’s composition to the organization’s resource requirements can hinder the organization. In the case of the SHIECAP organization, States that developed boards that aligned with both their healthcare environment and the strategy they implemented should exhibit superior performance (Hendry and Kiel 2004; Zahra and Pearce 1989). This issue of strategy is an interesting and underserved aspect of Resource Dependence Theory, and is discussed in the following section.
3.2.4 Boards and Strategy in Resource Dependence Theory

While the alignment between the board’s composition and the resources it requires from its environment is an inherently strategic decision, direct investigation of organizational strategy has been lacking from Resource Dependence Theory’s investigation of boards. Strategy is often mentioned in Resource Dependence literature, but rarely is it explicitly investigated. The first to investigate this link was Pearce and Zahra (1992) who used three operationalizations of strategy and found a significant link between those measures and the board as predictors of financial performance. This result has been difficult to reproduce, however, as Young (1992) found a relationship between CEO’s perception of strategy and board composition, while Weiner and Alexander (1993) found their definition of strategy to be idealized rather than drawn from the organizations (Weiner and Alexander 1993). Their study postulated that as hospitals and other healthcare organizations straddle both non and for-profit distinctions, there should be differences in board size and composition depending on the organization followed a philanthropic strategy (large boards focusing on their role as a community steward) or a corporate strategy (small boards focusing on efficient and effective management of resources). Unsurprisingly, the philanthropic/corporate distinctions were idealized categories, and most Hospital boards exhibited a hybrid approach (Weiner and Alexander 1993).

Hendry and Kiel (2004) provide an interesting perspective on the board’s relation to strategy that melds both Agency and Resource Perspectives. This perspective promotes the idea that boards vary in terms of their financial and strategic control, and therefore the boards can vary from having a high level of managerial control, to managing only the strategic or financial life of the organization, to simply being a rubber stamp for the top management team. This could serve to explain why results in assessing strategy in a resource-dependence context are inconsistent. In this research, the four strategies identified by ONC (Elevator, Capacity Builder, Orchestrator,
and Public Utility) are treated similarly to the strategy classifications used by Young (1992) (Defender, Prospector, Analyzer, and Reactor), as the organizations were pivotal in identifying their own strategy labels.

3.3 Board Size and Composition in Healthcare

Healthcare has been a favored context for board size and composition research, since its selection as the context for the Pfeffer’s (1972) replication study (Alexander et al. 2006; Boeker and Goodstein 1991; Goodstein et al. 1994; Keith G. Provan 1980; Kuntz et al. 2016; Mannion et al. 2015; Ozcan et al. 1997; Pfeffer 1973; Provan 1991; Veronesi et al. 2013; Weiner and Alexander 1993; Young et al. 1992). In general, findings from this industry have mirrored results from other industries that found that boards are tied to the needs of the organization (Boeker and Goodstein 1991; Pfeffer 1973), and that boards have an effect on both financial (Kuntz et al. 2016; Provan 1980) and operational performance (Mannion et al. 2015).

Specific focuses within healthcare include the board composition’s effect on legitimacy and efficiency (Ozcan et al. 1997). Boards can increase their legitimacy by increasing their size, but these larger boards lose the ability to effectively enact strategic change (Goodstein et al. 1994); each board must strike a balance between establishing legitimacy and remaining efficient and effective.

To solve this apparent conflict within hospital boards, many researchers focus on the role of clinicians on the board to increase a board’s legitimacy and to access the expertise of those individuals (Mannion et al. 2015; Veronesi et al. 2013), but little work has been done to understand these relationships in the context of health IT. The table below provides a sample of the research stream used in this section, highlighting the data and interest of the study. These
highlight the stream’s development and are organized into sections by interdependence of the board with the external environment, the internal environment, and performance.

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Data</th>
<th>Interest of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Environment's determinants board characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pfeffer, 1973</td>
<td>57 Illinois Hospital Survey</td>
<td>Environmental determinants of board size, composition, and function</td>
</tr>
<tr>
<td>Boeker and Goodstein, 1991</td>
<td>290 Hospitals from CA Health Facilities Commission Survey</td>
<td>Effect of performance and environmental changes on board composition</td>
</tr>
<tr>
<td><strong>Interdependency of the board and the organization's internal environment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provan, 1991</td>
<td>287 Non-Profit Community Hospitals from AHA Survey</td>
<td>Influence and information flow between management and boards</td>
</tr>
<tr>
<td>Young et al. 1992</td>
<td>109 NY and PA acute-care hospital survey</td>
<td>Effect of strategy on board composition</td>
</tr>
<tr>
<td>Weiner and Alexander, 1993</td>
<td>1,577 Non-Profit Community Hospitals from AHA Survey</td>
<td>Effect (existence) of varying types of hospital board structures</td>
</tr>
<tr>
<td>Goodstein et al., 1994</td>
<td>334 Hospitals from CA Health Facilities Commission Survey</td>
<td>Effect of board size on the board’s ability to initiate strategic change</td>
</tr>
<tr>
<td>Alexander et al., 2006</td>
<td>2,038 nonfederal, short term, community hospitals from AHA Survey</td>
<td>Effect of board compositions on enacting organizational change</td>
</tr>
<tr>
<td><strong>Effect of the board on organizational performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provan, 1980</td>
<td>46 Northeastern Human Service Agencies, Archival Data and Interviews</td>
<td>Impact of an externally powerful board on organizational effectiveness</td>
</tr>
<tr>
<td>Ozcan et al., 1997</td>
<td>40 Virginia Community Mental Health Centers from State Agency Data</td>
<td>Effect of board composition on needs fulfillment</td>
</tr>
<tr>
<td>Veronesi et al., 2013</td>
<td>169 UK acute-care trusts, Archival data</td>
<td>Effect of clinician’s board membership on performance</td>
</tr>
<tr>
<td>Mannion et al. 2015</td>
<td>95 UK healthcare trust survey</td>
<td>Effect of board actions on performance mitigated by board composition</td>
</tr>
<tr>
<td>Kuntz et al. 2016</td>
<td>175 German hospital corporations, Archival data</td>
<td>Effect of owner-initiated changes in board composition on performance</td>
</tr>
</tbody>
</table>

**Table 3.2: Healthcare Board of Directors research using Resource Dependence Theory**

These studies show a strong focus on hospitals’ boards as well as the shift in focus of the research stream from external determinants of the board, to the board’s relation to it’s internal environment, to the current focus of the effect of the board on performance. It is important to note
that the majority of these studies are quantitative in nature, and few dive into the qualitative understanding of their contexts.

3.4 Previous HIE Studies informing my approach to SHIECAP

As discussed in Chapter 2, SHIECAP was implemented to help establish HIE services as HIEs have historically struggled to become viable organizations (Vest and Gamm 2010). SHIECAP fundamentally changed the HIE landscape by broadening the focus from local efforts with varying organizational and non-organizational forms (Vest and Gamm 2010), to statewide efforts that adopted comparable organizational forms. Despite this shift, statewide efforts still face the same viability challenges of social pushback against adoption and use of the service, and financial difficulties in transitioning from grants to user-based funding. The following sections provide a targeted review of that research focused on the topics of HIE adoption and use, as well as the sustainability and viability of the organizations that offered this service.

Long-term financial sustainability for HIEs has remained elusive. Few HIE efforts have been able to monetize their service to cover operational costs (Adler-Milstein et al. 2013) and there is conflicting evidence as to whether HIEs have a concrete value proposition based on lowering healthcare utilization and lowering costs (Frisse and Holmes 2007; Frisse et al. 2012; McCormick et al. 2012). This further complicates the issue that the faster HIEs gain funding from participants based on service rather than grants, the more likely they are to become financially viable (Adler-Milstein et al. 2010). In shifting from the planning stage, lack of funding has been cited as a key barrier with no qualification as to source (Adler-Milstein et al. 2009). One method to reach this sustainability is to share a very limited set of data over a broad group of stakeholders and to use this initial base to further develop the service (Adler-Milstein et
al. 2010). As SHIECAP has recently ended, this is an ideal chance to see which initial conditions promoted the success of these efforts.

To better discuss these topics, the first section clarifies the shift from local efforts to statewide organizations, and highlights how the lessons learned from those efforts shaped SHIECAP. The second section highlights the breadth of research on HIEs, providing context for my selection of performance indicators discussed in the third and fourth sections. The short-term performance focusing on HIE adoption and use is the topic of the third section, while the fourth section provides a discussion of sustainability with implications for SHIECAP.

3.4.1 Local HIEs Variety Compared to SHIECAP

Local HIEs vary greatly in form and organizational niche, and as some SHIECAP Organizations attempt to orchestrate these varying efforts, it is important to understand this variety. These forms and niches vary from HIEs that exclusively exchange data among non-competing organizations, to HIEs brokered by an independent third-party, to EHR vendors that bundle HIE services into their IT platform (Joshua R. Vest et al. 2013). While this variety allows for HIEs to better adapt to their local environment, they lack institutional isomorphism which forms in more established organizational niches (DiMaggio and Powell 2007), and helps younger organizations in the niche contend with common issues like the adoption and use of their services. As no State will be able to remove competition from healthcare, and there will be significant political pushback against a governmental EHR, independently brokered HIEs are a more realistic model for sustainability to be transferred to the larger statewide efforts. Take for example the Santa Barbara County Care Data Exchange, an independently-brokered HIE that was lauded in the early 2000’s as an example for other HIEs to emulate due to its excellent design, but resulted in soaring costs and failure. The lack of community leadership, lack of a compelling value
proposition, and poor IT project management are often cited as the cause for this failure (Frohlich et al. 2007; Holmquest 2007; Miller and Miller 2007). Lessons learned from Santa Barbara have been applied to many statewide HIEs that were the template for SHIECAP’s organizations. These efforts are the Healthcare Efficiency and Affordability for New Yorkers Capital Grants Program (HEAL NY) (Campion et al. 2013; Kern and Kaushal 2007; Kern et al. 2009), and the Massachusetts eHealth Collaborative (MAeHC) (Goroll et al. 2009; Tripathi et al. 2009).

HEAL NY is the broadest effort, informing statewide regulation, provider organization’s roles and responsibilities, and vendor/support organization’s roles and responsibilities. Iterating this effort over several years, New York has been able to establish strong buy-in and engagement from multiple groups across the state, though this success did come with a significant price tag. In contrast, MAeHC focuses solely on promoting EHR adoption and HIE service use through broad stakeholder engagement and consensus building, at a fraction of the cost of HEAL NY. SHIECAP finds middle ground between these two efforts, requiring more alignment with policy goals and more robust IT project management than MAeHC, while not requiring as long or resource-intensive an engagement as HEAL NY.

By establishing common goals and requirements for statewide efforts, SHIECAP provided a common approach for statewide HIEs that was lacking in prior efforts. Many of the sub-state data-exchanging organizations of these prior efforts still exist and are incorporated into the SHIECAP organization for their state. Though the process for this incorporation is under-studied (Lenert et al. 2012), ONC allows for variability in the approach of SHIECAP organizations to account for the unique network of organizational dependencies in each State’s healthcare community as well as address the differing gaps between the State’s initial HIE readiness and the goals for SHIECAP. These are the elements that established the differing board size and composition of the SHIECAP organizations, as well as the development of SHIECAP strategies (Elevator, Capacity Builder, Orchestrator, and Public Utility). These elements were not
widespread among local HIEs, but the challenges that SHIECAP organizations face are the same that those local organizations faced.

3.4.2 Breadth of HIE Research

As a new organizational community, HIEs have been the focus of many research initiatives. Hripcsak et al. (2007) provides an excellent review covering many of the differing facets through which HIEs have been or could be evaluated. An abbreviated version of their model is shown in the following figure limited to the challenges faced by the SHIECAP organizations, with the arrows showing a general progression of the topics as the maturity of the organization increases.

Figure 3.1: HIE Evaluation Framework, Adapted from Hripcsak et al. (2007)

While this framework focuses on pivotal areas of HIEs, it ignored the complexity of many elements of the framework. Other meta-analyses focused specifically on HIE service use, and found that this term had few consistent research streams. Operationalizations of “use” spanned levels of analysis from the individual to organizational to network perspectives (Vest and Jasperson 2010). On the individual level, use was defined as access, diversity of information, and
measures user satisfaction. On the organizational level, it was operationalized as technical sophistication, number of exchange partners, and volume of data transferred; while network operationalizations included the number of unique patients accessed, percent of organizations providing data, and percent of information exchanged (Vest and Jasperson 2010). HIE service use is further complicated when considering differing levels of readiness in healthcare organizations to incorporate and leverage HIE services (Bowes 2010), the differing use cases of HIE (Politi et al. 2014; Vest and Jasperson 2012), and the sustainability of the offering organizations (Labkoff and Yasnoff 2007).

3.4.3 HIE performance as use.

The potential of HIE services to increase the quality of patient care, increase care outcomes, and lower overall healthcare costs drives most assessments of its potential value (Frisse and Holmes 2007). However, this value assumes the broad adoption of EHRs and many HIEs’ success is measured by recruiting EHR-enabled organizations and accelerating their use of HIE services (Hripcsak et al. 2007; Vest and Jasperson 2010). While the actions of individual HIEs is under-studied, the actions of participating organizations have received significant attention focusing on the mimetic, coercive and normative methods that influence their participation in HIEs (Campion and Gadd 2010). Out of these methods, the most influential determinant of whether an organization participates in an HIE is whether that organization has patients whose data is already included in the HIE. This eclipses both peer and geographic effects (Yaraghi et al. 2014). This differentiates HIEs from other health information technologies where peer effects tend to have greater sway on organizational action than patient resources (Hao et al. 2011), though social contracts, like trust, must exist between potential HIE partners (Ross et al. 2010).
This is shown by hospitals that are more prone to join HIEs that connect them to non-network external physicians over non-network hospitals as there are fewer competitive reasons to distrust external physicians (Furukawa et al. 2013). There is conflicting information that this is motivated by fear of losing patients through competitive actions such as poaching or publishing unfavorable care quality data (Pevnick et al. 2012; Yeager et al. 2014). The HITECH Act focused on removing some of these barriers to participation through SHIECAP and the regional extension centers by providing a social contract through regulation (Gold et al. 2012).

Even when these organizations were persuaded to join HIEs, this did not mean that the services would be used as intended. Two studies found that HIE services were used in 2.3% (Vest et al. 2011) and 21% (Vest et al. 2012) of patient encounters with time-critical situations and a patient’s unfamiliarity with the care location lessening HIE use (Vest et al. 2011). In contrast, patients with chronic conditions and recent emergency department visits increase HIE use (Vest et al. 2012).

From the physician’s perspective, HIE service use was facilitated by increased coordination of care and reduced healthcare utilization and Meaningful Use incentives; while barriers included concerns about availability and quality of patient data (Yeager et al. 2014). In the same way that a new car needs gas to get to a gas station, this is a “critical mass” problem where HIEs require participants to have a value proposition that convinces those organizations to join. Many HIEs stumble on this point, and detractors are quick to point out that “healthcare is local” despite the average number of reports exchanged by participating organization increases with its exchange partners (Joshua R Vest et al. 2013).

The claims that HIE service use directly lowers healthcare costs comes from the potential to lower admission/readmission rates, lower the amounts of procedures/tests requested, and by identifying chronic and improper users of care and shifting them to more appropriate and effective sources of care. While HIE is expected to lower admission rates (Johnson et al. 2011),
there is weak evidence supporting this position generally (Theera-Ampornpunt et al. 2009; Vest et al. 2014). There is stronger evidence that participation in an HIE does not have an effect on readmission rates (Jones et al. 2011) and that HIE service use increases the likelihood of emergency room visits and admission (Vest 2009). Similar evidence has been found for imaging and blood tests, as the electronic access to these results may increase ordering of these tests (McCormick et al. 2012). There is one exception to this in the Emergency Department setting that showed significant decreases in both hospital admissions and test ordering (Frisse et al. 2012). The issue remains an open question as to whether or not HIEs lower overall utilization rates, but as most of these studies state that HIE services are used in less than 5% of care encounters, the results shown might be more indicative of initial sensitization to the services rather than long-term disruptions in healthcare.

Through SHIECAP, healthcare utilization rates are still unavailable. However, the ONC has made available three metrics of HIE use. These are the transaction volumes for Direct and Query messages, as well as the total number of individuals actively eprescribing. These are used as the performance variable for this work and are described in more depth in Chapter 4.

### 3.4.4 SHIECAP as the next step in HIE

As discussed in Chapter 2, SHIECAP represents a fundamental shift in the approach to promoting HIEs, but the basic elements of performance remain the same: adoption and use in the short term, and organizational sustainability and viability in the long term. SHIECAP provided funds so that sustainability and viability concerns would not come second to adoption and use, and therefore conditioned these funds on broad stakeholder inclusion, alignment with key governmental programs and standards, and the design of these organizations to transition from grant funding to a sustainable model.
ONC identified four strategies from the SHIECAP plans that were partially a response to the existing health IT environment of the States, and partially a statement of the role the State government was willing/able to play in that environment. The ONC classified these initial strategies into Elevator, Capacity Builder, Orchestrator, and Public Utility.

As noted in Chapter 2, Elevator strategies focused on promoting directed-messaging among healthcare providers, representing the least permanent role for the State government and normally occurred where there was very little health IT adoption and no HIE activity. Capacity Builder focused on the development of sub-state HIEs, representing a minor role for State government, and normally occurred where there was moderate health IT adoption and HIE activity in the planning stages. Orchestrator focused on developing a “thin-layer” architecture where the State government would offer several services to operational sub-state HIEs and promote the closing of gaps in HIE coverage across the state. The final and most government-intensive strategy was Public Utility, where the State government provides complete HIE services to all stakeholders in the state. This final strategy was more popular in smaller states with significant HIT adoption but little HIE activity. Table 3.3 below shows these strategies.

These strategies align with the conceptualization of strategy in Zahra and Pearce (1992) which describes strategy as the scope of the organization’s business and shapes its long term plans (Pearce and Zahra 1992), and with the method of identification in Young (1992).

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator</td>
<td>Rapid facilitation of directed exchange capabilities to support Stage 1 Meaningful Use</td>
</tr>
<tr>
<td>Capacity Builder</td>
<td>Bolstering of sub-state exchanges through financial and technical support, tied to performance goals</td>
</tr>
<tr>
<td>Orchestrator</td>
<td>Thin-layer state-level network to connect existing sub-state exchanges</td>
</tr>
<tr>
<td>Public Utility</td>
<td>Statewide HIE activities providing a wide spectrum of HIE services directly to end-users and to sub-state exchanges where they exist</td>
</tr>
</tbody>
</table>

Table 3.3: General Description of SHIECAP Organization Strategies
3.5 SHIECAP Boards as a Resource Dependence Theory Context

SHIECAP organizations provide an interesting context to extend Resource Dependence Theory’s focus on board size and composition, as the goals and requirements of these efforts differ in three important ways from traditionally studied healthcare organizations.

First, the boards of traditionally-studied healthcare organizations must see to effectively and efficiently meet the healthcare needs of their region, while SHIECAP boards must focus on maximizing adoption and use of their HIE service. This provides a significant pressure for including stakeholder’s voices on the board to increase buy-in, and mitigate resistance through the process of co-optation (Hillman et al. 2009; Pfeffer 1972), a concern which is not present in traditional organizations. This difference directly impacts the appropriate measures of performance of these organizations. While healthcare organizations utilize financial and care metrics as measures of performance, SHIECAP organizations are assessed on their ability to engender use of their technology. These use measures are discussed in greater detail in the next chapter.

Second, traditional healthcare organizations must seek board members that increase the financial resources available to the organization. In contrast, SHIECAP organizations are challenged with establishing financial viability after SHIECAP, and are not in need of immediate financial resources. The ONC funds SHIECAP organizations through the HITECH Act, and each effort has a population-adjusted allotment of funds obviating the role of the board in gaining immediate external funding.

Third, SHIECAP organizations lack institutional isomorphism as was shown in the variety of HIEs shown in Section 3.3.1, and as the SHIECAP organizations are mostly unprecedented. Due to this, there is little argument for traditional “Insider” representation on the board. In effect, SHIECAP has created a context in which the role of the board is almost
exclusively dedicated to managing the information flow for the design and implementation of the statewide system, and developing legitimacy of the effort among many stakeholder groups to assure their buy-in after the SHIECAP funds are expended. This creates a context that should garner significant involvement from Business Experts, Support Specialist, and Community Influentials.

3.6 Research Questions

SHIECAP provides an interesting context to extend Resource Dependence Theory’s focus on board size and composition. As shown in the preceding section, Resource Dependence Theory normally focuses on stable, established organizations (Bernstein et al. 2015; Hillman et al. 2000; Kiel and Nicholson 2003; Lester et al. 2008; Pearce and Zahra 1992; Pfeffer 1972; Zona et al. 2015), and following Pfeffer’s choice (1973) to do his replication study in the context of hospital boards, healthcare organizations have been a favored context within the research stream (Kuntz et al. 2016; Mannion et al. 2015; Pfeffer 1973; Provan 1988, 1991; Kovner 1974; Young et al. 1992). SHIECAP organizations represent an opportunity to extend the implications for Resource Dependency Theory to a context where I weaken the assumption that the organization is established and unfunded. While studies of entrepreneurial (Kroll et al. 2007), high-tech organizations (Knockaert and Ucbasaran 2013) that also exist under these conditions have been conducted, these studies focus on the actions of the board rather than the alignment of the board, strategy and performance of these organizations.

To capture Resource Dependence Theory’s perspective on this context, I approach SHIECAP organizations using a refinement of Pfeffer’s (1972) seminal article. These refinements include first, a more detailed understanding of board composition using the taxonomy of board compositions from Hillman et al (2000); second, the organizational strategies identified by ONC
as indicators of the resource requirements of each SHIECAP organization (Pearce and Zahra 1992); and third, metrics of performance that are applicable to IT. These refinements are important as they better describe how the SHIECAP organizations differ from the generally established, stable, and unitary organizations that have been the focus of Resource Dependence Theory.

SHIECAP organizations are collaborative organizations that are charged with enabling data exchange among unaffiliated healthcare organizations, and were given significant funding and agency to design/implement their solution. These differences give rise to the several research questions that follow. Figure 3.2 shows the structure of these questions, with the dotted lines in the figure below only affecting Research Question 6.

![Figure 3.2: Depiction of Research Questions](image)

**Figure 3.2: Depiction of Research Questions**

As the both the SHIECAP Organization Strategy (Dullabh et al. 2011; Tripathi and Hyatt 2011) and board size and composition are determined by the environment of the SHIECAP organization (Hillman et al. 2009), I expect there to be a relationship between the board size and composition of these efforts and strategy employed. This relationship is captured in Research Questions 1 and 2.

*RQ 1: Is there a relation between SHIECAP Organization Strategy and board size?*

*RQ 2: Is there a relation between SHIECAP Organization Strategy and board composition?*
As these SHIECAP organizations are concerned more with establishing the long-term financial sustainability of the HIEs rather than the short term viability, I expect that the legitimacy concerns will surpass the efficiency concerns of these boards (Ozcan et al. 1997). This will focus these boards on developing organizational buy-in as a source of future funds rather than on accessing sources of current investment (Goroll et al. 2009; Simmons 2012). I expect that larger boards and boards with larger proportions of healthcare providers will predict higher performance, as the large boards will increase access to larger sections of the healthcare community and other user of HIE services. Due to this, I expect board size and composition to predict measures of performance. In this effort, HIE use is my measure of performance and is indicated by directed and query-based transactions and the number of individuals actively eprescribing. Measures of the benefits of HIE are not included as these benefits are lagged and require consistent use of HIE services by healthcare providers, which is not supported by the literature (Frisse et al. 2012; Vest et al. 2014). This relationship is captured in Research Questions 3 and 4.

**RQ 3: Does board size predict SHIECAP Organization performance?**

**RQ 4: Does board composition predict SHIECAP Organization performance?**

Building on Pearce and Zahra (1992), I take the view that the selected SHIECAP Organization Strategy is indicative of the resources required by the SHIECAP organization to surmount the challenges of HIE-readiness and political environment of State. As each of the SHIECAP strategies (Elevator, Capacity Builder, Orchestrator, and Public Utility) are tailored to surmount specific hurdles in the adoption of HIE in the state (lack of health IT adoption, lack of local HIEs, lack of coordination among local HIEs, and of a “critical mass” of users to support local HIEs), I test to see if the differing strategies have differing effects of performance, to show
if these boards were effective. Given strategy’s alignment with this functional aspect of the environment, I expect a more direct effect between strategy and performance than what is shown in Research Questions 1-4.

**RQ 5: Does SHIECAP Organization Strategy have an effect on SHIECAP Organization performance?**

The common critique of board research is that the mechanism that relates the board to the measured outcome is not understood (Pettigrew 1992; Stinchcombe 1990). SHIECAP offers a revelatory opportunity (Yin 1989), to study both the effectiveness of the board efforts, and to unpack the interdependency of these organizations with the local HIEs already underway in the state. As SHIECAP organizations are statewide, there are many HIEs and HIE-promoting agencies that operated under significant uncertainty during SHIECAP. By capturing these organizations and their dependencies, I can build a clearer picture of the interdependencies inherent in HIE, with potential implications for population-based analytics and other health data sharing technologies. Due to this I propose the final question:

**RQ 6: What other unmeasured variables influenced the relationship between boards, strategy, and performance?**
Chapter 4: Research Methods and Design

To test the proposed research questions, this chapter describes an embedded case design to explore two distinct levels of analysis: 1) the State Health Information Exchange Cooperative Agreement Program (SHIECAP) nationally and 2) SHIECAP within North Carolina. The SHIECAP Case captures the first level of analysis, and uses predominantly quantitative methods on data and plans submitted to Office of the National Coordinator for Health IT (ONC) to investigate the relationship between boards, strategy and performance. In contrast, the North Carolina Case captures the second level of analysis, and uses interviews and archival documents to capture not-readily quantified variables and mechanisms that influence the relationships between boards, strategy and performance. This research design and accompanying methods are discussed over six sections. The first section describes the guiding research philosophy of this work. The second section describes the embedded case study method and the design for its application in this work. The third section describes the data collected and characterization for quantitative analysis in the SHIECAP Case. The fourth section describes the context and major actors within North Carolina and the data gathered from those actors for qualitative analysis in the North Carolina Case. The fifth section describes the analyses applied to each of these Cases individually, and illustrates how the results of these analyses will be combined to address the research questions. The sixth section concludes this chapter with a discussion the reliability of this research design and its implementation.

4.1 Research Philosophy

As this work seeks to both identify relationships and describe their generative mechanisms, this work borrows from the Functionalist and Interpretivist research paradigms, and
exists in the “Interpretivist-Functionalist Transition Zone” (Gioia and Pitre 1990). A Functionalist, quantitative approach is commonly used to establish the link between boards, strategy and performance (Hillman et al. 2000; Pfeffer 1972), while in contrast an Interpretivist qualitative approach is commonly used to understand actions within a rich context. By combining these two complementary approaches I aim to capture evidence of the relationship between boards strategy and performance while also describing the mechanism of that. The lack of this complementary lens in Resource Dependence Theory studies has led to several researchers calling for more qualitative investigation of these mechanisms (Kilduff 1993; Pettigrew 2001; Pratt 2007; Stinchcombe 1990). This tension among researchers shaped the selection of an embedded case as this study’s method, and allows for this study to investigate a contemporary phenomena within its real-life context even when the specific interplay between structure and action is predicted, but as yet unresearched (Dobson 1999; Yin 2003).

In this embedded case, the identification of relationships between boards, strategy and performance in the SHIECAP Case employs a mix of qualitative and quantitative methods commonly used in more Functionalist studies of Resource Dependence Theory (Hillman et al. 2000; Kroll et al. 2007; Pfeffer 1973; Zahra and Pearce 1989), while the North Carolina Case employs qualitative methods from investigative studies of Resource Dependence Theory (Hendry and Kiel 2004; Katila et al. 2008; Provan and Milward 1995) that are more in line with Interpretivist studies (Strauss and Glaser 1967) to capture both the relationships generative mechanisms, and the unique aspects of data-exchange organizations to shed new light on Resource Dependence Theory (Pettigrew 1992; Stinchcombe 1990).

While this mixed-method approach is uncommon in Resource Dependence literature, and quantitative assessments are by far more prevalent (Bernstein et al. 2015; Carper and Litschert 1983; Pfeffer 1973), there is a recognized need for qualitative research in the assigning of board characteristics (Daily et al. 1999; Hillman et al. 2000), and on the linking of board characteristics
to performance in rich, context-aware settings (Fitzgerald and Harvey 2015; Pettigrew 1992; Stinchcombe 1990). This is the link that ties this case together.

4.2 Case Study Method and Research Design

This research applies an embedded case research method (Yin 1989). In contrast to single and multiple case designs that focus on a single level of analysis, and holistic case designs that try to capture the entirety of a case, embedded case designs focus on a discrete set of analysis levels and clearly describes the rationale to define the set and the interrelation among levels. This type of case study research assists in investigating complex processes that span levels of analysis across numerous iterations (Yin 1989). With SHIECAP organizations, there are multiple States promoting HIE, and while these organizations embody the principles of Resource Dependence Theory, the relationships between boards, strategy and performance are the result of interacting mechanisms within each state. This makes SHIECAP an ideal context in which to apply an embedded case design using concepts developed from Resource Dependence Theory (Eisenhardt 1989b), to develop a better understanding of those concepts by contrasting SHIECAP nationally with the experience within North Carolina (Dyer and Wilkins 1991).

This study uses an embedded research design that embodies both elements from both Eisenhardt’s and Dyer and Wilkins’s critique of case research. While the SHIECAP Case assesses theoretical constructs by identifying relationships between boards, strategy and national performance, the North Carolina Case assesses the rich context of North Carolina’s participation to understand the mechanisms that construct those relationships. The general structure of this case is illustrated in the Figure 4.1, and elaborated in following sections.
Figure 4.1: Embedded case design highlighting the major relationships in each case

The SHIECAP Case, covered in more depth in Section 4.3, uses data from 44 States\(^3\) SHIECAP Strategic and Operational Plans combined with performance data collected by ONC. The Strategic and Operational Plans contain information on the board membership and strategy employed in each State, while the performance data describes data exchange use. These constructs are then used to offer preliminary responses to the first five research questions.

The North Carolina Case, covered in more depth in Section 4.4, uses North Carolina’s Strategic and Operational Plan, interviews with data exchange organizations and promoters, and analysis of archival documents to offer further explore the relationships identified in the

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\(^3\) Discussed in greater detail in Section 4.3.1, the six States not included in this case are Missouri, New Hampshire, New Jersey, Tennessee, Virginia, and Wyoming.
SHIECAP Case. While an individual Strategic and Operational Plan may seem well orchestrated, the local experience may contradict this assumption. The North Carolina Case provides richness and insight to better understand this disconnect, and better describe the challenges that other States are currently facing, driving the timeliness of this research. This insight would not be available if this study were to be attempted at any other time.

North Carolina was selected as the focus for this embedded case as it supported several operational HIEs and lacked any extreme contextual challenges such as a pre-existing statewide HIE or centralized population around a single city. This removed more mature efforts that may have created unique solutions that may not be reproducible under SHIECAP, such as Michigan’s MiHIN organization and New York’s HEAL NY programs. Also removed were states that had unique challenges, like Alaska’s need for significant investments in broadband access, or had confounding factors that would be strongly related to context, such as Alabama’s challenge with low health IT adoption, or had fewer barriers to collaboration like Delaware’s relatively dense and well-connected healthcare system.

North Carolina was an ideal candidate as the State was moderately sized, supported several geographically spread HIEs, and did not have an established statewide HIE prior to SHIECAP. Of particular importance when selecting North Carolina for this study, was a unique member on their SHIECAP organization board. This organization is the North Carolina Healthcare Information & Communications Alliance (NCHICA). NCHICA provides a unique role in North Carolina’s healthcare community as it provides a neutral and engaging environment where multiple members of the community can participate and learn about the challenges of Health IT through their many committees, workgroups and conferences. Organizations similar NCHICA were normally the core of the States’ SHIECAP organization, but in North Carolina that is not the case.
4.3 SHIECAP Case

The SHIECAP Case tests for a relationship between boards, strategy and performance across 44 State’s SHIECAP organizations. Figure 4.2 shows the general concept of this case, including the operationalization of boards, strategy and performance measures, as well as three environmental factors that were investigated as potential covariates.

To collect this data, the SHIECAP Case draws on two main sources: SHIECAP Strategic and Operational Plans, and the SHIECAP performance measures submitted to ONC. This section first describes the SHIECAP Strategic and Operational Plans and second, outlines how these plans were used to capture board characteristics and strategy. Third, this section describes the sources and limitations of the performance measures, and this section concludes with a similar discussion of the environmental factor data. A breakdown of these data sources is given in Table 4.1.
Table 4.1: Description of Data Source used per state

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Size per State</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Strategic and Operational Plans</td>
<td>100-200 Pages</td>
<td>HIE Government Involvement Strategy, Board Size and Comp.</td>
</tr>
<tr>
<td>Query-Based Exchange Transactions</td>
<td>7 Observations</td>
<td>Performance Response</td>
</tr>
<tr>
<td>Directed Exchange Transactions</td>
<td>7 Observations</td>
<td>Performance Response</td>
</tr>
<tr>
<td>Electronic Prescribing Adoption and Use</td>
<td>65 Observations</td>
<td>Performance Response</td>
</tr>
<tr>
<td>Non-federal Hospital EHR Adoption</td>
<td>4 Observations</td>
<td>EHR Adoption</td>
</tr>
<tr>
<td>Physician EHR Adoption</td>
<td>4 Observations</td>
<td>EHR Adoption</td>
</tr>
</tbody>
</table>

4.3.1 Data Collected from SHIECAP Strategic and Operational Plans

SHIECAP Strategic and Operational Plans were used to identify boards and strategies. Discussed in Chapter 2, these plans were submitted by participating States to ONC. As was mentioned earlier, SHIECAP was open to all 56 US states, protectorates and territories. Non-states such as Guam, the US Virgin Islands, the Northern Marianas Islands, Puerto Rico, and American Samoa were not included due to their unique healthcare environment and political structure. The District of Columbia was initially included, but due to lack of consistent data across other measures it was eliminated as well. Out of the States, 6 were removed from the analysis due to missing data. Virginia, Wyoming and Missouri were removed as their plans were unrecoverable, and New Hampshire, New Jersey, and Tennessee were removed as documentation of their board memberships were missing from their plans and were unable to be recovered by contacting the SHIECAP organization or State government. Each included plan, either strategic or operational, consisted of roughly 100-150 pages, resulting in a corpus of ten thousand to fifteen thousand pages.

For the included 44 States, their documents showed significant understanding of their local environment and planning preceding SHIECAP participation. This is understandable these
documents are the result of several revisions including ONC feedback before they were approved by the ONC. Also, any effort that required mid-course corrections was similarly required to resubmit their plan with the adjustment. Most of these adjustments were early in the program.

The information content was generally consistent across the documents with the following areas being elaborated:

- Current State analysis of HIE Readiness and Operations
- Future State statement of Goals and Mission
- Conceptual plan to close the gap between current and future states
- Coordination with other local, State and Federal healthcare initiatives
- Governance
- Financial Model(s)
- Technical Architecture and Implementation practices
- Policy Review

The Current State Analysis, the Conceptual Plan to close the gap between the current and future states, and the Governance sections were particularly enlightening to help ground this study in a rich understanding of the context. The Current State Analysis identifies any prior work that the SHIECAP organization inherited and also gave a good indication of the drafting organization’s perspective on the HIEs in their state. Though some of this perspective showed some nativism and myopia as a State’s status as “unique” was ironically common, as the following quotes show.

“Wisconsin has a deserved reputation as a national leader in improving healthcare quality. Our state is uniquely positioned to transform the healthcare sector because of its technical resources; strong industry partners in the technology and healthcare sectors; the widespread commitment, investment, and intellectual capacity brought to this work by the health community; and a remarkable history of collaboration across private sector competitors and across the public and private sectors.”
- Wisconsin SHIECAP Plan, 2010

“Maryland has a strong foundation and a number of special advantages above and beyond its convenient location for implementing a statewide HIE in collaboration with ONC.”
- Maryland SHIECAP Plan, 2011
These sections were also valuable to extend the ONC’s Strategy categories to those 16 States not included in their original review (See Table 4.6 for a breakdown of States by these Strategies, with the extended states bolded). While these plans described in significant detail the specific aspects of each effort, they also identified the main stakeholders of the SHIECAP organization, and how they would be served. These methods for serving the States stakeholders were the basis of extending the ONC’s strategies. General strategies that elevated stakeholder ability by enabling directed-messaging across the community were classified as Elevators; those that built up local HIEs that would manage the needs of a specific community were classified as Capacity Builders; those that orchestrated multiple HIEs’ service offering by standardizing some of the core services in a centralized source were classified as Orchestrators; and those that started a centralized statewide HIE that could serve hospitals and sub-state HIEs were classified as Public Utilities. These strategies were not mutually exclusive, however, as a state could opt to promote almost any combination of strategies. A table of these strategies is included as Table 4.5, and the combinations of strategies across the States are shown in Table 4.6.

The final aspect taken from these documents was the board of the SHIECAP organization that was normally located within discussion of governance. These boards were often described as advisory committees, coordinating committees, governing boards, and occasionally as boards of directors. Most SHIECAP Plans delineated which groups would hold a seat on the governing board of the SHIECAP organization. For those States that did not include a breakdown of their governing board, archival documents were garnered through web-searches and calling the appropriate organizations. The lists of board members identified either the board member’s name, organization, or stakeholder body. The Appendix D shows examples of these lists from both the SHIECAP Plans as well as those archival documents. The categorization of these groups to develop measures of board composition is discussed in the next section.
4.3.2 Categorization of Board Size and Composition

Board size was easily identified as a count of board members, but determining composition required coding those members to match established categories (Hillman et al. 2000). This was accomplished by capturing the organization or group that each board member represented, then generalizing those into substantive categories which were then mapped to Hillman et al.’s (2000) established categories. In the case that the individual seat was allocated to multiple organizations or groups, the seat was allocated according to which set of information was more commonly available in that board list. For instance, if a seat was allocated to “John Smith MD of New Haven Medical Center, representing Patients” when several other members of the board are lacking a “representing X” tag but all of them had their employers clearly stated, the seat was allocated to the employer. In the circumstance where both are prevalent, the employer/organization tags were used over the general stakeholder/interest tags. These allocations were captured in Excel and categorized by substantive codes to allow for easy and constant comparison within columns to iteratively adjust allocations and the substantive codes themselves. The background of organizations that were non-specific in their titles would be researched, and appropriate codes would be applied. Unique codes and less popular codes were then refined into more general categories before being linked to theoretical codes from Hillman et al. (2000).

Hillman et al. (2000), as described in Chapter 3, introduced a taxonomy of directors determined by the resources they bring to the firm, and showed how allocations across these categories reflect the resources required by the differing organizations. This taxonomy includes Insiders who are experts on the firm: Business Experts who are experienced in the market or competitive environment the firm faces; Support Specialists who provide links to specific areas of expertise, but do not form the foundation of firm strategy; and Community Influentials who
provide links to relevant groups beyond the firms competitors and suppliers (Hillman et al. 2000).

Table 4.2 gives a review of this taxonomy. The reason for this framework’s selection was due to its wide adoption, (over 50 studies discussing this framework since its publishing) and its easy cognitive fit with the boards of the SHIECAP Organizations (Hillman et al. 2009; Jones et al. 2008; Kroll et al. 2007).

<table>
<thead>
<tr>
<th>Director Label</th>
<th>Area of resource needs provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders</td>
<td>Expertise on the firm itself, as well as general strategy and direction</td>
</tr>
<tr>
<td></td>
<td>Specific knowledge in areas such as finance and law</td>
</tr>
<tr>
<td>Business Experts</td>
<td>Expertise on competition, decision making and problem solving for firms</td>
</tr>
<tr>
<td></td>
<td>Serve as sounding boards for ideas, provide alternative points of view</td>
</tr>
<tr>
<td></td>
<td>Channels of communication between firms</td>
</tr>
<tr>
<td></td>
<td>Legitimacy</td>
</tr>
<tr>
<td>Support Specialists</td>
<td>Provide specialized expertise on law, banking insurance and public relations</td>
</tr>
<tr>
<td></td>
<td>Provide channels of communication to large and powerful suppliers</td>
</tr>
<tr>
<td></td>
<td>Ease access to vital resources such as capital and legal support</td>
</tr>
<tr>
<td></td>
<td>Legitimacy</td>
</tr>
<tr>
<td>Community Influentials</td>
<td>Provide non-business perspective on issues, problems and ideas</td>
</tr>
<tr>
<td></td>
<td>Expertise about and influence with powerful groups in the community</td>
</tr>
<tr>
<td></td>
<td>Representation of interests outside of main competitive interests</td>
</tr>
<tr>
<td></td>
<td>Legitimacy</td>
</tr>
</tbody>
</table>

For this effort, government agencies and the board representatives of sub-committees represent Insiders. These are identified as Insiders as SHIECAP organizations are predominantly led by State agencies, and a major responsibility of these organizations is coordination with other Federal and State programs. Business Experts are represented by existing HIEs, healthcare providing organizations, health quality improvement organizations and payor organizations as these organizations provide a expertise for how care is provided and how it could be improved by HIEs. Payor and insurance organizations are included as Business Experts and not as Support Specialists due to the central role they play in many SHIECAP plans, and their close alignment to the provider organizations. Support Specialists are represented by consulting agencies due to these consultants being prevalent on many boards and specializing in law, finance, and IT

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4 Medicaid and Medicare agencies were included as payor organizations.
operations. Finally, Community Influentials are comprised by those organizations that represent patient and employer interests, the interests of pharmacies\(^5\), pharmaceuticals and laboratories, or the interests of educators and researchers. Also included in this group were those organizations that specialize in providing a venue for cross-specialty and cross-organizational communication, of which there was only one organization, but its unique nature did not seem appropriate to group with the healthcare providing organizations of Business Experts. In a few cases, several board seats were listed “At Discretion” and early board formations were unable to be located. These were included for counts of individual board size, but were not allocated to counts of Hilman’s codes. Table 4.3 provides specific of this theoretical coding, and Table 4.4 provides board counts for each substantive and theoretical code by state. Appendix B includes an example of North Carolina’s board composition.

<table>
<thead>
<tr>
<th>Director Label</th>
<th>Types of Organizational Links in Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders</td>
<td>State government representatives, specifically those in elected offices and departments of health and health services. Representatives of specialized sub-committees</td>
</tr>
<tr>
<td>Business Experts</td>
<td>Existing HIE Efforts and local networks of health data sharing</td>
</tr>
<tr>
<td></td>
<td>Care Providing Organizations and their associations</td>
</tr>
<tr>
<td></td>
<td>Professional Associations of Physicians</td>
</tr>
<tr>
<td></td>
<td>Healthcare Quality Improvement Organizations</td>
</tr>
<tr>
<td></td>
<td>Payor and Insurance Organizations</td>
</tr>
<tr>
<td>Support Specialists</td>
<td>Consultants with expertise in the selection, implementation and adoption of IT Consultants with expertise in Law, Finance, and other non-technical areas</td>
</tr>
<tr>
<td>Community Influentials</td>
<td>Representatives of Patient Interests and specific Patient Groups</td>
</tr>
<tr>
<td></td>
<td>Members of Education and Research groups not specialized in care quality</td>
</tr>
<tr>
<td></td>
<td>Local Employers</td>
</tr>
<tr>
<td></td>
<td>Pharmacy, Laboratory and Medical Equipment Organizations</td>
</tr>
<tr>
<td></td>
<td>Organizations that seek to promote communication and collaboration across professional and organizational lines.</td>
</tr>
</tbody>
</table>

Table 4.3: Theoretical coding of refined substantive codes of directors

\(^5\) Pharmacies such as CVS and Kerr Drugs were included in Community Influentials. Pharmacists and their professional organizations were included as Business Experts.
<table>
<thead>
<tr>
<th>State</th>
<th>Insider</th>
<th>Business Expert</th>
<th>Support Specialty</th>
<th>Community Influential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>23</td>
<td>6</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Alaska</td>
<td>13</td>
<td>1</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Arizona</td>
<td>23</td>
<td>3</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Arkansas</td>
<td>13</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>California</td>
<td>19</td>
<td>3</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Colorado</td>
<td>23</td>
<td>3</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Connecticut</td>
<td>20</td>
<td>4</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Delaware</td>
<td>17</td>
<td>2</td>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>Florida</td>
<td>18</td>
<td>2</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Georgia</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Hawaii</td>
<td>20</td>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Idaho</td>
<td>10</td>
<td>1</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Illinois</td>
<td>30</td>
<td>0</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Indiana</td>
<td>12</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Iowa</td>
<td>9</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Kansas</td>
<td>17</td>
<td>3</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Kentucky</td>
<td>23</td>
<td>10</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Louisiana</td>
<td>17</td>
<td>1</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Maine</td>
<td>24</td>
<td>2</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Maryland</td>
<td>15</td>
<td>1</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Michigan</td>
<td>13</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Minnesota</td>
<td>27</td>
<td>3</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Mississippi</td>
<td>11</td>
<td>2</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Montana</td>
<td>21</td>
<td>2</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Nebraska</td>
<td>17</td>
<td>2</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Nevada</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>New Mexico</td>
<td>35</td>
<td>1</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>New York</td>
<td>18</td>
<td>2</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>North Carolina</td>
<td>24</td>
<td>4</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>North Dakota</td>
<td>27</td>
<td>6</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Ohio</td>
<td>15</td>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Oregon</td>
<td>11</td>
<td>1</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>24</td>
<td>3</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>South Carolina</td>
<td>11</td>
<td>3</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>South Dakota</td>
<td>19</td>
<td>2</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Texas</td>
<td>13</td>
<td>2</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Utah</td>
<td>25</td>
<td>4</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Vermont</td>
<td>11</td>
<td>2</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Washington</td>
<td>12</td>
<td>1</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>West Virginia</td>
<td>17</td>
<td>2</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>15</td>
<td>3</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.4: Breakdown of 44 SHIECAP boards using Hillman et al.’s codes (2000)
Size of the board is derived from the sum of substantive codes, and therefore in the case of Vermont and Massachusetts, the board size is larger than the sum of theoretical codes due to their “At Discretion” board seats. For the calculation of board compositions, the size of each component was divided by the total board size, so in those two States the sum of the board compositions were less than one.

**4.3.3 Identification of SHIECAP Organization Strategy**

In contrast to SHIECAP organizations’ board composition, identifying the strategy employed by these organizations was more straightforward. To assist States that were in the approval process for SHIECAP, as well as research efforts like this one, ONC identified four prototypical models from the first 28 SHIECAP plans that were approved. These models are often discussed as “Strategic Approaches,” (Dullabh et al. 2012) but in this study these models are used as proxies for strategy. These strategies are the following:

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator</td>
<td>Rapid facilitation of directed exchange capabilities to support Stage 1 Meaningful Use</td>
</tr>
<tr>
<td>Capacity Builder</td>
<td>Bolstering of sub-state exchanges through financial and technical support, tied to performance goals</td>
</tr>
<tr>
<td>Orchesturator</td>
<td>Thin-layer state-level network to connect existing sub-state exchanges</td>
</tr>
<tr>
<td>Public Utility</td>
<td>Statewide HIE activities providing a wide spectrum of HIE services directly to end-users and to sub-state exchanges where they exist</td>
</tr>
</tbody>
</table>

**Table 4.5: General Description of SHIECAP Organization Strategies**

These strategies, however, were not exclusive, and it was common for States to implement two strategies in conjunction. For example, “Elevator” strategies that promoted directed-messaging, dovetailed well with the building of sub-state exchanges of “Capacity Builder” strategies. The challenge was that these strategies were not explicitly mentioned in the uncategorized SHIECAP Plans and ONC’s strategies needed to be extended to the 16 SHIECAP plans not covered in the original document (Tripathi and Hyatt 2011).
In this study, plans describing promotion of directed-messaging were labeled with “Elevator;” plans describing the founding or financial support for HIEs in the planning and growth stages as “Capacity Builder;” plans describing the development of “thin-layer” architectures or the management of multiple sub-state HIEs were “Orchestrators;” and plans that described the development of large, centralized services to offer HIE services were “Public Utilities.” Table 4.6 shows this categorization⁶, with author-coded States in bold, and highlighting the source of the strategy categorization from the original report on 28 States, follow-on summaries published by ONC, or from my analysis of the SHIECAP plan.

⁶ The reliability of these classifications is assessed through inter-coder agreement that is described at the end of this chapter.
<table>
<thead>
<tr>
<th>State</th>
<th>SHIECAP Organization Strategy</th>
<th>OCN EHR/EMR Modules Support</th>
<th>OCN State Summary</th>
<th>SHIECAP Plan</th>
<th>Capacity Builder</th>
<th>Orchestrator</th>
<th>Public Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>Public Utility</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Alaska</td>
<td>Public Utility</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Arizona</td>
<td>Capacity Builder/Orchestrator</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Arkansas</td>
<td>Elevator</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>California</td>
<td>Elevator/Orchestrator</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Colorado</td>
<td>Capacity Builder</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Connecticut</td>
<td>Elevator/Orchestrator</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Delaware</td>
<td>Public Utility</td>
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Table 4.6: Breakdown of 44 SHIECAP Organization Strategies
4.3.4 SHIECAP Performance Measure Data Structure

Three measures were selected to define success that align with HIE use described in Chapter 2. These include directed-messaging, patient record queries, and eprescribing. For directed-messaging and patient record queries, the ONC received aggregate transaction number from participating States. For eprescribing, Surescripts, which captured 95% of the market for eprescribing, submitted the total number of practitioners actively eprescribing on their system. The exact number of eprescribing transactions was unavailable. To control for maturity of each State’s data exchange community, each of these variables were used as their most recent submission, as well as the change in these variables over the period collected during SHIECAP. Table 4.7 shows the descriptive statistics and correlations of these variables.

4.3.4.1 Query-Based Exchange Transactions (n=27)

Query-based transactions were recorded quarterly by ONC between the second quarter of 2012 and the fourth quarter of 2013 and were self-reported to ONC by grantees of the SHIECAP program. While this data was broken down by the hospital/ambulatory divide, due to the fragmented nature of this data, this work only focused on the total value rather than distinguish between Hospitals and Physicians. Only 27 states had non-zero counts of transaction data and were included in this study. The states with 0 counts were excluded from this analysis as the ONC identified these zeros as a lack of data and not as true representations of the State’s transactions.

4.3.4.2 Directed-messaging Transactions (n=40)

Similar to query transactions, directed transactions were also recorded quarterly by ONC between the second quarter of 2012 and the fourth quarter of 2013 and were self-reported by
grantees of the SHIECAP program. In contrast with query-based exchange, directed exchange was delineated between hospitals and ambulatory agencies, clinical laboratories, and public health authorities. Similar to Query-based exchange, only the total values were used, and three states with zero counts of transaction data were excluded. Indiana was also removed from this analysis as their data fluctuated unpredictably, appearing to include data entry errors.

4.3.4.3 Electronic Prescribing Adoption and Use (n=44)

ePrescribing does not measure transactions, but rather the total number of healthcare providers actively eprescribing on the Surescripts Network. The data from Surescripts is the most prolific with monthly data between December 2008 and April 2014. The reason for including ePrescribing as a success measure is that it is not covered by the above variables, and it is a pivotal aspect of HIE. The reason for using Surescripts data is due to Surescripts being the largest, nearly monopolistic, ePrescribing IT vendor in the US, and ONC’s use of its data as an indicator of ePrescribing. This dataset also includes the percent of new and renewal prescriptions sent through their network, but it is unclear if that data pertains to the percent of total prescriptions sent within and without the network, or if that percent is a breakdown of eprescriptions within the network.

4.3.5 Environmental Factor Covariate Data Structure

The covariates selected from specialized datasets included counts of each State’s overall population, and measures of EHR adoption among physicians and hospitals. Each of these datasets is discussed below including my rational for their inclusion. Table 4.7 shows their descriptive statistics and correlations with the datasets introduced so far.
4.3.5.1 State Population

The population from the 2010 US census was used as it explained the majority of the variance in SHIECAP funding allocations, as shown in Figure 2.1. It was also shown to be correlated strongly with four of the six performance metrics shown in Table 4.7, and was tied to the selection of strategy. As Figure 4.3 shows below, Public Utility strategies were normally enacted in states with less than 5 million citizens, while Capacity Builder and Orchestrator were rarely enacted in states of that size.

![Boxplots of State Population over Strategies, (F=3.27, p<.05)](image-url)

Figure 4.3: Boxplots of State Population over Strategies, (F=3.27, p<.05)
4.3.5.2 Physician and Non-federal Hospital EHR Adoption

These are respectively derived from the National Electronic Health Record and the American Hospital Association annual surveys between 2008 and 2014 that estimate the percent of providers that have adopted EHRs. As EHR adoption is a necessary step to enable data exchange in healthcare, they were tested across all strategies and board compositions as well. No significant relations were found.
Table 4.7: Descriptive Statistics and Correlations

* = p<.05 , ** = p<.01 , *** = p<.001
4.4 The North Carolina Case

The North Carolina Case identified un-captured and not-readily quantified variables that shaped the relationships captured in the SHIECAP Case. This case identifies these variables through an analysis of several interviews with HIEs, the Regional Extension Center, and an HIE technology vendor that were operating in North Carolina during SHIECAP. The analysis of these interviews are augmented with the SHIECAP plan for North Carolina. As was mentioned in Section 4.2, North Carolina was selected as the context for this study for three reasons. First, in contrast to Alaska and Delaware, North Carolina was more representative as it lacked specific geographic challenges or benefits, while still maintaining functional local HIEs. Second, in contrast to Michigan and New York, North Carolina had no confounding variables based on prior statewide efforts to promote data exchange in Healthcare. Third, North Carolina was selected for the openness and community exhibited through NCHICA. NCHICA was a particularly important organization to the conduct of this study as several informal conversations with the organization’s CEO and participation in one of their conferences were particularly valuable in sensitizing myself to the North Carolina context and identifying valuable targets for interviews.

This section is separated in to two parts to describe this case’s data collection. The first part introduces the North Carolina context, focusing on the board and strategy derived from the SHIECAP plan, before describing each of the major organizations involved in this research. The second part describes the data collected from this context.

4.4.1 The North Carolina Context

This case focuses on organizations directly involved in promoting HIE services during SHIECAP. Due to the lack of focus placed on the actions and perspective of HIEs in current HIE
research (Panjamapirom et al. 2010; Vest et al. 2014), this work focuses on organizations promoting and offering data exchange services rather than directly focusing on healthcare providers. The role of healthcare providers in this research is still captured however in descriptions of HIE users and organizational leadership. To better understand this case, this section covers five key topics: the SHIECAP Plan, NCHICA, HIEs, the North Carolina Regional Extension Center, and the HIE Vendors.

4.4.1.1 North Carolina SHIECAP Plan

The North Carolina SHIECAP Strategic and Operational Plans spanned 301 pages, and described the founding of the State HIE; the North Carolina Health Information Exchange (NCHIE). This section first focuses on the board of NCHIE, and the strategy identified from their plan, and then describes House Bill 834, which was pivotal in understanding how this strategy was operationalized.

North Carolina’s Board was slightly larger than the average board, as it comprised 24 individuals including 4 Insiders, 11 Business Experts, 4 Support Specialists, and 5 Community Influentials. In terms of its composition, the board was relatively consistent with the national average with 17% Insiders (+1%), 45% Business Experts (-10%), 17% Support Specialists (+5%), and 21% Community Influentials (+4%). A complete list of the organizations that were on the board with their classification into these roles can be found in Appendix B.

As for the strategy employed, North Carolina was included in the original model categorization by ONC as both an Elevator and Orchestrator. In this strategy, North Carolina aggressively promoted healthcare provider adoption of direct-messaging systems to help them meet Meaningful Use, and the State intended to coordinate and collaborate with local HIEs to
assure statewide access to data exchange services. The following quote from the North Carolina SHIECAP Operational Plan shows the focus on Meaningful Use.

“The highest priority is given to facilitating providers’ ability to meet ONC’s 2011 priorities for Meaningful Use. Therefore, this plan includes a robust assessment of the current HIT and HIE landscape in three areas: e-prescribing, delivery of structured lab results and exchange of summary care records across unaffiliated organizations.” – NC Operational Plan

This statement clearly shows that North Carolina intended to enact an Elevator strategy as they are described earlier in this chapter. As for the label of Orchestrator, there is no mention of the offering a “thin-layer” architecture, though there is a description of “shared services” which is also indicative of an Orchestrator strategy.

“... NC HIE will leverage and support existing and emerging information exchange efforts across the state. In North Carolina, several [HIEs] have formed or are forming to offer providers direct access to a range of HIE services. It is envisioned that many of these [HIEs] could eventually serve as Qualified Organizations and provide gateways to the shared services that would be offered at a statewide level or offer to host services for other participants in statewide HIE.” – NC Operational Plan

The challenge with the description of North Carolina as an Orchestrator comes from House Bill 834, which required many healthcare providers to connect directly to NCHIE. The text of the specific prevision that mandated participation is included in Appendix H. Mandated participation directly undercuts the business model of the HIEs already in operation in North
Carolina, and supplants instead cooperating with these HIEs. This conflict is discussed in significant depth in Chapters 5 and 6.

### 4.4.1.2 North Carolina Healthcare Information & Communications Alliance (NCHICA)

NCHICA was founded in 1994 as a collaborative organization to include healthcare providers, payors, and vendors, as well as individual physicians, nurses, attorneys, and other professionals to help improve healthcare in North Carolina by providing a neutral environment where all of these groups can congregate and share information. This organization is an information hub for all healthcare-related organizations in North Carolina, and provides several conferences, workgroups and task forces for these groups to collaborate, forge new connections and share what they have learned with their broader community. My participation at one of these meetings and informal talks with the CEO of NCHICA were pivotal in gaining early access to the HIEs in North Carolina, and targeting this research; however, because this organization was not actively engaged in promoting or offering data exchange services, they were not included in the more formal interview or analysis processes.

### 4.4.1.3 HIEs in North Carolina

From talks with NCHICA, three operational HIEs were identified for inclusion in this study. Other HIEs were in planning stages, and still others that were limited to specific healthcare providers; these were not included as they did not align with the goals of SHIECAP, or never progressed through planning stages into operations. The remaining HIEs were the SHIECAP organization, NCHIE that was headquartered in the State capital of Raleigh, and two operational local exchanges, Coastal Connect Health Information Exchange (CCHIE) and WNC Datalink.
The operational range and headquarters of these organizations are shown in Figure 4.4. Each of these is described in more detail below the figure.

Figure 4.4: Headquarters and Geographic Territory of HIEs in North Carolina

At the time of the interviews, NCHIE was in the process of recruiting and onboarding hospitals that generated a large amount of data for HIE and was under the Community Care of North Carolina (CCNC) which managed the majority of North Carolina’s Medicaid beneficiaries. NCHIE employed 15 individuals, and was in the process of onboarding 27 hospitals and 662 ambulatory organizations. In terms of HIE size, this was a relatively large effort in terms of both the number of employees and the number of participating healthcare providers; few HIEs employed more than 5 individuals and served more than 25 hospitals\(^7\). In 2016 this organization was transitioned to North Carolina’s Department of Information Technology’s Government Data Analytics Center (GDAC) and renamed as the NCHIE Authority.

In contrast to NCHIE, CCHIE already had a strong support base at the time of interview. Headquartered in Wilmington, North Carolina, CCHIE was founded by an alliance of 12 hospitals that guided the growth and development of their exchange. Part of this guidance was the focus of developing the HIE intensively in an 11 county footprint, captured in Figure 4.4. At the

\(^7\) The national average is roughly 80 hospitals, with a median of 59.
time of interview CCHIE employed 5 individuals, through since that time, the organization has
grown to employ 6 individuals and has grown their participant base to 40 counties. It is currently
unclear how the recent shift of NCHIE will impact CCHIE.

While NCHIE and CCHIE were relatively new entrants to North Carolina, WNC
dataLink was founded in 2006 by the 16 westernmost hospitals in North Carolina as a part of the
Western North Carolina Health Network. WNC DataLink was shut down in 2014, citing the cost
challenges of service upkeep and the rise of alternative services in the region that made the HIE
redundant. WNC DataLink was the smallest HIE of the three in this case, employing only one
individual, who left prior to the closure of WNC DataLink. Both that director and the director who
oversaw the closure and transition of service were interviewed.

4.4.1.4 Area Health Education Centers, Regional North Carolina’s Regional Extension Center

Discussed in Chapter 2, Regional Extension Centers play a pivotal role in promoting
EHR adoption and connecting healthcare providers with appropriate health data exchange
services. This was another program developed by ONC with HITECH Act funding, though its
management and goals were developed separately from SHIECAP. In North Carolina, this role
was taken up by an existing organization focused on educating health professionals on numerous
topics, the North Carolina Area Health Education Centers (NC AHEC). CCHIE lauded these
organizations for the role they played, and while these organizations are no longer funded through
ONC, they continue in their original role as community educators.
4.4.1.5 HIE Vendor, Medicity

None of the HIEs captured in this case developed their own HIE technology, instead each licensed existing products. Medicity is a major HIE vendor, providing the technology behind the statewide services of Colorado, Delaware, Georgia, Ohio, Mississippi, South Dakota, Vermont and Wisconsin. Medicity also provides the technology behind 12 regional efforts including CCHIE. They continue to operate in this space.

4.4.2 Data Collected from North Carolina

Data collected from these organizations, depicted in Tables 4.8 and 4.9, included nine qualitative interviews, North Carolina’s Strategic and Operational Plans, and several archival documents gathered from the interview participants and their organizations websites. NCHICA was not included in these interviews. While they were pivotal in identifying interview candidates, they were not directly involved with promoting data exchange services. The purpose of this embedded case is to better capture the unmeasured variables that underlay the relationship between boards, strategy and performance through the in-depth investigation of local experience and actions of these organizations during SHIECAP. Due to this, the members of organizations actively involved in HIE were interviewed instead of focusing exclusively on organizational elites (Pettigrew 1992; Stinchcombe 1990). Discussion of the data collected, and method of collection follows below with methods of analysis included in Section 4.5.
This study followed purposive sampling, with an initial contact with NCHICA identifying three HIE efforts in the state: the NCHIE (the SHIECAP organization), WNC Datalink and CCHIE. I sent recruitment letters to each organization, and followed up with each until I received a response. Each organization consented to interviews. The interview protocol began with a verbal consent to be interviewed for research for publication, and if the participant consented and agreed to be recorded for transcription, the interview would continue as a semi-structured interview. While the interviewee was informed of practices in place to assure their confidentiality, the possibility of the informant’s identity being deduced by members of the community (specifically, other HIEs in North Carolina) was discussed. The interview did not progress if this was a concern. Semi-structured interview questions were developed and conducted in line with guidelines for ethnographic interview (Spradley 1979), and focused on developing a shared understanding of the founding of the organization, its business model, its method for delivering its services, and surfacing its interactions with other organizations in its community. Appendices E, F and G contain examples of the recruitment letters, interview protocol, and verbal consent memo.

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Table 4.8: Breakdown of Main Information Sources for the North Carolina Case
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Table 4.9: Breakdown of Interviews by Informant

Through this process, nine interviews were collected, with eight of these consenting to be recorded. These interviews were collected between 2012 and 2016 and provide an overview of the community concerns and practices over the course of SHIECAP. These interviews were transcribed into Word, and all personal identifiers were removed. Each interview was identified by the organization it represented and the role of the informant according to the roles captured in Table 4.9. This was done to assure the confidentiality of the informant in publication. After coding, the original recordings of the interviews were deleted. The method of this coding is discussed more in the following section.

4.5 Analysis and Synthesis of Cases

This section describes the methods employed to analyze both the data collected for the SHIECAP Case to identify relationships between boards, strategy and performance, as well as the North Carolina Case’s interviews to capture the mechanisms that supported or confounded those relationships. This section first discusses the quantitative analyses conducted in the SHIECAP Case to give preliminary evidence for Research Questions 1-5, and then the second section discusses the analyses conducted in the North Carolina Case to discuss Research Question 6. Table 4.10 shows this breakdown of research questions, data and analysis methods, but while this
Table appears to show that the North Carolina Case only answers Research Question #6, the connection between the SHIECAP Case and the North Carolina Case is much more nuanced, and discussed in the third section.

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</tbody>
</table>
| 1   | Is there a relation between SHIECAP Organization Strategy and board size? | Data: Board Sizes Identified in Table 4.4  
Method: ANOVA |
| 2   | Is there a relation between SHIECAP Organization Strategy and board composition? | Data: Strategies Identified in Table 4.6  
Method: Chi-square test (2 Models) |
| 3   | Does board size predict SHIECAP Organization performance? | Pred: Board Sizes Identified in Table 4.4  
Resp: Query (Final and Change)  
Resp: Direct Messages (Final and Change)  
Resp: ePrescribing (Final and Change)  
Method: OLS (Multilinear Regression (36 Models)) |
| 4   | Does board composition predict SHIECAP Organization performance? | Pred: Board Compositions derived from Table 4.4  
Resp: Query (Final and Change)  
Resp: Direct Messages (Final and Change)  
Resp: ePrescribing (Final and Change)  
Method: OLS Multilinear Regression (30 Models) |
| 5   | Does SHIECAP Organization Strategy have an effect on SHIECAP Organization performance? | Pred: Strategies Identified in Table 4.6  
Resp: Query (Final and Change)  
Resp: Direct Messages (Final and Change)  
Resp: ePrescribing (Final and Change)  
Method: ANOVA (6 Models) |
| North Carolina Case |                                                                   |
| 6   | What other unmeasured variables influenced the relationship between boards, strategy, and performance? | Data: 9 Interviews from HIE and support organizations  
Data: North Carolina SHIECAP Strategic / Operational Plan  
Data: North Carolina HIE Legislation (HB 834)  
Data: Archival documents shared by informants  
Method: Qualitative Analysis |

Table 4.10: Research Question Breakdown

4.5.1 Analysis of Boards, Strategy and Performance

The SHIECAP Case relied on ANOVA, chi-squared tests, and ordinary least-squares linear regression to identify the relations between boards, strategy and performance. Each of these methods has been applied in similar tests within Resource Dependence Theory. Pearce and Zahra (1992) used ANOVA to test the variable performance of several strategies, Hillman et al. (2000)
used chi-square to evaluate changes in board composition, and Kroll et al. (2007) applied regression to evaluate performance based on board composition. This section details the application of these methods to provide evidence for Research Questions 1 and 2 which relate boards to strategy, and Research Questions 3, 4, and 5 which relate boards and strategy to performance.

For Research Question 1, ANOVA was applied to check for differences in means of board size across strategies. For Research Question 2, a chi-square test was applied to the counts of the differing board compositions across the strategies. Both of these tests were constructed in Excel. As Table 4.6 showed, 22 of the States employed combinations of the strategies, as assessing each combination would lead to several combinations having no examples, each combined strategy was assessed as an example of both strategies. Take, for example, North Carolina’s 24-member board and Elevator/Orchestrator Strategy. For Research Question 1, North Carolina’s 24-member board was used to calculate the distribution for both Elevator and Orchestrator strategies instead. As this inflation of the sample size affects the mean and standard error of the analysis, assessments were made using both using the raw (n=44) mean, as well as the adjusted (n=66) mean. As there was no difference across significance thresholds for these tests, the results of the raw mean tests are presented in Chapter 5. For Research Question 2, the chi-square test was assessed using the adjusted counts.

For Research Questions 3 and 4, ordinary least squares regressions were conducted in Excel using StatPlus using measures of board size and composition to predict both the total number and change over time of query transactions, directed-messaging transactions, and eprescribing metrics. As Table 4.7 shows there is a strong correlation of State Population with Query and ePrescribing variables, due to this both of their totals and change over time variables were analyzed as per-capita values. Directed-messaging variables were not scaled.
For Research Question 3, six measures of board size were used. These were the total board count (Board Size), the total counts of Insiders, Business Experts, Support Specialists, and Community Influentials (Size by Components). Each of these counts were tested individually, which resulted in a total of 36 iterations of these regressions (6 measures of performance x 6 measures of board size). Board Size and Individual component tests resulted in the same values as Pearson Correlations over standardized values.

For Research Question 4, a similar process was followed. Salient changes included first shifting from total counts of board size to measures of proportion, and second from challenges arising from multicolinearity. First, board proportions for each of the board components were calculated by dividing the size of the individual component by the total board size. Second, as Table 4.7 shows, there are strong correlations between the proportions of board composition. Due to this, regression models that included all four measures of board composition showed high multicolinearity. To control for this, the most inter-correlated variable, Business Experts, was dropped from the model, and the measure of multicolinearity of the model decreased to acceptable levels. This adjustment had an added benefit of easing the interpretation of the model. Removing business experts from the model clarifies the interpretation of model by identifying from where the increases or decreases of the predictor variables come from. This shifts the interpretation from “an increase in Community Influentials proportion of the board, the model predicts,” to “by increasing the proportion of Community Influentials at the cost of Business Experts the model predicts…..” In the earlier statement it is unclear which groups’ proportion is being decreased to allow for Community Influentials, but the latter makes this clear. To further remove the influence of multicolinearity, each board composition is run individually, resulting in 30 models (6 measures of performance x 5 measures of board composition). Similar to the results of Research Question 3, these simple regressions with a single predictor can also be derived through Pearson Correlations.
For Research Question 5, the approach to Research Question 1 was re-used replacing the six performance measures for board size. The ANOVA calculation was again conducted in Excel.

4.5.2 Analysis of the North Carolina Case

While the SHIECAP Case relied on Functionalist analysis methods and theory-driven coding using Hillman et al.’s (2000) taxonomy and ONC’s strategies, the North Carolina Case relies on more Interpretivist methods developing theory from the data without applying a priori understandings (Charmaz 2006; Strauss and Glaser 1967). This section describes this qualitative analysis of the interviews, SHIECAP plans and archival documents (Saldana 2008; Strauss and Glaser 1967), that were used to give evidence for the sixth research question “What other unmeasured variables influenced the relationship between boards, strategy, and performance?” as well as context and detail to the first five research questions.

In this work, specific coding guidance was taken from Charmaz (2006) and Saldaña (2008) and followed five general steps. The first step entailed reviewing the transcripts and identifying “codable moments.” The second step was generating initial codes for each “moment.” The third step took these initial codes used them to develop categories which were applied to all initial codes. The fourth step took these categories and developed general themes that linked them. The fifth step refined these themes and the categories underneath them to general names and definitions for each theme. An example of this process is included in Figure 4.5 below.
A challenge in qualitative work like this is that often the process will move in the direction of interest to the researcher, deviating from the interests stated in the research questions. To combat this, I approached Resource Dependence Theory as the grounded theory to be “constantly compared” against (Strauss and Glaser 1967). Descriptions of each of these steps in this process are included below.

The first step identified “codable moments,” after a review of all 8 transcripts. This step was accomplished by identifying sections of text that discusses a specific idea pertaining to the operation of HIEs, their interaction with or dependence on an external organization, the

Figure 4.5: Example of qualitative coding process

Sure, only the hospitals and we got one ambulatory set of clinics that can contribute a continuity of care document on their EMR.

…[M]ost HIEs nationwide are primarily focused on [hospitals] because that’s where kind of the critical mass of data is and that’s where some of the dollars are in the organizations.

while we are [part of CCNC,] we operate pretty much entirely independently, we are co-located with [them] and we’ve been able to leverage [their] relationships and networks

Only data contributors to HIE are Hospitals.

Hospitals are the central target of many HIEs as they hold “critical mass of data” and have the capital to invest in HIE Services.

HIE leveraged parent organization’s network and relationships

Providers/Users to HIE

Providers

Leadership (payor) to HIE

Community Collaboration for HIEs

Codable Moment

Initial Code

Category

Theme

Sure, only the hospitals and we got one ambulatory set of clinics that can contribute a continuity of care document on their EMR.

…[M]ost HIEs nationwide are primarily focused on [hospitals] because that’s where kind of the critical mass of data is and that’s where some of the dollars are in the organizations.

while we are [part of CCNC,] we operate pretty much entirely independently, we are co-located with [them] and we’ve been able to leverage [their] relationships and networks

Only data contributors to HIE are Hospitals.

Hospitals are the central target of many HIEs as they hold “critical mass of data” and have the capital to invest in HIE Services.

HIE leveraged parent organization’s network and relationships

Providers/Users to HIE

Providers

Leadership (payor) to HIE

Community Collaboration for HIEs

Codable Moment

Initial Code

Category

Theme

Sure, only the hospitals and we got one ambulatory set of clinics that can contribute a continuity of care document on their EMR.

…[M]ost HIEs nationwide are primarily focused on [hospitals] because that’s where kind of the critical mass of data is and that’s where some of the dollars are in the organizations.

while we are [part of CCNC,] we operate pretty much entirely independently, we are co-located with [them] and we’ve been able to leverage [their] relationships and networks

Only data contributors to HIE are Hospitals.

Hospitals are the central target of many HIEs as they hold “critical mass of data” and have the capital to invest in HIE Services.

HIE leveraged parent organization’s network and relationships

Providers/Users to HIE

Providers

Leadership (payor) to HIE

Community Collaboration for HIEs

Codable Moment

Initial Code

Category

Theme

Sure, only the hospitals and we got one ambulatory set of clinics that can contribute a continuity of care document on their EMR.

…[M]ost HIEs nationwide are primarily focused on [hospitals] because that’s where kind of the critical mass of data is and that’s where some of the dollars are in the organizations.

while we are [part of CCNC,] we operate pretty much entirely independently, we are co-located with [them] and we’ve been able to leverage [their] relationships and networks

Only data contributors to HIE are Hospitals.

Hospitals are the central target of many HIEs as they hold “critical mass of data” and have the capital to invest in HIE Services.

HIE leveraged parent organization’s network and relationships

Providers/Users to HIE

Providers

Leadership (payor) to HIE

Community Collaboration for HIEs

Codable Moment

Initial Code

Category

Theme
interdependence of these external organizations, or the services -- and their ensuing use case -- offered by the HIEs. This was done in Word by selecting the appropriate text and creating a blank comment. Word was used to make later initial codes easier to share with informants.

The second step involved filling each of these blank comments with preliminary codes. As this process progressed through the transcripts, these preliminary codes were refined for language and focus, making these preliminary codes into initial codes. This refinement eased the next step of this process by standardizing language, and also by breaking up and combining “moments” to clearly capture the informant’s intent. This process was pivotal so that I could demonstrate to the informants that I was capturing their intent effectively, and clearly connecting my interpretation to a specific section of the transcript. This minimized misunderstandings between the informants and me, and allowed for more effective communication of their intent.

The goal of these codes were to capture the informant’s meaning in each of these sections in a manner that was clear to the informant, and eased the challenge of the third step. For example, initially a particularly detailed description of the recruitment and onboarding process for a hospital to connect to an HIE was identified to have over 7 “codable moments.” After this step, those “moments” with specific preliminary codes were combined into a singular initial code focusing on the mechanism of that interaction, rather than its discrete processes. After similar actions were taken across all transcripts there were 164 unique initial codes.

The third step took the 164 initial codes and used them to develop categories. As this case was focused on identifying the mechanisms that created the observed relationships between boards, strategy and performance, these initial codes were categorized by the organization or by the relationship they informed. This process identified several types of organizations, their

---

8 It is normal at this point to conduct a member check, however as there was significant delay between collection and analysis of these interviews, member checks were completed after coding completed. New understandings from the informants were incorporated into the draft and the resulting models when they resulted from these checks.
dynamics, and several strong relationships that connected them. For example, each HIE exists under a parent organization, or was founded by the organizations that sat on their board. These groups were coded as “Leadership,” however as later codes revealed, differentiations among leadership organizations were necessary to better capture inter-leadership organizational conflict. Due to this a subcategory was created for two types of “Leadership”: Payor organizations, and Provider organizations.

The fourth step took this network of organizations and relations and developed general themes that explained interesting elements of the relationship between boards, strategy and performance in this context. Through this period of in-depth immersion in the data and codes with a focus on these three relationships, three general themes were separated. The first theme focused on the relationship between the local HIEs (CCHIE and WNC Datalink) and the SHIECAP Organization (NCHIE), between the HIEs and Users, and between the HIEs and the organizations that facilitated their actions.

Through review and revision of the categories and their underlying initial codes, the fifth step refined these themes into three separate models. The first model was the “Community Collaboration for HIEs” that informs the resources that each of these organizations bring to the HIE. The second model was “Operationalizing of Strategy” which captured a central event that defined the relationship between the State HIE and the local HIEs. The third and final was a model of the “Social Mechanisms of HIE Use” that shows how the value of an HIE is determined by both the data accessible by the HIE but also on the versatility of it’s services. Table 4.11 shows how many codes were generated from each organization and how those codes were spread across the three themes:
4.5.3 Synthesis of SHIECAP and North Carolina Cases

Synthesis of these two cases back into the whole of the embedded case was done through application of the three models to the results of the analyses from Research Questions 1-5. For Research Questions 1 and 2 that connected boards and strategy, the model for Community Collaboration for HIEs and Operationalization of Strategy described how the board and strategy could be misaligned through their differing alignments to the environment. For Research Questions 3 and 4 that connected boards to performance, the Community Collaboration for HIEs and the Social Mechanisms of HIE Use describe the low amount of control the board can apply to influence the cycle of use. For Research Question 5, the Operationalization of Strategy helps to inform why these strategies might not have readily-identified results.
4.6 Quality of Research Design

This section discusses the research quality of this study from perspectives promoted by Yin (1989) and Lincoln and Guba (1985) (Lincoln and Guba 1985; Shenton 2004; Yin 1989). The tactics promoted by Yin (1989) in attesting to these measures of quality are listed in Table 4.12 with the methods applied in this research detailed in the following sections.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Case Study Tactic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct Validity</td>
<td>Use multiple sources of evidence</td>
</tr>
<tr>
<td></td>
<td>Establish chain of evidence</td>
</tr>
<tr>
<td></td>
<td>Have key informants review study draft</td>
</tr>
<tr>
<td>Internal Validity</td>
<td>Do pattern matching</td>
</tr>
<tr>
<td></td>
<td>Do explanation building</td>
</tr>
<tr>
<td></td>
<td>Do time-series analysis</td>
</tr>
<tr>
<td>External Validity</td>
<td>Multiple-Case: Use replication logic</td>
</tr>
<tr>
<td>Reliability</td>
<td>Use case study protocol</td>
</tr>
<tr>
<td></td>
<td>Develop case study database</td>
</tr>
</tbody>
</table>

**Table 4.12: Case Study Tactics for Four Design Tests from Yin (1989)**

4.6.1 Construct Validity

To demonstrate Construct Validity, Yin (1989) attests that the researcher must select specific concepts to study, and show that the selected measures do indeed reflect those concepts. In the SHIECAP Case, there are three concepts of central importance: Board Size/Composition, SHIECAP Organization Strategy, and SHIECAP Organization Performance. First, board size and composition are defined using similar measures in established research (Hillman et al. 2000).

Second, 28 States’ SHIECAP Organization Strategies are labeled directly from prior work (Dullabh et al. 2012; Tripathi and Hyatt 2011) and using those examples, I extend those labels to 16 additional States in the broader dataset. The coding of these two concepts were reviewed by two researchers unconnected to this study who were both given selections from 6 States to code according Hillman et al.’s (2000) board compositions and ONC’s (2011) categorization of SHIECAP Organization Strategies. All discrepancies between my coding and these researchers’
codes were discussed until inter-coder agreement was attained (Campbell et al. 2013). The process and documents used to attain this agreement can be found in the Appendix D.

The third concept, Performance, is operationalized from three metrics collected by the ONC and align to three methods of HIE use. HIE use is defined as the volume of directed-messaging transactions, the volume of record queries, and the total population of individuals actively eprescribing. In the case of eprescribing, a similar exchange transaction number is unavailable and the population is used as a proxy.

In the North Carolina Case, the study follows data derived from interviews, where member checking was completed inside interviews and from one interview to the next. After final coding and model generation, the initial coding and facets of the final model that were derived from their organization were shared with key informants to assure that the results of this analysis is not a misstatement of the informant’s intent. As this was a multi-year effort where one of the participant organizations closed over the course of the study, this could not be accomplished over all participants and organizations, though efforts were made to reach all participants. The coding and analysis is open to the advisors of this work for verification, but transcripts cannot be shared openly due to constraints imposed by confidentiality.

4.6.2 Internal Validity

Yin (1989) attests that the Internal Validity test only be applied to causal case studies. While this study is more descriptive in nature, the multiple linear regressions used in the SHIECAP Case are a common tool to infer causality. Multicolinearity and other similar issues that challenge internal validity are discussed earlier in this chapter.
4.6.3 External Validity

This effort follows the single-case logic of a revelatory case where this study is analytically generalizable to theory, but as the context under study is rare, it would be difficult to be captured by another researcher. As this study shows the outcome and processes of SHIECAP organizations, the overall outcome of the effort is a matter of public record, but the multiple, concurrent actions of organizations promoting HIE during this time are not. A researcher could only capture these SHIECAP participants during this time. While similar studies on the connection of Resource Dependence Theory to community organization’s actions could benefit from this research, this effort would not be generalizable to another Nation’s HIEs.

4.6.4 Reliability

Reliability in case studies is demonstrated by the development of a clear enough “path” through the research for others to follow and reproduce. In the SHIECAP Case, there is clear access to the data and assumptions made for others to reproduce this study, but in the North Carolina Case this path is less clear. As the North Carolina Case relies on Interpretivist interviews, it is colored by my own understanding of HIEs and the North Carolina context. However, beginning with the interview data, the qualitative coding practices followed have been documented, allowing the deconstruction of the thick descriptions in the later case narrative, allowing for a measure of that reproducibility.

4.6.5 Trustworthiness

Some Interpretivist researchers distance themselves from evaluations of “Validity” and “Reliability” due to the more positivist connotations of these terms. Instead, these researchers
adopt measures of “Trustworthiness” as put forward by Lincoln and Guba (1985). These measures supplant and adapt the notions of Internal Validity for Credibility, External Validity for Transferability, Reliability for Dependability, and Conformability for Objectivity (Lincoln and Guba 1985). There are several strategies for assessing whether a qualitative effort has met the criteria of “Trustworthiness” (Shenton 2004). Table 4.13 provides a truncated list of these:

<table>
<thead>
<tr>
<th>Quality Construct</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credibility</td>
<td>Research method is well established in qualitative work in context</td>
</tr>
<tr>
<td></td>
<td>Triangulation</td>
</tr>
<tr>
<td></td>
<td>Iterative questioning (in-interview corroboration)</td>
</tr>
<tr>
<td></td>
<td>Explains negative cases</td>
</tr>
<tr>
<td></td>
<td>Thick description of phenomenon under study</td>
</tr>
<tr>
<td></td>
<td>Member checks</td>
</tr>
<tr>
<td>Transferability</td>
<td>Thick description of phenomena environment, developed over time</td>
</tr>
<tr>
<td>Dependability</td>
<td>Thick description of research design and implementation</td>
</tr>
<tr>
<td></td>
<td>Operational detail in data gathering</td>
</tr>
<tr>
<td></td>
<td>Reflective appraisal of the phenomenon</td>
</tr>
<tr>
<td>Conformability</td>
<td>Development of “Audit Trail”</td>
</tr>
</tbody>
</table>

Table 4.13: Strategies for Ensuring Trustworthiness from Shenton (2004)

For this effort, all of these strategies are present. This study began with a long period of appreciation for the context, and then employed well-used tools and techniques to structure the effort and collect the data required and analyze it. Multiple sources of data were used to assess the veracity of information gathered, and the source and contexts of these data sets are well described. Understanding of this context was developed with the help of several members of the community who helped guide and correct my understanding. The processes of this effort’s data collection are well described above and several tools used in gathering this information are included at the end of this chapter. The goal of this was to create the equivalent of an “audit trail” so that other researchers could follow this work from the development of propositions through the presentation of results.
Chapter 5: Analysis Results

This chapter presents the results of the analyses described in Chapter 4. The SHIECAP Case’s results are presented in the first two sections of this chapter, and are followed by the results from the North Carolina Case in the third section. The embedded case is brought together in the fourth section. The first section informs Research Questions 1 and 2, focusing on the relation between the SHIECAP organization’s boards and their strategies. No evidence is found from the ANOVA and Chi-square to infer a significant relation between these concepts. The second section informs Research Questions 3, 4, and 5 by testing whether boards or strategies predict performance measures, and culminates in a review of the results from the SHIECAP Case. The third section informs Research Question 6, and reports three models that capture confounding factors that are not readily incorporated into the analysis of the SHIECAP Case; these factors were developed from qualitative analyses of North Carolina’s SHIECAP experience. The fourth and final section unifies these two cases to explain some of the null results found in the SHIECAP Case. A discussion of the implications of these results to theory and practice is included in Chapter 6.

5.1 SHIECAP Case: Alignment of SHIECAP Boards and Strategies

This section reports on findings of statistical analyses comparing board size across strategies, and counts of board compositions across strategies. No significant differences are found across average board sizes nor are they found across counts of board compositions. There is no evidence to support that board size and composition are related to strategy in this context.
5.1.1 Board Size across Strategies

According to Pearce and Zahra (1992), there should be a relationship between board size and the strategy it pursues, as each strategy requires differing amounts and varieties of resources from the environment. Figure 5.1 shows the relationship for SHIECAP boards and their strategies with the average distribution over all States given for comparison.

![Boxplot of Board Sizes across all strategies (F = 0.98, p > .10)](image)

**Figure 5.1: Boxplot of Board Sizes across all strategies (F = 0.98, p > .10)**

As Figure 5.1 shows, there is no significant difference in board size across the different strategies (F = 0.98, p > .10). All strategies have an average board size between 15 and 20 members, and the majority of boards consist of 10 to 25 members. This consistency is not particularly surprising as 23 out of 44 States employed a pair of strategies, as was described in Chapter 4. Due to this, no evidence is found to support Research Question 1’s proposition that there is a relationship between Board Size and Strategy.
5.1.2 Board Composition across Strategies

According to Hillman et al. (2000) and Kroll et al. (2007), the board compositions should reflect to the needs of the firm. Table 5.1 and 5.2 show the results of two tests to identify if there are differences in compositions across the differing SHIECAP organization strategies. These tests both the broadest categories of board composition, Insiders and Outsiders, as well as the more granular approach that breaks down Outsiders into Business Experts, Support Specialists, and Community Influentials. The results presented in this section use counts of the individual board members, and ANOVA was also conducted on their proportion of the board. None of these tests showed a significant deviation across any of the strategies.

<table>
<thead>
<tr>
<th></th>
<th>Insider</th>
<th>Outsider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator</td>
<td>43.15</td>
<td>257.85</td>
</tr>
<tr>
<td></td>
<td>(0.230)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Capacity Builder</td>
<td>18.64</td>
<td>111.36</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Orchestrator</td>
<td>48.74</td>
<td>291.26</td>
</tr>
<tr>
<td></td>
<td>(0.372)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Public Utility</td>
<td>53.47</td>
<td>319.53</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.007)</td>
</tr>
</tbody>
</table>

Table 5.1: Expected Frequencies and Residuals for Insiders and Outsiders (Chi-square = 0.76, p>0.10)

Table 5.1 shows no significant differences (p>.10) in counts of Insiders and Outsiders between the strategies. Table 5.2 further separates the Outsider label into Business Experts, Support Specialists, and Community Influentials, to capture whether the Outsider label occluded potential deviations. No differences were found. Table 5.2 also shows no significant differences (p>.10) in counts of Hillman’s taxonomy of board members between the strategies. Similar to Section 5.1, no evidence is found to support Research Question #2’s proposition that there is a relationship between board compositions, using either breakdown, across the SHIECAP strategies.
Table 5.2: Expected Frequencies and Residuals for Hillman et al (2000) Counts of Board Members (Chi-square = 6.39, p>0.10)

<table>
<thead>
<tr>
<th></th>
<th>Insider</th>
<th>Business Expert</th>
<th>Support Specialist</th>
<th>Community Influential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator</td>
<td>43.15</td>
<td>165.5</td>
<td>37.1</td>
<td>55.25</td>
</tr>
<tr>
<td></td>
<td>(0.230)</td>
<td>(0.038)</td>
<td>(0.022)</td>
<td>(0.408)</td>
</tr>
<tr>
<td>Capacity</td>
<td>18.64</td>
<td>71.48</td>
<td>16.02</td>
<td>23.86</td>
</tr>
<tr>
<td>Builder</td>
<td>(0.007)</td>
<td>(0.420)</td>
<td>(0.000)</td>
<td>(1.106)</td>
</tr>
<tr>
<td>Orchestrator</td>
<td>48.74</td>
<td>186.94</td>
<td>41.91</td>
<td>62.41</td>
</tr>
<tr>
<td></td>
<td>(0.372)</td>
<td>(0.337)</td>
<td>(0.228)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Public Utility</td>
<td>53.47</td>
<td>205.08</td>
<td>45.97</td>
<td>68.47</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(1.235)</td>
<td>(0.343)</td>
<td>(1.601)</td>
</tr>
</tbody>
</table>

5.2 SHIECAP Case: Effect of Boards and Strategies on Performance

This section shifts focus from the alignment between boards and strategy to their individual effects on performance, and presents the results from linear regression and ANOVA to identify this effect. Both performance measures for Queries and ePrescribing were strongly correlated with State population and hence were analyzed as “per capita.” As this section included 104 iterations, a table of F-scores is included in each section to help identify significant relations, which are then the focus of that section. Factor analysis and Principle Component analysis are often used to lessen the number of iterations, but this study fails to meet the most forgiving of requirements for the use of these tools (n>100, where this study has n=44), precluding their use. As the simple regressions for the tests of the board compositions individually result in the same value as the correlation of standardized variables, these are identified as “correlations” in this section’s tables.
5.2.1 Board Size Predicting Performance

To identify relations between board size and performance variables, each of the 6 performance variables were regressed across 6 measures of board size. The first two measures both captured the total board (Total board size and board size by components), while the final 4 measures tested individually each component of board composition (Insiders, Business Experts, Support Specialists, and Community Influentials). All of these models were tested to see if there was predictive value in the size of certain compositions in contrast to their proportions, which are tested in Section 5.2.2. Out of these 36 regressions, only three were found to be statistically significant. Table 5.3\(^9\) shows the F-score of these regressions to highlight, which will be discussed in greater detail later in the section.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Board Size Model</th>
<th>Size by Components</th>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queries</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>Change in Queries</td>
<td>n.s.</td>
<td>n.s.</td>
<td>0.13*</td>
</tr>
<tr>
<td>Directed Messages</td>
<td>n.s.</td>
<td>n.s.</td>
<td>0.16*</td>
</tr>
<tr>
<td>Change in Directed Messages</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>ePrescribing Population</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>Change in ePrescribing Pop</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Table 5.3: Adjusted R\(^2\) of Board Size models predicting Performance Variables\(^10\)

As Table 5.3 shows, the three iterations which were statistically significant were simple regressions, with Business Experts predicting Queries (Adj R\(^2\)=.13, F=4.83, p<.05), and Support Specialists predicting both Queries (Adj R\(^2\)=.16, F=5.78, p<.05) and Change in Queries (Adj

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\(^9\) Table 5.3 and 5.6 shows the adjusted R-squared of regressions with significant F-scores. F-scores as these are measures of the statistical significance of the model, whereas the adjusted R-squared shows the strength of the relationship between predictor and response.

\(^10\) * = p<.05 , ** = p<.01 , *** = p<.001
R² = .14, F=5.17, p<.05). The adjusted R-squared as well as the betas for the predictor variables are shown in Table 5.4 for the models predicting Queries, and Table 5.5 for the specific models predicting Change in Queries.

Table 5.4: Regression Analysis of the Relationship between Board Size and counts of Board Composition and dependent variable Queries (df=26)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Board Size</th>
<th>Size by Components Model</th>
<th>Insiders</th>
<th>Business Experts</th>
<th>Support Specialists</th>
<th>Community Influentials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board Size</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insiders</td>
<td></td>
<td>0.002</td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Experts</td>
<td>-0.005</td>
<td>-0.006*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support Specialists</td>
<td>0.016*</td>
<td></td>
<td></td>
<td></td>
<td>0.018*</td>
<td></td>
</tr>
<tr>
<td>Community Influentials</td>
<td></td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td>-0.006</td>
</tr>
<tr>
<td>Model F</td>
<td>0.92</td>
<td>2.70</td>
<td>1.33</td>
<td>4.83*</td>
<td>5.78*</td>
<td>0.75</td>
</tr>
<tr>
<td>Model Adjusted R²</td>
<td>0.00</td>
<td>0.21</td>
<td>0.01</td>
<td>0.13</td>
<td>0.16</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

Table 5.4 shows that board size, as an aggregate, does not relate to the number of queries of patient records. Business Experts and Support Specialists both show a significant relationship (p<.05), and Size by Components is also interesting and is nearly significant (p<.10). Table 5.4 shows that there is a relationship between board size and performance in SHIECAP, but that relationship is limited to the inclusion of Business Experts and Support Specialists. The results of that relationship are that for each additional Business Expert on the board, I can expect a decrease in patient record queries by 5 queries per 1,000 patients, and for each additional Support Specialist, an increase of 16 queries per 1,000 patients.

11 * = p<.05 , ** = p<.01 , *** = p<.001
Table 5.5: Regression Analysis of the Relationship between Board Size and counts of Board Composition and Change in Queries (df=26)\textsuperscript{12}

<table>
<thead>
<tr>
<th>Variables</th>
<th>Board Size</th>
<th>Size by Components Model</th>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Insiders</td>
</tr>
<tr>
<td>Board Size</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insiders</td>
<td>-0.002</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>Business Experts</td>
<td>-0.004</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>Support Specialists</td>
<td>0.017*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Influentials</td>
<td>-0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model F</td>
<td>0.68</td>
<td>2.02</td>
<td>0.37</td>
</tr>
<tr>
<td>Model Adjusted $R^2$</td>
<td>-0.01</td>
<td>0.14</td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Similar to the Table 5.4, Table 5.5 shows a significant relationship (Adj $R^2=.14$, $F=5.17$, $p<.05$) between Support Specialists and the Change in Queries between early 2012 and late 2013, but in contrast, there is no significant relationship with Business experts, nor in the combined model (Adj $R^2=.14$, $F=2.02$, $p>.10$). Viewed independently, this suggests that the inclusion of an additional Support Specialist would increase the number of queries during this time period by 17 transactions per 1,000 patients. As this relationship becomes uncertain when I include the other measures of board size, it is likely that the interaction of Support Specialists with other board member categories makes this effect uncertain. Combined with Table 5.4’s results, there is only weak evidence for Research Question 3’s proposition of a relation between board size and performance.

\textsuperscript{12} * = p<.05 , ** = p<.01 , *** = p<.001
5.2.2 Board Composition Predicting Performance

Similar to the investigation of board size, the study of board composition for Research Question 4 utilizes multiple predictor models. The major change between these two sets of iterations is that board compositions capture proportions of the board rather than its absolute counts. As was discussed in the previous chapter, the first model excludes the proportion of Business Experts. This exclusion is due to the multicolinearity exhibited by regressions that included all of the board categories (Insider, Business Expert, Support Specialists, and Community Influentials) as an effect of the strong correlations between the categories. By excluding the most inter-correlated term, Business Experts, the Parsimonious Composition Model allows testing of the complete board without the skew of multicolinearity, and gives the added benefit of clarifying the results of these models by removing the challenge apparent in a complete model where the increase of one variable necessitates the decrease in another variable. By excluding Business Experts, this turns the interpretation of results to the increase of a board category at the cost of Business experts, or the decrease of a board category to the benefit of Business Experts. Following the same pattern as the prior section, the first measures captured the complete board, while the final 4 measures tested individually each component of board composition (Insiders, Business Experts, Support Specialists, and Community Influentials). Table 5.4 shows the F-scores for this set of iterations.
As Table 5.6 shows, board composition is a powerful predictor of Queries and Change in Queries. The adjusted R-squared for the relation between board composition and Queries is shown in Table 5.7; Change in Queries is shown in Table 5.8.

Table 5.6: Adjusted $R^2$ of Board Composition models predicting Performance Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parsimonious Composition Model</th>
<th>Insiders</th>
<th>Business Experts</th>
<th>Support Specialists</th>
<th>Community Influentials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queries</td>
<td>0.31**</td>
<td>0.21*</td>
<td>0.28**</td>
<td>0.30**</td>
<td>n.s.</td>
</tr>
<tr>
<td>Change in Queries</td>
<td>0.25*</td>
<td>n.s.</td>
<td>0.20*</td>
<td>0.29**</td>
<td>n.s.</td>
</tr>
<tr>
<td>Directed Messages</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>Change in Directed Messages</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>ePrescribing Population</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Table 5.7: Regression Analysis of the Relationship between Board Composition and Queries (df=26)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parsimonious Composition Model</th>
<th>Insiders</th>
<th>Business Experts</th>
<th>Support Specialists</th>
<th>Community Influentials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders (%)</td>
<td>0.210</td>
<td>0.307*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Experts (%)</td>
<td></td>
<td></td>
<td></td>
<td>-0.277**</td>
<td></td>
</tr>
<tr>
<td>Support Specialists (%)</td>
<td>0.412**</td>
<td></td>
<td></td>
<td>0.462**</td>
<td></td>
</tr>
<tr>
<td>Community Influentials (%)</td>
<td>0.107</td>
<td></td>
<td></td>
<td></td>
<td>-0.042</td>
</tr>
<tr>
<td>Model F</td>
<td>4.91**</td>
<td>4.43*</td>
<td>11.16**</td>
<td>12.25**</td>
<td>0.07</td>
</tr>
<tr>
<td>Model Adjusted $R^2$</td>
<td>0.31</td>
<td>0.12</td>
<td>0.28</td>
<td>0.30**</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

Table 5.7 shows the Parsimonious Composition Model is a strong predictor of Queries (Adj $R^2=.31$, $F=4.91$, $p<.01$). It is important to compare the Business Experts and Support Specialists models with the Parsimonious model, as the strongly negative relationship between

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$^{13}$ * = p<.05 , ** = p<.01 , *** = p<.001  
$^{14}$ * = p<.05 , ** = p<.01 , *** = p<.001
the proportion of Business Experts on the board (Adj R²=.28, F=11.16, p<.01) and the consistently positive and significant relationship between Support Specialists and queries offers strong evidence that increasing the number of Support Specialists at the cost of Business Experts is predictive of increases in queries. Drawing on the Parsimonious Composition Model as it includes the largest number of factors while remaining significant, for a 20-person board, replacing 2 Business Experts (10% of the board) with Support Specialists increases the number of queries by 41 for every 1,000 patients.

Table 5.8: Regression Analysis of the Relationship between Board Composition and Change in Queries (df=26)\(^{15}\)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parsimonious Composition Model</th>
<th>Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insiders (%)</td>
<td>Business Experts (%)</td>
</tr>
<tr>
<td>Insiders (%)</td>
<td>0.106</td>
<td>0.215</td>
</tr>
<tr>
<td>Business Experts (%)</td>
<td></td>
<td>-0.231*</td>
</tr>
<tr>
<td>Support Specialists (%)</td>
<td>0.413**</td>
<td>0.434**</td>
</tr>
<tr>
<td>Community Influentials (%)</td>
<td>0.073</td>
<td></td>
</tr>
<tr>
<td>Model F</td>
<td>3.86*</td>
<td>2.16</td>
</tr>
<tr>
<td>Model Adjusted R²</td>
<td>0.25</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Table 5.8 shows Board Composition is also a significant predictor of Change in Queries (Adj R²=.25, F=3.86, p<.05), and shows a similar relationship between Business Experts and Support Specialists as did Table 5.7. The negative relationship between the proportion of Business Experts on the board (Adj R²=.20, F=7.58, p<.05), and the consistently positive and significant relationship between Support Specialists and queries, offers strong evidence that increasing the number of Support Specialists at the cost of Business Experts is predictive of an increase in Queries between 2012 and 2013. Drawing on the Parsimonious Model as it is the most

\(^{15}\) * = p<.05 , ** = p<.01 , *** = p<.001
descriptive model while remaining significant, for a 20-person board, replacing 2 Business Experts with Support Specialists increases the number of queries by 41 for every 1,000 patients.

Due to the strong results shown in Tables 5.7 and 5.8, there is clear evidence for Research Question #4 that Board Composition is predictive of Queries and Change in Queries, but there is no evidence supporting its predictive value for the other performance measures. In combination with Section 5.2.1, this shows that both Board Size and Composition, when using Hillman et al.’s (2000) categories, show a strong relationship with certain performance values.

5.2.3 Strategy Predicting Performance

In contrast to Board Size and Composition, when compared across the same measures of performance there are no significant differences across Elevator, Capacity Builder, Orchestrator and Public Utility strategies.16

5.2.4 Summary of Findings from the SHIECAP Case

In summary, the SHIECAP Case finds no alignment between boards and strategy and no relationship between strategy and performance, but it does find evidence supporting boards effect on performance.

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16 Preliminary analysis of Strategies found a significant relationship between Strategy and ePrescribing measures, but this was found to be an artifact of Strategies being strongly related to State Population. Once the ePrescribing measure was scaled by State Population, this relation disappeared as the table shows.
As Table 5.9 shows, the SHIECAP Case found no evidence to support a relationship between boards and strategy (Research Questions 1 and 2), no evidence to support a relationship between strategy and performance (Research Question 5), but did find moderate evidence to support a relationship between boards and performance (Research Questions 3 and 4). As the preceding section described, boards were found to predict the number of query transactions but not the number directed messages or the eprescribing metric. While there was no evidence for total board size effecting performance, counts of board components weakly predicted the total number of query transactions (Adj $R^2=.21$, $F=2.70$, $p<.10$), but not the change in query transactions (Adj $R^2=.14$, $F=2.02$, $p>.10$). Board composition as a proportion of the board was a much stronger and more significant predictor of both query transactions metrics (Total query Adj $R^2=.31$, $F=4.91$, $p<.01$; Change in query Adj $R^2=.25$, $F=3.86$, $p<.05$). This increased strength and significance of composition over size offers moderate evidence that adjusting board membership would be a more effective method of increasing performance than simply adding new board members.

What is starkly evident from these results of the SHIECAP case are (1) the signs of the correlations and significant betas of these regressions, and (2) the lack of significant relations with the strategy variable. As Tables 5.4, 5.5, 5.7, and 5.8 show, there is a negative relationship between Business Experts and performance and a positive relationship between Support Specialists and performance. This shows that increasing the number or proportion of healthcare providers on the board will not increase use, but increasing the number or proportion of lawyers,
financiers and IT consultants would have a significant positive effect on use. The implications of these results will be discussed in greater detail in Chapter 6.

5.3 North Carolina Case

This section focuses on providing information to help answer Research Question #6 “What other unmeasured variables influence board/performance relationship?” and to better explain the results from the SHIECAP Case’s analyses of boards, strategy and performance. As analysis progressed on the interviews from North Carolina’s SHIECAP organization (NCHIE), two HIEs (CCHIE and WNC Datalink) and two supporting organizations (NCAHEC and Medicity) three clear unmeasured variables emerged from the data impacting boards, strategy, and performance. The first variable impacted boards and their relationships with strategy and performance. For the board of directors at NCHIE, SHIECAP organization, there was a clear disconnect between the board’s membership and the community of organizations that were necessary for its operation. This had significant effects on the performance of the organization and the effectiveness of its strategy. The first unmeasured variable had strong implications for the alignment between the board and its environment and was titled “Community Collaboration for HIE.” The second variable extended this interest in strategy.

As Chapter 4 showed, North Carolina crafted an Elevator/Orchestrator strategy in their SHIECAP plan that matched their State’s environment, which had strong local HIEs to leverage. That genial relationship was not found in this study’s interviews; and HIEs are absent from the NCHIE board, while there are numerous governmental representatives. What was evident in the interviews was significant uncertainty and distrust due to House Bill 834 (HB834), included in Appendix H, which appeared to supplant the local HIEs in favor of NCHIE. This action drastically changed North Carolina’s strategy to a more draconian form of the Public Utility
Strategy. This second unmeasured variable had strong implications for how this study captured strategy, and was titled “Operationalizing Strategy.” The third variable extended this interest in boards and strategy, and focused at a detailed level how performance was generated.

The third variable that emerged from the data was synthesized from informants’ discussions of their interactions with users, and descriptions of how their services bring value to those users. While perspectives varied across organizations and roles, all informants saw the benefit of data exchange in healthcare. In several interviews there were in-depth accounts of how these services evolved and how those services were used, revealing a tactical focus on HIEs that was missing from earlier discussions of boards and strategy. This third unmeasured variable was the process that developed the performance variables of this study. It had clear implications for how boards and strategy impacted performance, and was titled “Social Mechanism of HIE Use.”

Until now, this investigation ‘black boxed’ the mechanisms through which boards and strategy affect performance. While Research Question 6 is generally labeled ‘integration’ in Figure 5.2 (reproduced here from Chapter 1), it focuses on these three unmeasured variables. Figure 5.3 shows how these three unmeasured variables impact the research questions discussed in the SHIECAP case.

Figure 5.2: Depiction of Research Questions from Chapter 1
Community Collaboration for HIEs sheds light on the alignment of SHIECAP boards to the challenges of developing HIEs by describing the needs and requirements implicit in HIEs interactions with other organizations. Operationalizing Strategy helps to clarify the construction of orchestrated statewide HIEs by focusing on the interaction between HIEs and the North Carolina SHIECAP Organization (NCHIE). Social Mechanism of HIE Use describes the engine that drives HIE use, which my metrics of performance captured.

5.3.1 Community Collaboration for HIEs

The first unmeasured variable clarified the link between board and its environment. As was mentioned earlier, boards that better align with their environment result in increased performance (Pfeffer 1973), but this result is often used as the explanation for increased performance instead of the focus of the investigation. Through the interviews from North
Carolina, there was a clear gap between the struggles faced by HIEs, the organizations that needed to share resources, and the NCHIE’s board as it led that SHIECAP organization. This gap described a model of the community supporting HIEs through a resource sharing collaboration and was unimaginatively titled “Community Collaboration for HIEs.” To discuss this community, this section first discusses the board composition of NCHIE, before discussing the organizations that emerged from the interviews in each of the board composition categories. This section concludes with a discussion of how this model informs the alignment of the board to the environment, as well as the board’s effect on performance and alignment to strategy.

5.3.1.1 NCHIE’s Board of Directors

NCHIE’s board included 24 members comprised of 4 Insiders, 11 Business Experts, 4 Support Specialists, and 5 Community Influentials. Table 5.10 provides a breakdown of these board members. As Table 5.10 shows, Insiders comprise 2 members of elected government, and 2 members from local health departments. As SHIECAP funds are disbursed through the state, these groups are the closest analogy to Hillman’s (2000) original conception of the Insider label. These groups provide insight and expertise on the interaction between the State government and the State’s healthcare community, which aligns well with the Meaningful Use-promoting goal of SHIECAP.
<table>
<thead>
<tr>
<th>Director Label</th>
<th>Organization Type</th>
<th>Board Member Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insiders (4)</td>
<td>Elected Gov’t</td>
<td>NC State Senator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC State Representative</td>
</tr>
<tr>
<td>Health Dept.</td>
<td></td>
<td>NC Dept. of Health and Human Services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Henderson County Health Dept.</td>
</tr>
<tr>
<td>Business Experts (11)</td>
<td>Healthcare Provider</td>
<td>Community Care of NC (CCNC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WakeMed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC Community Health Center Assoc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UNC Health Care System</td>
</tr>
<tr>
<td></td>
<td>Physician Professional Assoc.</td>
<td>NC Medical Board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC Medical Society</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Old North State Medical Society</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC Nurses Association</td>
</tr>
<tr>
<td></td>
<td></td>
<td>American Academy of Pediatrics</td>
</tr>
<tr>
<td></td>
<td>Payor Org.</td>
<td>Blue Cross Blue Shield of NC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC Medicaid Director</td>
</tr>
<tr>
<td>Support Specialists (4)</td>
<td>IT Specialists</td>
<td>NC Health IT Coordinator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NC Chief Information Officer</td>
</tr>
<tr>
<td></td>
<td>REC</td>
<td>NC Area Health Education Centers</td>
</tr>
<tr>
<td></td>
<td>Legal Consultant</td>
<td>Larsen Allen, LLP</td>
</tr>
<tr>
<td>Comm. Influentials (5)</td>
<td>Comm. Alliance</td>
<td>NCHICA</td>
</tr>
<tr>
<td></td>
<td>Education Institution</td>
<td>UNC’s Department of Family Medicine</td>
</tr>
<tr>
<td></td>
<td>Lab, Pharmacy, or Medical Equipment Vendor</td>
<td>GlaxoSmithKline</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kerr Drugs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Labcorp</td>
</tr>
</tbody>
</table>

**Table 5.10: NCHIE’s Board of Directors by Director Labels**

Business Experts comprise the largest share of the board with 4 members drawn from healthcare providers, 5 from physician professional associations, and 2 from payor organizations. These groups are labeled as Business Experts as they complement the Insiders with expertise in the functional mechanisms of providing healthcare and would be the principle users of HIEs. They are strategically important as these groups are also the major contributors of data to these SHIECAP organizations, and were viewed as the main conduit to sustainability of these organizations as eventual funding sources of these organizations. Support Specialists include 4 members who provide specialized expertise but are not part of the strategic core. In this context these include IT specialists, legal consultants, and the Regional Extension Center. Community
Influentials are further removed from the strategic core of the organization and they provide legitimacy of the effort with the broader community. In comparison with other SHIECAP boards, the only deviation of NCHIE is that the North Carolina Health Information and Communications Alliance (NCHICA) is not the SHIECAP organization. Aside from this deviation, NCHIE’s board is of similar size and composition to many SHIECAP boards. The interviews from North Carolina show a different perspective however, and highlight several organizations and interactions, which would greatly effect the evaluation of board membership and its alignment with the healthcare community. The model for Community Collaboration for HIEs that captures this is shown in Figure 5.3.

![Figure 5.3: Community Collaboration for HIEs](image)

**5.3.1.2 Environmental Alignment of HIEs**

Throughout the North Carolina interviews, four major relationships were common. The first relationship was between the local HIEs, the SHIECAP Organization and the State
Government. There was significant uncertainty and mistrust in this relationship due to the benefits that the SHIECAP Organization (NCHIE) could receive from the power of the State Government. Combined, these organizations are analogous to “Insiders” as they provide the core expertise for controlling the statewide HIE, and are represented by trapezoids in Figure 5.4. The second relationship was between the HIEs and the healthcare providers that used their services. This relationship was critical for the success of HIEs, as healthcare providers are the principle users of HIE services as well as the source of the exchanged data. These organizations were analogous to “Business Experts” as they were experts on the competitive hurdles stalling data exchange between healthcare providers, as well as its potential benefits. They are represented by the ovals in Figure 5.4. The third relationship was between the HIEs and supporting organizations. This relationship specifically concerned the IT vendors that developed and maintained the systems that HIEs leveraged and the REC (NCAHEC) that promoted health IT throughout the broader community, including connecting healthcare providers with the appropriate HIE. As these organizations provided specialized expertise on a focused set of topics, they are similar to “Support Specialists,” and are represented by the solid rectangles in Figure 5.4. The final relationship was between the HIEs and NCHICA. This relationship was relatively amorphous as NCHICA did not hold a specific relation with any of the organizations interviewed but instead provided an unbiased venue to develop community understanding on HIE as a part of several healthcare topics. Due to NCHICA’s strong community connection and unbiased position, it is analogous to “Community Influentials,” and is represented by the dotted lines in Figure 5.4.

The Insiders, NCHIE and the State Government together, provided both a carrot and stick to motivate healthcare providers to participate in NCHIE. The State Government enacted HB 834 (See Appendix) which required all healthcare providers to connect to NCHIE, while NCHIE

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17 In the interviews, no distinction was made between healthcare providers and their professional associations.
focused on building a business model that enticed healthcare providers to join the HIE. NCHIE was identified in the North Carolina Case as an Insider due to its close relationship with the State Government, and conflict with other HIEs in the state. The relationship with the State Government was clear as NCHIE received financial support from varied sources within the State Government to help offset the cost concerns of HIE integrations.

“[W]e’ve been able to overcome some of the cost barriers through a couple of approaches one is that we’ve got a couple grant programs going on. One through State and Federal HITECH dollars through the Medicaid Agency and another through the Office of Rural Health and the North Carolina Community Health Center Association that connect up all the Federally qualified health centers in the State. Those have been wonderful because they’ve provided essentially the funding for those one-time setup and integration fees, and then the participant, the physicians practices, are kind of left responsible for their ongoing annual fees which is $150 per clinical user.” - Management (under CCNC) at NCHIE

“So where the physician practices, it’s more challenging on a lot of fronts rather than the cost of one set of interfaces across the whole hospital or whole hospital system, we’re talking about high integration cost for a single practice site” - Management (under CCNC) at NCHIE

Through this support, NCHIE was able to start the process of onboarding many healthcare providers. The close relationship between NCHIE and the State Government is understandable, as NCHIE was located in the State capital of Raleigh, which had little HIE coverage. NCHIE also benefitted greatly from its position as part of CCNC. CCNC, which served as NCHIE’s parent company, is a healthcare coordination organization that works almost exclusively with Medicaid patients, bridging the gap between a payor organization and a provider.
organization. The goodwill and legitimacy that came from being connected with this Business Expert organization was a benefit to NCHIE as CCNC was already embedded in the community. NCHIE outlines the benefits of this relationship in the following quote, which transitions to the second relationship.

“[O]ur parent company at the NCHIE is Community Care of North Carolina and traditionally they’ve been sort of a Medicaid-focused Organization and they’ve sort of expanded their business model over the past couple of years and they do serve other patients populations and other needs but they have been focused on sort of serving the Medicaid and safety-net patient populations. 

…

“[I]t has been of benefit to us that we are a part of the Community Care of North Carolina family of companies, that’s actually our parent company and while we are branded and we operate pretty much entirely independently, we are co-located with CCNC Community Care, and we’ve been able to leverage Community Care’s relationships and networks state wide.”

- Management (under CCNC) at NCHIE

Despite the very positive relationship between NCHIE and CCNC, this positive relationship appears to have had a negative effect on the relationship with other Business Experts (local HIEs and healthcare providers). This link is understandable as many healthcare providers already supported local HIEs. Healthcare providers founded both WNC Datalink and CCHIE.

“It's a program that lives underneath a parent organization called the WNC Health Network and the WNC Health Network was developed by the 16 westernmost hospitals in North Carolina.”

- Management (pre-closure) at WNC Datalink
“*Our organization was born out of a hospital alliance, the Coastal Carolinas Health Alliance*”

- Management at CCHIE

These healthcare providers took particularly strong roles in the local HIEs, guiding and funding vendor selection and directly determining the fate of the organization.

“I don't want to say at the mercy of our board of directors, but our board ultimately makes the decision. And as of this... we've requested to see what they would be interested in.”

- Management (pre-closure) at WNC Datalink

“5 of the 12 hospitals came forward saying that we will pay the check as we have a technology vendor and we will support this and we will deploy it and the way they chose that was we have Medicity and picked it based on their ability to do exactly what the physicians were ready for and to roll out those pieces.” - Management at CCHIE

Similar to CCNC, these large healthcare providers actively promote their HIEs and see value in them, but there is pushback due to some basic misconceptions stemming from misguided concerns over the Patient Protection and Affordable Care Act (PPACA, Obamacare).

“*Another practice actually thought that we were –that he wanted nothing to do with Obamacare and he had this misconception that we could not shake, *”

- Account Specialist at CCHIE
CCHIE eventually built trust with the healthcare providers with whom this individual shared patients, and convinced that individual of the value of the HIE as well as its lack of connection to Obamacare.

“...after one of the dinners that we spoke at, after he had heard one of the other doctors give an overview of what it was doing for him and his practice he reached out to us and asked to be connected, and we gladly connected him” - Account Specialist at CCHIE

The trust and legitimacy that Business Experts provide is pivotal, as HIEs replace or run parallel to their existing networks of information exchange.

“The Hospitals will identify who they want to have it, and that’s how we will get started and again go above and beyond and offer it to those others that are high value. So yeah, the hospitals kind of direct us, based on who they feel will benefit most from it, who pulls medical records everyday and really hounding them.” - Account Specialist at CCHIE

Many HIEs recognize this trust is contingent on the incorporation of the HIEs’ services into the healthcare provider’s organization; instead of attempting to re-engineer or instill cookie-cutter workflows, they work to integrate HIE services into existing workflows.

“... figuring out how they do things in that practice and its different among all the practices and figuring out where the HIE can be incorporated, we don’t want to completely revamp their workflow,” -Account Specialist at CCHIE

Despite these challenges there is obvious interest among physicians.
“[I]n the last 8 months, ... the physicians have done a 180. They realize how important the exchange is and having that information on the query tool and access that they are now starting to go ‘I am ready to contribute information’” - Management at CCHIE

Fulfilling this interest is a significant challenge for the local HIEs. The source of this challenge, and also some of the solution to it, is the third relationship, the Support Specialists. These are the IT vendors that provide the HIE and EHR systems, and the REC that promotes their adoption. Each of these are discussed below.

The relationship with IT vendors, both HIE-providing and EHR-providing, is critical as the core technological challenge of HIEs is the many non-interoperable EHR systems in use among healthcare providers. To illustrate this, focus on number of EHR vendors in the following quote.

“I think there are over 200 [EHR] vendors in North Carolina. So we’re by no means working with anywhere near all of them but we have done integration with Allscripts, Allscripts pro [EHR] on the Ambulatory side. And we are about to begin integrations with some of their other products as well as GE. I think we’re in progress with McKesson. We just, we’ve already signed or are about to sign Cerner sites -- that’ll be our first aggregation, Cerner”

- Management (under CCNC) at NCHIE

Aside from the logistical challenge of coordinating all of these vendors, the main barrier is that integrating an EHR into a specific HIE is a significant cost. So much so that HIEs are using tools to work around particularly challenging integrations so that providers can share their data
without incurring the significant costs. This tool aggregates a provider’s data and makes it sharable on the HIE. The aggregator tool and its need are described in the following quote.

“Another reason is that we have sort of tapped into a piece of technology that is sort of a data aggregation tool. It is a third-party tool. So rather than, when we approach a practice and maybe they’re on a certain EMR-- I don’t want to name names --and that EMR has quoted them 10 or 12 grand for integration with an HIE and that is just the interface fees on the EMR Side and then we have interface fees that we need to pass on to the practice that will be covered via the subsidy.”
- Management (under CCNC) at NCHIE

This challenge of non-interoperable systems only increases the value of co-opting these IT vendors into the SHIECAP organization, though they are oddly absent from NCHIE and other SHIECAP boards. Their incorporation into SHIECAP boards would not solve the challenge of having multiple EHRs in the environment as these vendors specialize and tailor their products to better adapt into the organization’s workflows. Strategically selecting representatives from competing vendors could co-opt their organizations into collaborating.

The role of the second Support Specialist approached this problem from the provider perspective. As the REC, NCAHEC helped match providers across North Carolina with the IT products that would be most useful:

“I think it’s about 1200 practices we’ve work with across the state, or have worked with for Meaningful Use and some quality improvement,”
- Account Specialist (Health IT) at NCAHEC
“[W]e advise practices to really see what their needs are for health information exchange so a lot of it is driven by us trying to drive Meaningful Use stage two in the practice and so we really kind of pushed them to look into any other technology vendor, decide what their needs are and then decide which health information exchange product fits that or vendor fits that.”

- Account Specialist (Health IT) at NCAHEC

As long as healthcare providers have differing needs and capabilities, there will be multiple EHRs tailored to those needs. The selection of vendors with NCAHEC’s guidance can assist with lessening the challenge of later interoperability challenges. It would be possible, with better coordination and collaboration between the SHIECAP organization and these Support Specialists, to shift the view of data exchange as an ancillary service and interoperability as a later problem to solve into HIEs as a necessary and desired service.

The final relationship in this analysis differed from the earlier three as it did not wield regulatory power, provide strategic guidance or aid in surmounting technical challenges. Instead, this relationship built community within North Carolina, and included only one organization as a Community Influential, the North Carolina Health Information and Communication’s Alliance (NCHICA), which indirectly promoted the collaboration necessary for HIE. While this organization plays a significant role in North Carolina’s healthcare community and played a significant role in shaping this research, NCHICA’s direct role only surfaced on one occasion in the interviews, as it facilitated the connection between a local HIE and the US Department of Veteran’s Affairs.

In reviewing the four relationships that construct the Community Collaboration for HIEs, there is significant overlap between the model and NCHIE’s board, with a few key exceptions. This overlap as well as the accessible resources of each group identified in this model is shown in Table 5.11. From the Insiders, there is no NCHIE membership, and from the Business Experts,
there is no local HIE representation. This lack of representation helps to explain the uncertainty between Insiders and Business Experts that is compounded by the increased influence of CCNC on NCHIE. From the Support Specialists, there are no IT vendors on the board, however this role could have been mitigated by the Health IT Coordinator, which would explain why the challenge of connecting different EHR systems was a challenge instead of an insurmountable barrier. As for the Community Influential, it’s influence was shown through the openness of the community, but it was puzzling as to why their role was not more pronounced and lauded by the organizations in this study.

<table>
<thead>
<tr>
<th>Director Label</th>
<th>Organization</th>
<th>Accessible Resources</th>
</tr>
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<tbody>
<tr>
<td>Insiders</td>
<td>NCHIE (SHIECAP Org.)</td>
<td>HIE Service, Expertise</td>
</tr>
<tr>
<td></td>
<td><strong>State Government</strong></td>
<td>Regulatory Control, Funding</td>
</tr>
<tr>
<td>Business Experts</td>
<td>CCNC</td>
<td>Legitimacy, Expertise</td>
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<tr>
<td></td>
<td>Local HIEs</td>
<td>Data, Expertise</td>
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<td></td>
<td>Healthcare Providers</td>
<td>Data, Legitimacy, Expertise</td>
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<tr>
<td>Support Specialists</td>
<td>IT Vendors</td>
<td>IT Systems, Influence</td>
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<td></td>
<td><strong>NCAHCE</strong></td>
<td>Influence, Expertise</td>
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<tr>
<td>Comm. Influentials</td>
<td><strong>NCHICA</strong></td>
<td>Influence, Legitimacy</td>
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Table 5.11: Accessible Resources of the Differing Organizations in the Community (NCHIE Board Members Bolded)

This model impacts the understanding of the board of directors used in this dissertation in three ways. First, this shows the alignment of the board to its environment focused principally on healthcare providers and government representatives with little representation of established HIEs and other organizations that had expertise in this technology. As Table 4.4 showed, 16 of the 44 States included in this study have HIEs represented on their board, North Carolina is not unique in this omission. While there are no evident problems in North Carolina’s technological approach to SHIECAP, the information gap this lack of representation caused had fairly obvious repercussions in operations. Second, there are still several organizations whose role on the NCHIE board is not explained in this analysis, specifically the role of pharmacy, laboratory, and medical device organizations in guiding NCHIE. Third, while governmental and healthcare provider representation is strategically important, the lack of representation in more operational
organizations seems to have hampered the implementation of strategy. This conflict over strategy is the topic of the second unmeasured variable “Operationalizing Strategy.”

5.3.2 Operationalizing Strategy

The second unmeasured variable that came from the North Carolina Case was that the strategy described in North Carolina’s SHIECAP Plan and captured by the ONC did not align with the strategy captured in the North Carolina interviews. North Carolina’s SHIECAP plan described an Orchestrator/Elevator strategy, but in application, NCHIE more closely resembled a Public Utility, offering HIE services directly to healthcare providers and competing with the State’s operational HIEs. Instead of providing a “thin-layer” architecture as other Orchestrator strategies operationalized, North Carolina mandated healthcare provider’s participation in NCHIE through legislation. The bill, HB 834\(^\text{18}\), was not unique across other SHIECAP efforts as State legislation was a common tool to used to ensure that healthcare providers serving Medicare and Medicaid populations adopted appropriate technologies, standards, and practices. The conflict arose from the contrast between the collaborative approaches that normally typified Orchestrator strategies, and the requirement of HB 834 that healthcare providers participate in NCHIE, which directly undercutting local HIEs. Further muddying the strategy classification, HB 834 did not clarify the method of participation. This led to significant uncertainty among HIEs and healthcare providers as to how their participation in HIEs would need to change. To discuss this operationalization challenge, this section first discusses the tension between the SHIECAP organization and the local HIEs before moving to discussing the tension between the leadership of these two organizations. I then discuss the issue of trust in this strategy before showing that

\(^{18}\) Pertinent sections included in Appendix H
this similar tensions exist between the SHIECAP organizations and Federal efforts. This section concludes with a discussion of the implications of this model for capturing strategy.

This conflict was most clear between CCHIE and NCHIE, but was also evident from WNC Datalink. CCHIE already had a strong community base, but due to HB 834 CCHIE, it was asked to incur NCHIE’s fees in order to connect its members to the statewide HIE. CCHIE continued to fight for its members, while WNC Datalink was closed. This section reviews this conflict as a discussion of the challenges of capturing operationalized versions of the strategies identified by ONC. Figure 5.4 shows the crux of this interaction.

![Figure 5.5: Crux of challenge in North Carolina’s Operationalization of Strategy](image)

The central tension of this operationalization was between CCHIE and NCHIE, as HB 834 mandated that CCHIE’s participants also connect to NCHIE. There was significant pushback to this as CCHIE would have to incur NCHIE’s fees to facilitate this mandatory connection.
“As far as the eastern exchange, Coastal Connect, we’ve had several meetings, discussions, and negotiations with Coastal. We’d like to do an enterprise-wide connection. We’d like to just connect with them HIE to HIE. Thereby connect all of their participants to the statewide network. The challenges have been around cost because Coastal Connect is already charging their participants fees to participate and the NCHIE also charges fees and we haven’t been able to come to an agreement around what would be reasonable even at a reduced NCHIE rate to pass through to the Coastal Connect participants who belong essentially to both exchanges.

…

“The other HIEs are pretty much affiliated with health systems that are resisting the price tag of connecting to NCHIE.”

- Management (under CCNC) at NCHIE

This statement shows NCHIE’s perspective that the main challenge to connect CCHIE to the network was cost, and that the pushback was from CCHIE’s participants rather than CCHIE itself. However, this perspective was not shared by CCHIE, which did not see value in the connection to an exchange that did not have data useful to CCHIE’s current members.

“[W]e do have a state HIE that currently is not, it has no information in it, some practices are connected, but no one is getting any from it, the North Carolina HIE. So, sometimes people will say, “Well, I’m already paying to connect to that, but the value is not in it. So, why should I connect to this as well?” - Account Specialist at CCHIE
“So, we would love if the value was there and they don’t have any information that’s moving or bi-directional at this point. So, there’s not value to pay that high, high cost to connect. If the value was there, we would have those conversations and do whatever we can to bring more value to our community and their community.” – Account Specialist at CCHIE

This value proposition issue is discussed in greater detail in Section 5.3.3. This mistrust is not limited to only CCHIE and NCHIE; the REC also remarked on the mistrust between NCHIE’s parent company, CCNC, and the organizations that lead CCHIE to be self-evident.

“NCHIE being a part of [CCNC] which is also some of the management service for Medicare, ... a lot of the hospitals are a conflict of interest in it so I think that is a challenge, and probably the trust issue is the biggest thing in North Carolina, having the hospitals trusting one another”

- Account Specialist (Health IT) at NCAHEC

“Our state agency has struggled, and one of other comments that continues to come out of this is this trust policy with our state agency is actually a payor and not everyone is comfortable openly giving their information to a payor, or they are not comfortable with this payor, is asking for a lot a money just to participate to give them your data” – Management at CCHIE

Trust between these organizations is interesting as a method that HIEs use to develop this trust is by including them on their boards of directors. While often HIEs have little say in selection of their founding board members, it is clear that shared board membership engenders this trust through information sharing.
“Trust is a huge part of it. When we collaborate with these entities, truly everyone has a seat at the table and they may take a while to make decisions sometime because we do want to make sure that everyone is happy with the direction. But I would say, honestly, that just having such a diverse board, we have someone from Community Care, CCNC that sits on our board, that helps, and a big part of that is that they can keep us in the loop with what they are doing, and it helps us be able if they are doing something that we want to market to our community, we will do that, and vice-versa.” -Account Specialist at CCHIE

As CCNC is on both boards of CCHIE and NCHIE, this would normally show that the two boards are interlocked and would share information, but in contrast to that interlock, the prior quotes show significant challenges for these two HIEs to collaborate. This shows that the question of SHIECAP strategy is separate from board membership, as the issue of operationalizing collaborative strategies like Orchestrator is challenging. Though it is important to note that while HB 834 drastically changed North Carolina’s strategy, it may have been the best method forward for the state. HB 834 might have been a response to pushback from local and enterprise-based HIEs. It is important to note that this issue of cross-scale undercutting is not only an issue between local HIEs and the SHIECAP organization, as similar issues are found between the SHIECAP organizations and the Federal exchange.

“The result of [the Federal eHealth Exchange] sort of opening up in expanding their business model has been that some of the large organizations like the big integrated delivery networks in our state have looked at eHealth Exchange and its sort of Bare Minimum pricing and said “Well, you know why can’t we just connect to eHealth and have that serve all of our HIE needs?” and there are a lot of reasons why not. The eHealth Exchange is a very different model. It is not capable of a lot of the things that NCHIE and the other Statewide and local exchanges are (cont.)
capable of, but it sort of the cheap alternative and it’s been another sort of competing system and another reason that some large systems in our state have turned out with that reason for not connecting to the stage HIE." - Management (under CCNC) at NCHIE

In summation, this model intimated that the strategies described in the SHIECAP plans might not reflect how those plans were operationalized. While this operationalization would change the resource-requirements of the SHIECAP organization, the missing resources, trust and information, appear to be common to all of ONC’s strategies. Due to this, there are two operationalizations of strategy that are important to capture for Resource Dependence efforts. First, strategies must be captured both as symbolic activities (as ONC’s strategies attempted) and as operational entities (as this study attempted) by doing both a better measure of the social and material requirements of these strategies that can be better understood. Without understanding these strategies in this manner, it is difficult to assess the strategies on their performance impact. Second, the taxonomy of strategies must identify discrete sets of resources over both of these measures. The missing trust and information in North Carolina are resources that are common to all of ONC’s strategies, and without the strategies being discriminatory across resources there is no clear reason for the board size or composition to change across strategies. The identification of “strategy” for Resource Dependence requires a better measure of the resources required.

5.3.3 Social Mechanism of HIE

The third unmeasured variable focused on how the metrics of performance developed from the relationship between HIEs and healthcare providers. On one hand there were the services the HIEs offered such as basic HIPAA-compliant data exchange, and advanced services such as Patient Alerts, Data/Function Centralization, and Public Health Reporting. On the other
hand there were the use cases of these services by the healthcare providers. These two facets of data exchange created a reinforcing cycle which drove the number of directed-messaging and query-based transactions as well as the number of individuals actively eprescribing. This section describes the mechanism of the cycle that is captured in the Figure 5.6 and titled the “Social Mechanism of HIE.” This section first describes this model before discussing examples of the service/use case pairing and the value to healthcare providers. Second in this section is a discussion of the value accrued by the HIEs and how that spurs future services. This section then concludes with a discussion of how this model impacts the relationship of the board and its strategy to performance.

While in some cases, the Social Mechanism of HIE emerged from HIEs assisting healthcare providers with an existing service-improvement or cost-cutting campaign, in many instances the use cases of HIE services were emergent. Both of these types of use cases were often cited as HIEs’ value to healthcare providers, but the relationship was symbiotic as the perceived value of the HIE drove participation in the HIE’s network; this increased the amount of capital and data that HIE could leverage to offer its services. Balancing this simple mechanism is the crux of all HIE efforts.

![Figure 5.6: Mechanism of HIE Use](image)

Figure 5.6: Mechanism of HIE Use
As an example of this, take the case of CCHIE working with an Emergency Department (ED) that wants to lessen the use of their Emergency Medical Services (EMS) from individuals who used the ED as their sole interaction with medical personnel.

“We are working with one of our Hospital’s EMS system and their ED department. They’ve identified, about 60 patients that used their services most recently, they are coming to their service most recently by ambulance or maybe it is their first point of contact, and one thing that people who are not from North Carolina … have pointed out to us is that sometimes these [individuals] use the ED as they think taking an ambulance is going to get them in quicker, get them seen quicker, or maybe its just what mom and dad did and it is what they are going to do. So, many people in our region have this mentality of ‘Oh rats, something’s wrong. I’m in pain,’ the first thing they’re going to do is call an ambulance. For some like myself with health insurance, my mom said, ‘Please don’t ever call the ambulance unless it’s absolutely necessary. The ride in the ambulance is very expensive, even with health insurance.’ So, it’s just kind of a different mentality for a certain demographic of people. [W]e are working with them to notify EMS and the ED when these patients arrive or present -- so notifying them through this tool -- with physicians. It’s going to allow them to hopefully redirect that patient, depending on whatever’s wrong with them, and say … ‘Let us do this instead,’ to offer these alternatives instead of just popping in the EMS van and going and picking them up or admitting them to the ED, when they could go and see their primary care doctor or maybe getting them established with a primary care doctor. So, saving the hospital, definitely saving them money.”

- Account Specialist at CCHIE

Through the notification service offered by the HIE, the provider organization can identify individuals who may need education on the healthcare system and help them acclimate to
the broader US healthcare system, lessening the burden these individuals place on expensive ED visits. Another example of these HIE services can become emergent use cases is how individual physicians can use updated records to self-assess the quality of the care they offer.

“The emergency room physicians said that he appreciated being trained on access the community health record is because they transport patients a lot to one of the other facilities and as [the physician logs] on there after the patients gone and the patients received care at the other facility because [they] want to know if [they] treated that patient appropriately for transport”
- Management at CCHIE

These use cases increase the value proposition of the HIE, and increases the amount of information that can be shared on the network as more healthcare providers join the network. The start of a virtuous cycle, however, has proven to be a challenge for many HIEs, as the investment requirements of HIE systems needs to cover both the operational costs as well as reinvestment costs to keep the HIE system current, and getting that initial data and subscription funds flowing has proven challenging.

“[T]he ongoing cost of the system and the fact that we needed to upgrade the technology which was a significant capital expenditure requirement, it just meant that the system was no longer needed, so we had to go through the process of shutting it down, essentially that involved notifying all the constituents, the stakeholders that the system was going to be terminated and developing an action plan to make sure the system was brought down in a safe and secure manner.” - Management (post-closure) at WNC Datalink
“[W]e’re connecting entities quickly and particular physician practices but there’s not a lot of data flowing, there’s not a lot of usage yet because a lot of the data that the practices want will be coming from the hospital. We’re still in process in the on boarding majority of our hospital participants right now.” - Management (under CCNC) at NCHIE

The value creating mechanism that links the data shared with the HIE, the services the HIE can offer, and the use of those services by healthcare providers drove the number of transactions that were reported to ONC. This mechanism clearly shows where board members from healthcare providers, IT vendors and HIEs can impact this process, while also allowing for an understanding of how differing SHIECAP strategies can promote or hinder this mechanism.

After the phase of HIE use where HIEs exclusively provide data exchange services lies the next goal of HIEs, analytics. This is a phase where HIEs either have or enable access to nearly comprehensive patient data in a wide geographic area, and then can begin to better understand the health of the community under their care. The value of these resultant analytics is the primary goal for many of the HIE sustainability efforts. Few have neared this goal, and there are significant hurdles regarding patient record privacy and security that still need to be addressed. Currently, there is a lot of interest in this topic, but analytics are not currently in widespread use in North Carolina.

“It is phenomenal and it is only going to get bigger and bigger when folks start talking about analytics. That’s kind of phase two after you bring all the data in and get everybody connected figuring that out is going to be a lot harder than just getting folks connected considering all the different sources of information” - Management (pre-closure) at WNC Datalink
This future of analytics is going to fundamentally change which metrics will be appropriate to assess the performance of HIEs. The boards constructed and strategies implemented to craft this future evolution of HIEs may be drastically different from the boards and strategies captured in this study, but it will still be important to capture how those metrics were created to better understand how those boards and strategies affected that mechanism.

5.3.4 Summary of the North Carolina Case

The analysis of the North Carolina Case developed the three models presented in the preceding sections. Each of these informs specific aspects of this study’s interest in the relation between boards, strategy and performance. While each of these models have significant implications to theory that are discussed in Chapter 6, the most pivotal result from this Case is the operationalization of strategy. The stark difference between HB 834 and Orchestrator strategy that ONC identified shows a clear need to capture strategies in practice rather than planning and to use a taxonomy of strategy that differentiates across resource requirements. While this is a fairly obvious maxim, it is still shocking that the operationalization of a strategy can flip a State’s organization from decentralized collaboration to draconian centralization, and that the differing strategies captured by ONC may actually require the same sets of resources. This is discussed in more detail in the following sections and Chapter 6.

5.4 Synthesis of The SHIECAP and North Carolina Case

This section reconnects the North Carolina Case to the SHIECAP Case by discussing the implications of each of the results of the quantitative analysis of the SHIECAP Case through the lens of the models described in the North Carolina Case. Specific implications for Resource
Dependence Theory’s focus on the relationship between boards, strategy and performance are discussed

5.4.1 Board Size and Composition aligning with Strategy

According to Hillman et al. (2000) and Goodstein et al. (2004), there should be a relationship between Strategy and Board Size (Research Question 1), and between Strategy and Board Composition (Research Question 2). However, the SHIECAP Case did not find evidence of this link. From the analysis of the North Carolina Case, there are two perspectives that help to explain why this link is not the case. First, as the Community Collaboration for HIEs show, there are a large number of organizations that need to collaborate to accomplish the goals of SHIECAP, but these organizations are not strongly unified or regimented as is normally found within the organizations that Hillman et al. (2000) and Goodstein et al. (2004) studied. In SHIECAP, the coordination burden is significant but it does not appear to have been assumed by any organization aside from the State Government of North Carolina. This leads to the second explanation for the lack of a link between boards and strategy, the Operationalization of Strategy.

As was mentioned in the previous section, there are two perspectives on strategy that explain this lack of a link. First, in North Carolina there was a marked deviation from stated strategy, as the State enacted a Public Utility-fostering action instead of an Orchestrator-fostering action. If other States had similar deviations between the SHIECAP Plans and the enacted strategy, this would weaken the validity of the strategy variable. Second, it is possible that the action-focused strategies that ONC captured did not require sufficiently different sets of resources, and therefore did not require differing board size or composition across the strategies.
5.4.2 Board Size and Composition predicting SHIECAP Organization Performance

A relation was found between Board Size and Composition with Performance in the SHIECAP Case, however this was limited only to the Query performance variable. This result was particularly interesting as Business Experts were negatively correlated with query use while Support Specialists were positively associated. This was corroborated as the North Carolina Case captured an interoperability challenge that was mitigated by increased IT organization involvement. This supported the positive association with Support Specialists, while also capturing conflicts within Business Experts, which supported a negative association. It is unclear from this data whether this negative association is due to intra-Business Expert conflict due to its larger size, increasing the likelihood of capturing a social conflict, or whether the increase in Business Experts that were served by local HIEs were able to form a faction on the board. Implications of this will be explored more fully in Chapter 6.

5.4.3 Strategy predicting SHIECAP Organization Performance

No relationship was found in the SHIECAP Case to support a relationship between Strategy and SHIECAP Organization performance. As was mentioned earlier in Section 5.4.1, the strategy variable may not capture the enacted strategy and the ONC’s strategy taxonomy might not capture differences in resource requirements.
Chapter 6: Discussion

This chapter discusses implications from the results presented in Chapter 5 for both Resource Dependence Theory and practice. The first section focuses on the implications of the SHIECAP Case, specifically focusing on the link found between boards and performance. The second section discusses the challenges in defining boards, strategy and performance and capturing their interactions from the North Carolina Case. The third section discusses the synthesis of these two perspectives, highlighting the value of investigating Resource Dependence Theory using a mixed-methods approach. The fourth section shifts focus from theory to practice and discusses implications from this research as a whole to both statewide and local HIEs. From that point the Chapter moves from discussing implications to discussing limitations and future work.

6.1 Implications for Resource Dependence Theory from the SHIECAP Case

The SHIECAP Case found a significant relationship between boards and performance but failed to find a relationship with strategy. The nature of the board predicting performance is particularly interesting to theory, as it sheds light on the interactions between Hillman et al.’s (2000) director labels (Insider, Business Expert, Support Specialist, and Community Influential), and the established interaction between board size and composition (Insider/Outsider) and performance (Pfeffer 1972). On the other hand, the lack of a significant relationship between strategy and either board characteristic, size or composition, or performance is also interesting as it raises questions about the validity of this approach to capturing the strategy variable. Taken as a whole, the major implications of these findings were (1) that board characteristics (size and composition) and strategy were aligned to differing facets of the environment, (2) that the effect
of board characteristics on performance varies greatly over differing metrics, and (3) that ONC’s strategy classifications may not capture strategies that discriminate on resources. Each of these is described in more detail below.

6.1.1 Board and Strategy Alignment

There were no significant differences in the boards across differing strategies. This result was consistent across a measure of board size, as well as both measures of board composition: Insider/Outsider and the more detailed Insider, Business Expert, Support Specialist, and Community Influential. This disconnect is of note as the measures of boards and strategy were found to be significantly related to differing variables in this study. The strategy variable was strongly related to State population, which made intuitive sense as the operational challenges facing data exchange in large States differ from those of small states. There are three interpretations of this result: (1) strategies are not distinct in practice, (2) strategies and boards were designed to solve different problems, and (3) the large amount of collaboration to enact any of these strategies made the resource needs of the strategy similar.

First, similar to Weiner and Alexander’s (1993) result from their study of strategic differences in hospital boards, this study is shows that the ONC’s SHIECAP models are idealized rather than discrete strategies as 23 out of the 44 States included in this study used hybrid models, implementing two out of the four strategies. Follow-on tests were conducted to see if a breakdown of the four strategies into two groups that minimized overlap would garner a significant result, but none was found. The implication of this is that there were no appreciable differences across the strategies, and therefore these strategies did not require differing boards of directors.
The second explanation builds on Pearce and Zahra (1992) and Hendry and Kiel (2004) and focuses on the selection of strategy. As these strategies were derived from the SHIECAP plans, it is possible that the strategies were designed to fix a material problem within the State (such as lack of broadband access, lack of Meaningful Use attestations, or lack of data exchange availability), while the boards were designed to solve more social or agency-based problems. Hendry and Kiel (2004) supports this view, as the relationship between the board and the organization can vary in terms of the board’s control of financial resources and strategy. If these SHIECAP boards were designed to have little control, then there was little need for the alignment between the boards and their SHIECAP organizations. Despite this, both Pearce and Zahra (1992) and Hendry and Kiel (2004) assume that boards are strategically developed over time as the organization faced numerous challenges (Simmons 2012), while the boards of these SHIECAP organizations are new, the predicted alignment may yet to be developed.

The third explanation builds on collaboration in data exchange (Vest and Gamm 2010; Yaraghi et al. 2013), which demonstrates that HIEs require the collaboration of numerous organizations to operate. The strategies detailed by ONC focused on this collaboration, and it is possible that this required collaboration significantly aligned the specific resource needs of all strategies. This then required all boards to gather legitimacy and expertise in unifying large and devolved groups.

The implications of these three explanations to Resource Dependence Theory are the same however. Similar to Daily et al.’s (1999) finding that the “Insider” label was often used with little consistency and that there needed to be a clearer definition of these categories, there needs to be a clearer definition of the resource needs of differing types of strategy that can clearly capture the relationship, if any, between these strategies and the board of directors. In this work we’ve identified three aspects that could clarify this relationship.
First, there needs to be a better approach to capturing strategy that clearly identifies the resource-focused differences and overlap between strategies. Pearce and Zahra (1992) identified Grand Strategy (partially, only Internal Growth and Retrenchment), Diversification Strategy, and Leverage Strategy, as significantly effecting board size and composition. Young et al. (1992) found a similar effect across hospitals’ prospector, defender, analyzer and reactor strategies. In contrast however, Weiner and Alexander (1993) did not find a relationship across philanthropic and corporate organizations (1993). Out of these three studies Pearce and Zahra’s (1992) study stands out as diversification and leverage strategies have the clearest definition or resource requirements, whereas Young’s study focuses on the organization’s relationship with it’s environment, and Weiner with the organization’s structure. Due to this extreme variability in focus and results and the lack of a relationship with ONC’s action-based strategy I propose a resource-based view of strategy. Table 6.1 provides a matrix to map action-based strategies onto resources that can then be better mapped to observed board memberships.

<table>
<thead>
<tr>
<th>Resource Types</th>
<th>Material</th>
<th>Decision Support</th>
<th>Agency-Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessible</td>
<td>Data</td>
<td>Expertise</td>
<td>Trust</td>
</tr>
<tr>
<td>Physical</td>
<td>Analysis</td>
<td></td>
<td>Goodwill/Influence</td>
</tr>
<tr>
<td>Financial</td>
<td>Information</td>
<td></td>
<td>Control</td>
</tr>
</tbody>
</table>

Table 6.1: Resource Matrix

Table 6.1 shows a 3-by-3 matrix of resources that transition from concrete, material resources, to information/expertise-based resources that assist with decisionmaking through to more abstract resources that manage the alignment of external interests with the organization. Within each of these resource types, resources are separated by how the strength of the organization would interact with those resources. This interaction can be through native development within the organization, obtainable through contracting or merely accessible through more tenuous and temporary means. The difference between resource types and access as it impacts Strategy and
the Board of Directors can be illustrated by comparing what is meant by “data” and “information” in this table. First, let’s take the example of the Orchestrator Strategy. To coordinate all of the differing efforts, the strategy requires data on every group’s EHR system, and general disposition on HIE. This list of data is valuable to the strategy only if that data can be made into actionable information either through an overt analysis process or through an individual’s expertise. In this manner you can view the Material resources like inputs, and decision support as outputs. The third type of resource focuses on social resources that will enable or constrain the organization’s decisions made and actions taken. By mapping all four strategies ONC identified, similar patterns of resources are required, even though the physical assets and goals of each strategy differ.

Looking from the second perspective, the board, there are organizations like Local HIEs that have the community connections to pull in the data required for the Orchestrator strategy, but may lack the statewide perspective an organization like NCHICA would have to transform that information into useful information. Then organizations like CCNC and the State Government can use their Goodwill and Control over large segments of the healthcare community to guide the organization based on that information.

Second, the co-development of strategy and boards needs to be better understood. Pearce and Zahra (1992) established that boards aligned with their strategy, and Young et al. (1992) established that this alignment leads to increased performance but the coevolution of boards and strategy is little understood. By using tools to better understand the flow of this evolution we could better understand more specific questions such as whether HB 834 was the result of strong government involvement on NCHIE’s board, or if that board was crafted to have the resources to influence such an action.

Third, the collaborative requirement of these organizations may supersede other resource requirements. This would shift the pattern of resource requirements to the right in Table 6.1. Currently there is little resource dependence research on the effect of collaboration or diffusion of
control. Boards that bring cohesion and harmony of operations to the organization’s community may be easily mis-cast as on that Hendry and Kiel (2004) introduces that is removed from the management of the organizations financial or strategic control and rubber-stamp the decisions of the top management team. The strong collaborative needs of these SHIECAP organizations may have diffused the boards focus from internal actions to external management. Disambiguating these collaboration-focused boards from ineffective rubber-stamping boards is not currently a simple task.

6.1.2 Board Predicting Performance

Both board size and composition were found to predict query transactions but neither predicted directed-messaging nor eprescribing. The positive association of Support Specialists and negative association of Business Experts in those predictive models are particularly interesting. The lack of a relationship with directed-messaging is not surprising, as healthcare providers have a predilection for directed-messaging as it is similar to prior data exchange methods they already use (Campion et al. 2012) while Surescripts’ dominant eprescribing market share (95%) explains SHIECAP boards lacking a significant effect.

With query transactions, however, the positive association of Support Specialists upholds findings from Jones et al. (2008) that found that the inclusion of Support Specialists (focusing on lawyers and bankers) greatly increased several performance metrics. This work is in contrast to both Jones et al. (2008) and partly to Kroll et al. (2007) that found a positive association with performance from Business Experts and Support Specialists. Kroll et al. (2007) further divided the Business Expert label into two activities: Advice and Monitoring. Kroll found a positive relationship with advice-giving Business Experts, and a negative relation with monitoring Business Experts. It is important to note that both of these studies used the board proportion of
Business Experts and Support Specialists, so the results are not concerned with overly large boards as a limiter on performance (Goodstein et al. 1994). As this study found a significant relationship both in the size and proportion of Business Experts and Support Specialists, there are three conclusions that can be drawn.

First, as Business Experts are large in terms of size (roughly 10 members per board, and consistently representing over half of the board of directors), it is likely that coordinating over that large of a body is diminished by the ability of the board to take concerted action (Goodstein et al. 1994), and that their proportion on the board is ill-aligned with the resource needs of performance. The potential for Business Experts to be taking Kroll’s monitoring roll is also a possibility and discussed further in section 6.2.1, which discusses the implications for the board from the North Carolina Case.

Second, Support Specialist, defined in this study as legal, financial, and technical consultants, are small in size (roughly 2 members per board and consisting of 10% of the board composition), but as this group includes legal and technical consultants, they are significantly capable of assisting in navigating the legal barriers to data exchange as well as the significant technical hurdles of facilitating data exchange across non-interoperable EHR systems.

Implications for Resource Dependence Theory from these explanations are threefold. There is a need for a better understanding of the alignment of Hillman’s board composition to the roles these groups play on the board, as the resources these groups bring vary significantly. There is a need to capture the alignment of the board to the needs of performance to better assess the performance results, and there is a need for a more operationalized mapping of board members to Hillman’s board composition. This work provides three contributions to solve these problems. (1) This work clearly identifies and describes the roles that each of the organizations is perceived to play as this work constructed my metrics for board composition (illustrated in Table 5.10). (2) This work showed that of these three performance variables, the board only showed a significant
relationship with those that were not already identified as accepted from prior research (Campion et al. 2012) and industry standings (Surescripts). (3) This work provides a clear categorization scheme, demonstrating which organizations mapped to which board categories, this will provide future researchers with a reproducible method for capturing board composition from this industry space (see Table 4.4).

6.1.3 Strategy Predicting Performance

No relation was found between the strategies defined by the ONC and performance. This is in contrast to board size and composition that have a significant relation to performance, though the strength of that relation is weak. Aside from the issues that were already discussed in Section 6.1.1, there are four explanations for this lack of a link. First, the strategies captured by ONC do not differentiate based on resource requirements. Second, the goals of the Strategy are not well-aligned materially with the performance metrics I captured. Third, the results of the strategy are not well matched temporally with my metrics, and fourth these strategies were simply ineffectual. These are significant issues consistently discussed in the HIE literature (Hripcsak et al. 2013; Vest and Jasperson 2010; Wilcox et al. 2006), but the resource dependence literature rarely investigates the connection between strategy and performance. Due to the inconsistent methods of capturing strategy and the unclear differences in resource requirements across those strategies, it is understandable that strategy variables are not widely used within Resource Dependence Theory.

The first explanation implies that Elevator, Capacity Builder, Orchestrator and Public Utility Strategies all had similar resource requirements. While the building of directed-messaging capability among healthcare providers appears to require different material resources than developing a statewide HIE, it is possible that social and expertise resources are common and
critical to both strategies. This would serve to build on Weiner and Alexander’s (1993) results that found that idealized strategies were often not ideally implemented in practice, but shifts the implication of this result to the validity of the strategy variable as a proxy for a differing portfolio of resource requirements.

The second and third issue both signify that the effect of the strategies were not captured in the performance metrics. This can be due to the strategies not enabling or motivating use of HIEs after adoption, as is the case with Direct, or to the effect of the strategy being significantly delayed, as is the case with Capacity Builder. Because there were no differences across the strategies in terms of performance, I can only conclude that they are all equally influential in terms of performance, though that influence may have been 0.

There is little implications for resource dependency theory from this result, aside from adding to the implication stated above that there is a need for a more granular understand of strategies, and how they impact, not only boards, but also performance. This is discussed in more detail in the next section.

6.2 Implications for Resource Dependence Theory from Qualitative Results

The North Carolina Case had three major findings that help to inform Resource Dependence Theory. These were the model of Community Collaboration for HIEs that helps to define the alignment of the board to the organizations in its functional environment, the model of operationalizing strategy that identified a key variable in capturing strategy and its resource requirements, and the social mechanism of use which helps identify how to approach use in a context like SHIECAP where the control over performance is low. The implications and contributions of each of these to theory are included in the sections below.
6.2.1 Community Collaboration for HIEs

The main result of the Community Collaboration for HIEs is to identify those organizations in North Carolina’s community that have a direct impact on data. Section 5.3.1 identified key organizations and organization types that enabled data exchange in North Carolina’s healthcare community and mapped them to the resources they brought to their HIEs. The implication of this organizational mapping was (1) to better identify sources of board members and resources within the community and (2) to better align the board with both strategy and performance.

This identification is key as Veronesi et al. (2013) described the importance of including Business Experts from functional areas of the organization as these individuals bring legitimacy as well as practical knowledge of the services of the organization (Mannion et al. 2015; Veronesi et al. 2013). As described earlier, the inclusion of Support Specialists and the correct Business Experts are significant determinants of performance (Hillman et al. 2000; Jones et al. 2008; Kroll et al. 2007). This aspect from Kroll et al. (2007) of the correct Business Experts is particularly important, as misalignment between the board and its community leads to lower performance (Young et al. 1992). The Community Collaboration for HIEs identified several organizations that were absent from NCHIE’s board and several key resources that were not garnered by NCHIE’s board. This absence captured a specific misalignment between the NCHIE board and its organizational community, highlighting the abstract resources that need to be garnered by the board, not just the distracting material resources.

The contribution to theory from this result is to identify a need, not only from the functional perspective as the strategies identified, but also from the more abstract social and inter-organizational perspective. It is evident from NCHIE that a stronger alignment to the functional areas identified in the ONC strategies moved the board away from other pivotal social and
informational resources like neutrality between healthcare providers as NCHICA promotes.
Incorporating an assessment of the board using a matrix similar to Table 6.1 may assist in clarifying the resource needs of the organization.

6.2.2 Operationalizing Strategy

A key result from the North Carolina Case was the identification of Operationalizing strategy as a confounding factor in connecting strategy, both to the board and performance. In operationalizing the Orchestrator Strategy, North Carolina’s House enacted a bill that mandated participation in NCHIE, undercutting the business model of local HIEs. This bill further disrupted HIEs as to connect through NCHIE would force the local HIEs to pay for duplicated service when at that time there were few digital assets behind the service (at that time). The important implication of this result is, that for Resource Dependence Theory, strategies can fundamentally change based on the manner in which they are operationalized.

This aspect of operationalization is missing from Pearce and Zahra’s (1992) analysis of the fit between boards and strategies; Weiner and Alexander (2004) discuss the need for more operationalization of strategy terms, but do not capture this operationalization. This work shows viscerally that a shift from a collaborative approach to a more draconian approach causes significant uncertainty and pushback within the community and lessens the trust that is necessary for data exchange to be successful. The contribution of this model to Resource Dependence Theory is to show that the operationalization of strategy can drastically affect legitimacy concerns of new efforts.
6.2.3 Social Mechanism of HIE Use

The North Carolina Case showed that “Use” is developed from a mechanism where the participating provider transforms Services offered by the HIEs into use cases, and as this use increases more healthcare providers participate in the HIE, thus increasing its value and the value of their services. This mechanism informs how boards and strategy influence performance, and in general shows how the performance variable is created.

The main implications to Resource Dependence Theory of this model are twofold. First it helps identify where the functional experts on HIEs may be found within user organizations and within HIEs. Several studies in healthcare have shown how increasing the members of the board who understand the functional processes of the organization increases the performance of the organization. Mannion et al. (2015) and Veronesi et al. (2013) showed how the inclusion of physicians on Hospital board increased their care outcomes, and this model helps inform identification of potential board members who understand and can facilitate this process. The second implication is in identifying the core resource that HIEs must have to be successful: data. This may seem like an obvious statement, but much of the HIE literature and the Resource Dependence Literature focuses on usage, co-optation, and participation, when the key resource for HIEs is simply data.

6.3 Implications for Resource Dependency Theory from Combined Results

Individually, the SHIECAP and North Carolina Cases show fairly directed results on specific aspects of Resource Dependence Theory. However, when they are combined, they show a much more powerful picture from the Resource dependence perspective of the mechanisms that relate boards, strategy and performance in this context. Specifically, these implications come
from three topics: Performance in data exchange contexts; Collaboration in data exchange contexts; and the potential limits of co-optation in board membership. First, performance in this study was operationalized as three variables that indicated the use of data exchange services. This is vastly different from Kroll et al. (2007) and Pfeffer’s (1972) operationalization of performance. The implications of this difference is that performance variables based on metrics other than financial data can also be applied to Resource Dependence Theory with positive results, opening up new and interesting avenues of research into service utilization and system success. Second, collaboration in data exchange highlights a central theme in the results connecting the board to strategy, its environment and its performance. There is little possibility for control, which recasts ideas from Hendry and Kiel (2004). Third, the consistent negative coefficient on Business Expert size and proportion of the board, when combined with the mistrust developed in the operationalization of strategy in North Carolina, begins to show that there may be limits to the co-optive power of boards. Each of these is discussed in detail in the following sections.

6.3.1 “Performance” in data exchange contexts

Applied in the SHIECAP Case, and drawn from the data of the North Carolina Case, this study has focused on the use of data exchange services as a measure of performance. This is vastly different than the majority of resource dependence research which focuses on financial metrics (Gales and Kesner 1994; Zahra and Pearce 1989), but the financial benefit of a data service is rarely readily available, though some have attempted to forecast the potential cost savings of these services (Frisse et al. 2012; Vest et al. 2014).

Through this lens, the result that board size was indicative of query-base performance is particularly interesting as there was no relation to the directed-messaging transactions, even through they go through the same model of HIE use. While this is partially explained by Campion
et al. (2012) who found a significant preference among healthcare providers to use directed-messaging over query systems, it shows that the board had a different effect on directed-messaging than on query-based messaging. This is important for Resource Dependence Theory for two reasons. First, as both of these systems are used simultaneously, it would be particularly difficult to distinguish from which side financial performance was derived, which makes high-granularity data use metrics like the ones used in this study very valuable for theory. Second, this difference potentially shows a closer alignment between the board and query-users/promoters than with direct promoters. Being able to parse these differences will be pivotal for further research applying Resource Dependence Theory to this context.

6.3.2 Collaboration in data exchange contexts

The relationship between the board, strategy, and performance in SHIECAP organizations is less direct than those in other organizations studied by Resource Dependence Theory. For a SHIECAP Organization to be successful, there needs to be significant collaboration across healthcare providers, EHR vendors, HIEs, payors, and governmental organizations. If any of these organizations does not collaborate there are significant repercussions, as is apparent from HB 834 in North Carolina. Due to this, the amount of control that an individual board has, or that an individual strategy can enact, is significantly diffused through the community before the performance metrics can be affected. In this manner, SHIECAP Organizations are necessarily collaborative, not insular (Hillman et al. 2000; Kroll et al. 2007).

This is a significant area for growth within Resource Dependence Theory, as informational networks like these data exchanges in Healthcare begin to create new resources that will be required to measure new interdependencies that did not affect the traditional organizations covered by the theory. This collaboration-focused model further develops capabilities of the
theory to explain larger arrangements of organizations, but it also has its risks as is discussed in the following section.

6.3.3 Potential limits of co-optation in board membership

A core tenet of Resource Dependence Theory’s focus on boards of directors is that board membership co-opts a member’s resources and interests, aligning them with the board (Hillman et al. 2009; Pfeffer 1973). This is used as a tool to access material resources, and also to manage external dependencies by removing a potential detractor through including their voice in strategic decisions (Hillman et al. 2009). As mentioned in Chapter 3, there are limits to this co-optation as boards can become large enough to detract from strategic actions (Goodstein et al. 1994), but in combining the SHIECAP and North Carolina Cases, there appears to be a similar effect when a segment of the board grows too large. This is shown in the negative effect of Business Experts on performance. When this is combined with the pushback shown in the North Carolina Case, this provides a new potential limit to the co-optive power of the board. This limit is faction formation, where a board has tried to co-opt a necessary segment of its community, but that segment’s share of the board was large enough to counteract the consensus-seeking co-optive power of board membership. In this manner, it appears that SHIECAP boards’ share of business experts failed to align their interests with the SHIECAP organization, and instead had that faction of board members attempt to align the SHIECAP organization to their faction’s interest.

6.4 Implications for Practice from Results

There are three main implications from the SHIECAP Case and the North Carolina Case that would be beneficial for other States that are still expanding their efforts. My goal in this
section is not to repeat industry-standard maxims like “develop a sustainable business model,” “plan to transition from grant funding,” and “develop transparency and trust with your stakeholders,” but to instead share unique and interesting findings that were developed through this study and shared with by my participants. First of these is the concern over co-optation raised the prior section. It is of paramount importance to align efforts of the community toward promoting data exchange. While buy-in is an important aspect of this alignment, HIEs need to make sure that they are not unbalancing their efforts and allowing their organizations to be co-opted by uncooperative board members. Second is the focus on developing a growing business model as the value is not in the services the HIEs offer but in the data they have access to and what they can do with it. Third is to understand the virtuous cycle of use. Each of the HIEs in the study at some point struggled with or witnessed data access issues.

6.4.1 Board Membership Challenges

Many HIEs have failed due to lack of buy-in (Vest and Gamm 2010), and while bringing a resistant organization in as a leadership role is one way to develop their buy in, it is particularly risky. There is still significant pushback against data sharing across network boundaries (Furukawa et al. 2014), and as the North Carolina Case shows the leadership of an HIE has significant power over the operations of the organization. Yeager (2014) highlighted the need for champions of the value of HIE. The North Carolina Case echoed this perspective in their discussion of the provider who was convinced the HIE was a part of Obamacare, and eventually, that an individual voluntarily asked to participate with that HIE after the value was shown in the practices that that the individual interacted with. The focus on adding benefit to the community is a much more powerful and consistently positive tract than co-opting recalcitrant healthcare providers.
6.4.2 Challenge of Developing a User-centric Business Model

While developing a viable and sustainable business model has been a common suggestion among HIEs for decades, the North Carolina Case shows interesting best practices. First, focus on developing the region and showing value for all practices within the region. Second, plan for upgrade costs prior to them becoming necessary. Third, focus on developing value-added use cases with your practices. Each of these best practices allowed an HIE to withstand significant external pressures, or contributed to their closure if they did not plan for these practices.

6.4.3 Virtuous Cycle of Use

While the link to clearly improved health outcomes is unclear on the national level, the mechanism that drives continued use of HIE services is clear from the North Carolina Case. The self-reinforcing cycle between the HIE and its user will drive HIEs toward sustainability, but only if HIEs value the data within their systems as a strategic asset that brings further value to the Healthcare hand the HIEs as they are used.

6.5 Limitations

There are four core limitations of this study: the availability of granular data on strategy, the availability of longitudinal transaction data, the programmatic nature of SHIECAP, and the unknowable “need” for an HIE. The first limitation is the available data, on strategy and performance as both of these datasets apply to a very narrow time period and the quality of these datasets is outside the control of the researcher. As was mentioned in Chapter 4, most of the strategy codes were identified by ONC as “broad illustrative models” that would later be
operationalized to fit local conditions. This was recognized even as the ONC classified these strategies.

“As plans are approved and activities move from planning into implementation and evaluation phases, it is evident that multiple approaches are being used to achieve program goals. The variety of models reflects that each plan is tailored to the existing capacity, exchange patterns and market conditions in the state.”


As these strategies were not mutually exclusive and were potentially operationalized differently, the results on strategy from this study cannot be translated beyond this current context.

The second limitation is the availability of transaction data. This data was collected by ONC from voluntary submissions made by each State’s SHIECAP organization, and without supporting documentation that included documentation of the States’ collection or reporting methodology; it is difficult to translate these findings to the States that did not submit transaction data.

The third limitation is the programmatic nature of SHIECAP. While SHIECAP provided a unique and revelatory opportunity to study the implications of Resource Dependence Theory, HIEs existed prior to SHIECAP and some States were significantly better prepared or had a significantly more technologically adept healthcare community. As there was no baseline longitudinal data across the states, this effort captured the effect of SHIECAP on HIE use over the period between 2009 and 2013. Due to this, it is uncertain which challenges were surmounted by States that participated in prior Federal efforts like the Health Information Security and Privacy Collaboration (HISPC), or which were surmounted by inter-state collaborations like that between CCHIE and Carolina’s Health System and skewed my data.
The fourth limitation is the unknowable “need” for HIEs. This research did not capture the underlying topography of patient healthcare utilization overtly. This work assumed that the HIEs in operation had strategically placed themselves so that they captured a logical segment of the population where there was little patient crossover with organizations in its local area. The secondary aspect of this pertains to my discussion of the HIE cycle of use, and points to the use of HIE to replace an organization’s EHR. By this I mean that the provider uses the HIE’s services to augment their use of their own data without really leveraging data held by other healthcare providers as there may be very little crossover outside of that healthcare providers practice.

6.6 Future Work

There are five major topics of future work that would augment this study. The first four of these map to the limitations of this current study: capturing strategy from a Resource Dependence perspective, designing an unobtrusive method to capture HIE use, a historical study of HIE-promoting efforts in each state, and mapping patient crossover across each state. The fifth study is a replication of the North Carolina Case across several states to see if similar ecologies of organizations are present and if similar tensions develop.

As was mentioned in the limitations section, the Strategy distinction used in the study could be significantly refined by developing a mutually-exclusive coding scheme for strategy based on the stated approach in the SHIECAP Plan coupled with the State’s current approach. This could potentially show a different between the outcomes of each strategy that eluded this effort.

The second study focuses on creating an unobtrusive and transparent reporting mechanism to track HIE use. This dataset would be invaluable for future research on HIEs, and
would be a non-trivial problem to deploy across the differing modes of HIE while keeping the system HIPAA-compliant.

The third study focuses on identifying the HIE experience of each state to develop a better understanding of the starting conditions of each HIE. This will serve HIEs to better understand the effects that their actions had in excess of the environmental hurdles and boons they inherited from prior efforts.

The fourth study is a hybrid of the prior two studies, relying on data that would require connecting with every care provider in a state to identify the volume of records they receive and request in a given period. This data would be compared with the volume of records they send to create a general map of areas with high patient crossover, and then comparing those results to the geographic span of HIEs and healthcare utilization would garner interesting results irrespective of the outcome.

The final study is a replication. As interesting and vibrant as North Carolina is, the tensions and connections identified in that state need to be replicated in another state context, to either confirm or extend the findings found in this dissertation.
References:


Appendix A: Historical Approaches to HIE (1980-2009)

Interest in HIE began in the late 1980’s as IT’s potential for cost reduction and quality assessments caught hold of the healthcare community. This interest spurred the Hartford Foundation to create the first organizations to offer HIE as a service. While some current efforts can trace their organization’s existence to these early efforts, almost all of these organizations failed due to a lack to financial sustainability, a lack of community buy-in due to security, competitive, and political concerns (Vest and Gamm 2010). There have been three major “waves” of interest in HIE, each with their own distinct approach. This section will cover these approaches chronologically beginning with the Community Health Management Information Systems (CHMISs), followed by Community Health Information Networks (CHINs) and concluding the approach that directly preceded and was incorporated into SHIECAP, the Regional Health Information Organizations (RHIOs) (Joshua R. Vest et al. 2013).

The earliest wave, CHMIS, began in the late 80’s and continued through the early 90’s. This approach was typified by regional, patient and payor-led, centralized databases of health records. These organizations developed and implement technology that had not existed previously, facing the technical challenge of integrating disparate data sources and the social challenge of changing the psychology of the industry from firm-focused competition to care-focused collaboration (Stark et al. 1996). This quickly led to obscenely high technology costs, and stringent pushback from both providers and patients. Providers were concerned with the personal and competitive liability of sharing data, while patients needed more control over how their information could be used and distributed (Vest and Gamm 2010). It is understandable how these concerns over data use quickly led to legislative action in 1996.

These organizations were the predecessors of current Health Information Exchanges (HIEs), which offer the service and cause significant confusion as a term of reference.
Existing during the late 90’s, CHINs responded to providers’ liability concerns by adopting decentralized networks in their approach to sharing health data (Zinn 1994). While this decentralized approach lessened community concerns, these efforts still struggled to justify their financial benefit. Specialized health IT vendors helped lower development costs, but the basic value proposition of HIE had yet to be clearly proven. Despite easing the technological challenges faced by the preceding CHMIS, these vendors increased the social challenges of establishing HIEs. Vendors would strain efforts that attempted to share data with partners who adopted a competing vendor’s solution (Vest and Gamm 2010). These challenges were insurmountable by the CHINs and resulted in their failure. A groundswell of public interest and significant political support rekindled interest in HIE and helped to navigate these competitive interests. This groundswell resulted in the Agency for Healthcare Research and Quality (AHRQ)’s funding of the Health Information Security and Privacy Collaboration that greatly shaped the CHINs successors.

RHIOs succeeded CHINs in the early 2000s as the main HIE approach. RHIOs differ from CHINs and CHMISs by relaxing almost all prescriptions on who should manage the organization, what the business model should be, where the data should be stored, and for what purpose the HIE should be employed. This allowed for significant diversity across RHIOs, but allowed for HIE, potentially, to be more closely aligned with the local environment. Despite this potential, RHIOs faced significant attrition, due to challenges in transitioning from grant funding to community-based funding (Morris et al. 2012), and due to adoption challenges (Gadd et al. 2011; Myers et al. 2012). Prior to SHIECAP, the RHIOs in existence were few and served very limited populations. There were notable exceptions that surpassed most RHIOs however in New York, Michigan and Massachusetts, and these efforts helped shape SHIECAP.
Appendix B: North Carolina SHIECAP Board (NCHIE)

Total Board: 24 members\textsuperscript{20}

- Insiders (4)
  - North Carolina State Senator
  - North Carolina State Representative
  - North Carolina Department of Health and Human Services
  - Henderson County Health Department

- Business Experts (11)
  - WakeMed
  - North Carolina Community Care Networks
  - North Carolina Community Health Center Association
  - UNC Health Care System
  - North Carolina Medical Board
  - North Carolina Medical Society
  - Old North State Medical Society
  - North Carolina Nurses Association
  - American Academy of Pediatrics
  - Blue Cross Blue Shield of North Carolina
  - North Carolina State Medicaid Director

- Support Specialists (4)
  - North Carolina State Health IT Coordinator
  - North Carolina Chief Information Officer
  - North Carolina Regional Extension Center
  - Larsen Allen, LLP

- Community Influentials (5)
  - NCHICA
  - UNC’s Department of Family Medicine
  - GlaxoSmithKline
  - Kerr Drugs
  - Labcorp

\textsuperscript{20} See Appendix D.4 for the excerpt from the SHIECAP Plan that lists these organizations
Appendix C: HIE Literature Review Process

C.1 Overview of Work

This work approaches HIE as a question of the evolution of organizational communities (Aldrich and Ruef 2009), and draws on Resource Dependence Theory (Hillman et al. 2009; Pfeffer and Salancik 1978) to frame the interdependence of HIE efforts on governmental and care-providing organizations. This section examines literature on HIE efforts, and organizes it to highlight the findings and areas of study. These are then contrasted with the SHIECAP organizations and argues for several research questions, motivated by the theories above, that investigate the gap between the actions of practice and the reviewed findings.

C.2 HIE Studies

Initial literature search was conducted via Web of Science, selecting first articles published since 2005 including the terms “Health Information Exchange,” “Regional Health Information Organization,” or “Health Data Sharing” as topics.21 “Health Data Sharing” was included as a term to broaden the search to include research which avoids the definitional challenges of HIE and RHIOs. 2005 was selected as a starting point for this review as that year marked the beginning of the Agency for Healthcare Research and Quality (AHRQ)- and ONC-funded Health Information Security and Privacy Collaboration (HISPC), the first Federal push to promote interoperable HIE. This initial search yielded 408 articles which were then limited to English-language articles published in conferences and journals with more than 10 electronically-available articles to assure that the source publication had a vibrant community to assess rigor and

21 The acronym “RHIO” was included in this search, but “HIE” was not as “HIE” results included many topics that were not pertinent to this effort.
validity within the context of HIE. This limited the number of articles to 126. The breakdown by title is shown below.

<table>
<thead>
<tr>
<th>Journal Title</th>
<th>Number of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal of the American Medical Informatics Association (JAMIA)</td>
<td>41</td>
</tr>
<tr>
<td>Int. Journal of Medical Informatics</td>
<td>25</td>
</tr>
<tr>
<td>Health Affairs</td>
<td>21</td>
</tr>
<tr>
<td>Journal of Biomedical Informatics</td>
<td>15</td>
</tr>
<tr>
<td>Journal of Medical Systems</td>
<td>14</td>
</tr>
<tr>
<td>Applied Clinical Informatics</td>
<td>10</td>
</tr>
</tbody>
</table>

Table C.1: Initial Breakdown of Articles by Journal before manual AMIA Search

As a significant portion of the resulting articles were from JAMIA, I conducted a manual review of JAMIA and AMIA’s Annual Symposium to identify potentially pertinent articles for this review. This review was conducted from 2009, as the initial search included few articles before this time. After removing duplicates, this addition increased the article count to 298. This new corpus was then culled to remove non-research articles such as perspectives and editorials; and research articles focused on HIT but lacking impact on HIE or the ecology that surrounds HIE in the US. This removed 109 articles. This process and the resulting articles are shown in the following figure and table:

Figure C.1: Flow of information through review process
These remaining articles were then reviewed and categorized for further decomposition. This initial categorization focused on the authors’ conceptualization of HIE. “Ecosystem” studies were those that conceptualized HIE as an inter-organizational service between many types of organizations. Then there were the articles that focused on specific organizations. “Use Cases” focused on the effects of HIE use and the nature of that use; “Implementation” which discussed the adoption of HIE services by stakeholders and the changes this brought to the organization.

The next categorization were those articles that focused on mediating strata between organizations. “Technology” discussed the design and development of technical solutions to the novel problems of HIE. “Perspective” discussed physician and patient perception/satisfaction with HIE; and “Privacy” captured those articles which specifically dove into the topic. These were then regrouped into the Network, Node and Link categories and were further decomposed into the sub-categories shown in the table below. This decomposition was done to highlight the difference in focus between HIE research at different scales of analysis and to avoid potential confusion due to inappropriate generalization of results across scales.

<table>
<thead>
<tr>
<th>Journal Title</th>
<th>Total</th>
<th>Pre-ARRA</th>
<th>’09</th>
<th>’10</th>
<th>’11</th>
<th>’12</th>
<th>’13</th>
<th>’14</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMIA Annual Symposium</td>
<td>89</td>
<td>NA</td>
<td>14</td>
<td>18</td>
<td>17</td>
<td>22</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>JAMIA</td>
<td>31</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Health Affairs</td>
<td>21</td>
<td>5</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Int. Journal of Medical Informatics</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Journal of Biomedical Informatics</td>
<td>15</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Journal of Medical Systems</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Applied Clinical Informatics</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>190</strong></td>
<td><strong>16</strong></td>
<td><strong>24</strong></td>
<td><strong>25</strong></td>
<td><strong>30</strong></td>
<td><strong>55</strong></td>
<td><strong>23</strong></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

Table C.2: Final Breakdown by Journal/Conference by Year, showing surge in interest at SHIECAP Mid-point (2012)
| Network (70) | Evaluation of Network Actions and Qualities (40) | Organizational Need | 17 |
| | | Measuring HIE | 8 |
| | | Network Growth | 7 |
| | | Use Drivers/Challenges | 5 |
| | | Sustainability | 3 |
| Description of Actors and Resources (30) | Federal-Level | 9 |
| | | State-Level | 19 |
| | | User-Level | 2 |
| Node (63) | Use Case (46) | Effects | 31 |
| | | Secondary Use | 5 |
| | | Patient Use | 4 |
| | | Models of Info. Flow | 3 |
| | | Challenges | 3 |
| Implementation (14) | Adoption | 9 |
| | | Workflow | 3 |
| | | SNOMED/LIONC | 2 |
| Link (57) | Underlying Technology (28) | Systems Development | 13 |
| | | Identifying Requirements | 5 |
| | | Implemented Tech | 4 |
| | | Analysis of Tech in use | 3 |
| | | Tech Architecture | 1 |
| | | Human Factors | 1 |
| | | Integration Study | 1 |
| Perspectives on HIE (20) | From Physicians | 10 |
| | | From Provider Orgs | 5 |
| | | Technology Use | 2 |
| | | Misconceptions | 2 |
| | | From Patients | 1 |
| Privacy (9) | | | 9 |

Table C.3: Breakdown of Articles by Topic Area
Appendix D: Inter-coder Agreement Procedure

Based on guidance in Campbell (2013), two unaffiliated researchers were asked to code unitized sections of State HIE Cooperative Agreement Program Plans based on coding guidance. Both researchers were asked to code the same set of plans, and were given the same guidance for the coding of both strategies and boards of directors. While the researchers were coding, they were able to ask the principle researcher clarifying questions and to discuss the material. Any discrepancies between the principle researcher’s initial coding and the unaffiliated researchers coding was discussed until agreement was reached. From these discussions three adjustments were made to the coding. First, “Elevator” strategies were extended to those states, which aggressively pursued Meaningful Use benchmarks. Second, “Medicaid” agencies and directors were moved from Public Health Organizations (insider) to Payor Organizations (business experts). Third, Pharmacy representatives were split into two groups: Pharmacists and their representatives (Business Experts), and Pharmacy Organizations (Community Influentials). The following pages show the documents used to develop this inter-coder agreement, beginning with the coding guidance (Appendices D.1 and D.2) and materials for identifying Strategy and Board Composition from the SHIECAP plans (Appendices D.3 and D.4). As was mentioned in Chapter 4, the strategy excerpts in section D.3 are derived from the SHIECAP plan, whereas the board memberships are derived from the SHIECAP plan, State Regulation, or Archival records.
D.1: Intercoder Agreement Document - Strategy

SHIECAP Organization Strategy Primer (quoted from *State HIE Strategic and Operational Plan Emerging Models*)

**Elevator Strategy:**
“[S]tates that employ an initial, focused effort to rapidly enable simple interoperability through directed exchange to ensure providers have an option to meet meaningful use (MU) in 2011. A key component of this model is the development of Health Information Service Providers (HISPs) to facilitate directed exchange services across the entire state and directory services to support care summary exchange across providers.”

**Capacity-Builder Strategy:**
“[B]olstering existing exchange capabilities through financial and technical support or incentives. The distinct difference between the Orchestrator and the Capacity-builder model is the Capacity-builder’s early focus on enabling—through financial or technical support—existing or developing exchanges to support their local regions or communities rather than connecting them through state-level services.”

**Orchestrator Strategy:**
“[A] thin-layer state-level network which facilitates HIE transactions across existing sub-state exchanges, forming a network-of-networks. It is distinguished from the Capacity-builder model in that it focuses on the creation of a statewide network (rather than on building capacity of sub-state nodes), and differs from the Public Utility model due to its primary focus on connecting existing nodes rather than providing “retail” HIE services directly to end-users or deploying a full-spectrum of centralized HIE services.”

**Public Utility Strategy:**
“[P]roactive state-led approach, founded upon a relatively robust statewide entity that has broad participation and support among stakeholders across the state; well-developed management and staff capable of policy development, business analysis, project management, and technology deployment; provision of retail services directly to end-users including individual providers and potentially patients; and strong policy and/or funding support from the state government or other stakeholders. This model differs from the Orchestrator model by focusing on the state-level entity as the central nexus of HIE activities in the state rather than being the coordinator of multiple networks. Resources are directed to launch or expand upon a state-level infrastructure that centrally handles/routes messages and provide shared services across existing HIE capacity (where it exists) as well as directly to end-users.”
**D.2: Inter-coder Agreement Document – Boards**

Board Composition Primer (quoted from Hillman et al. (2000))

**Insiders**
“[D]irectors who serve currently or have served in the past as active managers, employees or owners of the firm”

**Business Experts**
“[D]irectors who are active or retired executives in other for-profit organizations, and directors who serve on other large corporate boards”

**Support Specialists**
“[D]irectors who provide expertise and linkages in specific, identifiable areas that support the firm’s strategies but do not form the foundation on which the strategy is built”

**Community Influentials**
“[D]irectors with experience and linkages relevant to the firm’s environment beyond competitor firms and suppliers”
D.3: State Strategic/Operational Plan Excerpts - Strategy

**Alaska:** (From Alaska’s Strategic Plan for SHIECAP)

“In May 2009, the Alaska legislature unanimously passed Senate Bill 133 (SB 133), an act creating a statewide Health Information Exchange (HIE) system that is interoperable and compliant with state and federal specifications and protocols for exchanging health records and data. SB 133 required the Department of Health and Social Services (DHSS) to establish a HIE with a non-profit governing board that represents Alaska's stakeholder communities. In November 2009, DHSS submitted a draft HIT Plan to the Office of the National Coordinator (ONC) for Health Information Technology (HIT) detailing the development of an economical, sustainable HIE in Alaska.

“In March 2010, DHSS entered into a cooperative agreement with ONC to create an HIE in Alaska. In accordance with the American Recovery and Reinvestment Act (ARRA), the Governor named DHSS, Division of Health Care Services (DHCS) as the State Designated Entity (SDE) to implement Alaska's HIE under the ONC Cooperative Agreement Program. The Governor also announced Mr. Paul Cartland as the State Health Information Technology (HIT) Coordinator. In April 2010, DHSS contracted with the Alaska eHealth Network (AeHN) to be the non-profit governing board that will procure and manage Alaska's HIE.

“In addition to SB 133 the Alaska Health Care Commission (AHCC) was established in December 2008 under Administrative Order 246 (A.O. 246) to address growing concerns over the condition of Alaska's healthcare system. In January 2010 the AHCC, in accordance with A.O. 246, provided a five year (2010 – 2014) strategic plan on transforming healthcare in Alaska. The AHCC was chartered to provide recommendations for and foster the development of a statewide plan to address quality, accessibility and availability of healthcare for all citizens of the state.”
Colorado: (From ONC Plan Summary)

“The Colorado Regional Health Information Organization (CORHIO), a public-private partnership, has been designated to improve health care quality through cost effective and secure implementation of health information exchange (HIE). The CORHIO strategy is to build upon the local and regional HIE initiatives and leverage the expertise and support of a large number of Colorado healthcare resources from the public and private sector. CORHIO is also the Regional Extension Center (REC) and partners with the CO Rural Health Center to assist critical access hospitals.

“Quality Health Network (QHN), is a fully functional health information organization (HIO) and quality improvement collaborative serving over 300 providers and 2185 licensed online users. CORHIO and QHN will interconnect as QHN continues expanding its operations in the Western Slope region of Colorado and CORHIO focuses on the remainder of the state.

“CORHIO approach is to convene communities and identify the common HIE goals and technology needs in each community. The community-based rollout approach ensures that each community is able to build upon existing HIE efforts that are being developed locally. CORHIO has initiated the geographic rollout process in six communities across Colorado”

Georgia: (From Georgia’s Strategic and Operational Plan for SHIECAP)

“Change in the health information technology and health information exchange environments in Georgia is moving faster than the speed of recording such change. Since the Georgia Department of Community Health (DCH) submitted its initial version of the Georgia Health Information Exchange Strategic and Operational Plans in late August 2010, much progress has taken place.

“In November 2010, the Georgia Health Information Exchange, Inc. (GHIE), an established non-profit 501(c)(3) corporation, agreed to govern the statewide HIE. GHIE has agreed upon a two-prong strategy: 1. enabling simple interoperability to assure basic exchange; and 2. developing a robust HIE. Simple interoperability will enable more providers to join the exchange. A robust HIE is essential to establishing a powerful health IT infrastructure, enabling meaningful use and exchanging health information. The strategy is based upon the recommendations to DCH by the Health Information Technology and Transparency Advisory Board from 2006 through 2010. “

“The consensus of stakeholders is that the statewide HIE must:

• Use national standards to facilitate interoperability;
• Enable hospitals and other providers to demonstrate compliance with the requirements for meaningful use, as needed to obtain Medicaid and Medicare incentive payments;
• Comply with applicable federal and state requirements for privacy and security; and
• Build on technology that is already working. GHIE is committed to the use of NHIN standards (notably the Direct Project), achieving interoperability at the lowest possible cost, and the integration of existing HIEs as partners. GHIE and its participants envision steady and incremental growth of the statewide HIE. Both DCH and GHIE recognize that plans must be flexible and adaptable, in order to accommodate change as the use of health care technology expands across the state. Both DCH and GHIE anticipate that these Plans will need to be updated on a regular basis."

**Kansas:** (From Kansas’s Strategic and Operational Plan for SHIECAP)

“**Goal 1:** Enable interoperable health information exchange within Kansas, across state borders and with the National Health Information Network (NHIN).

Establish a governance model for statewide health information exchange

Develop and enable intra-state health information exchange

Establish core services for KHIE

Establish services as KHIE and KHIE users evolve

Establish integration between KHIE and approved HIOs

Develop and enable inter-state health information exchange

**Goal 2:** Ensure trust and support for statewide health information exchange.

**Goal 3:** Secure financial resources to develop and sustain HIE.

**Goal 4:** Create synergies and leverage resources available through all state and federal programs to support health information exchange and the effective use of HIT to improve health and health care.

**Goal 5:** Improve coordination of care, quality of care, and health outcomes and decrease healthcare costs in Kansas through health information exchange and support meaningful use of electronic health records.

**Goal 6:** Ongoing assessment, evaluation, and adjustments to Kansas statewide health information exchange."

**Kentucky:** (From Kentucky’s Strategic and Operational Plan for SHIECAP)

“Central to this strategy is the development of KHIE, a flexible and robust core network which acts as a foundation for the evolution of exchange across the Commonwealth. KHIE connects to all entities on a non-discriminatory basis. This network provides a low cost solution that fills potential gaps in coverage areas while providing unique, differentiated, and valuable services to broad constituencies. The value associated with these services provides the foundation for its sustainability.
“In addition, public policy levers have been actively used to encourage health information exchange. They include the integration of KHIE with the Kentucky Department of Medicaid Services (DMS) and the Kentucky Department of Public Health (DPH). Medicaid patients in Kentucky are served by four managed care organizations (MCOs) that are required to connect to KHIE. Connection to various registries, disease registries, and the new birth registry are also core network functions.

“KHIE has worked in a highly coordinated fashion with the Kentucky REC in assisting providers in reaching Meaningful Use. This includes joint outreach initiatives and conferences. The KHIE and Kentucky REC cooperation has been a major element in the success of health information exchange in the Commonwealth.

<table>
<thead>
<tr>
<th>Entity</th>
<th>Type</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kentucky Health Information Exchange</td>
<td>State Designated HIE</td>
<td>181 Signed Participation Agreements (324 Locations)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>54 LIVE Connections</td>
</tr>
<tr>
<td>HealthBridge</td>
<td>HIO</td>
<td>6 hospitals, more than 70 practices (all live)</td>
</tr>
<tr>
<td>Northeast Kentucky RHIO</td>
<td>HIO</td>
<td>2 hospitals, 16 ambulatory sites</td>
</tr>
<tr>
<td>LouHIE</td>
<td>HIO</td>
<td>No Active Exchange</td>
</tr>
<tr>
<td>6 Hospital Systems</td>
<td>IDN</td>
<td>Internal and Affiliates</td>
</tr>
<tr>
<td>Norton Healthcare/Humana</td>
<td>ACO</td>
<td>For Employees</td>
</tr>
<tr>
<td>Direct</td>
<td>Directed Exchange</td>
<td>Very Limited</td>
</tr>
</tbody>
</table>

“As depicted in Table 3.1, KHIE provides the majority of health information exchange activities within Kentucky. There is one active HIO in Kentucky, Cincinnati-based HealthBridge, which provides services in five counties in Northern Kentucky, an area served by one large provider network. HealthBridge and KHIE established the basis for interconnection in May, 2012. Two other HIOs, the Northeast Kentucky RHIO and the Louisville HIE, are in existence, but do not provide active exchange at this point.

“Large providers are in the process of implementing health information exchange within their organizations. As evidenced by the network log analysis in this Assessment, the degree of data sharing through KHIE with non-affiliated entities varies by provider, and has been somewhat limited. Several large providers have connected to KHIE, but are electing to complete their internal networks before pushing data.”
Louisiana: (From ONC Plan Summary)

“In post-Katrina, funding and contracts were awarded to develop health information technology and health information exchange. Health Information Exchange (HIE) activity in Louisiana is led by the Louisiana Health Information Exchange (LaHIE), managed by the Louisiana Health Care Quality Forum (LHCQF), whose mission is to be the neutral entity for facilitating authorized sharing of information among all stakeholders to improve the health of Louisiana’s citizens. LaHIE seeks to employ health information technology to enable improvements in health, to minimize variations in care and to address disparities in health care delivery. Louisiana has no existing organization facilitating exchange in the state. As a result Louisiana will be developing exchange in a phased approach with a short term focus on enabling point-to-point exchange with a long-term vision for robust exchange through LaHIE, with outcomes of achieving meaningful use, coordination of patient-centered care, public health management, and the support of clinical quality improvement.”
D.4: State Strategic/Operational Plan Excerpts – Boards

Alabama:

Alabama HIE Advisory Commission Members

- Gary H. Stackel, MPH, Chair, Commissioner, Alabama Medicaid Agency
- Donald Williamson, MD, Vice-Chair, State Health Officer, Alabama Department of Public Health
- Mark Jackson, Medical Association of the State of Alabama
- Linda Lee, Executive Director, Alabama Chapter American Academy of Pediatrics
- Jeff Arrington, Executive Vice President, Alabama Academy of Family Practice Physicians
- J. Michael Horley, President, Alabama Hospital Association
- Louise F. Jones, Executive Director, Alabama Pharmacy Association
- Louis E. Cottrell, Jr., Executive Director, Alabama Nursing Home Association
- Mary Finch, JD, MBA, Chief Executive Officer, Alabama Primary Health Care Association
- Jim Burns, Alabama Department of Finance, Information Services Division
- Dan Roach, Ill, MD, Director of Medical Informatics, Center for Strategic Health Innovation, University of South Alabama (Regional Extension Center Awardee)
- Frank O’Neil, Communications Director, ProAssurance Alabama
- Anna Blair, Policy Analyst, Alabama Arise
- Doug McIntyre, Vice President, Blue Cross and Blue Shield of Alabama
- Michael Waldram, MD, CEO University of Alabama at Birmingham (UAB) Hospital
- Don Henderson, CEO and President, Jackson Hospital
- Kelli S. Powers, CEO, Athens-Limestone Hospital
- Nancy T. Buckner, Commissioner, Alabama Department of Human Resources
- Gary Boswell, EdD, Commissioner, Alabama Department of Rehabilitation Services
- John Houston, Commissioner, Alabama Department of Mental Health
- Irene Collins, Commissioner, Alabama Department of Senior Services
- Sam Miller, MD, Alabama State Board of Health
- Hayes V. Whiteside, MD, Patient Privacy Representative
Alaska:

AeHN Board of Directors Meeting
January 17, 2011
11:30 AM to 1:00 PM

Location: BP Energy Center
Dial in: 866-856-0521, 4045847#

Business Agenda
1. Call to Order/Paul Sherry
   a. Welcome and Introductions
   b. Approval of Minutes
   c. Approval of Agenda
2. President’s Report/Paul Sherry
3. Executive Director’s Report/Bill Sorrells
4. Annual Meeting Discussion/Bill Sorrells
5. Marketing Plan/Linda Boochever
6. Statewide ARRA Projects/Paul Cartland
7. Alaska EHR Alliance Update/Linda Boochever
8. Arrangements for next meeting
9. Adjournment
Michigan:

Act No. 137
Public Acts of 2006
Approved by the Governor
May 10, 2006
Filed with the Secretary of State
May 12, 2006

EFFECTIVE DATE: May 12, 2006

STATE OF MICHIGAN
93RD LEGISLATURE
REGULAR SESSION OF 2006


ENROLLED HOUSE BILL No. 5336

AN ACT to amend 1978 PA 368, entitled "An act to protect and promote the public health; to codify, revise, consolidate, classify, and add to the laws relating to public health; to provide for the prevention and control of disease and disabilities; to provide for the classification, administration, regulation, financing, and maintenance of personal, environmental, and other health services and activities; to create or continue, and prescribe the powers and duties of, departments, boards, commissions, councils, committees, task forces, and other agencies; to prescribe the powers and duties of governmental entities and officials; to regulate occupations, facilities, and agencies affecting the public health; to regulate health maintenance organizations and certain third party administrators and insurers; to provide for the imposition of a regulatory fee; to provide for the levy of taxes against certain health facilities or agencies; to promote the efficient and economical delivery of health care services; to provide for the appropriate utilization of health care facilities and services, and to provide for the closure of hospitals or consolidation of hospitals or services; to provide for the collection and use of data and information; to provide for the transfer of property; to provide certain immunity from liability; to regulate and prohibit the sale and offering for sale of drug paraphernalia under certain circumstances; to provide for the implementation of federal law; to provide for penalties and remedies; to provide for sanctions for violations of this act and local ordinance; to provide for an appropriation and supplemental; to repeal certain acts and parts of acts; to repeal certain parts of this act; and to repeal certain parts of this act on specific dates," (MCL 333.1101 to 333.252511) by adding part 65.

The People of the State of Michigan enact:

PART 25. HEALTH INFORMATION TECHNOLOGY

Sec. 2501. As used in this part:
(a) "Commission" means the health information technology commission created under section 2508.
(b) "Department" means the department of community health.
Michigan (cont.)

Sec. 2683. (1) The health information technology commission is created within the department to facilitate and promote the design, implementation, operation, and maintenance of an interoperable health care information infrastructure in this state. The commission shall consist of 11 members appointed by the governor in accordance with subsection (2) as follows:

(a) The director of the department or his or her designee.

(b) The director of the department of information technology or his or her designee.

(c) One individual representing a nonprofit health care corporation operating pursuant to the nonprofit health care corporation reform act, 1980 PA 309, MCL 500.1101 to 500.1105.

(d) One individual representing hospitals.

(e) One individual representing doctors of medicine.

(f) One individual representing dentists.

(g) One individual representing purchasers or employers.

(h) One individual representing the pharmaceutical industry.

(i) One individual representing schools of medicine in Michigan.

(j) One individual representing the health information technology field.

(k) One individual representing pharmacists.

(l) One individual representing health plans or other third party payers.

(m) One individual representing consumers.

(2) Of the members appointed under subsection (1), there shall be representatives from both the public and private sectors. In order to be appointed to the commission, each individual shall have experience and expertise in at least 1 of the following areas and each of the following areas shall be represented on the commission:

(a) Health information technology.

(b) Administration of health systems.

(c) Research of health information.

(d) Health finance, reimbursement, and economics.

(e) Health plans and integrated delivery systems.

(f) Privacy of health care information.

(g) Medical records.

(h) Patient care.

(i) Data systems management.

(j) Mental health.

(k) A member of the commission shall serve for a term of 4 years or until a successor is appointed. Of the members first appointed after the effective date of the amendatory act that added this part, 3 shall be appointed for a term of 1 year, 3 shall be appointed for a term of 2 years, and 6 shall be appointed for a term of 4 years. If a vacancy occurs on the commission, the governor shall make an appointment for the unexpired term in the same manner as the original appointment. The governor may reduce a member of the commission for incompetency, dereliction of duty, malfeasance, misfeasance, or mismanagement in office, or any other good cause.

(4) At the first meeting of the commission, a majority of the members shall elect from its members a chairperson and other officers as it considers necessary or appropriate. After the first meeting, the commission shall meet at least quarterly, or more frequently at the call of the chairperson or on request by a majority of the members. A majority of the members of the commission appointed and serving constitute a quorum for the transaction of business at a meeting of the commission.

(5) Any business that the commission may perform shall be conducted at a public meeting held in compliance with the open meetings act, 1976 PA 327, MCL 15.261 to 15.275. The commission shall give public notice of the time, date, and place of the meeting in the manner required by the open meetings act, 1976 PA 327, MCL 15.261 to 15.275.

(6) The commission shall make available a writing prepared, owned, used, in the possession of, or retained by the commission in the performance of an official function as the commission to the public in compliance with the freedom of information act, 1976 PA 442, MCL 15.231 to 15.266.

(7) Each commission shall ensure adequate opportunity for the participation of health care professionals and outside advisors with expertise in health information privacy, health information security, health care quality and patient
**Montana:**

*HealthShare Montana Board (Modified to reflect the board of directors as of July 2010)*

<table>
<thead>
<tr>
<th>Member</th>
<th>Position</th>
<th>Title</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kristin Julie</td>
<td>Chair</td>
<td></td>
<td>RiverStone Health</td>
</tr>
<tr>
<td>Greg Drieses, MD</td>
<td>Secretary</td>
<td></td>
<td>DPHHS</td>
</tr>
<tr>
<td>Dwight Heatherman, MD</td>
<td>Vice Chair</td>
<td></td>
<td>DPHHS &amp; DOC</td>
</tr>
<tr>
<td>Daniel Halman</td>
<td>Vice President of Information Services</td>
<td></td>
<td>Montana Association of Healthcare Purchasers</td>
</tr>
<tr>
<td>Gail Bresso-Zimmer, ex officio</td>
<td>Slate HIT Director</td>
<td></td>
<td>Billings Clinic</td>
</tr>
<tr>
<td>Deb Maluccio</td>
<td>Behavioral Health Program Facilitator</td>
<td></td>
<td>Montana Chamber of Commerce</td>
</tr>
<tr>
<td>Demi Greiling</td>
<td>Executive Director</td>
<td></td>
<td>Health Information Exchange of Montana</td>
</tr>
<tr>
<td>Chris Stevens</td>
<td>Vice President and CIO</td>
<td></td>
<td>Montana Healthcare Network</td>
</tr>
<tr>
<td>Chelsea Culpeon</td>
<td>Health Benefits Director</td>
<td></td>
<td>St. Vincent Healthcare</td>
</tr>
<tr>
<td>Kea Smith</td>
<td>Director</td>
<td></td>
<td>Mountain-Pacific Quality Health</td>
</tr>
<tr>
<td>Greg Drieses, MD</td>
<td>CEO</td>
<td></td>
<td>Brody School of Medicine</td>
</tr>
<tr>
<td>John McDougan, MD</td>
<td>Medical Ethics/Asst Professor</td>
<td></td>
<td>Montana Office of Rural Health/AHEC</td>
</tr>
<tr>
<td>David Kibbe, MD</td>
<td>Senior Advisor</td>
<td></td>
<td>American Academy of Family Physicians</td>
</tr>
<tr>
<td>Jack King</td>
<td>Executive Director</td>
<td></td>
<td>Northcentral Montana Healthcare Alliance</td>
</tr>
<tr>
<td>Steve McNeece</td>
<td>CEO</td>
<td></td>
<td>Community Hospital of Anaconda</td>
</tr>
<tr>
<td>Bob Olson</td>
<td>Vice President</td>
<td></td>
<td>Montana Hospital Association</td>
</tr>
<tr>
<td>Reajee Pillai</td>
<td>Director of Planning and Performance Measurement</td>
<td></td>
<td>New West Health</td>
</tr>
<tr>
<td>William Rater, MD</td>
<td>Chief Medical Officer</td>
<td></td>
<td>Community Hospital of Anaconda</td>
</tr>
<tr>
<td>Mike Schweitzer, MD</td>
<td>Chief Medical Officer</td>
<td></td>
<td>St. Vincent Healthcare and Holy Rosary Healthcare</td>
</tr>
<tr>
<td>Pamela Sedlak, MD</td>
<td>Orthopedic Surgeon</td>
<td></td>
<td>St. Patrick Hospital &amp; Health Sciences Center</td>
</tr>
<tr>
<td>Rita Speak</td>
<td>Chief Information Officer</td>
<td></td>
<td>St. Patrick Hospital &amp; Health Sciences Center</td>
</tr>
</tbody>
</table>
North Carolina:

North Carolina Health Information Exchange

0.5. Governance

5.1. Overview

North Carolina has convened the state’s health care leaders and health IT and HIE stakeholder community through multiple forums across the past few years, as detailed in the Strategic Plan. Those efforts informed the decision to establish a public-private partnership to govern statewide Health Information Exchange services in North Carolina.

As an independent statewide public-private HIE governance entity, the NC HIE will be responsible for ensuring consistency, inclusiveness, transparency, focus, and accountability for HIE creation, sustainability, and operational effectiveness.

The NC HIE non-for-profit entity was incorporated in April 2010 and its Board of Directors held its first board meeting on May 14, 2010.

To support a collaborative, informed planning process and with an eye toward broad representation, the NC HIE Board of Directors invited stakeholders from all relevant stakeholder groups to participate on one of four Workgroups tasked with developing recommendations to inform the development of an Operational Plan that will serve as an implementation guide for the NC HIE and ensure that the Statewide HIE will be built in the public interest.

The multi-stakeholder Governance Workgroup’s deliberations have focused on the development and review of key provisions of the Bylaws for the Statewide HIE, the nomination process for future Board candidates for the Statewide HIE and the model by which organizations can become participants in the HIE.

5.2. Articles of Incorporation

The North Carolina Health Information Exchange (the “Corporation”) was incorporated under North Carolina Articles of Incorporation effective April 25, 2010. The Organization’s Interim CEO is Alan Hirsch. A copy of the Articles of Incorporation is included in Appendix 13.2.

5.3. Board of Directors

The North Carolina Health Information Exchange Board of Directors held its first meeting on May 14, 2010 and has continued to meet monthly throughout the Statewide HIE Operational Plan development process.

The Board was appointed in partnership with the Governor of North Carolina to ensure an appropriate balance of broad stakeholder representation, industry expertise, credibility among external stakeholders, ability of its members to make decisions to serve the greater public interests and commitment of its members to advancing the goals of statewide HIE in North Carolina.

The Board of Directors is co-chaired by North Carolina Department of Health and Human Services Secretary, Margaret M. Curd and former chairman and CEO of GlaxoSmithKline, Inc. and national pediatric health advocate, Dr. Robert Sanders.

Statewide HIE Operational Plan
October 25, 2010

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North Carolina (cont.):

Board members include:

- Dr. William Atkinson, CEO WakeMed
- Thomas Bridges, Director Henderson County Health Department
- Dr. Hadley Callaway, past President North Carolina Medical Society
- Anthony Chiello, CEO Kerr Drugs
- Dr. Samuel Cyert, Co-Lead of North Carolina Regional Health IT Extension Center
- Dr. Allen Dobson, Chairman Board of Directors for North Carolina Community Care Networks
- Dr. Gloria Frelis, President of the Old North State Medical Society
- David King, CEO Labcorp
- Rebecca Kitzmiller, North Carolina Nurses Association
- Alan Morsey, CEO North Carolina Community Health Center Association
- Dr. Warren Newton, Chair of UNC’s Department of Family Medicine and Chair of the American Board of Family Medicine
- John Richter, Executive Senior Principle Larsen Allen, LLP and Long-term Care Representative
- Dr. William Roper, Dean School of Medicine and CEO of the UNC Health Care System at the University of North Carolina at Chapel Hill and chairman of Board of Directors of the National Quality Forum
- Dr. George Saunders, President North Carolina Medical Board
- Dr. Sam Spicer, President NCHICA and Chief Medical Officer New Hanover Regional Medical Center
- Senator Josh Stein, North Carolina State Senator and Consumer Representative
- Dr. Dave Tayloe, Past President American Academy of Pediatrics
- Representative Thom Tillis, North Carolina State Representative
- Brad Wilson, CEO Blue Cross Blue Shield of North Carolina

Ex Officio Members:

- Steve Cline, DDS, North Carolina State Health IT Coordinator
- Jerry Franick, North Carolina Chief Information Officer
- Lauren Gray, North Carolina State Medicaid Director
Rhode Island:

2010 Board Members

James Purcell, Chairman
President & CEO, BCBSRI

Vul Ehr, Vice Chair
RI Medical Society; Governor, American College of Physicians

Laura Adams, President
President & CEO, Rhode Island Quality Institute

Charles Fogarty, Secretary (resigned 1/3/11)
Former RI Lieutenant Governor

Mark Reynolds, Treasurer
CEO, Neighborhood Health Plan of Rhode Island

Members

Gary Alexander (resigned 2011)
Secretary, RI Office of Health and Human Services (ex-officio)

Raymond Bandusky
Executive Director, RI Disability Law Center

Richard Besdine, MD
The Warren Alpert Medical School of Brown University

Troyen Brennan, MD
EVP and Chief Medical Officer, CVS Caremark

Nitin Damle, MD
South County Internal Medicine

Stephan Farrell
CEO, UnitedHealthcare of NE

Marie Ghazal, RN
President & CEO, Rhode Island Free Clinic

Bernadette Hawes
Consumer

John Hynes
President & CEO, Care New England Health System

John Keimig
CEO, Quality Partners of RI

Charles Kinney
CEO, Westerly Hospital

Christopher Koller
RI Health Insurance Commissioner (ex-officio)

Richard Leclerc
President, Gateway Health, Inc.

Edward Quinlan (resigned 2011)
CEO, RI Hospital Association

Hon. Elizabeth Roberts (resigned 1/26/11)
RI Lieutenant Governor

James Roosevelt
President & CEO, Tufts Health Plan

Michael Ryan (resigned September, 2010)
President & CEO, National Grid

George Vecchione
President and CEO, Lifespan Corporation

Laurie White
President, Greater Providence Chamber of Commerce
Texas:

Texas Health Services Authority

The THSA is governed by a 13-member board, the composition of which is outlined in statute. It is required to be a multi-stakeholder group of individuals who represent consumers, clinical laboratories, health benefit plans, hospitals, regional health information exchange initiatives, pharmacies, physicians, and rural health care providers. The Board’s Chair, Ed Marx and THSA’s Chief Executive Officer, Tony Gilman, and his staff oversee the daily operations. The 2010 THSA board members are:

- **Edward W. Marx**, Chair: Mr. Marx of Collinwood is chief information officer of Texas Health Resources. He served in the U.S. Army and received a bachelor's degree and a master’s degree from Colorado State University.
- **Kathleen R. Mechler**, Vice Chair: Ms. Mechler of Frederickburg is a registered nurse and co-director and chief operating officer of Texas A&M Health Science Center Rural and Community Health Institute. She served in the U.S. Air Force and received a bachelor's degree and master's degree in administration from Texas State University.
- **Matthew Hamlin**, Treasurer: Mr. Hamlin of Argyle is regional vice president of Quint Diagnostics. He received a bachelor's degree from Ohio Wesleyan University and a master's degree in business administration from George Washington University.
- **Alesia R. Adamsen**, Secretary: Ms. Adamsen of San Antonio is a member of the leadership team at Open Health Tools. She served in the Oregon Army National Guard and received a bachelor's degree and a master's degree in computer science and information assurance from Portland State University.
- **Fred Buckwalter**: Dr. Buckwalter of Houston is vice president, medical affairs, for Community Health Choice in Houston. He received a medical degree from McMaster University. He is board certified in Internal Medicine, Infectious Diseases, and Quality Assurance and Utilization Review.
- **Raymond F. Davis**: Mr. Davis of El Paso is employed by Perot Systems Corporation and serves as chief information officer at Sierra Providence Health Network. He received a bachelor's degree from the University of Texas at El Paso.
- **David C. Fleeger**: Dr. Fleeger of Austin is a surgeon at the Central Texas Colon and Rectal Clinic. He received a bachelor's degree from Baylor University and a medical degree from Texas A&M University.
- **Donna Montemayor**: Ms. Montemayor of San Antonio is senior director of pharmacy corporate operations for H-E-B. She is a member of the Bexar County Pharmacy Association, Texas Pharmacy Association, and University of Texas Pharmacy Alumni Association. She is also a member of the Texas Federation of Drugstore Board of Directors and National Association of Chain Drug Stores, and is chair of the H-E-B Good Living Expo. Ms. Montemayor received a bachelor's degree from the University of Texas at Austin.
- **Judy Powell**: Ms. Powell of The Woodlands is a community volunteer and former chair of the Texas State Board of Professional Counselors. She received a bachelor's degree from Wesleyan College and attended the University of Tennessee for graduate studies.
- **J. Darren Rodgers**: Mr. Rodgers of Dallas is president of Blue Cross and Blue Shield of Texas. He received a bachelor's degree from the University of Georgia, a master's degree in liberal arts from Duke University, a master's of business administration from Tulane University, and a master's degree in dispute resolution from Southern Methodist University.
- **Stephen Yuroc**: Dr. Yuroc of Austin is a partner at Clinical Pathology Associates. He received a bachelor's degree and a medical degree from Northwestern University, and a master's of business administration from the University of Houston.
- **Dee F. Porter**: Mr. Porter of Austin is chief operating officer of the Texas Department of State Health Services. She received a bachelor's degree from the University of Oklahoma and attended the Oklahoma City University Meinders School of Business. She serves as an ex-officio member on the board.
- **Ralph Vahle**: Dr. Vahle of Austin is an assistant commissioner of prevention and preparedness services at the Texas Department of State Health Services. He received two bachelor's degrees from the University of Texas, a medical degree from the University of Texas Medical Branch at Galveston, and a master's degree in public health from the Harvard University School of Public Health. He serves as an ex-officio member on the board.

1.2.4 Health Care Policy Council

Parallel to, and in coordination with, the work of the HITAC, THCSIP, and THSA, the HCPC, an operating unit of the Governor’s Office, has undertaken a series of planning and policy development activities relating to health IT and HIE. In addition to providing the staffing for the HITAC, THCSIP, and THSA, the HCPC has developed several reports on health IT in Texas, including The State of Health IT in Texas, The Value of Health IT in Texas, and The State Health Information Architecture (a link to this report is included in Appendix H, References and Sources).
Appendix E: Example Recruiting Letter

Hello,

My name is Jon Becker and I am a PhD Candidate. My doctoral research is to understand how Health Information Exchanges (HIEs) are stabilizing and becoming sustainable. North Carolina has a unique and interesting environment for HIE, and it is my goal as a researcher to help tell the story of how your organizations are finding success while many other state ecosystems are faltering. It is in this spirit that I am looking to recruit North Carolinian HIEs for this research. I want to investigate how your networks of health data sharing have developed since your founding and the actions your organizations have to bring your organizations to their current status. From this I aim to identify the previous, existing and future inflection points in the evolution of HIE’s value to benefit your organizations, and the greater community of North Carolina, as well as faltering HIEs in other states.

To accomplish this, I will require your help in gathering information on how your organization interacts with its stakeholders, and how your organization’s network has evolved over time. This would require participating in interviews to add depth and understanding to how your organizations identify and interact with other organizations, and if there would be any other data that could help depict the evolution of the data you curate would be of great assistance. More information on the specifics of the procedures for these data collections including details on how they can be adapted to fit your organizations unique practices and context will be shared with those interested in participating.

I believe the results of this study can place North Carolina as a model for other state HIE ecosystems, while also highlighting the best practices of individual HIEs. As the study unfolds, you will be the first to know about emerging results without waiting for the long lead times that typically go into academic publication cycles. I expect the results of this research to identify sustainable “clusters” of healthcare activity, and identify practices that appear to be best practices for HIEs to recruit those clusters. These results would benefit your organizations in the identification and recruitment of new clients. I look forward to seeing how I can best tailor this research to meet your unique needs, and I respectfully request your participation in the study. Please feel free to email me at jdb373@ist.psu.edu with any questions or concerns you may have.

I look forward to your participation.

Cordially,

Jonathan Becker
PhD Candidate
College of Information Science and Technology
Pennsylvania State University, University Park
Appendix F: Verbal Talking Points Memo

These talking points for the start of interviews was developed through participation with PennState’s IRB.

Hello!

Introduce yourself as a Penn State researcher

Inform participant that this study is being conducted for research as a part of your dissertation

Describe interview process, recording, and potential follow up if you don’t understand something

TELL THEM participation is voluntary, can end at any time they choose; and they can elect to not answer any specific questions.

Ask if they have any questions, and if they are OK with this.

(They should respond here)

If they assent, inform them that you are glad and are starting the recording.

AFTER INTERVIEW THANK THEM AND ASK IF YOU MISSED ANYTHING OR NEED TO TALK TO ANYONE/ORG SPECIFICALLY
Appendix G: Semi-Structured Interview Protocol

IRB Review ID: 43005

Nature/History of the firm (adapted if information is available online)
1. When was [Name-RHIO] Founded?
2. Was the founding entrepreneurial or a spinoff of a larger effort?
3. Is the RHIO a subsidiary of another organization? Name?
4. What is the primary function of [Name-RHIO]?
5. What other functions do you perform?
6. Were there active HIE efforts in your area when [Name-RHIO] was founded?
7. What is the business model of [Name-RHIO]
8. Has this model evolved over time? How so?
9. How much funding of [Name-RHIO] comes from public sources?
10. How much from private sources?
11. How do you monetize your business model?
12. How is that working for you?

Perception of External Organizations
13. What are the organizations that you most commonly interact with?
14. Which of those organizations realize the most value from [Name-RHIO]?
15. How would you break down the organizations that contract to you for HIE?
16. What organizations do you interact with to support your HIE efforts?
17. How pivotal are these organizations to your operations?
18. Are there links among the organizations you work with that you try to leverage? How so?
   For what Purpose?
19. Are their networks of organizations that you avoid? Why?
20. Are their networks of organizations that avoid you?
21. What is your relationship with Regulatory bodies?
22. What is your relationship with REC

Perception of External Environment
23. Briefly describe the regulatory environment of [Name-RHIO]
24. Briefly describe the competitive environment
25. Briefly describe the resource environment
26. how much change do you see in the (Regulatory, Competitive, or Resource) environment?
27. How complex is the (Regulatory, Competitive, or Resource) environment?
28. How easy is it to find information about new partners in the (Regulatory, Competitive, or Resource) environment?
29. How predictable is change in this arena?
Identify the External Networks and their constituents
30. What are the organizations that your role interacts with on a frequent basis (daily/monthly)?
31. Which organizations do you know the organization interacts with but are not a major concern of your area?
32. How would you categorize these organizations?
33. Are their interactions between these categories? How so?
34. Has there been a change in these organizations since this RHIO has been founded?
35. Are there More/Less Vendors or care providers?
   a. Changing Roles?
   b. Changing Importance?
   c. Changing Relations?
36. Where do you see this network evolving into?

Perception of Internal Structure, specifically IT
37. How does your organization manage Health Information?
38. How do you transfer patient’s health information?
39. Who owns a patient’s information?
40. Is patient information viewed as an asset by your clients?
41. What limitations are there for HIE?
42. Does your capability scale?

SIM Practices
43. How do you identify new potential partners
   a. In Regulation?
   b. Support?
   c. In need of HIE?
44. How do you initiate contact? Could you walk me through this process?
45. Why do you choose that method?
46. Is that method standard or adapted? Why?
47. How do you select a group over others?
48. What Challenges do you face in recruiting new clients?
49. Could you illustrate an “easy” recruitment?
50. What was the most difficult recruitment and how was it difficult?
51. Have you lost any clients? Why?
52. Which groups can influence your actions?
53. How do they go about doing this?
54. What do you do to manage one of these relationships over the long term?
RHIO Vendor Questions:
55. Could you walk me through Vendor’s role in Health Information Exchange? And how your position fits into that role?
56. How to HIE/RHIos fit into that?
57. Where do new clients come from? The HIE or do providers contact you directly?
58. Your Website lists ## Clients, would it be possible to get a list of these?
59. How do you monetize your solutions?
60. Which solutions to which customers?
61. From your perspective, what are Medicity’s major competitors in this area?
Appendix H: Part 14 of North Carolina House Bill 834

PART XIV. PARTICIPATION IN NORTH CAROLINA HEALTH INFORMATION EXCHANGE

SECTION 14.1. Article 29A of Chapter 90 of the General Statutes is amended by adding a new section to read:

"§ 90-413.3A. Required participation in NC HIE for some providers.

(a) The General Assembly makes the following findings:

(1) That controlling escalating health care costs of the Medicaid program is of significant importance to the State, its taxpayers, and its Medicaid recipients.

(2) That the State needs timely access to claims and clinical information in order to assess performance, pinpoint medical expense trends, identify beneficiary health risks, and evaluate how the State is spending Medicaid dollars.

(3) That making this clinical information available through the North Carolina Health Information Exchange will improve care coordination within and across health systems, increase care quality, enable more effective population health management, reduce duplication of medical services, augment syndromic surveillance, allow more accurate measurement of care services and outcomes, increase strategic knowledge about the health of the population, and facilitate health cost-containment.

(b) Notwithstanding any other provision of law, based upon the findings set forth in subsection (a) of this section, any hospital, as defined in G.S. 131E-76(c), that has an electronic health record system shall connect to the NC HIE and submit individual patient demographic and clinical data on services paid for with Medicaid funds."

SECTION 14.2. This Part becomes effective January 1, 2014.
Jonathan Becker
PhD Candidate
College of Information Sciences and Technology (IST)
PennState University
LinkedIn: /in/JonBeckerPhD
Voice: 607.XXX.XXXX
Mail: jdb373@ist.psu.edu

Education
PhD. Health Informatics, College of IST, PennState University.
Diss. Title: A Resource Dependence Perspective on Statewide Health Information Exchanges
Graduation Date: August 13, 2016.
Undergraduate. PennState University. 2002-2007
Bachelor of Science. Finance (Accounting Concentration). GPA: 3.75
Bachelor of Arts. International Politics. GPA: 3.85

Recognition and Awards
Honorable Mention. National Science Foundation Graduate Fellowship Program. 2010.

Publications in Refereed Journals and Conference Proceedings

Presentations and Reports

Teaching Experience:
EA 872, EA 874, EA 875, IST 897. Enterprise Architecture Masters Sequence
IST 301. Information and Organizations
IST 302. IT Project Management
IST 402. Introduction to the Intelligence Community
IST 440W. Innovation and Entrepreneurship