**Fostering Participation and Capacity Building
with Neighborhood Information Systems**

by

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Dedication

To my mother, Judith Epstein,
who instilled in me a hunger for knowledge and a respect for formal education

&

To my wife, Iris Fadlon,
who convinced me not to wait—we could finish all our work *and* start a family

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drove multiple hours to babysit while I attended conferences. In the past few months, my wife, Iris Fadlon, has come home from her medical residency and cared for our two children alone while I finished my research job at 6pm and stayed until midnight to finish this dissertation. My friends Mary and Stephen Clark provided hospitality and local knowledge of Minneapolis that resulted in a lovely and productive week.

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List of Abbreviations

CDC   community development corporation

GIS   geographic information system

MIS   management information system

NIS   neighborhood information system

NPI   Neighborhood Progress, Inc.

PPGIS   public participation geographic information system

Rehab   rehabilitation (an improvement in the physical condition of a place of residence)

Abstract

Applying information to decision making, monitoring neighborhood conditions, targeting resources, and recommending action have long been key urban planning functions. Increasingly, nonprofit organizations like community development corporations (CDCs) carry out these functions in distressed urban areas. Scholars in multiple disciplines argue that "data democratization"—increased access to data—would support a wide range of community change efforts. Proponents of a specific data delivery tool—neighborhood information systems (NIS)— claim that the technology can increase public participation and build capacity in distressed urban neighborhoods. This research evaluates these claims in Cleveland where the mortgage foreclosure crisis has left a glut of vacant and abandoned properties and a dire need to prioritize activities with limited resources. The research provides an integrated theoretical framework, bringing together four distinct bodies of knowledge for the first time: science and technology studies; participation, capacity, and capacity building; geographic information systems; and management information systems. The mixed-methods approach employed includes interviews with sixty community development professionals in Cleveland and a longitudinal regression analysis of thirty CDCs' housing rehabilitation outcomes between July 1, 2007 to June 30, 2011. NIS increased the *networking capacity* of CDCs engaged in the city's Code Enforcement Partnership by improving communication between partners. NIS also increased *programmatic capacity*, especially as measured by the percentage of CDC-owned properties sold to new owners who pay taxes on those properties. Staff in one CDC successfully leveraged NIS to improve public participation, a measure of *political capacity*. The findings also suggest that access to NIS does not fundamentally change CDC priorities. This research helps to fill specific gaps in multiple bodies of knowledge and features an in depth analysis of threats to validity, practical implications for decision-making with NIS, and recommendations for NIS developers and funders. Developers and funders in other cities may wish to consider their role as not just democratizing data—but providing a platform for partnerships by enabling organizations to better share data in order to achieve shared objectives.

Chapter 1: Introduction

The mortgage foreclosure crisis led to a glut of vacant and abandoned properties in some U.S. cities that outstripped available resources for demolition and challenged local leaders to strategize and prioritize community development activities (Nelson 2008). While applying information to decision making, monitoring neighborhood conditions, targeting resources, and recommending action have long been key urban planning functions (Friedmann 1987; Meyerson 1956; Myers 1997; Thomson 2008) the language employed by some public officials revealed the scale and urgency of the problem. A county representative estimated in 2011, for example, that ten thousand homes inside Cleveland were "rotting corpses" (Niquette 2011). Prioritizing such a large demolition queue—and identifying homes that can be saved before they meet the same end—requires organizing an immense amount of information and weighing options against each other. Scholars and practitioners have recognized the potential of technology to support mapping, sorting, and filtering tasks (Chandler et al. 2006; Harris 1989) and for neighborhood-level data to empower local organizations tackling planning issues (Sawicki and Craig 1996). But, few researchers have studied the actual *impact* of technology and data on urban planning decisions and outcomes (Sieber 2006). This gap in knowledge is unfortunate because the Department of Housing and Urban Development has provided software to grantees to improve their capacity (Leitner et al. 2000) and yet still identifies capacity as a problem (HUD 2010). For decades, nonprofit organizations—many grant funded—have been providing services once provided by government agencies directly (Wolch 1990). Determining *if*, *when*, and *how* technology improves the capacity of such organizations to conduct planning activities would benefit those organizations, technology developers and funders—and city residents. That is the goal of this research—more specifically—to determine *if, when,* and *how* neighborhood information systems can improve the capacity of community development corporations in Cleveland to rehabilitate vacant and abandoned housing.

Neighborhood information systems (NIS) are not a standardized product but a loose term for a composite of technologies. A NIS installation includes (1) a spatially enabled database, which

ties geographic information such as neighborhood boundaries to attributes such as population size; (2) a web-based interface that facilitates data selection, download, and mapping; and (3) a web-server that allows multiple users to access the system at the same time over the Internet. Users employ NISs for grant-writing, advocacy, neighborhood stabilization, community organizing, protecting health & safety, decision-support, and predicting residential abandonment (Kingsley 1998; Enterprise 2010; Kingsley and Treuhaft 2008; Krouk, Pitkin, and Richman 2000). The following vignette, constructed from multiple interviews, illustrates how a CDC employee might incorporate NIS into community development work.

One morning in 2011, Lisa Smith[1] was driving the same route to work as always when she saw something that made her stop the car and get out. A man stood pensively in front of a house that had been vacant for months. In a friendly tone he explained his plan to *flip* it. Someone—he reasoned—might be willing to buy the place from him in a few months for more money. Lisa saw similar speculation all the time in her work at the community development corporation (CDC). Speculators like this rarely improved the property or paid property taxes. While a responsible owner could rehabilitate the house in its current condition, after a few more flips—it would be too rundown. Lisa knew she would have to act quickly. When she arrived at work, she looked up the property on a website maintained by one of the local universities. She saw a few minor code violations, but nothing that would prevent the CDC from buying and rehabilitating the property. Lisa also looked up the oversized, vacant, and *ugly* house next door. She would need to get rid of *that* house in order to market the house she planned to buy. Lisa selected data from different city agencies to examine together. She smiled. The system showed that the ugly house had already passed through a number of sheriff sales without a buyer. It was eligible for demolition by the county, which would happen faster than demolition by the city. She drafted a short email to her supervisor that outlined a plan to buy one house and knock down the other. Once her supervisor approved the plan, Lisa would record it on the website for city and county employees to see, which often—though not always—insured that the right house was left standing and the right house was knocked down.

The website Lisa used is an example of a neighborhood information system. The vignette

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[1] This vignette is based primarily on interview (#17,364,10/19/2011). The name has been changed.

weaves together many of the key issues in this research. Vacant properties pose a serious problem. Often, CDC employees—not city employees—address the problem at the neighborhood level. They select among multiple options and strategies with the help of neighborhood information systems. System proponents, developers, and funders expect that the technology will have a positive impact. In medical parlance, these proponents approach data and technology as a *treatment* for a disease—vacant and abandoned properties in this case. More generally, proponents argue that these systems can *treat* a number of problems, including lack of government accountability and transparency, poor public participation in decision making, and the low capacity of organizations in distressed urban areas (Kubisch et al. 2010; Kingsley 1999; Treuhaft 2006). While researchers routinely evaluate the efficacy of pharmaceutical or surgical interventions in the health fields, researchers rarely evaluate the efficacy of technological interventions in planning. In this study, I develop and apply a method to conduct such evaluations.

The vignette also makes clear that users can integrate NIS into workflows that mix strategic thinking with serendipity and emotion. Lisa ran into this would-be speculator by chance and responded emotionally to his plan to flip a house within her jurisdiction. She had not previously suggested rehabilitating this particular house. According to the NIS, it was not an ideal rehabilitation target—especially with a dilapidated house right next door. But, her desire to protect the neighborhood from another speculator motivated her course of action. Lisa relied on the NIS initially as one might rely on a friend known for caution—to play devil's advocate and supply reasons *not* to proceed. Such reasons may have included unseen property damage or a murky title that could delay acquisition.

To proponents, NIS serves as the nerve center for an impartial, systematic decision-making process they refer to as *data-driven.* Lisa's workflow hardly seems *driven* by data though. She clearly *used* data. She relied on the NIS to reality-check the first house and to provide information about sheriff sales, which she transformed into a demolition strategy for the second house. But, serendipity—seeing a man outside a vacant house and stopping to talk with him— catalyzed the whole decision-making process. Anger, frustration, sadness, hope, rebelliousness, and a sense of responsibility all may have played a role. After all, most organizations are made by, of, and for human beings—not data. The vignette raises many questions. What would Lisa

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have done if the NIS were not available? Did using the NIS save her time? If so, does that mean Lisa can be more productive? Did using the NIS result in a better outcome? How do community development professionals even define a better outcome? If Lisa's decision-making process was flawed—how could it have been improved? Given that decision-making in organizations may differ from the *data-driven* process that NIS proponents envision, should developers and foundations continue to pour time and money into building and maintaining these systems?

NIS supporters have yet to posit explicit mechanisms and theories that connect the provision of data with these benefits. Their reports provide intriguing vignettes and anecdotal evidence, but not fuller evaluations. None isolate the impact of specific data and tools on specific planning processes. In one report, the authors write that the impact of the NIS in Providence, Rhode Island, is its incorporation into a foreclosure early warning system and into neighborhood policing efforts (Treuhaft et al. 2007). This assertion conflates use with effect. How did the NIS help these projects? How should institutions and individuals employ the technology for the greatest benefit?

NIS supporters make claims that—if true—could radically improve decision-making in organizations conducting important geographically targeted work. Community development corporations (CDCs) in particular seek to improve the quality of life in specific distressed neighborhoods (Rubin 2000) and their investments have had a positive impact on property values (Galster et al. 2005). Most recently, some of these organizations have helped to rehabilitate vacant and abandoned structures left behind by the foreclosure crisis (Kingsley et al. 2009). But, the need for such services—subsidized in part through community development block grants (CDBGs)—can outstrip the capacity of local-level organizations (HUD 2010). Increasing the capacity of grantees remains a Department of Housing and Urban Development (HUD) priority (ibid). NIS may provide just the needed capacity boost to enable small nonprofit organizations to meet local demand for community development services. Furthermore, funders often require neighborhood interventions to include components that line up with supposed NIS strengths, such as public participation (Kubisch et al. 2010). Behind these exciting claims and urgent needs lies conflicting evidence. On one hand, many planning activities involve routine calculations that computers can automate (Chandler et al. 2006; Harris 1989). On the other hand, studies show that introducing new technology rarely produces the desired organizational improvements

(Robey and Sahay 2001).

Chapter 2: Literature Review

This research weaves together knowledge from four largely disparate areas: science and technology studies (STS), capacity and capacity building, public participation geographic information systems (PPGIS) and neighborhood information systems (NIS), and management information systems (MIS).

Science and Technology Studies[2] (STS)

Definitions of technology often contain a material component and a social component (Grint and Woolgar 1997:9–10). Two opposing theoretical approaches describe the relationship between these components. Technological determinism holds that a given technology impacts society in a predestined and unmediated manner. Social contingency[3] holds that the impact of technology is mediated by social factors. These approaches are not monolithic. Scholars have identified and organized strains of deterministic thinking into typologies including hard and soft (Smith 1994); normative, nomological, and unintended consequences (Bimber 1994); and justificatory, descriptive methodological, and normative (Wyatt 2008).

The earliest known example of technologically deterministic thinking in the United States occurred in 1787 when an avid supporter of factory industrialization proclaimed that it led to "paths of virtue" and promoted "political salvation" in an unstable economy (Smith 1994:4). The claimed benefits of technology do not stop at logically connected outcomes such as factory productivity, but extend to wider social change.. Although hinted at from the mid-1800s to early 1900s (see for instance Brette 2003 concerning Veblen), social contingency came much later.

Latour and Woolgar's (1979) work paved the way for contingency theory by raising doubts about whether scientists follow the scientific method and whether technology stands separate from society. Contingency theorists focus on the factors mediating technology development and technology use. For example, those employing actor-network theory have

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[2] This field of study is also referred to as *science, technology, and society*, with no change in the acronym (STS).

[3] *Social contingency* is also referred to as *social construction*

sought to explain how a myriad of interconnected people, policies, events, and extant technical artifacts contribute to the development of other technologies (Latour 2007) such as GIS (Harvey 2001) and housing (Cowan, Morgan, and Mcdermont 2009). Other theorists have sought to explain the integration of a new technology into an existing lifestyle, organization, or industry (e.g.: Barley 1986; Leonardi 2007; Zuboff 1988).

Contingency theorists argue that organizational change occurs as individuals respond to a technology's *affordances* and *constraints* (Leonardi and Barley 2010). Increasingly, organizational leadership tries to initiate change through the introduction of new information technologies. These efforts frequently fall short of expectations (Robey and Sahay 2001). For instance, adoption of expensive enterprise resource planning systems that integrate sales, procurement, accounting, and other business activities does not always yield the efficiency gains and cost savings vendors promise and customers expect (Grant et al. 2006). However, many studies treat information technologies identically to mechanical technologies, failing to understand the role information plays in the specific workplace under investigation (Leonardi 2007). An exceptional study found that when computer technicians gained access to each other's solutions to past customer problems, they not only learned how to solve those problems but sought out the appropriate coworker for advice directly, contrary to established protocol (Leonardi 2007). The study showed that information affects both decisions (how to solve the problem) and relationships (whom to speak to about the problem).

Nuanced studies about technology—especially information technology—have not left a mark on the world of practice or the popular media. Financial incentives push marketers to exaggerate benefits, and customers remain hopeful that the newest device will work miracles. Professionals in the fields of computers and telecommunications continue to embrace "the language of momentum, trajectory, and technical imperatives" (Winner 1997:1). The Arab Spring in 2010 provides a recent example. Despite video footage of violent clashes between *human* actors and a diversity of eventual outcomes (see Howard 2011), technology pundits and activists both attributed Facebook, Twitter, and the Internet with performing the hard but inevitably successful work of spreading democracy. After Mubarak's departure, a Google executive active in the Egyptian grassroots opposition exclaimed in an interview that "if you want to liberate a society, just give them the Internet" (Cooper 2011). To be fair, technologies can seduce even ardent adherents of the socially contingent approach in their private lives and

elicit a sense of wonder, offering technological determinism a certain level of immortality (Wyatt 2008:167).

Participation, Capacity, and Capacity Building

Urban planning and technology scholars offer slightly different understandings of participation, capacity, and capacity building. In terms of participation, since at least the 1960s, academics in planning and political science defined participation as public involvement in decision making, accountability, and transparency (Arnstein 1969). Democratic societies include legal requirements for the governed to have a voice in their government. Scholars provide different normative prescriptions ranging from self-government, which models citizens as deliberative community members (Barber 1984; Etzioni 1993) to e-government, which models citizens as individual consumers (Ho 1999; Osborne and Gaebler 1992). Leaning toward the former model, planning scholars have defined and measured participation by how well participants represent a constituency (Morrissey 2000), the number of participants (ibid), the freedom participants enjoy to create new option (Lowndes 1995), and the degree of influence over a decision (Arnstein 1969). Although planning as a discipline holds participatory decision making as a desirable ideal (Friedmann 1987), the literature includes both reasons for and against increased public participation. While the involvement of local residents and affected parties can increase the legitimacy of nonprofit and governmental organizations, including CDCs (Glickman and Servon 1998), residents may want to pursue activities that professional planners believe are discriminatory (Bratt 2009; Campbell 1996; Kymlicka and Norman 1994) or unlikely to succeed on technical grounds.

Scholars trained in engineering and communications employ the term "access" over "participation". In the 1980s and 1990s, technology boosters argued that new information and communication tools would provide everyone with better choices and better access to goods and services (e.g.: Negroponte 1996). The term "digital divide" first appeared in a 1995 report by the National Telecommunication and Information Agency to describe systematic socioeconomic gaps in use of computer networks. A study in 2000 showed that nearly eighty-percent of white Americans earning at least $75,000 were online while three quarters or more of black Americans and people 65 years old or over were not online (Lenhart 2000). In 2011, 21% of Americans reported not using the Internet with age and income still explanatory—but not race (Zickuhr and

Smith 2012). While cell phones have brought many people online for the first time, reasons for not using the Internet still include: lack of access, lack of a computer, or the cost of access (28%); the time or difficulty to learn how (21%); and disinterest (42%) (ibid). Early policy discourse on ending the digital divide both in the U.S. and internationally focused on improving the distribution of personal computers and Internet infrastructure with an underlying logic described by one critic as "'technologic optimism bordering on determinism'" (Epstein et al. 2011:94 quoting Thompson 2004). Later discourse has focused on skills and the social resources necessary for building those skills—arguing that material access alone is insufficient for enjoying the benefits of information technologies (Epstein et al. 2011).

Definitions of capacity and capacity building also differ between disciplines. Scholars in urban planning, sociology, and public health define *capacity* as the power of an individual, organization, network, or community to accomplish a task or goal and *capacity building* as increasing that power (e.g Chaskin 2001; Glickman and Servon 1998; Maclellan-Wright et al. 2007). In technology studies, *capacity* often refers to the power—called the *affordance* (Oliver 2011)—inherent in a technology to accomplish a task or goal. This research examines technology through an urban planning lens and therefore explores planning related literature about *capacity* more thoroughly than technology related literature about *affordances*. The methods section picks up the *affordances* theme again by including questions designed to reveal how NIS delivers claimed benefits at the level of interface features and system functionality.

Chaskin (2001) and Maclellan-Wright et al (2007) both provide approaches for studying capacity at the community level. Chaskin's (2001) framework, based on empirical community building work and designed to summarize observed processes, consists of six interrelated components. Each *level of social agency* (type of actor) draws upon *characteristics of community capacity* and pursues capacity building *functions* through a number of *strategies*. *Conditioning influences* help or hinder these efforts to build capacity and produce *other outcomes*. Maclellan-Wright et al (2007) developed a community capacity measurement instrument for guiding health related programming, which consists of nine distinct components with one to four indicators each. The components are *participation; leadership; community structures; role of external supports; asking why; resource mobilization; skill, knowledge, and learning; links with others; and sense of community.* Many overlaps exist between these two approaches. *Characteristics of community capacity* in the first approach explicitly includes the subcomponents "sense of

community" and "access to resources", which are main components in the second approach. Similarly, "leadership" falls under *strategies* in the first approach and stands on its own in the second approach. However, Chaskin's *conditioning influences* have no parallel in the other framework and are extremely useful for research on community development corporations, which serve neighborhoods with very different conditions that influence both the strategies staff members adopt and their chance for success. Moreover, Chaskin's attention to multiple levels of social agency (individuals, organizations, and networks) dovetails with a model for examining information systems introduced later which posits that benefits may accrue at the individual, organizational, or even higher levels. For these reasons, Chaskin's model merits closer inspection.

Figure 1 below illustrates the relationship between framework components with the most important flow occurring from left to right (Chaskin 2001, 295).[4] An actor from one of the *levels of social agency* (#2), for example the director of a CDC, draws upon skills and resources described by *characteristics of community capacity* to pursue a capacity building *function* (#3) such as the production of a new service—a house painting program. This director is affected by *conditioning influences* (#5) such as poor residential stability in the neighborhood. The residential turnover impacts the director's *strategies* (#4). He or she might need to focus on building leadership to replace leaders who have left or focus on organizational collaboration (networking) to tap leaders and resources outside the neighborhood. If successful, these strategies may build both the capacity of the CDC and of the community—and result in *other outcomes* (#6) as well, such as improved (or stabilized) real estate values. Note that CDC staff members seek to improve their *conditioning influences* (neighborhood conditions) and the model lacks such a feedback loop.

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[4] There are slight differences in the frameworks described by two related publications, an article (Chaskin 2001, 296) and a book (Chaskin et al. 2001, 12). This research follows the article version, which only places "organizing" under *Strategies* and does not include a somewhat overlapping "organizing and advocacy" *Function*.

Figure with boxes:

(5) Conditioning Influences
Safety
Residential stability
Density of acquaintance
Structure of opportunity
Patterns of migration
Race and class dynamics
Distribution of poor and resources

(4) Strategies
Leadership
Organizational development
Organizing
Organizational collaboration

(1) Characteristics of Community Capacity
Sense of community
Commitment
Ability to solve problems
Access to resources

(2) Levels of Social Agency
Individuals
Organizations
Networks

(3) Functions
Planning, decision making, and governance
Production of goods and services
Information dissemination

(6) Other Outcomes
Better services
Influence on decision making
Economic well-being

——— Border of main community capacity component

—— Border of secondary community capacity component

— · Border of mediating community capacity components or outputs

⟶ Flow of influence or use, i.e.: (2) actors use (4) strategies & (5) safety influences (1) commitment

Figure 1: Chaskin's (2001, 296) Community Capacity and Capacity Building Framework (legend added, inferred from author's text)

Scholars also offer multidimensional capacity frameworks for organizations (Fredericksen and London 2000; Glickman and Servon 1998; Lusthaus et al. 2002; McKinsey & Company 2001; De Vita and Fleming 2001). Some scholars have focused on a single dimension of capacity building, such as organizational capacity (Germann and Wilson 2004; Nu'Man et al. 2007) or financial capacity (Bowman 2011). Evaluations of how geographic information technology impacts nonprofit organizations are sometimes phrased in terms of the capacity of organizations to "adopt" the technology (e.g.: Bishop 2009).

Of the frameworks reviewed, Glickman and Servon's *CDC Capacity* provides the richest description of capacity and capacity building specifically geared toward the type of organizations under investigation in this research. It consists of five sub-capacities each summarized in the table below. Each sub-capacity relates to a number of *capacity building needs* that the authors

describe. For example, *resource capacity* relates to the needs for (1) long-term operating support, (2) resources for stabilization and expansion, (3) development capital, (4) access to funders, and (5) balanced portfolio risk (Glickman and Servon 1998). However, in their application of the framework (Glickman and Servon 2003), the authors address only a subset of these *capacity building needs* and this research adopts the same pragmatic approach.[5] A star (*) indicates that the capacity-building need is addressed qualitatively in this research. A plus (+) indicates that the capacity building need is addressed qualitatively and quantitatively in this research. Chapter 5 describes the measurement of these needs in detail. Needs left unmarked in the table are not addressed in this research at all.

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5   Glickman and Servon (2003) acknowledge the difficulty of operationalizing their framework, writing that "to gain an understanding of the effectiveness of CDCs and the impact partnerships have on their relative strength, it is necessary to measure the various dimensions of capacity. We approach this task with humility since it certainly is easier to identify what kinds of capacity exist in nonprofit organizations in theory than to measure them in practice. In addition, some of the elements of capacity are more difficult and fuzzy to measure and quantify than are others."

Table 1: Glickman and Servon's (1998) CDC Capacity Framework & Elements Implemented in this Research

Capacity	Description (The ability to...)	Capacity-Building Needs
Resource capacity	Increase, manage and sustain funding	1. Long-term operating support + 2. Development capital + 3. Resource for stabilization and expansion 4. Access to funders 5. Balanced portfolio risk
Organizational capacity	Leverage staff skills & work efficiently	1. Competent and stable staff + 2. Project management * 3. Effective executive director 4. Effective fiscal management 5. Board development and leadership 6. Managed growth 7. Evaluation

Programmatic capacity	Pursue community development (housing, economic development)	Skills related to:
		    1. Housing +
		    2. Organizing *
		    3. Commercial development
		    4. Economic development
		 5. Responsiveness to changing community concerns *

Networking capacity	Build partnerships with other organizations to move agendas forward	1. Strong relationships with other organizations and institutions * 2. Mutually supportive programs * 3. Promotion of CDCs' agendas externally * 4. Access to nonfinancial resources

Political Capacity	Influence government officials and express legitimacy within the community	Community participation * Political leverage * Educated constituents partners Conflict management
* Addressed qualitatively in this research + Addressed both qualitatively and quantitatively in this research Unmarked capacity-building needs are not addressed in this research		

The authors posit that training CDC staff to employ "management information systems" is a capacity building strategy addressing two needs of *organizational capacity*, "effective fiscal management" and "project management." This explicit mention of technology as potentially contributing to capacity building forms the foundation of this research, providing a bridge between the technology side of the theoretical framework and the capacity side of the theoretical framework (both discussed later) that is grounded in the literature. While Glickman and Servon's conceptualization of CDC capacity focuses on organizational level characteristics, these are not the only factors affecting a CDC's operations. Neighborhood context matters as well (Rubin 2000). Since Chaskin (2001) offers an approach to capacity with neighborhood context and Glickman and Servon (1998) offer an approach to capacity with institution specific detail, linking the two approaches into a single theoretical framework should prove useful (also discussed later).

Public Participation Geographic Information Systems (PPGIS) and Neighborhood Information Systems (NIS)

GIS & PPGIS

Increased use of geographic information systems (GIS) by scholars and practitioners in the early 1990s resulted in strongly worded exchanges between proponents and social theorists, which turned more constructive toward the end of the decade (Sullivan 2006). Proponents

demonstrated how the technology eased many tasks. At least seventy percent of the data processing in planning departments involves routine calculations on spatial data (Chandler et al. 2006). Much of this work is administrative (Harris 1989), like checking the zoning designation of parcels for permit applications. Critics argued that GIS—originally designed to simplify, quantify and analyze property arrangements for planning, control, and taxation—conflicts with the goals and workflow of community-based organizations (Kwan 2002; Leitner et al. 2000). Critics also emphasized the empiricist and positivist assumptions embedded in any discrete model of space (Pickles 1997) and—implicitly—to the tendency of governments to grossly simplify the relationships between people and land (Scott 1998).

The National Center for Geographic Information and Analysis, an independent consortium, started a number of research programs on GIS including Initiative 19 in 1996 focused on the social implications of spatial representations of people and space. Initiative 19 led to a series of meetings and discussions amongst scholars and practitioners interested in using spatial technologies to empower less privileged social groups (Sieber 2006). These proponents referred to public participation geographic information systems (PPGIS) as a means to this end. PPGIS also reflected the transfer of information technology from government agencies to (smaller) nonprofit organizations, as the former moved away from directly providing some goods and services and the latter moved to fill the gap. This shift of responsibilities had been occurring for decades (Wolch 1990). Neighborhood groups use GIS for a range of purposes including administrative (e.g. to maintain a database of properties), strategic (e.g. to target resources), tactical (e.g. maps for persuasion), and organizational (e.g. for grant writing) (Craig and Elwood 1998). Staff in nonprofit organizations have employed GIS to examine issues at the neighborhood and national levels, including bike-paths, residential foreclosures, transit-oriented development, and green infrastructure (Al-Kodmany 2012).

Evaluations of GIS fall into two broad categories, one focused on the technical details of the technology (hardware, software, and data) and one focused on the impact of the technology on social outcomes. The former category started as far back as NCGIA Initiative 1 (1988) and continues today (e.g. Brown 2012). The latter category remains rare (Nedovic-Budic 1999; Sieber 2006). Nedovic-Budic (1999) reviews methods relevant to the evaluation of GIS effects and selects the original form of the DeLone and McLean model (1992) to organize findings. The next section will explain this model in detail. Note now though that Nedovic-Budic employs the

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model as an organizational aid to inventory *methods* not the results of *evaluations*. She concludes that within the planning field, evaluations of GIS should focus on "organizational goal achievement, public policy and decision-making effectiveness, and societal or community impacts" (1999, 293). She emphasizes the importance of multiple forms of data collection: qualitative, quantitative, cross-sectional, and longitudinal (ibid). After an extensive review, Sieber (2006) finds that outcomes in the PPGIS literature vary from material deliverables (maps and reports) to empowerment, participation, equity, and increased democracy. But, the literature fails to firmly connect technology with outcome. She writes that

> "Few PPGIS researchers explore measures of PPGIS effectiveness. Difficulties in measurement arise from the demands to establish a causal or associative relationship between technology and the outcome ascribed to it. A positive effect may be unconnected to PPGIS and instead reflect a well-connected and resourced organization."
>
> (Sieber 2006:502)

Despite the dearth of evaluations available, several organizations have advocated for broader use of GIS technology. HUD provided GIS tools to community development corporations to improve their capacity to complete funded projects (Leitner et al. 2000). In 1995 the Urban Institute and partners in seven cities started the National Neighborhood Indicators Partnership, which advocates for the development of neighborhood-level indicator systems and their application in distressed urban areas (NNIP Webpage, "Concept"). The systems of many partners include mapping and querying on a web page, providing community-based organizations GIS functionality as envisioned by PPGIS scholars (e.g. Leitner et al. 2000) and providing a conceptual bridge between GIS and NIS.

NIS

The National Neighborhood Indicators Partnership (NNIP) currently includes 47 organizations across 36 cities. While the vast majority are private nonprofit organizations, the list includes government institutions like the Chicago Metropolitan Agency for Planning (CMAP) and academic institutions like the Baltimore Neighborhood Indicators Alliance (BNIA) at the University of Baltimore, the Center on Urban Poverty and Community Development at Case Western Reserve University, and the Center for Urban and Regional Affairs (CURA) at the

University of Minnesota. Community development and technology scholars and practitioners frequently refer to these types of organizations as "data intermediaries" (i.e. Kubisch et al. 2010) because they form an intermediate step between raw data producers and lay data users that makes the data easier to access. NNIP partners commit to building a recurrently updated data system, strengthening distressed neighborhoods, and working with organizations that use data for "advocacy, organizing, program planning, or policy development" (NNIP n.d.).

In supporting NNIP, the Urban Institute returned to the idea of an urban social report (Bell 1969; Kingsley 1998) popular at the time of its founding in 1968 after violence in American cities brought attention to inner city neighborhoods, blight, social inequality, and racism. Respected and influential foundations such as The Annie E. Casey Foundation, the Rockefeller Foundation, and the John D. and Catherine T. MacArthur Foundation have all provided NNIP with funding (NNIP n.d.). The theoretical roots of NIS can also be traced back to government accountability and performance tracking tools and to the previously described rise of PPGIS (Hwang and Hoffman 2009).

In 1994, leaders in the New York City Police Department created an approach to evaluation and management that relied heavily on computer calculated statistics, which they called *CompStat*. The approach spread quickly to other departments and to other cities and countries. In 1999, Baltimore's *CitiStat* extended the principle to "all municipal functions" in order to "maximize personal accountability" across city government within a single program (Anon 2010). Hwang and Hoffman (2009) argue that the similarity between NIS and CitiStat lies in their mutual reliance on information technology, which "drives reinvention," and their mutual promotion of and benefit from "better data practice" (Hwang and Hoffman 2009, 168). While this argument has merit, focusing on data practice overlooks that CitiStat-style programs *do not* rely on data alone. They require political buy-in from city mayors and the heads of city departments to reward better performance and punish worse performance (Behn 2005). Focusing on data practice as a technical accomplishment may divert researchers' attention from assessing the contribution of data practice to neighborhood impacts. Similarly, Hwang and Hoffman (2009) argue that the connection to PPGIS concerns a common focus on how staff in neighborhood organizations employ the technology in their day-to-day work (i.e. Elwood 2002), which can divert researcher attention from assessing the contribution of such work to

neighborhood impacts.

As part of the Urban Institute, NNIP reports carry weight with government agencies, foundations, and community-based organizations. NNIP and its affiliates advocate for an approach to local-level decision-making that relies heavily on data and technology. Literature about NNIP and partner activities include material published by the network and material published in peer-review publications.

NNIP Produced Material[6]

Researchers associated with the Urban Institute, NNIP partners, NIS funders, and policy think tanks publish reports that describe, through mini case studies, how these systems are built and used across the county. The reports stress the need for collaboration between government agencies that produce and maintain major administrative datasets such as property records, data intermediaries that make these datasets easier to understand, and local foundations that fund such activities. For example, the Providence Plan, a NNIP partner, has developed "long-term collaborative relationships with data providers…and assembled rich datasets that combine property-level and individual-level data from previously separate sources." (Treuhaft et al. 2007:29). The resulting NIS in Providence supports multiple neighborhood change efforts and each effort is described as a "community impact" of the system (ibid). A local early warning system draws on the NIS' property data to help prevent housing abandonment. Information in the NIS helps participants in neighborhood policing programs target their efforts and prisoner re-entry advocates understand and communicate relevant issues to a wider audience. Several reports capture the complex interplay between collaborative decision-making, technology development, and public policy-making. For example, staff at the Polis Center in Indianapolis, a NNIP partner, strove to create an early warning system for housing abandonment but found that it lacked support after a reshuffling of jobs and priorities in local government (despite a related meeting attended by 400 residents). Thinking practically, Polis Center staff members met with

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[6] Several NNIP thought-leaders published a new book in September 2014 that may elaborate on some of what is analyzed here: *Strengthening Communities with Neighborhood Data* by G. Thomas Kingsley, Claudia J. Coulton, and Kathryn L.S. Pettit.

representatives from other non-profit organizations and devised a completely different tool for evaluating Community Development Block Grant applications (Kingsley and Pettit 2008, 10). Data can act as an aid to decision-making (such as in the Providence early warning system)—but also as an aid to public mobilization. For example, leaders in two organizations supporting the NNIP partner in Atlanta sought to raise interest in a new data system for combatting mortgage foreclosures in the city. Staff in the Office of University-Community Partnerships (OUCP) at Emory University and in the Atlanta Regional Commission (ARC) acquired census tract level HDMA data from the Urban Institute and made a series of maps examining foreclosures, which they then presented to various audiences. The team felt that "the data 'got their foot in the door' to mobilizing serious joint consideration of [foreclosure] response strategies" (Kingsley et al. 2009, 18).

While helpful in showing the breadth of different projects, a review of these publications reveals a number of analytical shortcomings:

1) *Poorly defined terms.* Key concepts like poor neighborhoods (Kingsley 1998), low-income neighborhoods (Enterprise 2010; Kingsley and Treuhaft 2008), distressed urban neighborhoods (ibid), participation, and capacity building remain loosely or implicitly defined.

2) *Conflating use with impact.* Treuhaft et al. (2007:29) write that the "community impacts" of the NIS in Providence are its incorporation into an early warning system, neighborhood policing, advocacy around prisoner reentry, and tools for "neighborhood and regional action". While many technology scholars define *use* as a form of impact, at least one dissenting scholar argues that "information has no intrinsic value" and impact must reflect influence on "human decision-makers" that affects "physical events" *(DeLone and Mclean 1992, 69, quoting Emery 1971)*. This dissenting opinion dovetails with those of many practicing planners and planning scholars who seek to improve the lives of people and the function of places and to measure those changes (Myers 1997). Impact might be usefully redefined as the contribution of NIS to the outcomes of the various Providence programs—but not as its use alone.

3) *Vague connection between use and impact.* Kingsley and Pettit (2008) do not mention how—if at all—NIS was used in an Indianapolis summit attended by four hundred

residents. The Community Development Block Grant tool that eventually emerged from the summit does use NIS, but does not appear to directly involve residents in any way. Yet, the narrative suggests a connection between NIS and public participation.

4) *No counterfactual from which to measure impacts.* Staff at Emory University and at the Atlanta Regional Commission (ARC) believe data from NIS "got their foot in the door", helping to mobilize a six county coalition around mortgage foreclosure prevention (Kingsley et al. 2009, 18–21). An accurate evaluation should compare NIS to tools staff members employed previously.

5) *No confirmation of mechanisms.* Kingsley (1998, 1999) claims "one-stop shopping" is a key NIS advantage because it saves users time. NIS systems frequently provide mapping, which has proven useful in participatory planning efforts (Al-Kodmany 1999). NIS may also provide tools for avoiding "data overload" by focusing user attention on relevant information and making reasonable predictions (Simon 1945:123 & 248). Time savings, visual cues, and data reduction are three potential mechanisms through which NIS may deliver benefits under certain conditions, but reports from practitioners do not confirm the "why" behind claimed benefits.

Despite these shortcomings, practitioners and scholars involved with comprehensive community initiatives designed to involve residents in decision-making and build the capacity of individuals and institutions see NNIP as "one of the most important new resources in the community change field" (Kubisch et al. 2010:39). The perceived potential of NIS to contribute positively in community change efforts is very high. Evidence in peer-review publication to support this potential or its realization remains sparse, as the next section explains.

Peer-Reviewed Material

Despite frequent mention in professional practice reports and the growth of NNIP from seven to thirty-five locations, only nineteen articles or briefs in peer-review journals mention the partnership directly.[7] The dearth of peer reviewed studies alone reveals a broad gap in

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[7] Multiple searches for "NNIP" or "National Neighborhood Indicators Partnership" in the University of Michigan's

knowledge. Several articles mention the partnership only to introduce the concept of neighborhood information systems (Ali et al. 2007; Borders, Edwards, and Miller 2013; Castro and Atkinson 2009; Planas Llado and Soler Maso 2011). Several articles discuss the development and management of neighborhood information systems in detail including the need for data sharing and collaboration (Hwang 2006; Stoecker 2006; Weitzman, Silver, and Brazil 2006). Urban Institute affiliated researchers authored two articles advocating for the use of indicator systems to improve policy (Howell et al. 2003; Kingsley 2003).

One study (Hwang and Hoffman 2009) examines the demographics and purpose of neighborhood information system use. A broad survey of 221 respondents distributed via NNIP partners and other NIS providers from December 2006 to March 2007 found that 92.7% were affiliated with organizations and only 7.3% of users were unaffiliated individual (ibid). The three largest organizational users were: community nonprofits, CDCs, and CBOs (29.2%); government agencies (17.8%); and universities and colleges (16.4%). Housing and demographic datasets proved the most popular in the survey. Respondents used the data for proposal writing, evaluation, and strategic planning. The survey had several limitations. First, data collection proceeded from a convenience sample to a snowball sample with no tracking of nonresponse error, and the authors admit to the possibility of self-selection bias (ibid). Second, the published results do not specify the user base of specific neighborhood information systems or the variability between systems. Third, the survey does not differentiate between users who access the system only once a year from those who access the system more regularly.

Two sets of scholars collect data through self-reporting (surveys and/or interviews) to examine the impacts of neighborhood information systems and bring somewhat contradictory findings (Hwang and Hoffman 2009; Weitzman et al. 2006). Weitzman *et al.* (2006) find that amassing neighborhood data does not ensure political change or better decision-making. Hwang and Hoffman (2009) find that data access through NIS empower community organizations and build capacity. They did not find evidence that NIS leads to more participatory decision making. The authors did not independently confirm respondent claims that the systems lead to empowerment or to capacity building.

ArticlesPlus meta-search engine, most recently submitted on 11/9/2014.

Management Information Systems (MIS)

Management information system (MIS) scholars have developed several approaches to evaluating information systems. One major stream examines user acceptance of technology (starting with Davis, Bagozzi, and Warshaw 1989) and another major stream examines information system success (starting with DeLone and McLean 1992). Since previous work in PPGIS has explored cultural acceptance of the technology (see Sieber 2006:494), the research herein focuses on the latter stream. Delone and Mclean's (1992) Information Success Model unites temporal ordering of subcomponents and covariance between subcomponents. It remains the most frequently cited model in the management information system literature (Lowry, Karuga, and Richardson 2007). Variations include extending the model to three dimensions (technical development, deployment to the user, and delivery of benefits) (Ballantine, Bonner, and Levy 1996), separating the temporal and covariance dimensions (Seddon 1997), and adding service quality as a subcomponent (DeLone and McLean 2003). Recently, several scholars have produced very different and specialized models for particular technologies including enterprise resource planning systems (e.g. Zaitar and Ouzarf 2012) and service-oriented architecture (e.g. Mueller et al. 2010).

DeLone and McLean's model provides a useful set of conceptual components while making few assumptions about the nature of the information system. The authors urge scholars to identify meaningful measures for model components in specific situations (DeLone and McLean 1992, 2003), a common approach in the field of information systems (Tate et al. 2014) despite the aforementioned move toward specialized models by some scholars. A review of four popular, general-purpose models (Davis et al. 1989; DeLone and McLean 1992, 2003; Seddon 1997) found enterprise systems, knowledge management, and data warehousing to be the most common evaluation targets (Urbach, Smolnik, and Riempp 2009). Furthermore, two articles about the evaluation of GIS (Nedovic-Budic 1999) and NIS (Hwang and Hoffman 2009) mention DeLone and Mclean's (1992) model—though neither applies it to empirical planning research. Nedovic-Budic (1999) employs the model to structure a literature review of methods for GIS evaluation. Hwang and Hoffman (2009) distill the framework into a definition of effective and successful NIS that—in the interest of brevity—removes the level of detail necessary for in-depth evaluations of specific systems.

Figure 2 (below) provides an overview of the DeLone and McLean model. All

components together capture an elusive dependent variable called "information system success". However, the authors argue that "causality flows in the same direction as the information process" (DeLone and McLean 2003:15)—from left to right—making earlier constructs independent variables for later constructs. The figure can be succinctly understood as having three columns. Components in the first column (*Information Quality, System Quality*, and *Service Quality*) capture the potential usefulness of the system. This column mostly concerns hardware and software, but *Service Quality* may involve customer support and training.

Components in the second column (*Intention to Use, Use*, and *User Satisfaction*) all involve people who use the information system. Individuals want to use the system (*Intention to Use*) based on its perceived usefulness from the first column. Given access, both in terms of infrastructure (an Internet connection) and permission (an account or no login required) *Intention* becomes *Use*. Critics argue that *use* is a behavior that must precede success—but does not cause it as the model assumes (DeLone and McLean 2003). The authors reply that research must examine the nature of *use* and not rely on narrowly defined quantitative measures (*ibid*). *User Satisfaction* measures the reaction of users to the system because "a 'good' information system perceived by its users as a 'poor' system is a poor system" (Nedovic-Budic 1999 cites Ives et al. 1983, 786).

The third column (*Net Benefits*) captures any gains that accrue from using the system. Originally, the model specified both *individual impacts* and *organizational impacts* (DeLone and McLean 1992) but the new model allows evaluators to define the relevant level (or levels) of social hierarchy for analysis. Nedovic-Budic (1999, 293) adds *societal impacts* to the model, noting that geographic information systems are "often viewed as a tool that will enhance public participation and involvement in the planning process" although—she concludes—the initial evidence "is not very optimistic". A positive or negative use experience and the presence or absence of benefits feed back into *User Satisfaction*.
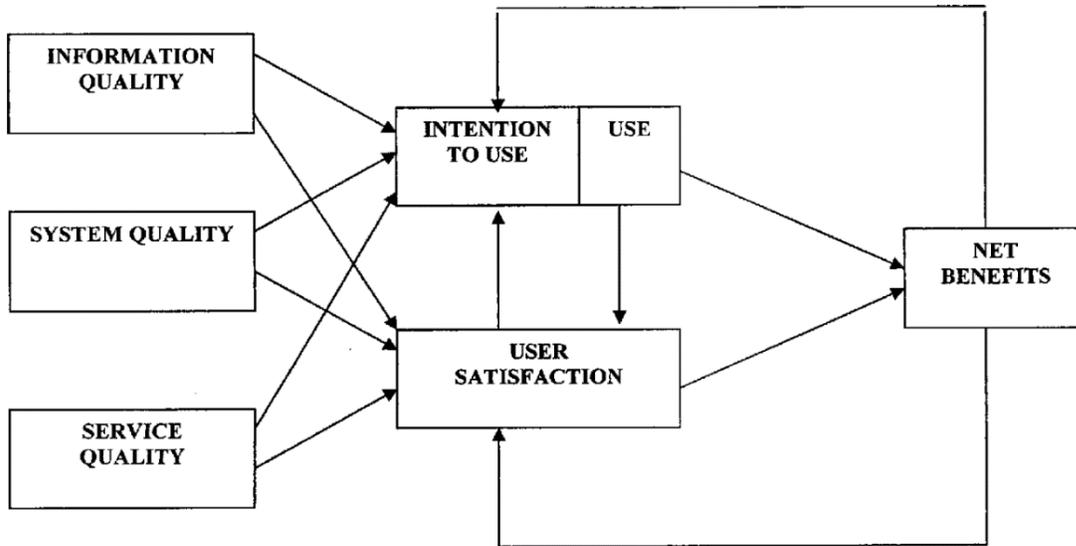
Figure 2: DeLone & McLean (2003) Framework for Information System Success

Scholars have employed different measures for model components. Table 2 (below) provides the number of measures DeLone and McLean (1992, 2003) identify and the measures employed in this research, which are described in detail in Chapter 5.

Table 2: Range of measures for each component in the DeLone & McLean (1992, 2003) model

Model Part	# Measures in Literature	Measures in this research
Information Quality	18	Breadth of data[8], Accuracy/Currency[9], Relevance
System Quality	23	Ease of use, Usefulness of system features & functions
Service Quality	5	Responsiveness, assurance, empathy

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8   The concept behind breadth of data falls under System Quality (Database contents) or Information Quality (Completeness) in the original model.

9   Accuracy and currency are listed under both System Quality and Information Quality in the original model. In the urban planning context, these concepts are closely connected and considered jointly in this research.

Information Use	23	Direct vs. chauffeured (indirect) use[10] Number of queries[11]
User Satisfaction	8	Decision-making satisfaction
Individual Impact	21	Time to make a decision[12]; Correctness of decision; Improved individual productivity
Organizational Impact	19	Range & scope of application; Increase work volume; Service effectiveness (defined later according to interviews as the transfer rate and rehab rate)

Scholars typically collect data through self-report surveys to apply the model (Petter, DeLone, and McLean 2008) and test for predicted correlations between components through structural equation modeling (Urbach et al. 2009). Multiple empirical studies have validated the model, including the primary relationship under investigation in this research—that between *use* and *net benefits*. In a broad meta-analysis, Petter *et. al.* (2008) found sixteen studies reporting that *use* positively contributed to *net benefits* at the individual level with six studies reporting no statistical relationship. The authors found five studies reporting that *use* positively contributed to *net benefits* at the organizational level with one study reporting no statistical relationship. Another meta-analysis confirmed the higher frequency of individual impact studies (26) versus organizational impact studies (12) (Urbach et al. 2009).

Both the management information system field in general and the DeLone and McLean

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10   Chauffeured use includes users who receive NIS data through another party, such as a CDC.

11   The number of queries per year likely include use by "confusion," a term Hwang and Hoffman (2009), employ to refer to useless queries submitted by users who do not know how to use the system properly. However, an alternative method considered for this research, days of use per year, does not capture sporadic but intense access staff members described in interviews. Another option, download time—a proxy for amount of data requested, was not possible to implement with the logfiles received and would have been distorted by poorly defined queries, server load, and Internet traffic.

12   In this research, time to make a decision includes the time to collect and arrange the information necessary to make the decision.

model in particular have been the subject of critique. MIS scholars tend to attribute changes in outcome to success of the system under investigation (Nedovic-Budic 1999) rather than actively seeking alternative explanations. Review of the figure above reveals that the DeLone and McLean model lacks formal mention of contingent variables (Ballantine et al. 1996). The model, according to several scholars, rests on deterministic assumptions (e.g.: Bartis and Mitev 2008). Some critics argue for a socially contingent approach, especially one realized through qualitative methods (ibid). Other critics add contingency quantitatively, via interaction terms, finding—for instance—that larger organizations benefit more from enterprise resource planning (ERP) software than smaller organizations (e.g.: Ifinedo and Nahar 2009).

Several MIS scholars have called for specific avenues of future research. It is important to explore new use contexts and different types of information systems that may reveal the existence of boundary conditions and limits to the DeLone and McLean model (Petter et al. 2008). Although DeLone and McLean (1992, 2003) argue for scholars to identify measures pertinent to specific domains, as a business oriented discipline, the bulk of MIS researchers focus on the for-profit sector. The literature review did not identify a single application of the model within the field of community development such as toward public participation or capacity building. Scholars should also consider new forms of data collection since overreliance on self-reported measures may introduce error (Petter et al. 2008; Tate et al. 2014). Further, measuring use solely as frequency of use oversimplifies a key model component (Petter et al. 2008). Tate *et. al.* (2014:1242) argue for "more process theories that examine the motors of change over time" and for qualitative and mixed-methods approaches that result in "richer and more insightful measures of success". They further recommend multi-level models, which examine both individual and organizational impacts (ibid).

Gaps in Knowledge and Calls for Research

This section reviews gaps in knowledge and calls for research revealed in the literature review. In the field of science and technology studies (STS), Leonardi (2007) argues that researchers should pay closer attention to the impact of increased information provided by information technologies, especially the impact within organizations. Wyatt (2008) argues that STS researchers must confront technological determinism directly by grappling with the reasons behind different outcomes regarding the same technology. These concerns remain largely outside

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of planning scholarship. Even when theoretical frameworks and measurement tools for participation (Arnstein 1969; Morrissey 2000) and capacity (e.g Chaskin 2001; Glickman and Servon 1998; Maclellan-Wright et al. 2007) refer to technologies such as management information systems, they do not call for evaluation of their impact on increasing participation and building capacity. Instead, for instance, Glickman and Servon (2003) identify political capacity, networking capacity, and neighborhood impacts of capacity building as difficult to measure and worthy of additional research. GIS scholars also find neighborhood (i.e. societal) impacts difficult to measure and to attribute back to the technology (Nedovic-Budic 1999; Sieber 2006). They urge researchers to fill these gaps and to find techniques to identify GIS contributions to organizational accomplishments and decision-making (ibid). Other scholars note the importance of reporting negative findings, noting the absence of writing about GIS failures (Tulloch and Shapiro 2003).

Neighborhood information systems provide GIS to users for free through an interactive website. Both practitioners and scholars have called for case studies showing the value of these systems for community development (Kingsley and Pettit 2008) with particular emphasis on contributions to participatory decision-making (Hwang and Hoffman 2009). Practitioners offer use vignettes that sometimes conflate use with impact (e.g. Treuhaft et al. 2007) and do not employ a counterfactual from which to measure NIS impacts (e.g. Kingsley et al. 2009). Practitioners rarely confirm the mechanism delivering claimed impacts, which may include one-stop-shopping (Kingsley 1998, 1999), mapping (Al-Kodmany 1999), and data reduction (Simon 1945). These practices decrease confidence in findings. Scholars studying NIS offer conflicting reports. Weitzman *et al*. (2006) find that amassing neighborhood data does not ensure political change or better decision-making. Hwang and Hoffman (2009) find that data access through NIS empower community organizations and build capacity. They did not find evidence that NIS leads to more participatory decision making. The authors did not independently confirm respondent claims that the systems lead to empowerment or to capacity building.

MIS scholars have identified several weaknesses in their work and called for specific remedies. Past evaluations have not sought alternative explanations for impacts or explained why some users benefit more than others (Ballantine et al. 1996; Nedovic-Budic 1999). Bartis and Mitev (2008) argue specifically for a socially contingent approach. There is a need to examine different types of information systems (Petter et al. 2008) and different types of data collection—

avoiding overreliance on self-reported measures (Petter et al. 2008; Tate et al. 2014). Tate *et. al.* (2014) argue for studies of process through qualitative and mixed-methods approaches and for multi-level models that include both individual and organizational impacts. The following table summarizes these gaps and calls for research topics and methods. Scholars have not urged the use of specific methods in science and technology studies and participation, capacity, and capacity building. Therefore, the corresponding cells in the "Needed Method" column are marked with "N/A", meaning "not applicable".

Table 3: Gaps in Knowledge and Calls for Research by Body of Knowledge

Body of Knowledge	Gaps in Knowledge and Calls for Research	
	Needed Topic	Needed Method
Science and Technology Studies (STS)	Impact of information technology (IT) within organizations and reasons for divergent outcomes	N/A
Participation, Capacity, and Capacity Building	Political capacity, networking capacity, and neighborhood impacts. Evaluation of IT contribution.	N/A
GIS, PPGIS, and Neighborhood Information Systems (NIS)	Evaluation of technology effects. Separate *use* & *impact*	In depth case studies, quantitative, or mixed-methods.
Management Information Systems	Diversity of system types and use scenarios, including in non-profit organizations and for community development.	Qualitative, mixed methods, attention to alternative explanations, multi-level models.

The largest gap in knowledge remains unidentified even after reviewing the work of critical scholars *within* these diverse literatures because the gap lies *between* them. While these fields are

related, they are estranged—barely on speaking terms. As mentioned previously, Nedovic-Budic (1999) and Hwang and Hoffman (2009) reference DeLone and McLean's (1992) model, but GIS and NIS scholars have yet to employ the model in an empirical evaluation. Similarly, STS and MIS scholars have yet to apply their concepts and models to investigate capacity building efforts. The research herein seeks to address this overarching gap by providing a unified theoretical framework for evaluating the socially contingent impact of technology on capacity building. Developing the unified theoretical framework from foundational work in the aforementioned fields should formalize and strengthen the connections between them and help fill each of the identified gaps.

The research identifies and seeks to explain divergent technological impacts, positioning it to contribute to the contingent approach to technology common in science and technology studies. It will also examine the connection between technology and capacity building, including political capacity building and network capacity building. The theoretical framework employed herein separates use from impact and examines impact in depth. Finally, the DeLone and McLean model has never before been applied using the mixed methods employed herein and never before been applied to this particular combination of technology (NIS) and organization (CDC), which positions the research to contribute to the diversity of MIS evaluations. The mixed methods approach aids the search for alternative explanations, protects against some spurious correlations, and enables multi-level work (qualitative interviews for individuals and quantitative administrative records for organizations).

The next chapter, *Chapter 3* (page 30), details the specific research questions, the hypothesized answers to those research questions, and the reasons for the hypothesized answers drawn from the relevant literature. *Chapter 4* (page 40) describes the theoretical framework and explains how it unifies relevant work in disparate fields. *Chapter 5* (page 47) details the research design, case selection criteria, selected case and subcases (i.e. embedded cases), operationalization of theoretical framework components, and the methods for each research question.

Chapter 3: Research Questions and Hypotheses

The research questions in this chapter were developed to address gaps in knowledge identified previously in the literature review. For example, there is little understanding about how information technologies might support capacity building efforts. Scholars have also explicitly called for more research on political capacity (which includes public participation) and network capacity. These gaps are the focus of several research questions. Question 3 examines the relationship between NIS use and public participation and capacity building from a process perspective. Question 4 and Question 5 examines this relationship from a causal perspective. The research questions are ordered to provide a complete picture of NIS, from proponent claims; to use of the system in community development, to benefits from use of the system. The hypotheses that follow each research question were developed by extrapolating from research discussed previously in the literature review and several additional studies introduced below. There are five research questions (Q1 to Q5).

Q1. What claims do NNIP partner organizations make about neighborhood information systems in their mission statements and websites?

Technology scholars often systematize and test vendor claims (e.g. Schubert and Williams 2009) and this research question seeks to extend the practice to neighborhood information systems in order to better structure findings into a practical and constructive evaluation. The claims are drawn from mission statements and webpages of NNIP partners, mostly nonprofits. The connection of mission statements to actual priorities and activities within nonprofit organizations remains unknown. But in the for-profit sector, issues emphasized in mission statements reflect both the image directors wish to convey to the public and the day-to-day priorities and activities within the organization (Bartkus and Glassman 2008). This suggests that mission statements will reflect the expectations of NNIP membership. According to NNIP, partners must:

- Build and operate an information system with recurrently updated indicators on

neighborhood conditions

- Facilitate and promote the direct practical use of data by community and government leaders in community building and local policymaking; and

- Emphasize the use of information to build the capacities of institutions and residents in distressed neighborhoods.

(NNIP Website, "Becoming a Partner")

NNIP membership requirements lead to the following hypothesis:

Hypothesis 1

The mission statements and webpages will emphasize "indicators" (data), users (community and government leaders), and the purpose or outcome of use (policymaking and capacity building that benefit institutions and residents in distressed neighborhoods).

Q2. Who uses NIS and how frequently?

The term *use* herein refers to any activity a human being undertakes to obtain data stored in an information system. The history of computers and GIS in the field of urban planning suggests that staff in government agencies and nonprofits conducting planning activities *will* use NIS—if it makes the work easier (Chandler et al. 2006; Harris 1989). As noted in Chapter 3, a survey of NIS users nationwide supports this claim, finding that 92.7% of users were affiliated with organizations (Hwang and Hoffman 2009). The three most common organizational affiliations were: community nonprofits, CDCs, and CBOs (29.2%); government agencies (17.8%); and universities and colleges (16.4%).

The same survey found that only 7.3% of users were unaffiliated individuals (Hwang and Hoffman 2009), exposing a potential problem when juxtaposed against the final NNIP membership requirement quoted above. Nationally, residents compose less than a tenth of NIS users and residents in distressed urban areas may compose a tiny fraction of that tenth. Mention of non-stockholders such as customers and community members in corporate mission statements remains purely symbolic without these parties enjoying any corresponding influence over decision-making (Bartkus and Glassman 2008). Mention of residents in NNIP mission statements and webpages may also be purely symbolic. There are several alternative explanations however. The average percent of resident users reported in the survey might mask significant differences between NNIP sites. Perhaps residents benefit from NIS indirectly when institutional users access the system. For example, institutional users could pass NIS information to residents over the phone or in a newsletter. Institutional users might rely on NIS to plan activities that build the capacity of residents—residents who never use the system directly. The answer to this research question will begin to narrow the long list of possible relationships between residents and NIS.

The survey asked users to rank the relative frequency (from "never" to "always") with which they accessed various categories of data ("demographics", "housing", "health", etc.) but did not ask for more precise measures of data access (Hwang and Hoffman 2009). Since many NIS providers are affiliated with universities—students, professors, and staff are likely to know about and use the systems. A professor may employ the system for multiple studies in a planning-related field or recommend students use the system to complete a project he or she

assigns every year or every semester. But, since such use is not central to a job responsibility, this use will be less frequent than use by government and CDC staff members involved in planning.

Compared with institutional users, predicting the frequency of NIS use by residents is less clear cut. The literature suggests that the most vulnerable members of society may not have the opportunity to enjoy any benefits that NIS provide because they lack access or interest (Zickuhr and Smith 2012) or skill (Epstein et al. 2011). Furthermore, initial exploratory interviews suggested that NIS providers in Cleveland, Detroit, and Minneapolis advertise NIS to organizational users more than to individual users.

The reasoning above yields three hypotheses:

Hypothesis 2a

City departmental and CDC staff will be the most frequent users of neighborhood information systems.

Hypothesis 2b

People affiliated with local educational institutions will use the NIS, but less frequently than people affiliated with local government departments or with CDCs.

Hypothesis 2c

Residents not affiliated with governmental, educational, or community development organizations will not use NIS frequently or will not use NIS at all.

Q3. How do Community Development Corporation (CDC) staff use NIS?

Community development refers to efforts to improve the well-being of residents in a particular geographic area through built environment, human capital, social capital, and commercial strategies (Rubin 2000; DeFilippis and Saegert 2008) though considerable disagreement persists over details (e.g.: DeFilippis 2010; Kirkpatrick 2007; Shaffer 2006). Built environment strategies include housing and real estate development, code enforcement, paint programs, side lot adoption, and the demolition of dangerous structures. Human capital strategies include workforce development, technical training, and general education programs. Social capital strategies include strengthening the relations between people and between people and local organizations. Commercial strategies include business attraction, business retention, business incubators, and facade maintenance grants. Specific CDCs prioritize these strategies differently and may integrate NIS differently into their work.

While vendors and pundits claim that technology will radically alter organizational structures and employee workflows, scholarship suggests that computer applications reinforce the preexisting structure of organizations (Grint and Woolgar 1997:25) and that employees integrate software into preexisting workflows (Grant et al. 2006). For these reasons, hypothesis 3a states:

Hypothesis 3a

CDC staff members will use NIS to pursue the same work as they pursued before using NIS.

Theory also suggests that a given technology may provide *affordances* that make certain activities and ways of working easier (Oliver 2011). CDC staff members will likely only use NIS in work for which it is well-suited. As Chapter 4 will make clear, funders and programmers developed one version of the NIS under investigation to assist with a physical development strategy of community development. Therefore, the next hypothesis is:

Hypothesis 3b

CDC staff members will use NIS primarily to pursue the physical development strategy such as through residential rehabilitation.

As the theoretical framework in Chapter 4 will explain, the ability of a CDC to conduct public participation activities is an expression of that CDC's political capacity. However, this research presents questions about participation and capacity separately to mirror the claims of NIS proponents.

Q4. Does NIS improve public participation and, if so, what factors mediate the improvement?

The claim that NIS can improve public participation encounters two challenges in the literature, one related to CDCs and one related to GIS. Historically, Community Action Agencies (CAAs)—the predecessors of Community Development Corporations (CDCs) created by the Economic Opportunity Act of 1964—strove to achieve "maximum feasible participation" of local residents in decision-making (DeFilippis 2008). But, perceived radicalization of some CAAs ended direct federal funding of grassroots participation and gave rise to the current Community Development Block Grant (CDBG) system in which cities receive money and make allocations to community organizations (ibid). In response to reductions in federal support in the 1980s and 1990s many CDC directors saw residential and commercial real-estate construction and management as a path to solvency (ibid) and reassigned community organizers to non-organizing tasks (Vidal and Keyes 2005). Intrinsic tensions between aggressive community organizing and development deal-making limits the extent to which the two approaches can coexist in the same institution (Yin 1998; Stoecker 2003; Smock 2003; Stoecker 2008). Consequently, many CDCs become disconnected from the day to day lives of local residents. From this point of view, there is little reason to believe CDC staff members will employ NIS to pursue public participation and therefore little reason to expect an opportunity to examine the tool's impact. Therefore, the first hypothesis for this research question is:

Hypothesis 4a

CDC staff members will not use NIS to increase public participation because they will not be pursuing public participation activities and NIS does not require them to pursue public participation activities.

There remains insufficient evidence to conclude that NIS could increase public participation. GIS has been employed successfully within public participation processes to capture local neighborhood knowledge, formally express residents' preferences, and deepen

communication about important issues (Talen 2000). Some scholars even argue that Internet-based GIS could provide unprecedented levels of public participation (Drummond and French 2008). However, multiple studies reveal that even when a stated goal of GIS use, an increase in public participation does not automatically occur and change remains difficult to define, measure, and detect (Sieber 2006). Therefore, the next hypothesis is:

Hypothesis 4b

NIS will not increase public participation within CDCs employing NIS in public participation activities.

Q5. Does NIS improve the capacity of a CDC and, if so, what factors mediate the improvement?

The basis for the earlier hypothesis that CDC staff members will not change their workflow to use NIS suggests that any capacity improvements that require such changes will not occur (Grant et al. 2006; Grint and Woolgar 1997). HUD previously supplied local community development organizations with GIS software to bolster their capacity (Leitner et al. 2000) and GIS software is now even more affordable and widely available—yet HUD recently reported that some local community development organizations still lack the capacity necessary to complete contracted activities (HUD 2010). Clearly, GIS provision does not guarantee greater capacity. GIS overlaps considerably with NIS, suggesting that the latter will not guarantee greater capacity either. Scholars evaluating GIS report that capacity improvements—when detected at all—vary by organization (Elwood 2008; Robey and Sahay 2001). The following factors are associated with some form of capacity gain—variously defined—from GIS (ibid):

- More resources (money, computers, and employees)

- The presence of staff trained on GIS

- Decentralized decision-making (more staff autonomy)

- Good fit between staff assumptions and GIS assumptions (e.g. staff conceive of space in

terms of discrete parcels and not something more abstract)

Management researchers found that simply controlling more material resources (money, property) and better intangible resources (reputation, business practices) can lead to firm growth and success, depending on how these factors are defined and measured (Newbert 2007). Such empirical findings for the resource-based approach to analyzing organizations, though rather weak, dovetails with the findings concerning when GIS builds an organization's capacity. Therefore, this research examines several of these factors as alternative explanations for an increase in capacity. Take, for example, staff members in a community development corporation who increase their use of NIS and rehabilitate more vacant properties than last year. The analysis would have to control for a potential increase in resources as well, such as CDBG funding and employees. The increase in production may not be due to NIS entirely. It may not be due to NIS at all. Further, since CDCs operate *in* and *on* specific neighborhoods—local environmental factors such as the residential vacancy rate and owner occupancy rate may strongly determine what type of work staff members pursue and their level of success. These competing explanations seem—as a whole—more convincing than technology alone; therefore the hypothesis for this research question is:

Hypothesis 5

NIS does not improve the capacity of CDCs to conduct community development. Capacity improvements are more succinctly explained by other factors.

These research questions were selected to help fill gaps in knowledge highlighted in Chapter 2. The hypotheses were developed by extrapolating from the limited information currently available. Determining the correctness of these hypotheses requires conducting empirical research. Chapter 4 lays out the theoretical framework employed in the research and Chapter 5 describes the research design and methods. Chapter 6 and 7 detail the findings, with the correctness of the hypotheses clearly noted. However, findings always come with caveats and

Chapter 8 acknowledges relevant threats to validity. Finally, Chapter 9 discusses the findings in terms of contributions, implications, and recommendations.

Chapter 4: Theoretical Framework

The theoretical framework employed in this research, shown in Figure 3, consists of defined terms, a sub-framework for evaluating the impact of an information system (based on Delone & McLean 2003), and a sub-framework for understanding the relationships between participation, capacity building, and information (based on Chaskin 2001; Glickman and Servon 1998; Sawicki and Craig 1996). Community development scholars and practitioners employ concepts that are difficult to define, but must be pinned down in this research. In the U.S., the term *neighborhood* refers to a city subsection with a "propensity toward homogeneity" in terms of housing type (Thomson 2008) and very possibly a similar homogeneity in terms of housing quality, household income, and racial/ethnic makeup. Neighborhood residents share an interest in the provision of certain goods and services due to mutual proximity (DeRienzo 2008). The term *community* goes a step further, suggesting that people living in proximity share a sense of purpose (ibid).

The framework weaves related but hitherto disparate research streams into a workable whole for the first time using two techniques, *routing* and *refined replacement*. The color of a component in Figure 3 signifies the original work as labeled in the legend entitled "Component Sources" in the upper right hand corner. Gray lines *route* components structured by DeLone and McLean (2003)[13] shown in gray to related components structured by Chaskin (2001)[14] shown in orange. Several items in Chaskin's "Characteristics" components have been *refined and replaced* by more specific and detailed theoretical understandings drawn from the literature (Glickman and Servon 1998; Sawicki and Craig 1996). Components depicted with a thin outline are measured qualitatively while those depicted with a thick gray outline are measured both qualitatively and quantitatively, as detailed in the legend entitled "Component Methods" in the upper left hand corner. The quantitative models take a CDC's *Characteristics* and *Neighborhood Context* as independent variables (inputs) and that CDC's annual *Outcomes* as the dependent

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[13] see Figure 2 on page 25 for comparison

[14] see Figure 1 one page 12 for comparison

variables (outputs). Each dependent variable requires a separate model. The legend entitled "Component connection" on the bottom of the figure describes the three types of relationships between the components:

- *Flow of influence or use* (thin blue lines): Chaskin's empirical work suggests, for instance, that neighborhood context affects the decisions and priorities of social actors.

- *Quantitative inputs and outputs* (thick gray lines): While thick gray outlines on certain components show that they are measured both qualitatively and quantitatively, the connection lines show the structure of the quantitative evaluation models with both *Characteristics* and *Neighborhood Context* explaining *Outcomes*.

- *Feedback* (black dotted lines): The study of capacity building and community development requires showing that past outputs contribute to future inputs.
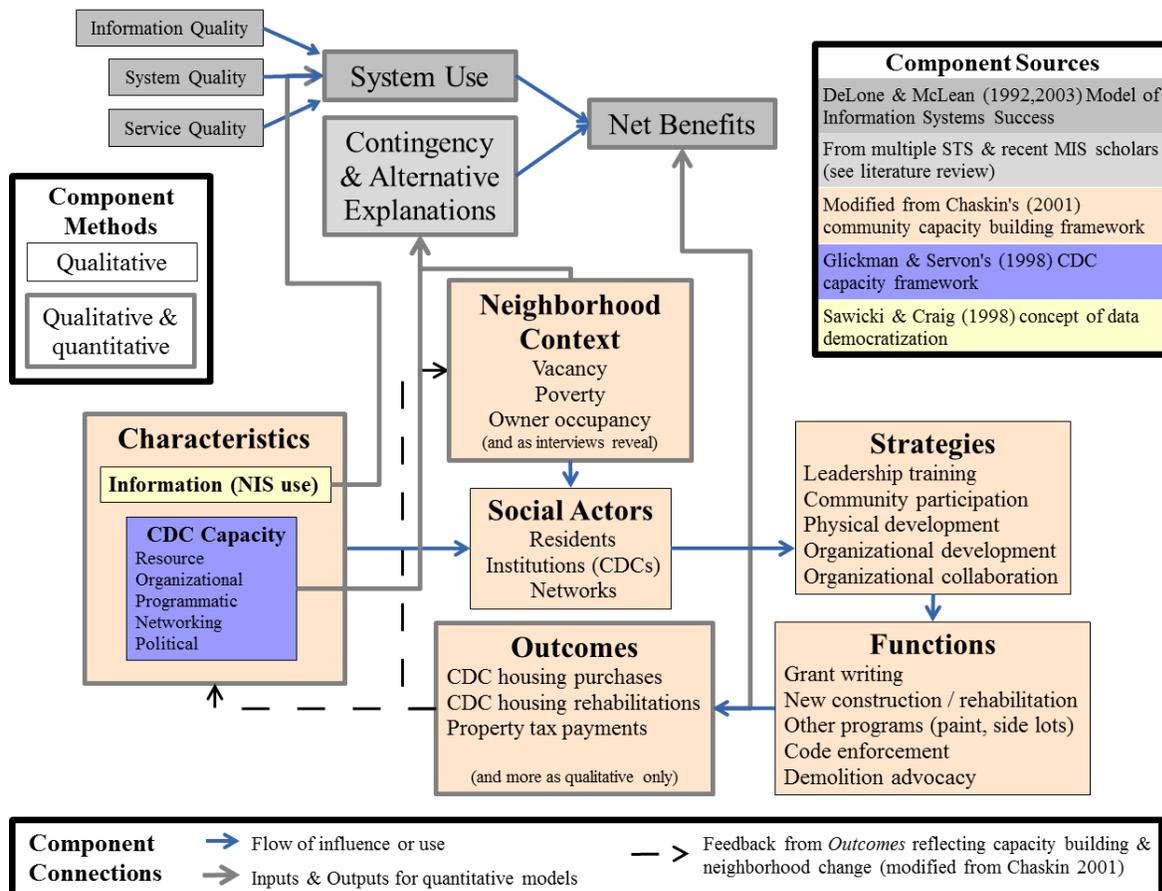
Figure 3: Final theoretical framework incorporating multiple sub-frameworks

Each component is described in the sections that follow.

Information Quality, System Quality, and Service Quality

Information Quality focuses on the data in the information system. The term *information* here refers to the finest grain "facts" in the system—not to their interpretation in reports. *Information* quality*, therefore, is *data* quality. *System Quality* includes aspects of the hardware and software that affect an information system's speed, reliability, and range of functions. *Service quality* covers assistance that information system providers offer to information system users. Delone and McLean added this component to the 2003 model after receiving criticism that the 1992 model lacked such a component. They noted that in the 1980s, computer users shifted from being primarily engineers, scientists, and other technology professionals to laypeople (so called "end users"). This meant that information system creators no longer just built and maintained the systems—they needed to provide customer service as well. These components contribute to a potential user's decision to actually use the information system. They therefore also may be correctly conceptualized as feeding into the *Information (NIS use)* item within the *Characteristics* component, but are drawn as shown above to minimize clutter (to the extent possible in a complex figure) and to keep components from the same literature together.

System Use

System Use measures how, how often, or how intensely users employ the system. The methods and data sources in Chapter 5 discuss this component in detail.

Contingency and Alternative Explanations

As discussed in Chapter 3, even the updated (2003) DeLone and McLean success model rests on deterministic assumptions (Ballantine et al. 1996; Bartis and Mitev 2008). Both science, technology, and society (STS) scholars and management information systems (MIS) scholars argue for theoretical frameworks that allow impacts to vary widely from case to case based on social context (contingency) and that consider non-technological reasons for those impacts (alternative explanations). Recent scholars have added model components to address its shortcomings either qualitatively (Bartis and Mitev 2008) or quantitatively (Ifinedo and Nahar 2009). The mixed-methods approach employed herein does both as described in Chapter 5.

Net Benefits

Net benefits measure the impact of information system use. The methods and data sources in Chapter 5 discuss this component in detail.

Characteristics

This component is based on Chaskin's *characteristics of community capacity*, which cover community level attributes such as the "ability to solve problems" and "access to resources" in the original framework (Chaskin et al. 2001, 16)[15]. However, these clearly vary from actor to actor and are re-conceptualized and expanded upon in the final framework. CDC capacity (Glickman & Servon 1998) provides a rich model with which to examine many types of organizations, especially community development corporations.

Although not detailed in the figure above, all of a CDCs various sub-capacities are interrelated (Glickman and Servon 1998) and contribute to outputs that become the inputs of capacities in the future (De Vita and Fleming 2001:23), potentially causing an endogeneity problem. As Chapter 5 will show, the qualitative methods in this research avoid endogeneity by revealing the relationship between preexisting and outcome levels of specific sub-capacities through rich narrative description and probing. The quantitative methods in this research avoid endogeneity by operationalizing relationships suggested in the qualitative data without placing measures representing the same sub-capacity as both an independent and dependent variable. For example, organizational capacity (staff size and NIS use), resource capacity (CDBG funding, SII participation) are modeled as explanatory of programmatic capacity building (e.g. the number of residential housing units rehabilitated).

While Chaskin places "information dissemination" under *functions,* he does not account for "information access"—the primary concern of this research. Sawicki and Craig's (1996) concept of data democratization serves this purpose, placed within this component because distinct actors make use of the data to varying degrees. This placement within the theoretical framework also follows a precedent set by scholars examining the impact of Internet and communications technologies in developing countries. They approach information as an asset or

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[15] Chaskin's concept of "commitment" falls outside the scope of this research.

resource accessed at an actor level (Gigler 2004; Kleine 2010). While listed separately in the framework, NIS use is a measure of Glickman and Servon's *organizational capacity.*

Social Actors

The final framework addresses three types of actors: residents, institutions, and networks of institutions. This research focuses on community development corporations (institutions), but also examines related activities by block club activists (residents), housing committee members (residents), a code enforcement partnership (network), and an investment initiative (network).

Functions

Functions are the work that a CDC's capacity enables it to perform. The framework considers common CDC functions in Cleveland: grant writing, residential rehabilitation, code enforcement, demolition advocacy, and other programs. This work is described more in detail though the common tasks that functions share that are conducive to NIS use (starting on page 112). Actors perform the same functions in different ways depending on the strategies they adopt.

Strategies

Strategies represent five different approaches to capacity building.

1. The *physical development* strategy holds that improving the built environment will improve quality of life for neighborhood residents. Although Chaskin (2001) does not include this strategy in his capacity building framework, it is necessary for studying community development corporations because CDC staff members frequently employ the *physical development strategy* explicitly or implicitly in their work (Rubin 1995). For example, Neighborhood Progress Inc.'s *Strategic Investment Initiative*, which supports CDCs in several Cleveland neighborhoods, seeks to ameliorate the blight of abandoned houses enough to catalyze investment from the private market (see description in Treuhaft and Kingsley 2008).

2. The *community participation* strategy holds that "bringing people together" will help

"solve community problems and address collective goals" (Chaskin 2001, 92). Chaskin calls this strategy "organizing" or "community organizing". The strategy has been renamed here to cover a broader range of activities, from initially convening a resident-led housing committee that holds public officials accountable (see "Committees" on page 127 and "Political Capacity" on page 133) to helping individual residents with basic research on problem properties over the phone (see "Fielding call-ins" on page 121). While the instances vary considerably, CDC staff members pursuing this strategy share a willingness to involve residents in the nuts-and-bolts of community development on a parcel by parcel level. Chaskin *et al.* (2006) explains these aspects of capacity building as institutional efforts to build social capital (Putnam 1995).

3. The *leadership development* strategy holds that influential people can "direct the attention" of neighborhood residents toward "goals and the paths to achieve them" (Chaskin 2001,28 cites Bass 1990).

4. The *organizational development* strategy holds that organizations "can be important vehicles for solving community problems, and for helping community members find common ground and take action in the service of shared goals" (Chaskin 2001, 61).

5. The *organizational collaboration* strategy, like the *community participation* strategy, focuses on bringing people together to solve shared problems, but does so at the organization rather than the individual level in order to access resources outside a particular organization or geographic neighborhood (Chaskin 2001, 123).

This research recognizes that actors may apply different *strategies* to different *functions*. For example, CDC staff members may combine *community participation* and *leadership development* strategies to pursue the function of *demolition advocacy*. Similarly, they may apply an *organizational collaboration* strategy for code enforcement. Therefore, the *strategies* component flows into the *functions* component in the final framework.

Neighborhood context

These are environmental factors such as vacancy rate and owner occupancy rate that may

help or hinder capacity and capacity building. Chaskin referred to these as *conditioning influences.*

Outcomes

Outcomes are neighborhood changes produced by a social actor, such as rehabilitated housing. In this research, outcomes must be attributed to (1) the neighborhood information system; (2) another element of CDC capacity; (3) neighborhood context; or (4) unknown/unmeasured factors. Outcomes feed back into the *Characteristics* component as a new (hopefully higher) level of CDC capacity and feed back into the *Neighborhood context* component as new (hopefully positive) environmental factors.

This chapter has shown how important theoretical foundations from disparate academic fields—along with criticisms of those foundations—can be brought together into a single cohesive framework to examine the contingent impacts of an information system at multiple social levels (individuals, organizations, and networks) while accounting for alternative (non-technological) explanations. It identifies and provides examples of two techniques for weaving together separate theoretical constructs, *routing* and *refined replacement.* Next, Chapter 5 grounds this theoretical framework by articulating the research design, methods, and data.

Chapter 5: Research Design, Methods, and Data

Critical Case

This research employs a single critical case research design with multiple embedded cases (Yin 2009) and a mixed methods triangulation strategy (Jick 1979). NIS proponents do not yet offer a theory explaining why the technology should promote capacity building in organizations and individuals, nor do they qualify such claims. A default theory, though overly simplistic and deterministic, provides a way to move forward:

If NIS, then capacity building (A→B)

A single critical case provides leverage to challenge such a theory (Yin 2009), since a given treatment (technology) that fails to produce the anticipated effect (capacity building) in the most ideal circumstances is unlikely to succeed in worse circumstances. But, such a research design does little to enrich impoverished theory. Multiple cases provide opportunities to examine when and why a theory holds true, and thus facilitate theory building. This research combines both approaches by examining a critical case city with multiple imbedded organizations as the units of analysis.

A critical case, by definition, provides the optimum conditions to support a theory. While "best" and "easiest" also describe such cases, the term "critical" reflects that the theory must hold in such a situation for it to retain any plausibility. If the empirical outcome conflicts with the outcome predicted by the theory—then the theory should be dismissed in its current form. Put another way, a critical case provides a theory with plenty of rope to hang itself. Additionally, by providing optimum conditions, a critical case provides the best chance of detecting the predicted outcome. This point of view expresses the concern that social science techniques are not infinitely sensitive; a theory may hold in less than ideal conditions—but the predicted outcome may remain undetectable. Determining the optimum conditions for theory left implicit in the relevant literature poses a challenge. The site selection process for this research sought to

meet three criteria:

1. A pressing need for information

   a) <u>A problem to solve</u>. Information matters in the face of a challenging task or a constraint on resources.

   b) <u>Strategic action possible</u>. Without a perceived chance to apply information to a pressing need, an actor will not seek out such information. Incessant conflict between public agencies and non-profit developers, for example, would likely undermine the usefulness of a NIS because follow-through on strategic choices remains impossible. A critical case city would therefore demonstrate some level of cooperation between major community development actors.

2. A well-respected neighborhood information system (NIS)

   a) <u>Well-implemented & mature feature-set</u>. Examining the impact of a poorly implemented or fledgling NIS will bias the research toward an easily explainable negative finding. Examining a well-implemented and mature NIS will bias the research toward a positive finding. A critical case design must provide a bias toward positive findings in order to bolster any shortcomings in the theory that the study reveals.

   b) <u>Availability of NIS training</u>. Previous research on geographic information systems highlight the need for technical assistance for new users (Sawicki and Craig 1996; Ghose 2011) although some newer scholars argue that new web-based systems reduce this need with a corresponding loss of analytical tools . A critical case must have such assistance available.

3. A well-respected community development system

   a) <u>High level of professionalization</u>. In a strictly deterministic approach, organizations benefit just from access to NIS—regardless of staff experience. However, if this approach proves incorrect, a critical case should still provide the best chance to validate NIS claims. Less experienced staff may not know what information to seek

or how to use that information to further community development. Personnel in a critical case therefore must show a high-level of community development acumen allowing them to extract whatever benefit the technology can offer.

b) <u>Organizations of every size.</u> Some scholars argue that organizations with greater resources (usually larger organizations) outperform smaller organizations (Wernerfelt 1984; then more critically Wernerfelt 2007). Accounting for the possibility that NIS does not explain performance but the number of employees and amount of funding do explain performance requires including a range of organization sizes. Working with multiple imbedded cases allows the research to meet this requirement.

c) Public/private sector cooperation. (See Item #1b)

Cleveland meets these three criteria as detailed below and summarized in Table 4 on page 57.

A pressing need for information: addressing problem properties

The wave of mortgage foreclosures hit Northeast Ohio early and hard. The number of foreclosures filed in Cuyahoga County quadrupled between 1995 and 2007, with local leaders already sounding the alarm on subprime lending in the late 1990s (Coulton and Hexter 2010). Nearly a fifth of the census tracts in the county saw at least a ten percent rise in vacancies between 2000 and 2010[17]. While the city's defenses included its strong community development industry system and neighborhood information system (ibid), these proved insufficient to stop vacant buildings from falling into disrepair. Between 2005 and 2008, the demand for municipal board-ups increased threefold, condemnations fourfold, and demolitions fivefold (Frater, Gilson, and O'Leary 2009).

A Cuyahoga County official estimated ten thousand homes inside Cleveland were "rotting corpses" (Niquette 2011). Toward the end of 2011, the Department of Community Development listed 7,761 properties as vacant and distressed (V&D) candidates for demolition[18].

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17 Based on NEO CANDO Census data downloaded 4/5/2013

18 V&D totals received as an Excel spreadsheet on April 2, 2012 from the Department of Community Development. The department defines vacant & distressed as an entire building with no evidence of occupancy and at least one of the following conditions: house is boarded; a considerable amount of minor defects exist; house is open and vandalized; major defects and damage to structural items exist; house is dilapidated; significant untrimmed

A single census tract (#1198) contained 1,182 such properties and 69 tracts contained over a hundred such properties each. In nineteen tracts, over ten percent of the structures were vacant and distressed in 2011. As of February 2013, more than 17,000 homes within the Cleveland Division of Water service area were not receiving water and were likely sitting vacant (Davis 2013). While not all of these structures are currently distressed, without care from the property owner or another party they are headed in that direction. For each property, local CDC staff must decide to: (1) advocate for immediate demolition; (2) motivate the homeowner (possibly a bank) to maintain the property; (3) acquire the property and pursue rehabilitation; or (4) hope that a responsible homeowner proceeds "as is". The first three options require identifying the current homeowner. Typing each address into the Cuyahoga County Auditor's website and receiving usable information takes a great deal of time, even in ideal circumstances. However, in many cases the circumstances are not ideal.

The city's housing court judge explains that "there are thousands of foreclosures in limbo, just hanging out there, just sitting, with nothing being done" (Conlin 2013). So called "zombie properties" occur when the bank managing a loan starts foreclosure proceedings, the homeowner vacates the property, and then the bank does not continue with foreclosure. Who is legally responsible for the property? Finding the answer requires more exacting title research.

Information can provide opportunities for strategic action in Cleveland. Understanding the full legal history of a property can reveal potential solutions. For example, a house in Cuyahoga County that passes through two sheriff sales without a buyer becomes eligible for demolition by the county. The Cuyahoga County Land Bank will acquire certain types of properties, clear the title, and offer CDCs first choice to purchase at a reduced price for rehabilitation. Since creative options for action exist in Cleveland, a tool that links map, homebuyer, lien, loan, court, and sheriff sale information together would benefit community development professionals.

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vegetation and/or trash, deteriorated walkways, driveways, fencing; property is severely overgrown; property is the site of much debris or abandoned vehicles (Anon 2011)

The Neighborhood Information Systems: NEO CANDO & the NST web app

Researchers and staffers at the Center on Urban Poverty and Development started the CAN DO system in 1992. They updated and renamed the tool in 2005, placing it on the web. NEO CANDO (Northeast Ohio Community and Neighborhood Data for Organizing) contains data for seventeen counties and parcel-level data for Cuyahoga County and provides integrated mapping. The National Vacant Properties Campaign considered it the best NIS in the country (LISC 2009:18). With support from NPI, the City of Cleveland, Cuyahoga County, and the Cuyahoga County Land Bank, the Center developed the Neighborhood Stabilization Team web application (NST web app) for CDC and city staff, which includes additional public data, proprietary information on adjustable rate mortgages, and custom fields for user notes (#46, 12/20/2010 and other interviews)[20].

Both the Center on Urban Poverty and Community Development that owns and operates the system and Neighborhood Progress Inc. offer CDC staffers training on the local neighborhood information systems. NEO CANDO provides a clear interface for locating and mapping information along with detailed descriptions of the data sources, geographic levels, and terminology. The Center is part of the Mandel School of Applied Social Sciences, which offers master's students in applied social science (MSASS) a NEO CANDO training every year. They offer similar trainings to the general public on request. Such requests resulted in trainings for the University's library staff, the Begun Center for Violence Prevention Research, the First Suburbs Consortium of Cuyahoga County, and Project Access (personal communication 11/9/2011). Initially, the Center offered bi-weekly trainings for the more advanced tool, the NST web application. These sessions are monthly and open to anyone, though the trainers advertise specifically for CDC staffers. The city's code inspectors, city council members, and housing court have attended special trainings. Until June 30, 2012, Neighborhood Progress—with NSP2 funding—provided additional technical support to area CDC staff. Usually, each session would include staffers from a single CDC who brought questions about specific problem properties in their service area. A NPI representative with legal training and proficiency with the NST web

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[20] The format for citing interviews is (#Assigned Person ID, Date of Interview) for individuals affiliated with a community development corporation or government entity and ('resident', Date of Interview) for individuals without such an affiliation.

application answered these questions from both a legal and technical perspective using maps and tables from the application projected on a large screen. He informed attendants about new functions in the software, new data sources, and upcoming funding opportunities (observed in person on 11/8/2011). These training opportunities make Cleveland a critical case for studying NIS since community development professionals with training are more likely to exploit any benefit the technology can provide.

The Community Development System

In cities across the United States, non-profit organizations and government agencies pursue community development through a dense network of interlocking relationships that form an industry system (Yin 1998). Researchers highlight numerous components of this system in Cleveland as especially strong and focused on housing (Dewar 2013; McQuarrie and Krumholz 2011; Yin 1998). The level of professionalization, presence of development organizations of different sizes, and cross-sector cooperation make Cleveland a critical case for NIS research, as explained in more detail below.

Professionalization

Scholars in non-profit management and public administration refer to the process of moving from voluntary to paid staff, formalizing duties, and standardizing knowledge as "professionalization" (Hwang and Powell 2009; Markowitz and Tice 2002; Vakil 1997). In terms of community development in Cleveland, this process has involved non-profit intermediary organizations, both competition and cooperation between local CDCs, local degree-granting universities, and the technical training opportunities already mentioned.

An impressive array of local and national non-profit intermediary organizations call Cleveland home. City agencies, local foundations, and local corporations worked together to establish Neighborhood Progress Inc. (NPI) in 1989, which provides financial, technical, and capacity-building services to CDCs pursuing physical development projects (Lowe 2008; McQuarrie and Krumholz 2011). NPI's Strategic Investment Initiative received a Bright Ideas award in 2010 from the Ash Center at Harvard University (Ash Center 2010). It features "precise, narrow targeting" to restore private markets "in a select number of Cleveland neighborhoods which have undergone previous decline but show potential to

'recover'"(Neighborhood Progress Inc. 2011). In 2010, NPI paid about $3M in grants including to thirteen CDCs in amounts ranging from $5K (St. Clair Superior) to $702K (Buckeye)[23]. NPI gave $10K to upgrade NEO CANDO in 2004 and has continued to give about $50,000 a year to maintain and expand the application (#46, 10/20/2011). The Cleveland Foundation gives roughly $80M in grants to non-profit organizations in Cleveland and surrounding areas—including to several CDCs.[25] Cleveland is also one of the sites for Living Cities' Integration Initiative, which brings together the financial resources of anchor institutions, foundations, and government agencies to create economic opportunities in the city (Hexter, Austrian, and Clouse 2013)

Two large national community development intermediaries, LISC and Enterprise Community Partners once operated in the city, strengthening the local community development system. LISC no longer appears to be active in Cleveland, focusing its Ohio efforts in Toledo and Cincinnati. Enterprise still supports projects in Cleveland, largely through local partners, including NPI and the Cleveland Housing Network. In 2004, Enterprise pitched in with NPI to upgrade NEO CANDO, giving $30K (#46, 10/20/2011). Enterprise has been involved in implementing or funding several development projects in Cleveland including Opportunity Homes, a scatter-site project in six neighborhoods (started in 2009), St. Luke's Manor senior housing, which transforms a vacant, historic hospital (started in 2011), and The Winton on Lorain, which provides homes to homeless men and women (completed in 2013)(Enterprise Community Partners n.d.).

The relationships between CDCs in Cleveland express both competition and cooperation and have resulted in the survival of CDCs that focus on—and are successful at—housing construction and rehabilitation. The Department of Community Development and the City Council are each responsible for distributing half the city's CDBG allocation. When historical development patterns or ward boundary changes place multiple CDCs within the jurisdiction of a single council representative, the competition can be especially fierce. In 2011, the Department

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23 According to the IRS 990 Form for 2011

25 An overview of the Cleveland Foundation's grant making is available at
   http://www.clevelandfoundation.org/grants/our-grantmaking/ with more detailed accounting available through
   its searchable online grants database.

of Community Development funded twenty-five CDCs[27], down from thirty-two in 2005.[28] The number of voting organizational members for the local CDC trade association—the Cleveland Neighborhood Development Coalition—fell to thirty-six as of April 2013 from forty-eight in October 2011[29]. In 2011, Detroit Shoreway, one of the few Cleveland CDCs that rehabilitates both single-family and multi-family housing, received additional CDBG funding to open a new office for three adjoining neighborhoods, each of which once had its own development organization.

Despite the inherent professional competition, organizational cooperation between CDCs is especially strong in Cleveland. As mentioned above, the city's CDCs belong to a trade organization, which holds trainings, hosts forums, and organizes policy advocacy. The Cleveland Housing Network (CHN), managed in part by 15 constituent CDCs, is a national leader in producing affordable lease-to-purchase housing with low income housing tax credits (LIHTC) (McQuarrie and Krumholz 2011). Although best known for its successful confrontational tactics, Empowering and Strengthening Ohio's People (ESOP)[30] worked successfully under contract with NPI to conduct foreclosure prevention door-knocking with CDC staff and to target banks holding sizeable portfolios of vacant property (#46 11/8/2011 & other interviews)—a further sign of the innovative and collaborative nature of the community development system in Cleveland.

CDCs in Cleveland benefit from two local universities and the information resources they provide. The Center on Urban Poverty and Community Development at Case Western Reserve University continues to develop two neighborhood information systems: (1) NEO CANDO for the general public and (2) the Neighborhood Stabilization Team (NST) web application for CDC staff members and other nonprofit and government community development professionals. The Center is part of the Mandel School of Applied Social Sciences, which produces student interns and graduates who often work in local CDCs. Cleveland State University offers a Planning

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27 Not counting Detroit Shoreway's SCFBC office, which receives its own funding stream from the city, but does not have its own accounting department or IRS number.

28 FOIA spreadsheets [meaning?]

29 Current page available at http://www.cndc2.org/members.html#votingMembers. Oct 2001 page available at http://web.archive.org/web/20011023182449/http://www.cndc2.org/members_sponsors.htm

30 Originally, the acronym stood for East Side Organizing Project. The name was changed in 2007.

Accreditation Board-accredited Master's in Urban Planning, Design, and Development through the Maxine Goodman Levin College of Urban Affairs. The College houses NODIS, a regional data system designated by the State of Ohio and the U.S. Bureau of the Census.

Variation in CDC size

Cleveland CDC staff sizes roughly reflect the central tendency and variability of CDC staff sizes nationally. This variability allows the current research to examine the impact of staff size on development outcomes and the interaction between staff size and NIS use. In 2005, CDCs employed a median of seven fulltime and three part-time people. CDCs in Cleveland receiving CDBG funding that same year employed a median of 6.5 people and one part-time person. The national survey (NCCED 2006) showed a wide spread between the largest organization (1,100 employees) and the smallest organizations (a few volunteers). In Cleveland this spread was from two to thirty-four fulltime employees. Consolidation and the housing crisis have only increased the variability of staff sizes. In 2012, the median CDC staff size in Cleveland was eight people with a range from 0.5 (one part-time person) to fifty people (source calls/websites). Uniform staff sizes (small or large) would have made separating staff size effects from NIS use effects extremely difficult. However, the situation in Cleveland makes such in-depth study possible, strengthening its position as a critical case for NIS study.

Multi-sector cooperation

Community development requires at least a modicum of cooperation between public sector agencies, non-profit actors, and—with housing construction and rehabilitation—for-profit lenders. The community development system in Cleveland far exceeds this minimum threshold. Ex-CDC staff members routinely move on to prominent positions in non-profit intermediaries and government agencies—including the mayor's chair—where they support and protect community development programs (McQuarrie and Krumholz 2011). Low-income housing projects benefit from nearly free property from the city's land bank and a complete tax abatement for fifteen years on new construction (McQuarrie & Krumholz 2011). The Cuyahoga County Land Bank allows CDCs to acquire tax-foreclosed properties at very low cost, motivating staffers to research the available selections carefully. But, these examples of cooperation do not change the fact that misunderstandings can and do arise between local

government agencies and CDC staff about specific properties. The city has accidently bulldozed properties a local CDC intended to acquire and rehabilitate. The recent Code Enforcement Partnership between the City of Cleveland and many area CDCs provides a framework to coordinate community development efforts more closely and efficiently.

While the need for code enforcement activity increased rapidly in Cleveland during the foreclosure crisis, the city lost 25% of its code inspectors in 2009 due to budget cuts (Frater et al. 2009). The remaining enforcers simply could not manage the workload. Representatives from NPI, several CDCs, and the city's Building and Housing Department and Community Development Department came up with an innovative solution. The partnership divides responsibilities between CDC staff and city code enforcers. The former conducts a windshield survey of every housing unit, works with homeowners to correct minor violations, and refers major violations to city staff. The latter pursue only major violations and minor violations that the homeowner does not—or cannot afford to—correct. The partnership participants turned to the NST web application to facilitate data sharing. For the first time ever, CDC staff members can directly view code enforcement actions and city staff members can view which properties are marked locally for demolition[31] or for redevelopment.

Cleveland also provides examples of strong cooperation with for-profit entities to further physical development projects. City officials and non-profit organizations in Cleveland challenged bank mergers in the 1990s under the Community Reinvestment Act, resulting in a $4.2 billion neighborhood lending pool and a new crop of bankers eager to support local projects (McQuarrie & Krumholz 2011). Together, the high level of cooperation between community development actors makes Cleveland a critical case for NIS research generally and for NIS improvements to inter-organizational coordination more specifically.

Table 4 (below) reviews all the criteria for a critical case of NIS use and summarizes how Cleveland meets these criteria.

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[31] The NST web application does not allow CDC staffers to prioritize demolition targets. Some CDC staffers email code enforcement officers a list of priority demolitions (#10,384,2/20/12).

Table 4: Summary of Cleveland as Critical Case for NIS Use

Criteria	Sub-criteria	Cleveland Detail	
Pressing need for information	Problem	Addressing vacant & abandoned property from foreclosure crisis in context of municipal budget cuts.	
	Strategic action truly possible	(See cooperation between key actors)	
The Neighborhood Information System (NIS)	Maturity & Feature-set	NEO CANDO recognized as one of the best NIS in the country. NST web application even more advanced.	
	Availability of technical training	The Center of Urban Poverty and Community Development at Case Western Reserve University Neighborhood Progress Inc.	
The community development system	Professional-ization	Nonprofit Intermediaries	Local: Neighborhood Progress Inc (NPI) The Cleveland Foundation National: Enterprise Community Partners Local Initiatives Support Corporation (LISC)
		CDC-driven organizations	Cleveland Neighborhood Development Coalition (CNDC) Cleveland Housing Network (CHN)
		Degree granting institutions	The Center on Urban Poverty and Community Development (at CWRU) Maxine Goodman Levin College of Urban Affairs (at CSU)
	Range of CDC sizes	In 2012, CDC fulltime staff sizes ranged from 3 to 50 people	
	Cooperation between key actors	Positive community/bank relationships Common CDC/government career trajectory (revolving door) City & County Land Banks Code Enforcement Partnership	

Embedded Cases

CDCs are generally non-profit, tax-exempt entities created to improve quality of life in specific parts of a city—often poorer areas. But, the term lacks a more formal legal definition. The authors of the National Congress for Community Economic Development's last census of these organizations explain that:

Community development is a broad term, embracing a wide array of organizations that work to reinvigorate poor areas. The groups go by different designations, depending on their roots and mix of activities. While not all are technically incorporated as "community development corporations" (CDCs), that term has, over time, become synonymous with the industry as a whole, and is used here as such.

(NCCED 2006:3)

This research includes all 30 community development organizations that received CDBG funding from Cleveland's Community Development Department between July 1, 2007, and June 30, 2011. Several organizations lost funding during this period and several gained funding during this period as detailed in the footnotes for specific entries. I use the term *community development corporation* (CDC) to refer to these funded organizations. Under this definition, Harvard Community Services, founded in 1970, only became a CDC in 2009 when it started to receive CDBG funding. Conversely, the Stockyard Redevelopment Organization stopped functioning as a CDC in 2010, when it stopped receiving CDBG funding. This definition:

1. Quickly and strategically winnows the list of potential organizations to include in the research from over 3,400 nonprofits in the City of Cleveland[32] to just 30 organizations that definitely met criteria relevant both to the topic under investigation (community development) and the research design (critical case with a pressing need for information). Every CDBG funded project must[33]:

    a. Directly benefit low-and moderate-income residents

    b. Eliminate and prevent blight and property deterioration

    c. Serve an urgent need

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[32][need the name of the website or the webpage to precede the url] http://www.guidestar.org/ last accessed 6/9/2014

[33]http://www.city.cleveland.oh.us/CityofCleveland/Home/Government/CityAgencies/CommunityDevelopment/BlockGrantProgram last accessed 6/9/2014

2. Permits uniform tracking of organizational size since CDBG applicants submit budget details and—historically—also the number of fulltime staff members. Controlling for funding and staffing levels permits better estimation of the effect NIS has on program outcomes.

All the CDCs that lost CDBG funding during the research period appear to have quickly gone out of business. The research, therefore, may overlook what Harvard Community Services accomplished *before* receiving CDBG funding, but it does not overlook what CDCs accomplished *after* losing CDBG funding.

I targeted a representative subset of organizations for semi-structured interviews and performed quantitative modeling of programmatic capacity for all organizations. CDC performance may stem from organizational factors (such as the number of employees, amount of funding, level of NIS use) or neighborhood factors (such as vacancy rate and poverty rate). Table 5 (below) provides some of these details for each embedded case to convey the diversity of situations under investigation. The average number of *employees* between 2005 and 2012 is based on an earlier figure from city CDBG records and a later figure based on a combination of interviews and the organizations' websites[34]. The average amount of *CDBG* funding is based on city records for all years from 2007 to 2011. The aereal weighting method employed in this research allocates the appropriate parts of Census block groups to CDC service areas to permit an accurate analysis of socio-economic and built-environment conditions within the most meaningful geographic units for the research topic (see Saporito et al. 2007). The average *population*, residential *vacancy*, and percent of people in *poverty* from 2007 to 2011 is based on the proportion of individual American Community Survey (ACS) block groups falling within CDC service areas as reported to Neighborhood Progress Inc. in August 2012. At least one staff member in CDCs marked with a check (✓) in the interview column ("I") was interviewed in-person, by phone, or by email.

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34 The IRS 990 form proved an unreliable source of information about staff size. Employee recall of staff levels also proved suspect.

Table 5: Overview of Cleveland Community Development Corporations

#	Interview	Organization Name	Employees	CDBG	Population	Vacancy	Poverty
1		Bellaire Puritas Development Corporation	12	$476,885	24,299	9%	20%
2	✓	Buckeye Area Development Corporation	8	$580,796	24,833	24%	35%
3	✓	Burten, Bell, Carr Development Inc.	8	$296,872	17,627	25%	66%
4	✓	Collinwood Nottingham Villages Development Corporation	5	$225,870	6,432	28%	31%
5		Consortium for Economic and Community Development[35]	9	$236,633	16,104	25%	41%
6	✓	Cudell Improvement Inc.	9	$289,119	21,794	19%	35%
7	✓	Detroit Shoreway Community Development Organization	24	$367,093	12,028	23%	41%
8	✓	Stockyard, Clark-Fulton Brooklyn Centre Neighborhood Development Office[36]	(13)	$423,819	24,996	23%	40%
9		Euclid-St Clair Development Corporation[37]	5	$286,244	17,217	27%	33%
10	✓	Fairfax Renaissance Development Corporation	17	$276,072	4,964	30%	39%
11	✓	Famicos Foundation	42	$524,411	18,140	28%	36%
12		Flats Oxbow Association[38]	2	$82,882	4,746	17%	41%
13	✓	Glenville Development Corporation	6	$197,614	19,701	31%	38%
14		Harvard Community Services[39]	25	$290,637	22,258	18%	23%
15		Historic Gateway Neighborhood Corporation	3	$21,037	2,726	16%	33%
16		Historic Warehouse District Development Corporation	4	$23,752	170	12%	19%
17	✓	Kamm's Corners Development Corporation	5	$332,890	22,700	7%	9%
18		Little Italy Redevelopment Corporation	1	$66,249	1,430	20%	34%
19		Midtown Cleveland Inc.	5	$33,867	3,270	22%	50%
20	✓	Mt. Pleasant Now Development Corporation	16	$260,536	22,273	31%	36%
21	✓	Northeast Shores Development Corporation	6	$289,330	13,000	21%	29%
22		Ohio City Near West Development	8	$188,487	6,427	19%	39%

35 Received CDBG funding through 2008. Last IRS 990 form filed in 2007.

36 The Detroit Shoreway Community Development Organization opened the Stockyard, Clark-Fulton, Brookyln Centre (SCFBC) Neighborhood Development Office in 2010. The city lists CDBG funding to SCFBC separately.

37 Received CDBG funding until 2010. Last IRS 990 Form filed in 2009.

38 Received CDBG funding until 2010. Last IRS 990 Form filed in 2008.

39 Received CDBG funding starting in 2009.

		Corporation[40]					
23	✓	Old Brooklyn Community Development Corporation	8	$527,935	33,539	12%	18%
24		Shaker Square Area Development Corporation	7	$92,341	8,838	18%	22%
25	✓	Slavic Village Development	15	$479,772	20,644	37%	39%
26	✓	St. Clair Superior Development Corporation	8	$295,329	9,447	32%	40%
27		Stockyard Redevelopment Organization[41]	5	$228,426	11,238	22%	40%
28	✓	Tremont West Development Corporation	9	$299,147	7,773	17%	43%
29	✓	Union Miles Development Corporation	6	$337,667	25,822	28%	33%
30	✓	Westown Community Development Corporation	5	$340,511	21,446	15%	28%
		CITY OF CLEVELAND			403,163	22%	33%

As Figure 4 shows, Cleveland CDCs claim service areas that cover nearly the entire city and that often overlap. A combination of less available funding, ward boundary redrawing, and housing market changes place CDCs in increasing competition with each other, resulting in consolidation.

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[40] Name changed to "Ohio City Inc." in 2011, toward the end of this study.

41 Received CDBG funding until 2010. Last IRS 990 Form filed in 2009.
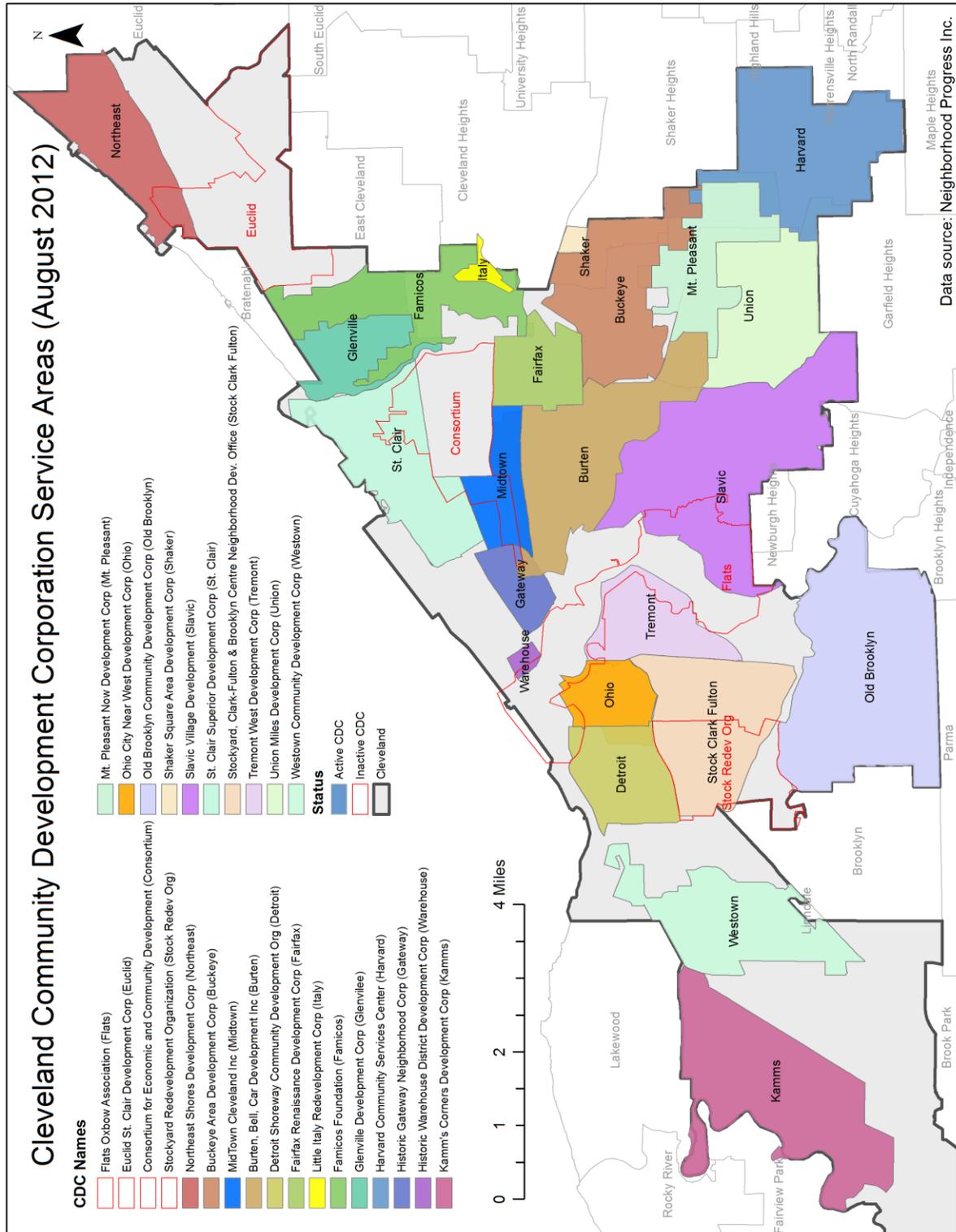
Figure 4: Cleveland Community Development Corporation Service Areas (August 2012)

Methods and Data Sources

The methods and data sources vary slightly with each research question. To avoid redundancy, data sources introduced in an early research question are simply referenced in later research questions rather than described again in full detail.

Q1. What claims do NNIP partner organizations make about neighborhood information systems in their mission statements and websites?

Data Collection

At the time of data collection in July 2012, the NNIP website provided a list of 49 partners in 36 U.S. cities along with links to their websites. Nearly all partner websites include explicit mission statements. When absent, the analysis relies on text from pages labeled "about us". Phrases from the websites were copy and pasted by hand into a multipart form in a Microsoft Access database and then coded using four subforms with prepopulated lists of codes. The codes were iteratively developed during coding until additional modifications were not necessary. I copy and pasted phrases from the websites into one of four subforms visible on a single main form. Each subform was designed to store a type of content:

1. Related actors, such as anticipated users and strategic partners

2. Goals, strategies, results, or products, which may involve "buzzwords" (repeated or trendy terms)

3. Services and specific named programs that rely on the information system

4. Causal claims that include a subject, verb, and (claimed) result

Data Analysis

I transferred selections of text from the website relevant to these *a priori* themes to an Access Database and assigned qualitative codes developed iteratively through common techniques (Bernard and Ryan 2010:56–61) such as:

1. Repetition, which suggests a focus or preoccupation (such as with *data quality*);
2. Indigenous typologies, which—in this research—took the form of trade jargon and conveyed a trend or ideal (such as *one-stop-shopping* for data); and
3. Linguistic connectors, which communicate explicit or implicit causal relationships

(such as between data access and societal benefit)

Below, Figure 5 shows the form used to enter and code the mission statements and website content.

Figure 5: Data Entry Form for Analysis of NNIP Mission Statements & Websites

After entering these data, I queried the database to create summary tables using the SQL programming language.

Q2. Who uses NIS and how frequently?

Data Collection

Answering this research question requires processing logfiles for NEO CANDO and the NST web application generously provided by the Center on Urban Poverty and Community Development. Logfiles are computer records automatically generated during the execution of

tasks such as processing user queries for information stored in a NIS. The earliest query in the log is dated 8/24/2005 and the last query is dated 5/8/2012. The logfiles received include the name of a user's employer, but not the name of the user. However, each user has a unique numerical identification number. My agreement with the Center permits me to conduct analysis on the data, but forbids me from sharing the raw data or publishing detailed tallies of NIS use by specific organizations.

I originally received five tables: a single table of user information and four separate logs of system subcomponents: property information, social indicators, neighborhood profiles, and the NST web application. Again, these files do not contain the actual property data, social indicator data, etc.—but details about r*equests* for this data. I combined these four separate logs into a single log that included a column describing the log type (property, social, etc). I stored the logs as tables in a database. Table 6 (below) summarizes the number of records and columns in the two final database tables.

Table 6: Summary of NIS Logfiles

Table	# Total Rows	Columns
Users	9,996	userid, usertype, company, title, city, state, zipcode
Logs	368,605	userid, logtype, date

Both tables include the *userid* column, facilitating combined analysis. For example, it is possible to count the total number of queries made for parcel data on a specific day from a particular company across all employees. Before 2006 however, NEO CANDO did not require users to login, so no information is available concerning the identity of users or their employers.

Table 7 (below) provides a description for each column in a logfile record

Table 7: Logfile Column Descriptions

Logfile Column	Description
Userid	Unique user number
Usertype	A self-identified type of user from thirteen possible types: Community Development Non-Profit, Education, Foundation, Government, Healthcare / Medical, Media, Other For-Profit, Other Non-Profit, Public Citizen (Not Representing an Organization), Real Estate For-Profit, Research, Social Work, Unknown
Company	The name of the user's employer
Title	The user's work title
City	Either the user's home or work location (could be either)
Logtype	One of four types of information requests: property, social, profile, or NST
Date	Date of the NIS query

The user log table required extensive data cleaning in order to permit accurate aggregation by company name. For example, the 1,922 users associated with Case Western Reserve University—which houses the Poverty Center that produces both NIS systems—spelled the school 301 different ways such as "Case Sociology Department", "FPB School of Nursing", "case western eserve university", and "CWRU Med School". The same problem occurred with the names of community development corporations, which would have undermined the regression technique employed to answer research questions #4 and #5, which use CDCs as the level of analysis. Additionally, students, faculty, and staff members at educational institutions often declared themselves "Public Citizen (Not Representing an Organization)", the category I rely on to identify non-institutional users. I cleaned the *usertype* column by examining the company and title for each alleged "Public Citizen", reassigning 91 users to more accurate types. Of those reassigned, 84 (92%) were associated with an educational institution. Such cleaning ensures that students pursuing assignments and faculty members pursuing research are not mistaken for neighborhood residents independently investigating problem properties.

In order to better understand how residents use (or do not use) NIS, I conducted interviews with nine people active with two different CDCs, but not employed by a CDC.

Data Analysis

Answering this research question requires writing short computer programs in SQL to aggregate the total number of users of each *usertype* who submitted at least one NIS query. Generating subtotals for each year permits analyzing *usertype* trends over time. Filtering out users who do not submit more than a threshold number of queries reveals which *usertypes* rely on NIS more intensely. The *company* variable permits counting the number of unique organizations in addition to the number of unique users.

To understand the point of view of residents active with CDCs, I coded these interviews using the same approach described in the next chapter for interviews with CDC staff members.

Q3. How do CDC staff members use NIS?

I define a Cleveland CDC as any organization receiving CDBG funding from the city's Department of Community Development (see "Embedded Cases" on page 57).

Data Collection

From July 1, 2010, to July 16, 2013, I conducted semi-structured interviews with sixty people in thirty organizations in Cleveland and one state-level agency in Columbus. Thirteen interviews with employees in six different organizations were conducted in-person during September 2011, and several included NIS demonstrations. During this time I also observed a collaborative brainstorming and decision-making session using the NST web application at a Neighborhood Stabilization Team meeting between staff members from Neighborhood Progress Inc., the Poverty Center, and a single CDC. I completed the rest of the interviews over the phone and over email. Initial in-person and phone interviews lasted between twenty minutes and two hours. They were often followed-up with questions over email. Several interviewees also provided spreadsheets, maps, and reports.

Table 8 (below) summarizes the extent and type of contact I initiated with staff in each CDC marked previously with a check (✔) in Table 5 (page 59) and with the staff of other non-profit organizations and government agencies. The table shows the number of people (# People), type of communication (In person, Phone, Email), and total number of interviews per organization (Total # Times). For example, I interviewed four people at Fairfax Renaissance Development Corporation—one in person—and conducted four phone calls and a single follow-up email. Note that the email column presents only the number of emails I actually received from staff members and coded for analysis—not emails from my unsuccessful attempts to contact potential interviewees or emails concerning scheduling a phone call.

Table 8: Summary of Qualitative Data Collection

| Type | Organization | # People | Type of Communication | | | Total # Times |
			In person	Phone	Email	
Community Development Corporatons	Buckeye Area Dev. Corp	1	0	1	1	2
	Burten Bell Carr Dev. Inc.	2	0	3	0	3
	Collinwood & Nottingham Villages Dev. Corp.	1	0	1	0	1
	Cudell Improvement Inc.	1	0	1	0	1
	Detroit Shoreway Community Dev. Org.	3	0	4	0	4
	Fairfax Renaissance Dev. Corp.	4	1	4	0	5
	Famicos Foundation	3	0	4	1	5
	Glenville Dev. Corp.	1	0	1	0	1
	Kamms Corners Dev. Corp.	1	0	1	0	1
	Mount Pleasant NOW Dev. Corp.	1	0	2	2	4
	Northeast Shores Dev. Corp.	1	0	1	0	1
	Old Brooklyn Community Dev. Corp.	1	0	1	0	1
	Stockyards,Clark Fulton, Brooklyn Centre Community Dev. Office	3	2	4	7	13
	Slavic Village Dev.	6	3	4	4	11
	St. Clair Superior Dev. Corp.	3	0	3	1	4
	Tremont West Dev. Corp.	3	2	1	1	3
	Union Miles Dev. Corp.	1	0	1	0	1
	Westown Community Dev. Corp.	2	0	4	0	4
Other Non-Profit Organizations	Brooklyn Center Community Association	1	0	1	1	2
	Cleveland Housing Network	2	0	2	0	2
	Cleveland Neighborhood Development Coalition	1	0	1	0	1
	Neighborhood Progress Inc.	2	3	1	11	15
	Empowering and Strengthening Ohio's People	1	1	1	7	9
	Case Western Reserve University	2	1	2	0	3
	Cuyahoga Community Land Trust	1	0	1	0	1
Government Departments & Agencies	Cleveland Dept. of Building & Housing	4	0	4	3	7
	Cleveland Dept. Community Development	4	0	5	2	7
	Cleveland Housing Court	1	0	1	0	1

Cleveland Planning Commission	1	0	0	1	1
Cuyahoga Land Bank	1	0	1	1	2
Ohio Development Services Agency	1	0	1	0	1

In the interviews, I asked staff members whether and how they use NEO CANDO and the NST web application in their day-to-day community development functions. I also asked how they performed these same functions previously before the NIS. I wrote detailed notes during in-person and phone interviews, either by hand or on a laptop. I typed any handwritten notes shortly after the interview.

Determining which CDC activities actually involve NIS use permits restricting later quantitative investigations of participation and capacity building to only those activities that actually use the technology, reducing spurious findings.

Data Analysis

Interview database

I built a database for interviews using standard database principles of reducing redundancy by linking tables of unique information through keys and external keys. A key field uniquely identifies a record (row) in a table. An external key field in one table links to a key field in another table as shown in Table 9 (below). For example, quoted text in the Quotes table links to the Interviews table through the Interview-ID in the former, which matches a key field with the same name in the latter. In this way, thirty quotes from the same interview do not need duplicate information about the date and type of interview (phone, in-person, etc), they only point to the same Interview-ID. Similarly, the Employer and Target fields follow the same CDC naming convention employed for the NIS logfiles and CDBG administrative records, facilitating linking between the qualitative and quantitative sides of the research.

Table 9: Structure of the Interview Database

Table	Data Fields	Key	External Keys
Interviews	Full transcript Date Type (in-person, phone, email) Interview memo	Interview-ID	Person-ID
People	Personal Initials Person Memo	Person-ID	Employer (CDC name)
Quotes	Quoted text Quote memo	Quote-ID	Interview-ID Target (CDC name)
Codes	Code Code memo	Code-ID	Quote-ID

The database permits two types of qualitative coding: (1) coding by speaker/relationship, and (2) coding by topic. The Employer field stores the home institution of the speaker, and the Target field stores which institution he or she is talking about on a quote-by-quote basis. Unless an interviewee currently works for—or previously worked for—the organization targeted by his or her comments, those comments guide future questions to employees of that organization rather than providing definitive material about the organization.

Interview coding

The separate literatures on community development corporations and neighborhood information systems provides potential themes for coding. The former suggest activities that CDC employees perform regularly and the latter suggest how NIS users generally use the technology. However, the coding system employed in this research emerged from a long iterative process of reading, coding, and recoding interview transcripts. The need to capture detail and nuance concisely gave rise to a coding technique I call *parameterized coding*. *Appendix A: The Grammar of Parameterized Coding* (page 207) provides the rationale for and examples of the technique.

Coding analysis

Conducting qualitative analysis on these codes entails writing SQL queries that break

apart the long codes according to the standardized grammar, check for validity, and then perform sorting, filtering, and aggregation as needed.

Q4. Does NIS improve public participation and, if so, what factors mediate the improvement?

In this research public participation is defined as a key element of political capacity, as defined by Glickman and Servon (1988). The answer to this question relies exclusively on responses to semi-structured interview questions by CDC employees, resident activists, and government officials. The qualitative coding techniques detailed for research question #3 enabled easy characterization of uses, outcomes, and levels of evidence.

Q5. Does NIS improve capacity and, if so, what factors mediate the improvement?

This question is addressed through the *sequential exploratory strategy* described in Creswell (2009), which calls for initial qualitative data collection and analysis to guide subsequent quantitative data collection and analysis. This strategy permits the quantitative study of phenomena that are not well enough understood to otherwise approach constructively quantitatively. The results of semi-structured interviews guide the development of generalized estimating equation (GEE) models by helping to select appropriate variables. The qualitative data are also analyzed thoroughly using the coding techniques detailed for research question #3, which enable easy characterization of NIS uses, outcomes, and levels of evidence. In some cases interviewees may have performed the same work with NIS and without NIS and will be able to isolate its impact qualitatively.

The quantitative models are designed to explain the volume and quality of residential rehabilitation activities by CDC capacity (including NIS use), neighborhood characteristics, and consumer demand. High volume (number of units purchased) and high quality (percent of purchases transferred and percent of purchases improved) are interpreted as evidence of programmatic capacity building[42]. The quantitative models include data from July 1, 2007 (the

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42 An alternative approach, in which year-to-year *differences* in volume and quality are interpreted—if positive—as capacity building—has intuitive appeal, but proved difficult to implement in practice.

start of CDBG Year 33) to June 30, 2011 (the end of CDBG Year 36). For simplicity, the end of a CDBG pay period determines the year in this research—from 2008 to 2011. The Poverty Center did not begin to track NEO CANDO use by individual users until September 26, 2006. This date determined the earliest CDBG funding year that could be analyzed quantitatively.

In all the models, CDBG funding and NIS queries are aligned against outcomes occurring *six months later*. For example, year 2008 for CDBG and NIS runs June 1, 2007 to June 30, 2008 (the fiscal year) while year 2008 for outcomes runs January 1, 2008 to December 31, 2008 (the calendar year). This time shift serves two purposes. First, it reflects the qualitative findings that staff members can identify, renovate, and transfer a property in three to six months (with NIS sometimes starting the process). Second, it strengthens the claim that discovered correlations are causal by increasing the chance that NIS use *precedes* outcomes. Threats to validity caused by the ambiguous connection between a particular query and a particular outcome and the ambiguous timing are addressed in Chapter 8 (*Ambiguous Temporal Precedence* on page 184).

Generalized Estimating Equations

Generalized estimating equations (GEE) allow researchers to overcome two common statistical challenges: non-normally distributed data and repeated measures (Ballinger 2004). Non-normally distributed data often result in non-normally distributed residuals, violating a fundamental assumption of linear regression (Lewis-Beck 1980). Repeated measures of the same individuals or organizations violate another fundamental assumption of linear regression—that each observation is independent (ibid). Organizational researchers in particular have started to employ GEEs with longitudinal (panel) data (Ballinger 2004) and the current research demonstrates the method's promise in the field of urban planning. GEEs enable researchers to anticipate residuals that match the distribution of the dependent variable—including the Poisson

Firstly, this approach requires the first observation for each CDC to establish a baseline, reducing the overall "N" for statistical analysis from 110 to 80, completely eliminating two CDCs for which only one observation exists. Secondly, basing the dependent variable on differences requires then deciding which of the independent variables should also be based on differences. Thirdly, such an approach requires an additional interpretive step within a regression framework, which is—by definition—already a marginal approach: a unit change in the *difference* of X produces a corresponding change in the *difference* of Y equal to the coefficient of X. This approach may be useful in situations where more years of data are available.

distribution for count data. GEEs enable researchers to group observations from the same source and to assign weights based on the amount of additional information each additional observation provides (Hanley 2003). Like other forms of regression, GEEs produce marginal models based on the concept of *ceteris paribus* (holding other factors constant) to establish a unit change relationship between independent and dependent variables while remaining silent as to whether the former actually *cause* the corresponding change in the latter (Wooldridge 2001:34). However, repeated measures may be arranged into a table for analysis in which the independent variables represent a condition or event occurring prior to the condition or event represented by the dependent variables, strengthening the case for causality. This does not remove the possibility that independent variables dated *after* the dependent variable may also prove "explanatory".

The generalized estimating equations package for the R programming language is called "geepack" (Halekoh, Højsgaard, and Yan 2006). The package permits several weighting approaches, called "correlation structures" that determine how to approach repeated measures. These approaches are common to multiple GEE implementations and selecting among them remains more art than science. When the correlation structure is set to *independence*, generalized estimating equations produce the same model as traditional linear regression. When working with repeated measures, this option violates fundamental statistical assumptions and is therefore used to produce a baseline for comparison with other correlation structures without seriously changing the underlying computer code[43].

An *exchangeable* correlation structure posits that every measure of a unit of observation will be equally correlated with every other measure of the same unit of observation. For example, one CDC may purchase very few properties and another CDC may purchase many properties—but a single correlation estimate, alpha (α), would capture the similarity in outcomes from year to year in both cases. However, this option best suits a research design with repeated measures that have no intrinsic order. For example, the weights of five deer grazing in one field versus deer grazing in several other fields (Zuur et al. 2009:307). It is reasonable to assume that

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[43] However, in this research, assuming independence despite repeated measures did not greatly change the results. See, for example, the comparison of a model that assumes independence and the same model with an autoregressive correlation structure in Table 22 (page 164) and corresponding Figure 12 (page 168).

some fields support grazing more than other fields and therefore the measurements are not independent, but each measure reflects the mass of a different animal and the order does not matter.

The *autoregressive* correlation structure posits that measures of the same unit of observation closer to each other in time will be more correlated with each other than measures of the same unit of observation further apart in time. Measures of the same unit of observation that are one time unit apart (a year in this research) have a correlation of α, measures that are two time units apart have a correlation of α^2, and measures that are three time units apart have a correlation of α^3. Since $0 <= \alpha <= 1$, the correlation decreases with increased time between the measures[44]. This structure is the obvious option for researchers working with data collected at known, ordered, intervals.

The autoregressive correlation structure does not match the research design described herein perfectly, however. In many research domains, biological or physical limits determine how much the dependent variable can possibly vary from one observation to the next. For example, if the dependent variable were human body weight and the time between measurements was only one hour, we would expect a very high degree of correlation between observations of the dependent variable because even if an individual exercised vigorously and did not eat—metabolism limits how much body weight can fluctuate in such a short length of time. Similarly, if the dependent variable were the number of commercial construction projects a company currently had underway and the time between elements was one month, we would expect a very high degree of correlation because new projects may not begin every month—and ongoing projects take years to complete. But, several CDC staffers claimed they could locate, purchase, and rehabilitate a suitable property in three to six months. This timeframe allows for considerable fluctuation in year to year totals and does little to explain why annual outcomes should be correlated—save for stability in the underlying drivers of CDC activities. I hypothesize that this correlation structure, the default for this research design, will draw explanatory power away from the neighborhood factors that are based on Census data.

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[44] Except in the extremely rare case that $\alpha=1$ when temporal distance has no effect on the correlation between two measures.

Lastly, an *unstructured* correlation structure[45] holds that any two measures (b, c) of the same unit of observation have their own correlation $\alpha_{b,c}$. Researchers employ this approach when their research design and domain-specific theory fails to offer any guidance.

Given these choices, I elected to compare the independence and autoregressive correlation structures in order to compare traditional regression with the most obvious choice for ordered repeated measures. Traditional R^2 calculations are not possible with GEEs since some of the variance exists within groups and some between groups. While alternative calculations have been proposed (e.g. Natarajan et al. 2007) no such feature is readily available in R. Instead, I employ graphical techniques to assess model fit in this research, comparing actual and estimated values. I also calculate the mean percentage difference between the actual and estimated values across all organizations and years. A good model would have a very small percentage difference between the actual and estimated values.

The quantitative models rely on data drawn from numerous sources and arranged into neighborhood contextual factors, organizational factors, and outcomes as described in the theoretical framework (Figure 3 on page 41). The *quantity* of CDC property purchases is modeled in two stages. First neighborhood contextual factors alone predict the odds that a CDC will purchase at least one property (Stage 1). Then, both neighborhood and organizational factors predict how many properties a CDC will purchase. Interviews with CDC staff members suggest that this approach captures the fundamental decision-making process within the organization. The *quality* of CDC property purchases is modeled in a single stage based only on those properties that were purchased. Below, Table 10 provides an overview of the neighborhood contextual variables and Table 11 provides an overview of the organizational variables. The section that follows describes the construction of dependent variables based on property records.

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[45] Each approach to solving the repeated measures problem employs a matrix of correlations and is therefore similarly "structured". But, this one reads like an oxymoron—"unstructured correlation structure"—and lacks a theoretical foundation. It assumes that the correct correlation between two measures is just what appears in the data on hand.

Table 10: Neighborhood Context Variables

Variable	Description & Source
Residential vacancy rate	These variables are based on linear interpolation between the 2006-2010 and 2007-2011 American Community Survey (ACS) datasets[46]. An aerial weighting method assigns Census data to CDC service areas[47] based on their overlap with block groups, allowing the study to employ the most relevant geographies to CDC staff members (see Saporito et al. 2007 for more on the method) [48]. See *Unreliability of Measures* on page 176 for threats to validity due to margins of error in independent variables.
Owner occupancy rate	
Number of private sales	Both these variables come from an analysis of housing sales in CDC jurisdictions during the period under investigation using data provided by the Poverty Center at Case Western Reserve University. Sales involving CDCs were excluded in order to capture the desirability of each neighborhood in the private market over time.
Median cost per square foot of structure	

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46 The United States Census warns against crudely comparing datasets from overlapping years. The linear interpolation therefore may reduce the accuracy of a single year's estimate but captures the best estimate of the direction of neighborhood change. Without such interpolation, these variables would remain static over the longitudinal study. Single year estimates for these variables are not available at such a fine level of resolution, making this approach a reasonable compromise.

47 This research relies on CDC service areas reported to Neighborhood Progress Inc. in August 2012

48 The dataset includes other variables such as the poverty rate and income levels, but interviews suggested these primarily affect the ability of local homeowners to voluntarily correct code violations—which this research does not examine quantitatively.

Table 11: Organizational Variables

Capacity	Variable	Description & Source
Resource Capacity	CDBG	Annual Community Development Block Grant (CDBG) allocations from the City of Cleveland's Grantee Comparison Spreadsheets received via a Freedom of Information Act request.
	SII	CDCs participating in Neighborhood Progress Inc.'s Strategic Investment Initiative (SII) receive additional funding.
Organizational Capacity	Emp	The number of employees in the CDC according to a linear interpolation between a 2005 value and a 2012 value. The earlier value is from City of Cleveland's Grantee Comparison Spreadsheets and the latter value is from a combination of phone interviews and website searches[49].
	NIS	The annual number of property-related queries staff in each organization submitted to the neighborhood information system each year, obtained from the Poverty Center at Case Western Reserve University. This also falls under the definition of Programmatic Capacity, but Programmatic Capacity is defined as housing development outcomes, a dependent variable in the quantitative analysis.
Networking Capacity	SII	CDCs participating in Neighborhood Progress Inc.'s Strategic Investment Initiative (SII) receive access to

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49 The planned source for employee information, IRS 990 forms, proved inaccurate.

		resources outside the organization, such as technical support.
Programmatic Capacity (The *dependent* variables)	Purchases	The number of residential properties that a CDC takes title to in a given year that does not involve the Cleveland Housing Network. The process of identifying these properties is described below.
	Transfer rate	The percentage of purchased residential properties that a CDC eventually transfers (usually by selling) to a new owner who pays taxes on the property. Interviewees defined this success measure. The process of identifying these properties is described below.
	Rehab rate	The percentage of purchased residential properties that eventually undergo rehabilitation or new development after a CDC took title, regardless of who currently owns the property. Interviewees defined this success measure. The process of identifying these properties is described below.
Political capacity	N/A	This sub-capacity is not studied quantitatively in this research.

Measuring resource capacity with CDBG records.

The Community Development Department of the City of Cleveland maintains annual spreadsheets tracking the accomplishments of organizations that receive public funding such as Community Development Block Grants. Through a Freedom of Information Act request, I received seven such spreadsheets for 2005 (fiscal year 31) through 2011 (fiscal year 36) with years defined as starting on June 1 and ending on July 30. Spreadsheets before fiscal year 2008 (June 1, 2007) were not included in this research because user (CDC) specific NIS data is not available before September 2006.

Constructing the outcome variables: purchases, transfer rate, and rehab rate

CDC staffers support housing in many ways, from promoting a positive image of their neighborhood(s) to directly purchasing and rehabilitating properties. No master list of such activities exists for Cleveland (or likely any other city), especially not one that includes parcel numbers through which to analyze activities and outcomes over time. The quantitative side of this research includes only properties listing a CDC or a CDC related legal entity[50] on the chain of title from 2008 to 2011. Ownership permits CDC staff to optionally add a rider to the deed specifying how a developer must proceed, for example to start work within 30 days and to complete work within 270 days. The rider often specifies that failure to comply gives the CDC the "the right of reversion," the right to buy back the property for its original price. Since the CDC remains legally responsible for upkeep and taxes until selling a purchased property to the next owner, the subset of cases where a CDC takes title represents those in which organizational staffers are most directly involved and the organization is most liable financially. Examining specifically these cases better evaluates the potential of NIS, since higher stakes likely translate into more motivated property research. Examining the efficacy of NIS for less direct property transactions would have raised two difficulties I elected to avoid: (1) how to consistently detect CDC involvement short of ownership for a four-year duration for all CDCs at the parcel-level of detail necessary to track outcomes; and (2) how to argue that staffers used NIS to conduct research for these less-involved transactions. The research relies on the sources of data described below.

Property and building permit records

CDCs do not report all housing production and rehabilitation activities to any federal or municipal agency. Interviews with CDC staff members revealed that applying CDBG funding to directly purchase or rehabilitate property triggers higher building standards that may cause the finished house to cost more than target low-income buyers can afford. Therefore, the housing production and rehabilitation numbers reported to the city in the Grantee Comparison Spreadsheets do not provide a complete picture of CDC housing activities. There are two other ways to receive this information: (1) from CDC employees themselves and (2) from city and

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[50] For more on finding these entities based on IRS 990 tax forms, see *Finding CDC property purchases* on page 71.

county administrative records. Although I collected recent housing production and rehabilitation numbers from some CDCs, I worried that this data suffered from three sources of error:

1) Systematic exaggeration due to every person's desire to describe their hard work in a positive manner.

2) Accidental double counting of properties due to the complexity of the rehabilitation process: a property purchased one year and rehabilitated the next may be counted in the totals for both years.

3) Accidental recall errors. It is unreasonable to expect an employee to remember the number of houses rehabilitated in 2008, especially given the staff turnover rate in some CDCs.

Therefore, I designed a two step process to calculate housing activity for use as a dependent variable related to programmatic capacity:

1) Find all properties (with and without structures) purchased by each CDC between 7/1/2007 and 6/30/2011 using Cuyahoga County Auditor's records. These dates correspond to the start of CDBG fiscal year #33 (referred to as 2008 in this research) and the end of CDBG fiscal year #37 (referred to as 2011 in this research).

2) Determine whether the house activity was "successful" as defined by the interviewees. CDC employees define two categories of success, *transfer* and *improvement* (rehab or new construction). The former relies on Cuyahoga County Auditor's property tax records and the latter relies on Cleveland's Department of Building and Housing permit records.

The next sections describe these steps in more detail.

Finding CDC property purchases

CDCs purchase properties from individual homeowners, banks, and government entities

like the Cuyahoga County Land Bank. Since the housing crash, CDCs are primarily—though not exclusively—involved in rehabilitation over new construction. Therefore, the majority of the properties have an existing house. CDCs then sell this property to a developer or new owner for a small fee. A few CDCs also arrange deals between buyers and sellers without actually taking possession of the property. Since the CDC is not on the chain of title, such facilitated transactions are impossible to track through administrative property data alone and lie outside this research. CDCs take title both under their own business names and under the names of related businesses, often limited liability companies (LLCs)[51]. I find these related businesses using "Schedule R" of the IRS 990 form that must be completed annually for a non-profit organization to maintain tax exempt status. Schedule R includes subsections for the "Identification of Related Organizations Taxable as a Partnership" and "Identification of Related Organizations Taxable as a Corporation or Trust". From July 1, 2007, to June 30, 2011, CDCs in Cleveland purchased 368 properties. This count includes properties of all classes (residential, commercial, agricultural, land bank, and exempt) in order to capture any possible changes of class during the rehabilitation process[52].

The research *excludes* more than six-hundred properties purchased and rehabilitated by the Cleveland Housing Network (CHN), which differs from a CDC in several ways. CHN conducts activities across the city instead of focusing on a home neighborhood. It pursues housing development *only*—not code enforcement, paint programs, side lot expansions, or demolition advocacy like CDCs.

CHN is also far larger and more influential than any of the CDCs. In 2011, CHN received more than $23M in contributions and grants and over $43M in total revenue, roughly ten times more than even well-established CDCs such as Slavic Village Development and Detroit Shoreway Community Development Organization. According to one interview with a person knowledgeable about CHN, its staff members do not use NIS since they can contact city and

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[51] Readers familiar with the role of limited dividend housing associations (LDHAs) in LIHTCs in Michigan will note that these are in fact general or limited partnerships, limited liability companies, joint ventures, or trusts and would therefore be listed on 990 forms as well (www.legislature.mi.gov)

[52] Properties in the city or county land bank are most frequently—though not exclusively—assigned to the land bank class.

state agencies directly and receive any information they require in a timely fashion (#75, 6/24/2013). For this reason, staff members in nearly all CDCs leave CHN staff members to conduct their own housing research, even if the potential project falls within a CDC service area.

Staff in Slavic Village and Detroit Shoreway, however, supplement CHN research using NIS (#75, 6/24/2013). This poses a challenge to the quantitative side of the research design. Since all CHN production outcomes are excluded—any CDC submitted queries to support CHN projects would appear—*incorrectly*—to have no impact on the ground. But, including *all* CHN outcomes would wash out any beneficial impact NIS has on housing activities since CHN staff members have privileged access to information outside of NIS. A compromise solution, counting CHN outcomes only in the Slavic Village and Detroit Shoreway services areas may appear to stack the deck toward a statistically significant and positive finding. Omitting CHN outcomes completely should be viewed as a step toward a hypothetical better solution, perhaps one that incorporates CHN involvement as a Boolean independent variable with parcel as the unit of observation. Regardless, evaluating community development will likely always require identifying the property transactions of CDCs and assessing the completeness of the list. Please see *Imputation of CDC outcomes* under Threats to Validity on page 179 for further discussion. Table 12 (below) provides an overview of all detected property purchases by CDCs with years that the organization did not qualify as a CDC due to lack of CDBG funding marked with "n/a".

Table 12: CDC Property Purchases 2008-2011

Organization	Y2008	Y2009	Y2010	Y2011	TOTAL
Bellaire Puritas Development Corporation	0	4	7	0	11
Buckeye Area Development	0	0	3	0	3
Burten Bell Carr Development	0	2	2	0	4
Collinwood Nottingham Villages Development Corporation	18	24	21	4	67
Consortium for Economic and Community Development	0	n/a	n/a	n/a	0
Cudell Improvement Inc	0	9	16	0	25
Detroit Shoreway Community Development Corp	5	9	7	6	27
Euclid-St Clair Development Corporation	0	3	0	n/a	3
Fairfax Renaissance Development Corporation	13	12	12	2	39
Famicos Foundation	4	5	6	1	16
Flats Oxbow	0	0	0	n/a	0
Glenville Development Corporation	0	0	0	0	0
Harvard Community Services	n/a	2	2	0	4
Historic Gateway Neighborhood Corp	0	0	0	0	0
Historic Warehouse District Development Corp	0	0	0	0	0
Kamms Area Development Corp	0	0	1	2	3
Little Italy Redevelopment Corporation	0	0	0	0	0
Midtown Cleveland	0	0	0	0	0
Mt Pleasant Now Development	2	0	3	2	7
Northeast Shores Development Corporation	2	8	8	1	19
Ohio City Near West Development Corp	0	1	0	0	1
Old Brooklyn Community Development Corp	0	1	8	0	9
Shaker Square Area Development Corporation	0	0	1	0	1
Slavic Village Development	14	32	33	14	93
St Clair Superior Development Corporation	0	0	0	0	0
Stockyard Clark Fulton	n/a	n/a	1	5	6
Stockyard Redevelopment Organization	0	0	1	1	2
Tremont West Development Corporation	0	1	2	1	4
Union Miles Development Corporation	6	2	0	2	10
Westown Community Development Corp	0	8	6	0	14
TOTAL	64	123	140	41	368

CDC property purchases are not an end in and of themselves. As the next section details, interviewees described two end goals.

<u>Determining housing activity "success"</u>

CDC staffers engaged in purchasing and rehabilitating houses defined success in two ways:

Transferred: Several CDC employees report that transferring a CDC-owned property to a "responsible owner" (#48, 2/21/2012) –meaning someone who maintains the property and pays taxes—marks the end of a successful instance of community development. I do not track property upkeep but focus instead on tax delinquency as tracked by the Cuyahoga County Auditor. Any property purchased by a CDC during the time frame of this study and then owned by an individual or other non-public organization with no back taxes owed is counted as successfully *transferred*.

Improved: Another sign of successful community development occurs when a developer or new owner invests in a property received from a CDC. I define a closed permit of any of the following categories as constituting an *improvement.* These permits require an inspection to be marked as closed rather than ongoing or canceled. While developers may request a Certificate of Occupation (COO), this formality is not necessary for all rehabilitation projects. For example, any renovation under $15,000 does not legally require a new COO.

- For new housing construction: Only completed permits of type "New".

- For housing rehabilitation: Only completed permits of the following types: Electrical, Exterior Alterations , HVAC and Refrigeration, Plumbing , Interior Alterations , Interior Demolitions, Re-roofing, Additions , Change of Use , and Combo.

Ideally, such permits should have been requested after a CDC takes title in order to securely attribute the outcome to that CDC, but I allow for a one-month window to account for record keeping differences between departments and administrative errors. Therefore an application for new construction requested even 27 days before a CDC took title would count toward that CDCs physical improvement total provided the permit currently has a completed status and property records show a residential structure, which in Cleveland could have 1 to 3 units. This success measure does not consider who currently owns the property or whether taxes have been paid.

The total dataset includes thirty CDCs over four years. Some CDCs entered the study midway by gaining CDBG funding and some CDCs left the study midway by losing CDBG funding, yielding 111 rows of data instead of the 120 rows anticipated (30 CDCs x 4 years = 120). The table below shows for instance that the dataset includes four years of data for twenty-four of the organizations and only one year of data for two of the organizations.

Table 13: Physical Description of CDC Purchases Dataset

	Total Dataset		Purchases	
# Years of Data	CDCs	Rows	CDCs	Rows
1	2	2	6	6
2	0	0	7	14
3	4	12	3	9
4	24	96	6	24
Total	30	110	22	53

The columns concerning purchases reflect only the rows in which a CDC purchased at least one residential property in a given year. These columns show that only twenty-two of the thirty CDCs purchased properties during the study period and that only 53 of the 110 data rows involve a purchase. *Approximately fifty percent of these data rows have zero purchases.*

Modeling housing activity "success"

Researchers often use a two-stage model (Zuur et al. 2009) to explain data with many zeros. Interviews with CDC staff members support this approach, revealing that staff members employ a two-stage decision model themselves. They first identify neighborhood needs and then allocate resources to meet those needs. To a large degree, neighborhood contextual factors determine whether CDC staff members pursue residential redevelopment *at all*. The first stage of the quantitative model mirrors this decision making process, matching neighborhood factors

against a binary housing outcome (zero = no housing purchases; one = yes, at least one housing purchase). The second stage either models only the "yes" cases—or, down-weights the "no" cases using information from the first stage. The former approach is called a "hurdle" model since only data jumping over the first stage (i.e. non-zero) are included in the second stage. The latter approach is called a "zero inflated" model, which posits that—for domain specific reasons—zeros may occur in the second stage. Since staff at a community development corporation may decide that residential rehabilitation is necessary in their neighborhood (stage 1) but lack the capacity to purchase property and work with developers (stage 2) this research employs a zero inflated approach to modeling residential purchases by CDCs.

Figure 6 and Figure 7 display scatterplot matrices of key independent and dependent variables. The diagonal provides a histogram of the distribution of each variable. Below the diagonal are scatter plots of all variable combinations. Above the diagonal are correlations of all variable combinations. Larger correlations are printed in a larger font. Correlations too small to see are too small to cause multicollinearity problems (if between two independent variables) or to provide significant linear prediction (if between an independent and dependent variables). The first matrix (Figure 6) contains all the data and shows the large number of zeros in the outcome variables (no purchases and therefore no transfers and no rehabs), necessitating a two stage model. It also shows that all the count variables (NIS Queries, Number of Employees, Number of Private Sales, and Purchases by CDC) are highly right skewed. A Poisson distribution is therefore employed to model the residuals for the purchases model. The second matrix (Figure 7) shows only data rows in which the CDC made at least one purchase. This matrix shows that the two other dependent variables, transfer rate and rehab rate are less right skewed—though not normal. Regardless, a traditional Gaussian distribution is employed to model the residuals in these two models. The application of these scatter plot matrices to model construction is discussed in the quantitative section on programmatic capacity building.
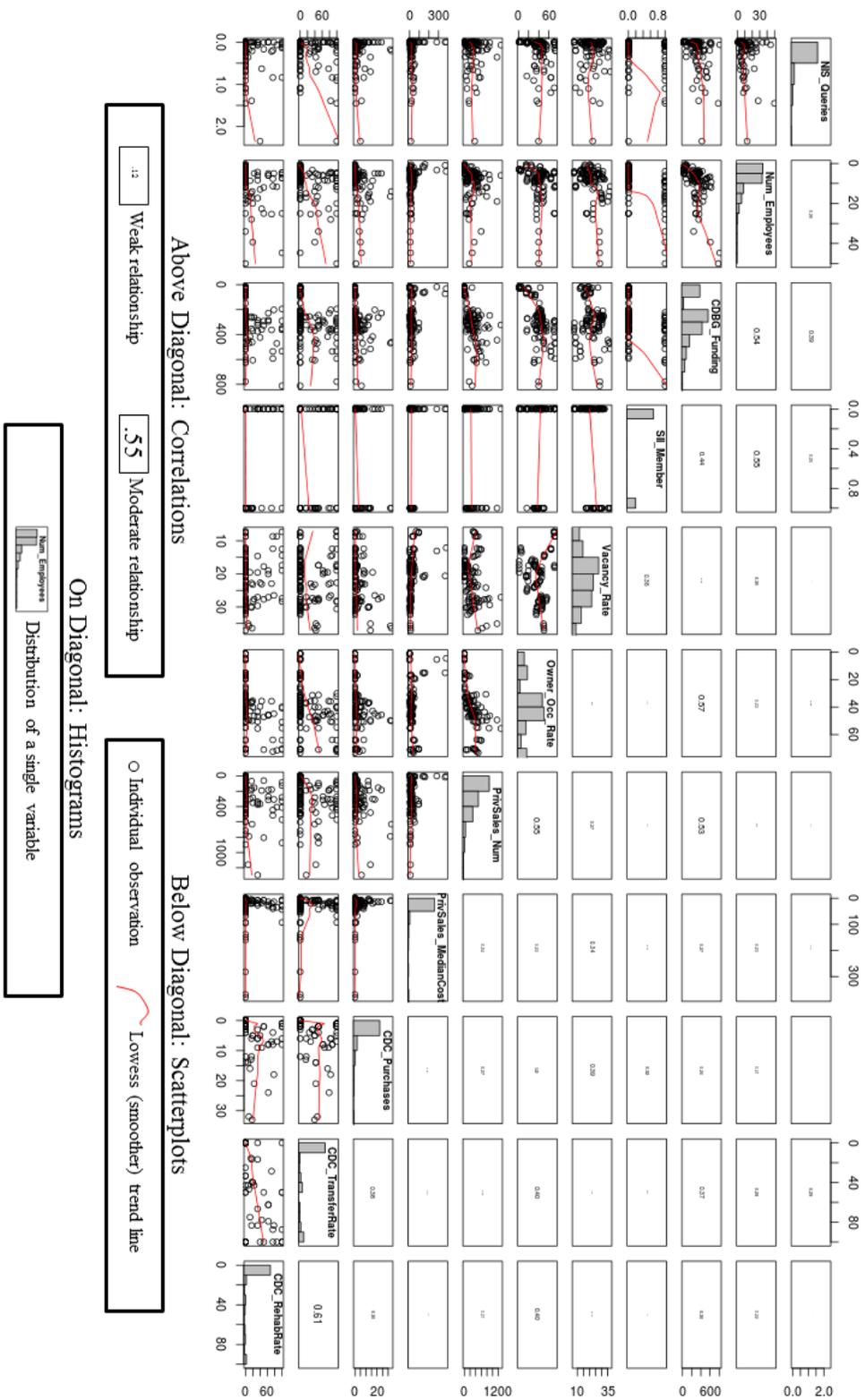
Figure 6: Scatterplot Matrix for all Data Rows (Purchases & Non-Purchases)
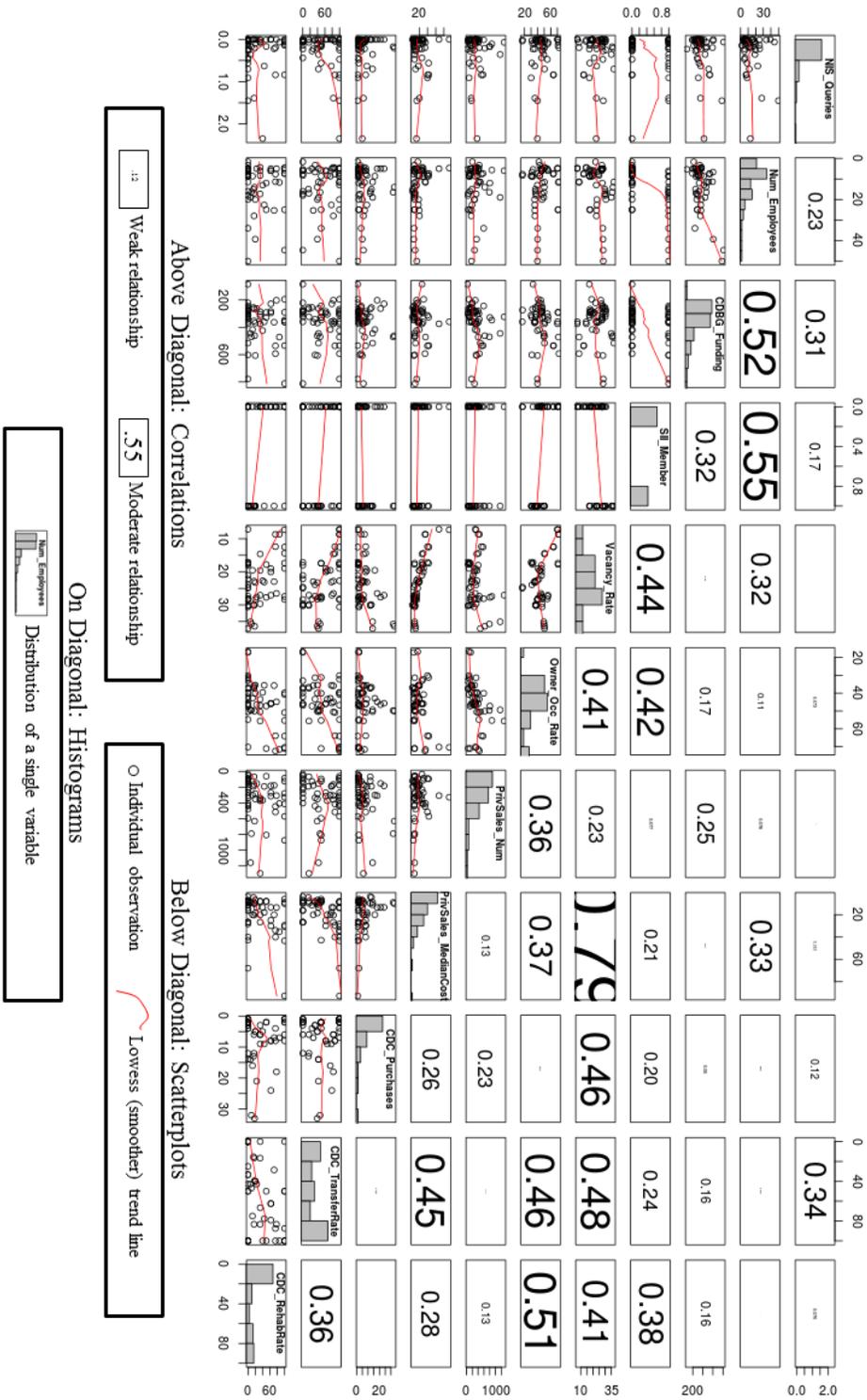
Figure 7: Scatterplot Matrix for Purchases Only (Non-Purchases Removed)

Chapter 6: Findings regarding System Quality, Data Quality, and Service Quality

The semi-structured interviews provide considerable validation of Delone and McLean's (2003) information system success model, which has received wide empirical support in other fields—but never in the field of community development. Scholars criticized an earlier version of the model (1992) for failing to capture system users' needs for training and assistance. DeLone and McLean (2003) responded by adding the "Service Quality" component (see model on page 24). Interviews conducted in this research did not reveal system aspects that fell outside the current model, validating its general construction. However, while the authors assert that the model flows in the direction of information use—from left to right—the interviews revealed that increased adoption results in more departments willing to share data and higher data quality overall in terms of *data breadth*. System use comes *after* data quality in the model. This finding suggests an area for further exploration and refinement. Despite this movement through the model in the opposite direction anticipated, the interviews show that the overall flow in the model is from left to right, which makes this chapter necessary. The answers to research questions 3, 4, and 5 refer to system use (middle of the model) and net benefits (end of the model), which depend on system quality, data quality, and service quality (start of the model). This chapter provides key findings for these early model components.

System Quality: Ubiquity, Selectivity, and Customizability

Interviewees described three aspect of the system directly related to system quality in DeLone and McLean's model. I refer to these aspects as *ubiquity, selectivity, and customizability*.

Ubiquity

In computer science, ubiquity refers to the widespread integration of information processing into everyday devices to such an extent that users are unaware of the underlying complexity (Weiser 1991). I employ the term in this research to represent a critical mass of

technology adoption. The breadth of data in the system exists due to the ubiquity of the system: widespread stakeholder adoption leads to more data contributions, which—in turn—improves data breadth.

In Cleveland, the NST web application is becoming ubiquitous among CDC staffers and the subset of municipal employees that interact with them on a regular basis. The former expressed pleasure that the latter were now on-board:

> "[Person] is training the city inspectors to use NST. So it will be both the city and the CDCs that change data. It doesn't make sense for just the CDCs to use it." (#3, 11/3/2011)

One individual closely involved with the development of the NST web application and familiar with a broad cross-section of users described the process of public sector adoption:

> "Government agencies were always legally obligated to give data but they found reasons not to. But, it reached a critical mass when agencies start using the [NST] system. Now, it is unusual to find an agency that will not share data." (#46, 10/20/2011)

Interviews (excerpted here) and logfiles (analyzed later) reveal that all the CDCs involved in residential rehabilitation, residential construction, or code enforcement use the system to some extent. The Cleveland Code Enforcement Partnership provides an example of this widespread adoption, as another interviewee explains:

> "The NST tool is the intermediary for the partnership between the city and CDCs for code enforcement. City Building and Housing, Planning, and the Housing Court [all have access]. Some City Councilmen and staff use it. We've given data to the Federal Reserve. City administrators and head staff love it. Most [non-management] staff see its value also." (#47, 8/11/2011)

Both NEO CANDO and the NST web application provide the most common elements of cloud computing—software, computing power, and data storage (Leavitt 2009) and—to a degree—its most common benefits: ease of access, cost savings, and data sharing.

In terms of ease of access, system administrators at CWRU's Poverty Center allow anyone to create an account for the NEO CANDO system and grant NST accounts to any city employee, CDC employee, or educational researcher. As discussed previously under system selectivity, a single web-based interface provides all neighborhood information system selection

tools. Users encounter the same login process, forms, and drop-down lists in NEO CANDO and in the NST web application as in countless other websites.

In terms of cost savings, while many interviewees praised the convenience of free access to both NEO CANDO and the NST web application, tracing such access to financial benefits proves exceedingly difficult. Employees in many organizations already enjoyed NEO CANDO when they received access to the more advanced NST web application—also for free. Therefore they gained more functionality and more underlying data for the same "price". An interviewee at one CDC acknowledged that her organization had stopped paying for the commercial Metroscan[53] product once NST became available. However, she could not trace the savings to a reallocation for another CDC expenditure and does not even think of the change in terms of cost savings:

> "In 2008, with the housing crisis—that hit non-profits hard. I don't think it [the NST web application] is money saved. I think it is money you are not losing. Like we had cable [TV] and now it is not feasible to have cable or those extras. We haven't lost anything— we can get the same info as before." (#17, 2/23/2012)

Once information is loaded into the system, data sharing occurs automatically because users manipulate a single set of property data—not a private set for each user or organization. To save query processing time, system administrators assign users access to a subset of properties corresponding roughly to a particular CDC's service area. But, these assignments allow users in organizations with adjacent (or overlapping) jurisdictions to still see each others' data. Also, employees at NPI and city departments gain access to property data for the entire city. This joint access transparently supports the common task of communicating information discussed further below. The NST web application provides data sharing to a larger degree than NEO CANDO due to its custom fields (see "Customization" below).

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[53] The website for CoreLogic, which produces MetroScan, describes it as "a comprehensive database of residential, commercial, industrial and vacant property," updated using, "more than 3,600 government and proprietary data sources." http://www.corelogic.com/products/metroscan-online.aspx#container-Overview

Selectivity

The term selectivity refers to the process of choosing best candidates or being able to differentiate between very similar choices[54](OED). Community development professionals select properties to research based either on criteria outside the NIS (i.e. windshield surveys, resident inquiries) or criteria inside the NIS. Users prefer NEO CANDO and the NST web application over other public websites because of the list building and filtering tools. A CDC employee may have a page full of parcel numbers of potentially vacant properties and want details like the owners' names, foreclosure status, and property tax status. As detailed in the answer to research question #5, "Does NIS improve the capacity of a CDC," community development corporation employees claim that the *selectivity* of the NIS saves time in housing rehabilitation work that is then reinvested into completing more rehabilitations (see "Times savings via selectivity" on page 138).

Customization

The term customization refers to the process of adapting something to particular requirements (OED). NST provides users with twenty blank fields to be used flexibly as needed by individual users or as defined within their respective organizations. In practice, only staff in very few organizations use these fields, but those who do speak convincingly of their benefits. These fields are used to store two types of locally collected data: systematic surveys and memos. One interviewee provided an example of the former, entering data from a vacancy survey conducted by the CDC to see the results alongside city vacancy data and USPS vacancy data (#5, 7/11/2011). Another interviewee provided an example of the latter, entering the participants in the CDC's weatherization and paint programs through their parcel numbers (#48, 1/18/2011). Interactions with residents can also lead to more ad-hoc memos. One interviewee explains that:

> "Some block clubs that are passionate do their own surveys on distressed properties...Some of them will type up a spreadsheet to send to me with data from their surveys… [or] eyesore cards that are self-explanatory. All the info residents gather get into NST. We get interns that help with data collection." (#48, 10/20/2011)

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54 Another definition relevant here comes from radio engineering. Selectivity refers to the ability to differentiate between similar signals or to pull a signal out of interference (OED).

Whatever we do in the office we plug them into the custom fields. I get a phone call from a resident that there are squatters. I call the city and plug in the complaint into a custom field. I [also] plug my redevelopment interest into the house." (#48, 2/21/2012)   Customization may provide time savings like selectivity but the interviews did not provide such detail. In the long term, customization may lead CDC employees to make different decisions than they would have without the custom fields by allowing them to better integrate locally collected data with city sources to reveal more assets, opportunities, and threats. Building up locally collected data sources and learning to integrate them likely takes years and impacts may take quite a while to appear.

Information Quality

Two components of data quality attracted the most attention in interviews, breadth of information and the accuracy and/or currency of the information. Although the interview questions focused on how interviewees used data, interviewees repeatedly commented, usually positively, on the quality of the data—not just about how they used them.

Breadth of information

The breadth of data is a product of the different types of data in the system and the number of different public agencies contributing data to the system. One CDC employee explains that

> "NST is not like Microsoft Word that everyone needs on their computer. But if you are like me and are dealing with land, NST is useful. There are so many columns: deed status, purchase price, etc." (#42, 10/11/2011)

Like with *selectivity,* CDC employees claim that the *breadth of information* in the NIS contributes to time savings for housing rehabilitation work (see page 139).

Currency / Accuracy of Information

In urban planning, data accuracy and data currency are closely related. Since the situation on the ground changes due to the natural effects of the environment on aging structures and the activities of numerous people—CDC employees, city workers, private investors, homeowners, copper scavengers, arsonists—old data quickly become wrong data.

Interviewees described several leaps in accuracy, mostly due to an increase in breadth—

the addition of data better suited to a particular task than the data previously available. One CDC staff person described the progression of data used to track vacancy:

> "Water turnoffs data is not the final answer on vacancy. People live without water. And water is sometimes left on in vacant buildings...So, we would send out a mass mail and whatever came back was vacant. Now we have USPS vacancy data in NST." (#42, 10/11/2011)

She concluded that while the software "gives us a big head start...the best information is from talking to people in the community. I jump out of my car when I see someone near a building." (ibid). A staff person at another CDC speaks to neighbors to determine the vacancy date of a house because they may have seen the last occupant leave (#10, 11/4/2011).

Several experienced users expressed frustration with the quality of data from city agencies, which feed the NST system. One CDC staffer exclaimed that some of the houses on Cleveland's worst-of-the-worst list for immediate demolition have already been rehabilitated. He continues:

> "The NST web app is still playing catchup with demolitions...There are four districts in the Building and Housing Department each with a chief inspector and they differ in data quality. The city is notorious for losing applications for side yard expansions. It holds back progress. The city water department is famous for bad data." (#48, 7/11/2011).

NIS cannot be more accurate than the data in the system. This CDC employee still uses NST daily though. Two employees at a different CDC conclude that while they also use a commercial property database (Metroscan), NEO CANDO and NST may be more current (#9, 2/8/2011 & #58, 3/2/2012).

Service Quality

Delone and McLean (2003) added service quality to their 1992 model based on ideas in marketing and noting the rise in computing by end users who need assistance. Surprisingly, the model is not explicit about the need for training, which both users and NST providers referred to repeatedly.

Training

CWRU's Poverty Center offers online and phone-in user assistance for NEO CANDO

and the NST web application. Master of Social Work students receive an annual NEO CANDO training and the Center employees offer other trainings—to university librarians for instance—as needed. Starting March 2011, the Poverty Center offered NST trainings twice a month and later switched to a monthly schedule. In the words of a Center staff member, "anyone can attend, but...[the trainings] are mostly broadcast to our CDC audience of users" (email 11/9/2011). The trainers supplement the monthly schedule with classes for specific groups such as the city's chief code inspectors, city council members, and housing court staff. NPI expanded its technical support to CDCs from nine CDCs involved in the Strategic Investment Initiative to 22 CDCs, all but two of which are located in Cleveland. A city department manager said that the Poverty Center has offered both private sessions for his staff in the workplace and group sessions at Case Western Reserve University (#72, 4/3/2012).

Responsiveness

Responsiveness means that an organization's service staff "give prompt service to users" (DeLone and McLean 2003:18). Only one interviewee provided material that aligned with the concept of responsiveness:

> "They are very responsive at implementing suggestions. I noticed there was no field to mark a missing lattice on the lower part of a porch during inspections. They have added a field. They also added wording so I know that 'garage out of plum' means 'leaning'." (#55, 10/21/2011)

Assurance and Empathy

Assurance means that an organization's service staff "have the knowledge to do their job well" and empathy means that an organization's service staff "has users' best interest at heart" (DeLone & McLean 2003). CDC employees appear confident that people at the Poverty Center are highly skilled and in the words of one long-term CDC staff member—"get it," get "the CDC's criteria and responsibilities" (#42, 11/10/2011)

Chapter 7: Findings regarding research questions

This chapter offers detailed findings for each research question.

Q1: What claims do NNIP partner organizations make about neighborhood information systems in their mission statements and websites?

NNIP Partner missions, activities, and claims

Staff members in NNIP affiliated organizations make claims about how data and technology impact community development. I examine the institutional websites of affiliates to better understand these claims, focusing on mission statements.

NNIP partner mission statements vary from those evoking data delivery as a goal (e.g. CamConnect in Camden) to those that do not mention data delivery at all (e.g. CMAP in Chicago). Many emphasize data provision as a strategy toward a social end. For example, the mission of DataHaven in New Haven, CT is to improve "the Greater New Haven and Valley Region by compiling and sharing high-quality public information for effective decision making" (DataHaven, "About DataHaven"). Nearly eighty-percent (37 of 47) of the websites of these organizations tout the data and high-tech tools found therein using 89 different words and phrases to describe their timeliness (recent, new, updated), quantity (comprehensive, extensive, more), quality (rigorous, assured, vetted), convenience (free, practical, one-stop shopping), scope (regional-level, neighborhood-level, parcel-level), formatting (table, map, profile), and potential function (track, compare, decide). NNIP partners generally provide data for display, download, and mapping online.

The websites contain statements about the identity of anticipated data users. For instance, the website for NEO CANDO in Cleveland states that "academic researchers, community and economic development professionals, public officials, neighborhood activists, business leaders and concerned citizens of all types can easily use this system to explore aspects of the area" (NEO CANDO n.d.). Employees of government agencies, nonprofit organizations, schools, and

businesses are the most anticipated data users across NNIP partners (61%)[55]. Nearly half (43%) of the websites specify residents, citizens, or individuals as data users. Terms that conflate private individuals and organization employees such as "community", "neighborhood", and "stakeholder" appear on nearly half (45%) of the websites in descriptions of anticipated users. Adding these instances raises the total for organizational users to 68% (32 websites) and individual users to 57% (27 websites)

The most prevalent themes on NNIP partner websites concern decision-making (68%), public participation (53%), capacity or capacity building (32%), accountability or transparency (21%) and social justice, equity, or equality (19%). I focus on the first three themes, especially on participation and capacity, because they are intimately tied to decision-making on the websites (e.g. "collaborative decision-making" and "the capacity to use information in decisions") and also intimately tied to decision-making in the urban planning literature (Arnstein 1969; Chaskin 2001; Davidoff 1965). Examples of participation on the websites vary widely. Many advisory groups worked together to decide which data and indicators Minnesota Compass would collect, process, and distribute (Anon n.d.). The website of Community Link in Sacramento claims that the organization offers users opportunities to "study and influence public policy" (Anon n.d.). Washington DC LISC seeks to address needs "identified by the neighborhood residents" (DC LISC n.d.). A few NNIP partners, like CURA in Minneapolis claim to support neighborhood associations and community organizing (CURA n.d.).

Examples of capacity and capacity building also vary widely—both in terms of subject (capacity of whom?) and objective (capacity for what?). Subjects include residents[56],

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55 This includes all organizational employees and those individuals likely to use NIS in connection with official duties such as university faculty and students.

56 Examples include the Polis Center at Indiana University-Purdue University Indianapolis and the Center for Urban and Regional Affairs at the University of Minnesota in Minneapolis.

organizations[57], and communities[58]. Objectives include the capacity to change[59], to make decisions[60], to act collectively[61], to collect and use information[62], and to meet goals and confront problems[63]. Some of the partners allude to subcategories of capacity such as organizational capacity (RHCDA), operating capacity (MetroGIS), and technical capacity (DC LISC). Capacity can also refer to the ability of an NNIP partner to provide information to prospective users (Providence Plan). The NNIP website states that NNIP partners "have adopted as a primary purpose using information to build the capacities of institutions and residents in distressed urban neighborhoods" (NNIP n.d.). *This implies that information—and perhaps the technology that delivers information—can build capacity.*

NNIP partner websites frequently describe data and information technologies as leading to desirable outcomes. These outcomes fall into four broad categories, listed in Table 14 (below) from vague to concrete.

Table 14: Claimed Outcomes from National Neighborhood Indicator Partnership (NNIP) Partner Websites

Claimed outcome	NNIP Partner Example (From respective websites)
Positive social change, more democracy	Community Research Institute's commitment to "building a growing data sharehouse for the region," improves "the democratic decision-making capacity in our local communities…"
	"…as stakeholders use the enhanced capabilities available to them through

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57 Examples include MetroGIS in Minneapolis, the Center for Urban and Regional Affairs at the University of Minnesota in Minneapolis, the Nonprofit Center in Milwauke, The Providence Plan, and the Regional Housing and Community Development Alliance in St. Louis.

58 Examples include: the Polis Center at Indiana University-Purdue University, the Urban Strategies Council in Oakland, and Community Link in Sacramento.

59 Such as the Polis Center at Indiana University-Purdue University Indianapolis

60 Such as the Community Research Institute at Grand Valley State University in Grand Rapids

61 Such as the Urban Strategies Council in Oakland

62 Examples include: the Urban Strategies Council in Oakland and the Nonprofit Center in Milwaukee

63 Examples include: the Urban Strategies Council in Oakland and the Nonprofit Center in Milwaukee

	MetroGIS, they better serve society's needs…"
Institutional collaboration, grassroots participation	The Piton Foundation "uses information and communication to bring people in Denver closer…through a deeper understanding of the collective challenges they face." "By layering data from many sources", Children's Optimal Health in Austin, "can help communities … unearth opportunities for collaborative change.
Communication, influence, advocacy	Staff members of the Greater New Orleans Community Data Center "believe that reliable, targeted data can help leaders create positive community change" The mission of Neighborhood Nexus in Atlanta, is "to provide data, tools and expertise as a catalyst to promote healthy communities…" Staff emphasize that "visualizing data and telling your own stories with the data are key."
Targeting, efficiency, decision-making	The Neighborhood Nexus website advertises "dashboard" technology, which displays and tracks a customized assortment of indicators to help users determine whether they are spending "limited resources in the right way." Similarly, the organization's asset maps allow users to "compare the data (i.e. food stamp recipients) to the assets (i.e. grocery stores) and determine if a gap exists" The Center for Community Building and Neighborhood Action's website in Memphis offers ", all the data needed to drive decision making in your community

Hypothesis 1 (see page 31) appears correct. The mission statements and webpages emphasize indicators and the purpose or outcome of system use. However, the causal statements above rely on implicit assumptions about the benefits of access to information, the use of

technology, the decision-making process of individuals and organizations, and the problems people face in low-income neighborhoods. What is the logical connection between a "data sharehouse" and "democratic decision-making capacity" (CRI n.d.)? How can using a technology allow someone to "better serve society's needs" (MetroGIS n.d.)? Under what conditions can leaders leverage data to "create positive community change" (GNOCDC)? What factors contribute to the decision making approach commonly referred to as "data-driven"—besides data? The rest of this research begins to answer some of these questions.

Q2. Who uses NIS and how frequently?

This chapter communicates findings from analyzing NIS logfiles and from interviews with NIS users and local residents. While there are more educational users, twenty non-profit organizations, mostly CDCs, use NIS far more intensely.

Overview

Based on logfile analysis, students, faculty, and staff are by far the largest user category when measured as at least one query per year. As Figure 8 shows below, this group grew exponentially from just 100 individuals in a handful of institutions in 2006 to nearly 1,200 individuals in 200 organizations in 2009 (displayed in blue). The distant second category, non-profit organizations, currently includes less than half the number of people but in a larger number of institutions (displayed in brown). Government users compose the third category with 300 people in 25 different agencies (displayed in purple). While the size of the educational/research category has plateaued, the latter two categories are still growing slowly. The number of "citizen" users—people unaffiliated with any of the other categories—plateaued at less than 100 people in 2007.

Refining the measure from at least one query a year to at least one query during each of six different months produces a radically different portrait of NIS users in Cleveland shown in Figure 9. These users may issue a query (or more) every other month for example. Users who do not use the system at least this frequently have been filtered away. The remaining users are not simply working on a single short-term project that requires data. NIS forms a part of their workflow. Using this measure, employees in non-profit organizations place in the top category with 65 people in 20 different institutions. Employees in government agencies place in a distant second category, three-fifths the size. Users in universities and research institutions fall into a close third category. In conclusion, institutional employees relying on NIS this heavily compose a rare but rapidly growing subset of users. In contrast, a negligible and stable number of individual citizens use NIS this heavily.

Figure 8: NIS Users At Least 1 Day Per Year

Figure 9: NIS Users At Least 6 Months Per Year (At least one query in six different months within the same year)

Semi-structured interviews with CDC staff, government employees, and a handful of neighborhood activists support this logfile analysis. As explored more fully in later sections, at least one staffer in every CDC conducting housing construction, housing rehabilitation, site assembly, or code enforcement work uses the NST web application. CDC staffers use NEO CANDO for grant applications that require demographic information.

The top four public jurisdictions with departments using either NEO CANDO or the NST web application are:

Table 15: Cleveland Area Public Entities Using NIS

#	Jurisdiction / Entity	# Queries
1	City of Cleveland	16,436
2	Cuyahoga County	5,553
3	City of South Euclid	4,166
4	City of Lakewood	1,615

City of Cleveland employees do not consistently specify which department they work in when creating a user profile. Based on the available data, the departments of Community Development, Building and Housing, Public Health, Law, and the Housing Court all use the system. Interviews confirm that city workers in Community Development and Building and Housing use the NST system with increasing frequency, but are silent on comparisons with other departments. The remainder of this section examines how CDC staff members and residents active in neighborhood-level development issues receive pertinent information.

CDC Staff NIS use patterns

The majority of interviewees at CDCs claimed to use either NEO CANDO or NST very frequently–or not at all. Frequent use varied from a few times a day to a few times per month. However, one interviewee described a very different pattern of use. For the common single property lookups that lead other employees to near daily NIS use, this individual prefers the

older tools. He explains why:

> "I get the data from the source, from the county auditor's website, from court records on individuals and properties. I look that up at the source from my favorites [bookmarks] on my computer. I have my own process and there is no reason for me to change. I did property research for this organization...[for a long time] before these tools became what they are now. ...if I'm looking at a few properties, I use my old method." (#67, 5/15/2013)

The reason for this use pattern is not lack of technical knowledge or difficulty learning new tools. This user downloads massive amounts of data from NST and loads them into a desktop GIS three or four times a year. He explains, "we do a lot of property research for land for larger projects...We do not try to go out and find houses to rehab" (ibid). This means his team is not constantly looking for opportunities that require immediate research and action like staff in other CDCs.

Resident activists NIS (non)use patterns

For the most part, residents do not use NEO CANDO and they cannot use the NST application, which requires employment in a governmental, nonprofit community development, or research institution. This section provides a mirror image of the next section, which covers— along with other topics—how CDC employees use NEO CANDO and NST in their work *with concerned residents*.

Most residents are *not* neighborhood activists and contact a CDC only when personal experience requires such contact. Most often, the resident wishes to express concerns about a problem property, expand his or her own property—or both. One resident described this last situation:

> "There were two houses next to my house and they were stripped, no windows – all sold for scrap. I was afraid someone would start a fire. I didn't want kids to play over there. And it was several years. The current owner is a bank. They never cut the grass or there is cut grass and paper on the lawn, making a mess. If I want to sell my house – how can I? [The city] condemned them. [The local CDC] was instrumental in getting them demolished. I told [CDC employee] that I wanted to buy the lot...[and she] will help me obtain the property, fill out paperwork, and it would be a clear title...[One of the houses] was sold several times. They would collect rent but not invest in the property. The owners never lived in the neighborhood. They never had to look at the house or listen to the renter's loud music. I've lived here 42 years. I like the neighborhood and I like my

house. I will now make a bigger garden, a three car garage, fence it in, put in a picnic table." (#54, 11/11/2011)

The next chapter describes such contact with residents from the point of view of the CDC employee receiving the phone call. In short, the employee uses the NST web application to retrieve information about the property's current owners and ownership history. Therefore, even a resident who is not a neighborhood activist—but telephones his or her local CDC with an inquiry—accesses NIS indirectly through the CDC employee on the other side of the line. Some neighborhood activists have learned to conduct property research on their own.

Most of the neighborhood activists interviewed enjoyed access to a personal computer and popular office software. While familiar with NEO CANDO, they used the County Auditor's website more often. They conduct first-pass research on a property before asking a CDC staff person to continue in more detail. Properties that are newly vacant, poorly maintained, or clearly dangerous attract their attention. Also, neighbors less knowledgeable about property research will ask these activists to pursue an investigation, possibly before purchasing and rehabbing a house. Although able to conduct some degree of research on their own, some activists question whether the effort warrants their time since CDC employees have greater skill and access to information. One activist provides this example:

> "I've gone online to see if there are back taxes, who owns [a property]. Sometimes my neighbors call me instead of the CDC for information. But, I've started sending email to the CDC to ask [about properties]. Usually, I go right to the County Auditor's website. I have it in my favorite places [bookmarks]. Are taxes current? Are there assessments for the city cutting the grass? Since I know [CDC staffer] has more access, I've been taking advantage of it. A resident called me and said the people in the beautiful house are gone. I called [CDC staffer] and he said it is in foreclosure. The people are in Puerto Rico but they are working with the bank. We are eagle-eye on that property so no one will break in...with my block club we watch it. Someone from Bank of America came and we came over to see who they were. When a property is boarded up, it tells thieves that it is vacant." (Resident, 3/9/2012)

However, another quiet-spoken resident paints a far darker portrait of violence and resilience on her street. She describes the events prompting her first property queries:

> "[My neighbor] got shot in his driveway because there were people dealing drugs on the street and having sex in a car. He told the guy to leave. The guy came back and shot him...[This neighbor] saw that I was good with computers and asked me to lookup who

owned nearby houses. I realize we had to do something. I've been hiding in my locked-up house and it wasn't enough. I started looking up back taxes on the County Auditor's website. The website is pretty good. Originally, I found the link to the website in the Plain Dealer [local paper] or I stumbled upon the Auditor's website. I'm not sure. This was four years ago. An absentee landlord next door was foreclosed on. The renters were nice people who were asked to leave in one day. So I helped them. They have rights. I
1)

At the time of this research, her neighbor, having recovered from the attack, was investigating the feasibility of personally rehabbing nearby homes in order to improve the area.

"If I had someone backing me like [names a particular CDC staffer] – maybe I could do it. I decided I'm going to try to change things after I got shot. [the CDC staffer] said she was going to get these houses boarded up and she did get them boarded up. Let's go to [the CDC] and get these houses demolished so the people aren't selling drugs from them...Instead of tearing down the house, can they [the CDC] donate it to me? I know a certified electrician and a certified plumber. And it is easy to run a paint brush across the house. I've got friends out of work who could help me put these homes together." (Resident, 11/8/2011)

In a different neighborhood, resident activists formed a housing committee at the suggestion of a staff person at their local CDC.

"I started attending those [CDC] meetings. 8 to 10 people questioned what the situation was. How many houses were vacant and abandoned? That was the task for the CDC—to identify vacant property...In March we asked how many houses [were] torn down last year—only 24 houses. That sparked outrage amongst the committee [members]. [Name of CDC staffer] felt that as residents we would need to engage and become more vocal. [We] decided on a public meeting. We basically took the CDC out of it. We didn't require them to make the flier [or to] make the appointment with the Director of Building and Housing. We call ourselves resident-driven." (Resident, 3/9/2012)

Her assertion that identifying vacant property is a central task of the local CDC not only proves correct in this particular case, but for nearly all CDCs in Cleveland. Later analysis shows that the common tasks CDC employees conduct using NIS include identifying vacant property. While "resident-driven" in terms of calling for, advertising, and running the meeting, the committee members still relied on CDC employees to provide evidence that the neighborhood was not receiving its "fair share" of demolitions:

"We created our list of 800 properties and took 25 of the worst of the worst and scheduled a small meeting with [residents, CDC staffers, and city officials] and went

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through the properties one by one. We told him [the Director of Building and Housing] 'focus on these'. We could tell him because of NEO CANDO [actually, the NST web application] they are on the demolition list and through the legal process. Some have been on the list for four years. I don't even know what is the full extent of what they [CDC staffers] can pull up. The limited version [NEO CANDO] is for regular residents. It seems any question I ask about a property [name of CDC staffer] can go online and get an answer." (Resident, 3/9/2012)

The relationship between committee members and CDC staff members is two-way. This committee's local CDC relies on them to follow updates on the Housing Court and Building Standards websites and to email testimony for use in Housing Court (#48,300,11/7/2011). Two different committee members explain that—while more demolitions are required—demolitions are not always the best answer.

"We found there were houses on the demolition list we didn't want on the list. They are in a historic district. They [the city] refused to take them off the list but are working with developers. There are 16 such houses and 6 on the demolition list. Some can't be saved. But we [members of the housing committee] don't like the thought process in the city— to spend every penny on tear downs. They are going to force up the value of properties left [they claim] but new construction is not always good construction. And this city has a history…we need to respect. Also, what about low income people? [Where will they live?]" (Resident, 3/9/2012)

"I use Excel to create a statistical formatting of four-year data. The County Auditor's website is useful so I don't have to bother [name of CDC staffer]. I've looked up maybe four houses in the last five or six months. I'm advocating for new policies and procedures in my historic district. We should allow people to evaluate condemnation targets for architectural value and rehab potential." (Resident, 11/7/2011)

In order to balance the argument for demolition (fueled by concerns for safety and preserving home values) against the argument for historic preservation (fueled by respect for place and concern for the less fortunate), the interviewee uses a simple rule of thumb: "would you let your mother live in this house?" (Resident, 11/7/2011).

Although committee members rely on the NST web application indirectly through CDC employees, they question the quality of the data and express concern that the general public knows so little about the availability of public information on housing in Cleveland.

"The idea, concept, is amazing for NEO CANDO. It was sincere—but only as good as the info put into it. But Cleveland—what impacts my daily life—our city doesn't get the info in there very well. The info at the Building Department is sketchy at best...I don't

think the general public knows that there is vacant house data in them [systems like NEO CANDO]. People don't know it [NEO CANDO] exists...I didn't even know about it over a year ago—and I had been on the [housing] committee for 3 or 4 months. I think it is a good thing—but no awareness and [poor] data quality." (Resident, 3/9/2012)

Neighborhood Connection grants of less than $5,000 each fund many block club activities and do not require demographic statistics in the proposal. The Cleveland Foundation has awarded more than 1,600 such grants since 2003, totaling $5 million (The Cleveland Foundation 2015). Block club leaders hear about the opportunity from CDC staff or from their City Councilman. Some leaders only ask the CDC to act as a fiscal agent should the application prove successful. Others also ask for help estimating a project budget and preparing the final application. The leaders of two successful block clubs explain how much they have accomplished—not only without using NEO CANDO—but without even using email.

> "We left technology behind. We are old-school. We are block clubs without e-mail. We fund gardening and organize people by letting them be people. Technology doesn't let people be people." (Resident, 11/8/2011)

> "I have gotten six houses torn down. I got it done with my mouth. I started at the [CDC], then [list of public officials she contacted]. All the inspectors know me by name...[name of CDC staffer] looks up who owns a house, taxes owed, and gets inspectors. I've been living here for 25 years. So I have my own information. I know this woman died four years ago. The house has no owner. There is black mold on the house, which is near our orchard..." (Resident, 11/8/2011)

Another resident activist bristled at the accusation that block club leaders or residents more generally need technical assistance with tools like NEO CANDO. She pointed out that there are bloggers of all ages in her neighborhood writing about planning issues in Cleveland and conversing on public access websites like REALNEO[64]. Upon learning about the NST web application during an interview for this research, she became alarmed and questioned aloud whether CDC employees should enjoy access to any technologies or information not granted to the general population. This research focuses on how CDC employees use NIS and the impact the systems have on CDC outcomes. It leaves many important ethical questions unexplored concerning privacy, the distribution of propriety data, and tiered access to information. The next

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[64] http://realneo.us/

section examines in more detail how CDC staff members use NEO CANDO and the NST web application.

Hypothesis 2a, 2b, and **2c** (page 33) are correct. There are fewer NIS users based in community development corporations, but they use the system frequently. There are more NIS users based in educational institutions, but they do not use the system frequently. Residents not affiliated with such organizations hardly use NIS at all.

Q3. How do CDC staffers use NIS?

Interviewees described in detail how they used the neighborhood information system. CDC employees rely on the system for a range of *common tasks* that overlap with multiple community development functions (introduced on page 40). The adjective "common" refers both to frequency (these tasks are executed often) and commonality (the same task serves many functions). For example, finding owners is a major part of both the rehabilitation function and the code enforcement function. Discovering that daily computer work in CDCs is divided into multipurpose, common tasks provides a glimpse inside DeLone and McLean's "Use" component specific to community development activity (see original model on page 24 and final theoretical framework on page 41). As the literature review explained, scholars—including DeLone and McLean—have called for applying the model in new domains, identifying more nuanced descriptions of use than the raw number of queries, and revealing richer understandings of work processes that involve information systems. The findings below contribute to filling the gaps identified by these scholars.

Common Tasks

By allowing CDC staff members to define the tasks they pursued with NIS, I discovered that they turn to the system again and again to pursue a few tasks common to multiple overarching development activities. These tasks are tracking vacancy, finding owners, vetting applicants, and communicating information. Table 16 (below) summarizes how the tasks form part of multiple larger development functions and the section that follows describes each task in detail.

Common tasks such as tracking vacancy and finding owners link NIS with CDC development functions like rehabbing houses and conducting code enforcement. A single common task overlaps multiple development functions. CDC staff members, for example, must survey homes on foot to pursue code enforcement. The NIS cannot conduct the survey, but excels at storing survey results and retrieving an owner's tax address, which a CDC staff member uses to send a letter warning of potential housing code violations and offering assistance through various CDC and city programs. The task of finding an owner's address is not only part of code enforcement though—it is necessary to acquire residential properties for rehabilitation and

sometimes even for grant writing.

Table 16: Common Tasks that rely on NIS

Development Function	Tracking vacancy	Finding owners	Vetting Applicants & Homeowners	Communicating information
single family rehab or new construction	Identify houses for rehab, empty lots for new construction	Use owner details in an acquisition strategy	Identify suitable new owners, investors, and developers based on their upkeep of other properties	Share intentions with coworkers & city
code enforcement	Know potential problem properties ahead of systematic housing survey	Use owner details to send warning letter and offer aid	Identify owners meriting special consideration such as one who participated in a paint program last year but now lost a job and cannot afford repairs.	Use owner info for letter to owner, store memos for self (follow-up), coworkers, and city
resident outreach	Answer questions about vacant properties and enter local knowledge	See "code enforcement" (triggered by resident concerns)	See "side lot expansions"	Answer questions about problem properties, enter local knowledge
grant writing	Include vacancy data in grant application	Include bank ownership trends in grant application	?	Is formal form of inter-organizational communication
demolition advocacy	Opt for demolition of some vacant houses	Convince owners to demolish or find other strategy	?	CDC staff share their initial survey with city and can check steps city agencies have taken
multi,commercial & assembly	Identify houses for rehab, lots for site	Use owner details in acquisition strategy	Identify suitable new owners, investors, developers based	Share intentions with coworkers & city

	assembly[65]		on their upkeep of other properties	
foreclosure prevention	Use proprietary adjustable rate mortgage data to target prevention efforts—before vacancy	Use owner details for door-knocking	?	Share door-knocking results with coworkers for follow-up. May feed into vacancy tracking.
Side lot expansion	Identify empty lots for side lot program	Lots already in land bank. See "vetting applicants".	Identify suitable neighbors to purchase side lot based on their upkeep of own property	Share intentions with coworkers & city employees
Planning	Examine trends	Use owner details in acquisition strategy to implement plan.	?	Create maps and tables for plans or download necessary data.
historic preservation	Often similar to Single Family, Multi-Family, or commercial development			
Other programming (paint, etc)	Often similar to code enforcement			

Tracking vacancy

The housing rehabilitation, code enforcement, and demolition advocacy development functions require CDC staffers to carefully track vacancy. For example, code enforcement requires knowing which properties are vacant and possibly abandoned because these may require more effort to keep up to code and may turn into legal cases.[66] Several other development

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65 In some neighborhoods there are so few commercial structures and vacant lots that CDC staffers do not need NIS for this work.

66 CDC staffers may advocate for the city to declare such a property a public nuisance and then seek receivership over the property as a step toward rehabilitating or demolishing it (see Ohio Revised Code http://codes.ohio.gov/orc/3767)

functions benefit from tracking vacancy, but to a lesser degree. This task often combines retrieving postal vacancy data[67] from NST[68] with conducting windshield surveys and entering the results into the system. One interviewee emphasized the centrality of this task:

> "it is extremely important for us to have a count of vacancy to know about our service area. This is a windshield survey. We literally get into a car and drive and [also] record severity [quality of structures]" (#48, 2/21/2012)

A CDC staff-initiated code enforcement action against the owner of a vacant and distressed house can lead to condemnation by the city. From that point, CDC staff either elect to purchase the house or advocate for demolition. When CDC staff elect to purchase a house, their ultimate goal is either (a) to rehabilitate and sell the property to a responsible owner, or (b) to transfer the property directly as-is to a responsible owner who will—at the very least—bring the house up to code and pay city taxes. But, the entire chain of events starts with tracking vacancy. The *breadth of data* section previously showed that NST eases this task by providing USPS vacancy status, widely considered by CDC staffers more accurate than water shutoff status for determining vacancy. Aspects of tracking vacancy directly associated with physical development are discussed further under that development function.

Finding owners

All the development functions that require tracking vacancy also require finding owners. Indeed, a vacancy determination usually triggers a search for the owner as one CDC staffer described:

> "In our neighborhood it is not so clear [a house] is vacant. We don't allow boarding on the outside. I may send an outreach letter [and wait for] 'returned undeliverable' to show me it is indeed vacant. Then I look on NST and look for alternative addresses for the owner." (#30, 3/27/2013)

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67 The data come from the United States Postal Service under an agreement with the Department of Housing and Urban Development and include all addresses (both residential and commercial) in the USPS database (see http://www.huduser.org/portal/datasets/usps.html). However, entries in the NST web application do not appear to include individual units of apartment buildings.

68 NST provides a Boolean flag for postal vacancy with "0" meaning occupied and "1" meaning either *vacant* (inhabitable but not one lives there) or *no-stat* (under construction or uninhabitable for other reasons) (see the NST Data Dictionary at http://neocando.case.edu/nst/resources.jsp)

Additionally, weatherization programs and paint programs require finding owners when the problem property is a rental, especially when the tenant is hard to reach or not forthcoming about the owner's address. Successfully administering these programs in a neighborhood may also trigger a search for the owners of surrounding vacant structures that undermine the value of the recently upgraded homes (#3, 11/03/2011).

NST greatly eases the task of finding homeowners by providing both list building tools and offering the tax address field from the County Auditor's website. In more complex cases, NST signals whether the county land bank, HUD, or Fannie Mae own the property. It can provide the name of a purchaser from a Sheriff Sale and links to any court cases involving the property. An employee at one CDC gushed about the system's impact on this task:

> "I took the [NST] training course and learned all the wonderful features and what we can do as CDC employees. It cuts out all the hard tracking of finding owners—does it at the click of a button. I can find where home owners live quickly instead of going to three different websites." (#10, 11/4/2011)

An employee of another CDC explained how easily he finds owners' addresses for code enforcement:

> "NST helps us handle the [code enforcement] data and immediately spits back owners' names and banks involved. We send out letters. They are polite and give a warning that the problems could lead to citations from the city in the future if not corrected." (#24, 10/18/2011)

In a more unusual case, a resident-initiated effort to preserve a historic vacant house required locating the current owner. After receiving a call from a concerned neighbor, a CDC staff person turned to NST and found that a bank owned the house in question. Over a period of months, he convinced the institution's representatives to stop demolition and donate the house to the CDC (#48, 7/11/2011).

Vetting Applicants

As employees of a nonprofit organization eligible to receive property from the Cuyahoga County Land Bank and other institutions at a fraction of market value, CDC staff are frequently approached by developers, local businesses, and residents hoping to acquire land and houses quickly and cheaply. CDC staff are placed in the unenviable position of determining who will

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make a responsible homeowner or neighbor and avoiding individuals likely to contribute further to the crisis of vacant and abandoned homes in the city. One CDC staff person explained the way she interacts with developers and local businesses:

> "When developers want my assistance, I help them as well. I have to determine if they are responsible. If they are responsible, I help. If not I tell them 'I see your taxes aren't paid'. I can use NST to pull a permit and to see if a developer has paid taxes. [Local bank] is doing a big development. I help them with site assembly. [Local business] hired us to help with acquisition and land assembly also." (#51, 11/11/2011)

Residents also approach the CDC for both houses to fix-up and side lot expansions. "The ultimate result [of a demolition] is our office doing a side lot expansion or a community garden", explains a staff person in a different CDC." He continues, "we screen interested property owners [using NST]" (#48, 2/21/2012).

Therefore, people working in CDCs employ NIS both for finding problem properties and for vetting potential new owners. They locate salvageable vacant properties saddled with unpaid city taxes and code violations and restrict the owners of such properties from receiving any more—at least through the community development system. Irresponsible owners can still purchase properties through the private market.

Communicating Information

CDC employees use NST to (a) communicate information with people in the same organization; (b) communicate information with people in other organizations; and (c) to communicate with residents.

<u>Communicating with people in the same organization through shared data</u>

Like many other websites, NST provides cloud-based data storage and retrieval. Users with access to the same records communicate with each other through the system by seeing each others' changes to shared information. As one CDC employee explains, he and his coworkers are constantly updating records with the understanding that the data may prove useful sometime in the future:

> "We put data into the system. We have our own weatherization program and we have houses in the city paint program. We bulk upload that into the system so in land assembly

and tax foreclosure recommendations we can see that some owners tried to upkeep their property [and take steps to help them]" (#48, 1/18/2011)

Communicating with people in other organizations

Staff in different organizations rely on NST to communicate with each other (a) through shared data, as above; and (b) through formal reports using information from the system.

Inter-organizational communication through shared data

As a cloud-based system, employees in different organizations can share data as easily as employees in the same organization. When all parties actively look for changes in the information, the overall effect can be profound, as one CDC staffer describes:

> "Before the NST webapp, we would get requests would get requestspp,, employees in different organizations can share data as easily as employees in the same organization. When all parties actively look for chananizations share data." (#10, 2/20/2012)

But this arrangement breaks down when one party either does not know how to use the system or does not understand the importance of checking for changes in the information. A CDC employee questioned why, over the last six months, the city placed three houses on the demolition list after she had earmarked them in NST for rehabilitation:

> "I don't know if the city is looking at our data. We specify that we want to rehab this property. Not everyone who works for the city has been trained on the NST web app. So, maybe they don't see our intention listed in NST. I'm pretty sure that is the problem—not everyone at the city is using it. We do want them to condemn properties because it helps with acquisition." (#10, 2/20/2012)

Finally, due to redistricting, servicing of some city blocks may shift to another CDC. Redistricting will trigger funding shifts as well that may cause some CDCs to close. One interviewee explained the importance of having electronic records that transcend the silos of individual institutions:

> "We are redistricting every 10 years. I would have to exchange paper files with another CDC. Now they will see notes in the web app. That information stands beyond the individual CDC. CDCs will go—in Cleveland they will shrink in number...Cleveland 2014 my service areas will change when the new council forms." (#30, 10/11/2012)

Inter-organizational communication through applications and reports

CDC staff members use NIS for grant writing and monitoring report writing. They apply

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for financial support from public agencies and private foundations. Additionally, some CDCs act as the fiscal agent for neighborhood block groups and other clubs that cannot receive funds directly due to lack of an IRS tax status. In these cases, staff members help residents prepare the initial applications. Nearly all funders require applicants to provide detailed information to support claims of eligibility and need. CDC staff members use demographic data in NEO CANDO and property data in NST to build their case for funding. Successful applications then require staff members to submit monitoring reports on a regular basis.

At the start of this research, the forms for these reports existed completely outside the NST web application, causing staff members to manually copy information from the system into the forms. The Department, the CDCs, and NST developers are now working together to streamline that arrangement. But, for several years CDC staffers expressed both gratitude that NST and NEO CANDO readily provided the necessary information and frustration at the amount of duplicate work they performed. One person working at a CDC described a common situation in which the system proves useful:

"To report for CDBG...I need to know the parcel number, , 10/19/2011)

Another interviewee describes (rather colorfully) how NST helps her staff track and report private development completed without CDC support:

"Our 'productive use' [reporting category] also comes from private purchases. Holy shit someone sided it [a house] and added new windows and I see [in NST] they pulled permits and it is in 'productive use'. We can [also] track sales." (#30, 3/27/2013)

CDC staff members also write reports to document activities subject to the Uniform Relocation Act (URA) which regulates the acquisition of property and displacement of people on federally funded projects. A staffer explained how she builds a body of evidence to support her URA-related claims:

"All NST information is automatically updated. I can print that as proof for the URA report, which HUD requires when Cleveland Housing Network goes to do a rehab. This is my tool for proof. I've usually accumulated a few copies to show over time. It pulls maps from Google and I can see the pictures." (#10, 11/4/2011)

Complaints about the CDBG reporting system—especially in connection with code enforcement—are numerous. A seasoned employee describes a high level of redundancy, which

includes both reports to the city and letters to homeowners:

> "I need to do the paper survey in the car and then enter information again into NST when I come back...I am [also] writing the letter which is a different task. We are having less people than we would like using NST because it doesn't generate the [monthly] report [that] we need to generate to get paid." (#30, 3/27/2013)

Since her organization downsized, there are simply not enough hours in the day to enter the code enforcement information into the CDBG form and also into the NST web application (#30, 10/11/2012). Adding urgency to the problem, she points out that CDC service areas will most likely expand in the next few years due to consolidation, forcing staff in the CDCs that survive to handle even more housing units. She argues that staffers should be able to enter field code enforcement surveys directly into the NST web application via a cell phone or other portable device and that should be sufficient to generate both the monthly report and letters to homeowners.

Communication between CDC staff members and local residents

CDC employees use NST to direct foreclosure prevention services to residents most at risk of foreclosure, to provide residents who call-in or drop-in the information they seek, and to support block club meetings and issue-based committees.

Information targeting with NIS

The NST web application features an "At Risk Factors" category that includes a subprime lender flag and a high cost mortgage flag[69] based on public HDMA data and an ARM reset date based on a purchased proprietary dataset. Staff from CDCs and Empowering and Strengthening Ohio's People (ESOP) joined together to leverage this information to conduct foreclosure prevention housecalls with homeowners most likely to be at risk of foreclosure. However, the utility of the information plummeted as layoffs outpaced ARM resets as the underlying problem. As one individual who works closely with staff in many CDCs explained:

> "That [ARM resets] is not the problem now. Now it is based on loss of income—not bad

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[69] It is unclear what constitutes high cost in these data. In some research "high cost' is synonymous with "subprime lender" (i.e. http://www.urban.org/uploadedpdf/411941_highcost.pdf). However NST has separate flags for high cost and subprime.

mortgages. , 11/8/2011)

Not only does the NIS direct CDC staffers into the neighborhood to speak with specific residents, the system also helps staffers field questions residents ask over the phone or in-person at the CDC office.

<u>Fielding call-ins and drop-ins with NIS</u>

All the CDC staff members interviewed receive call-ins from residents requesting information about a particular house or empty lot. The frequency of these calls varies from organization to organization from only a couple a week (#43, 2/23/2012) to an average of ten per week peaking at five on a single day (#48, 2/21/2012). Staff in two CDCs (#10, 2/20/2012 & #51, 11/11/2011) asserted that they receive more call-ins and walk-ins now than in 2006.

Even in a neighborhood with few functioning block clubs, individual residents will still call in, as one CDC employee describes:

> "There is always one person who calls about vacant buildings. We have a few key people who are really concerned: 'what are you going to with this building? That building? Did someone buy that building?' I tell them that I don't know but I'll check it out." (#58, 3/2/2012)

A staff person in a different CDC describes the types of phone calls he receives:

> "We have people [residents] that call about vacant homes and we try to do advocacy and we push foreclosure or demolition...also people call about side lot extensions. I tell [them] to call me once a month and once [the property] hits the land bank we can move on it." (#67, 5/15/2013)

For single properties and focused questions, NST's breadth of information and list building tools are useful but unnecessary. The County Auditor's website or a commercial product like Metroscan can suffice.

An employee in one organization meets regularly in her office with local residents. This practice appears rare but shows how community development professionals and local residents can employ a neighborhood information system in joint decision making.

> "When residents call me. They may come in and I use NEO CANDO with them in the office. They get comfort from knowing about the properties...Two or three times a week a resident will come in and I help them research properties. Sometimes they want to buy

and rehab homes. I help them with the research. Sometimes we see there is a loan and a lien and a lot of trouble with the property they want. So we look for others." (#51, 10/25/2011)

Communication with residents is not removed from the intra-organization and inter-organization data sharing discussed previously. Sometimes residents request information about a property with details in NST of complex provenance. An interviewee provides an example:

"The web app has custom fields. Whatever we do in the office we plug them into the custom fields. I get a phone call from a resident that there are squatters. I call the city and plug in the complaint into a custom field. I plug my redevelopment interest into the house. Then [a coworker] gets a complaint by a neighbor and I can tell the residents that [the coworker] is working with the owner to redevelop the problem property." (#48, 2/21/2012)

The information a CDC staff person retrieves from the system and provides to a resident may have originated with another staff person, another resident, or a city employee.

Supporting block clubs and committees with NIS

Several CDCs support active block clubs and housing committees by communicating with them about information stored in NIS. This use of the system is discussed in the next section, which examines different combinations of development strategies and functions.

Development Strategies and Functions

Interviewees reported many instances of applying development strategies to different development functions, some of which require NIS use for the common tasks outlined previously. A numerical overview of these interview results is available in Appendix A (See page 205). The Oxford English Dictionary defines a strategy as "the art of projecting and directing the larger military movements and operations of a campaign" or—in non-military settings—"a plan for successful action based on the rationality and interdependence of the moves of the opposing participants". This research defines a *development strategy* as one of four overarching approaches CDC staff members may adopt in pursuing community development: leadership strategy, organizational development strategy, organizing strategy, and organizational collaboration strategy (see page 44). In this research d*evelopment functions* are five distinct types of work pursued by many CDCs: grant writing, construction and rehabilitation of property, code

enforcement, demolition advocacy, and other programs (see page 44). For example, an organizational development strategy fits the grant writing development function as a CDC strives for more resources with which to address neighborhood problems. However, a leadership strategy or an organizing strategy are viable alternatives for the same development function, premised on growing stronger block clubs and local organizations to address the same neighborhood problems. The pairing of strategy and development function determine—in part—whether and how a given CDC uses a neighborhood information system. Several common configurations are detailed below.

The organizational development strategy and grant writing function

At least one staff member in every CDC targeted in this research employs NEO CANDO for grant writing. The system provides access to city administrative information and census data arranged by locally used geographies, such as statistical planning areas (SPA)--which serve as an official proxy for neighborhoods. Grant writing, when successful, builds *resource capacity.*

One CDC employee described using NEO CANDO on a large grant for the Hershey Foundation of Ohio to find the number of home owners versus renters in a section of her service area (#65, 12/6/2012). CDCs staffers also help block clubs apply for funding from the city and from private foundations. Such applications usually do not require quantitative evidence to support assertions of need. However, should a funder require such evidence from a block club, a CDC staffer would seek the desired information in NEO CANDO. Figure 10 illustrates the relationships between NIS, CDC, block club, and funder:
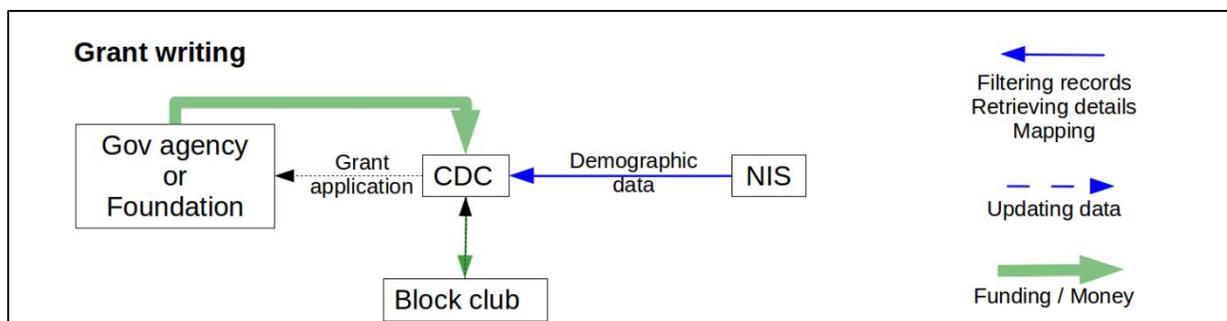
Figure 10: Relationship of NIS to Grant Writing by CDC Staffers

The next section addresses the various connections between a CDC and local residents in more detail.

The strategy of public participation and the function of community organizing

Staff from fourteen different CDCs provided detailed information about programming that involve frequent interaction with residents. Staff in ten of those CDCs commented also on the role (or lack of a role) of NIS in those interactions. In a few cases, resident contact occurs as part of a formal "community organizing" or "community outreach" program. However, more often it occurs as part of other CDC programming, underscoring its position in the model as a strategy whether interviewees refer to it as "organizing", as "participation" or as something else. As one interviewee explains:

> "Community organizing – [is] always part of the job. It may be a part of whatever program I'm working with at the time and can stand alone as well. Everything branches off of organizing. It takes community organizing to make programs succeed." (#58, 3/2/2012)

Participation can involve resident call-ins and walk-ins, block club activities, and service-area wide issue-based committees. In order to stress *community organizing* as a function rather than *public participation* as a strategy, this section stresses concrete programming and activities such as block clubs and issue-based committees. Block clubs tackle many issues while a given committee focuses on only one or two issues. NIS—when involved at all—provides information for a CDC staffer to share with people living or working in the service area or stores information a CDC staffer receives from people living or working in the service area.

Table 17 (below) provides an overview of development functions that involve contact with residents and NIS use by the number of different organizations matching the criteria. For example, staff members of three of the ten organizations who discussed contact with residents in detail, described demolition advocacy programs and two of them explained the role of the neighborhood information system.

Table 17: NIS Use Supporting Public Participation within Development Functions

Development Function	Staff from this number of CDCs discussed this function	Staff from this number of CDCs use NIS for this function

code enforcement	4	4
demolition advocacy	3	2
grant writing	2	1
single family new/rehab	2	2
other programming	2	2
side lot expansion	2	2
foreclosure prevention	2	2
historic preservation	1	1
Planning	1	1

Code enforcement and demolition advocacy were the most common development functions to involve residents, often in block club meetings. The following section describes the role of NIS in supporting public participation within these development functions.

Block Clubs

Community organizing ties into multiple other development functions such as demolition advocacy and code enforcement. For many CDCs, this is clear from the connections between block clubs and programmatic activities. As interviewees from two different CDCs explain:

> "Block club organizing is about quality of life issues...We do community building around re-use. Try to get those houses demolished, which leaves vacant land for yard expansions, community parks, and community gardens." (#65, 12/6/2012)

> "Community outreach includes community organizing work with the block clubs and responding to concerns, which feeds into the new code enforcement work." (#24, 10/18/2011)

However, public participation is not always as well integrated with programmatic activities. An interviewee in a third CDC does not promote "issue organizing" or turn block club member concerns about vacant and abandoned housing into an "organizing tool" (#64, 11/28/2012). In this case, block clubs are not part of a strategy of public participation but constitute a separate (siloed) development function that does not require NIS—underscoring the

weakness of deterministic claims about information technology. Although staffers in the same CDC use NIS for housing development and code enforcement, nothing about the technology forced them to adopt a more integrated and engaged approach to block clubs.

Staff in two CDCs (#15, 12/3/2012 and #65, 12/6/2012) asserted that they have stronger block clubs now than in 2006 in terms of number of clubs or frequency of meetings. Staff in two CDCs (#42, 11/10/2011 and #11, 12/3/2012) asserted that their local block clubs or outreach program had weakened since 2006. Changes in the level of block club activity should not be automatically attributed to CDC staff priorities and skill. As one CDC staff person explains:

> "Block clubs grow and shrink based on concerns on the street. ock clubs grow and shrink based on concerns on the street.ubs are victims of their own success. s are victims of their own success.." (#49, 2/27/2012)

One neighborhood, for example, did not have block clubs until 2007, when residents became more concerned about crime (#15, 12/3/2012). Many interviewees report staffing problems around organizing including relying solely on AmeriCorps VISTA interns from year-to-year and organizers being routinely assigned non-organizing tasks (#9, 2/8/2011). One interviewee described his CDC's organizer as "well rounded" because she does "accounts receivable, payout, and managing neighborhood groups...Always more than organizing". Another interviewee, sighing, said that after losing a dedicated outreach person, "we do what we can" (#11, 12/3/2012). The role of NIS within community organizing varies widely. The staff in one CDC regularly provide every block club with a printout of problem property addresses that shows "who owns it, bank, [and] taxes" (#53, 11/11/2011) while staff in another CDC will only occasionally use the NIS to "share [data] with the community to better identify area needs...that we can organize around." (#25, 2/3/2011). Other CDC staffers report never using NIS with block clubs.

Several interviewees described situations about which data are not necessary, do not exist, or take a tangential role in addressing neighborhood problems. The leaders of two of the most successful block clubs in Cleveland hardly touch the computer or request data at all. They rely on staff at their local CDC to help with applications for funding from the city and from foundations. Another interviewee put the need for hard data into perspective, a CDC staff person explained that "statistics don't affect the [block club] issues. If the [exact] poverty rate is 20% or

25% it won't affect the issue." (#49, 2/27/2012)

Staff members in some CDCs face gang and drug-related neighborhood problems. The NIS addresses these problems only indirectly by facilitating research on vacant structures used for crime. These staffers focus on more face-to-face community building rather than more data.

> "We were getting calls from three streets, drug ridden, full of abandoned housing—gunshots. I had a drug dealer pull a gun on me three months on the job....We have six block clubs, three active. We have a Christmas event—and no one has screwed with the tree yet. Even a local drug dealer says 'thank you for making the neighborhood nicer'. NEO CANDO is good for capturing data for repeat problems in homes. I'd like to use it more. But our staff is shrinking. We do a lot of door to door that doesn't require the computer. " (#30, 10/11/2012)

Committees are another community organizing tool.

Committees

A number of CDCs organize committees to bring together residents from neighborhoods across the service area to discuss and take action on shared problems. Staff and residents created the housing committee introduced in the previous section (Question #2: Who uses NIS and how frequently). They did this to pursue "demolition advocacy" because the ward, according to their research, "was not getting its fair share [of demolitions]" (resident, 11/7/2011). By shifting some responsibility from CDC staff members onto resident volunteers, such committees can make priority-setting and decision-making more democratic. One staff member explained that before the formation of this committee, the decision to prioritize one demolition over another was entirely his—and he did not even live in the service area (#50, 11/7/2011). Now, he provides the committee with information about problem properties and demolitions from a number of sources—especially from the NST web application. I discuss this example more fully in answer to Research Question #4, which concerns *political capacity* building (see page 133).

While block club leaders and local committee members may request information from their CDC, they often do not know where the information comes from. In only two interviews did a CDC staff member report that local resident activists were aware of the NST web application.

The physical development strategy and the housing rehabilitation, code enforcement, and

Housing rehabilitation

Thirteen interviewees from nine different CDCs discussed the rehabilitation of residential housing and all reported using the NST web application and receiving a benefit from the system. Five interviewees from three different CDCs provided evidence to support this claimed benefit.

Like any modern database, NST excels at identifying records that match particular criteria and looking up additional details about records of particular interest. In the context of use by CDC staffers, a record represents a property with a unique parcel number. CDC employees use this information to decide whether to purchase a house to rehabilitate or—less frequently—a vacant lot on which to build new. Interviewees explain how the common task of tracking vacancy (and problem properties more generally) fits within the physical development function of CDCs:

> "I can create a spreadsheet [in NST] to locate the 'low-hanging fruit'. The legal situation of some homes is a mess. They are stuck. I can determine which properties are bank owned and easy to acquire." (#51, 10/25/2011)

> "I'm so excited about the new [NST] web app. I do a lot of land acquisition. To see how we can acquire new properties…] tremendously." (#43, 2/23/2012)

> "[We] utilized law school fellows to research [with NST] over 300 distressed properties, ses…" (#5, 02/21/2012)

NST differs from other public websites by providing a single interface for data from thirteen different city and state agencies, aligning data from different agencies and also allowing CDC employees to enter their own data and notes. In some CDCs, the same search criteria inform multiple development functions. For example, a problem property with clear title that triggers code enforcement activity may become a CDC acquisition target in organizations with a "fine line between code enforcement and acquiring property" (#51, 10/25/2011) but not in others (#10, 2/20/2012). Figure 11 shows the relationship between CDC, NIS, and various development stakeholders.
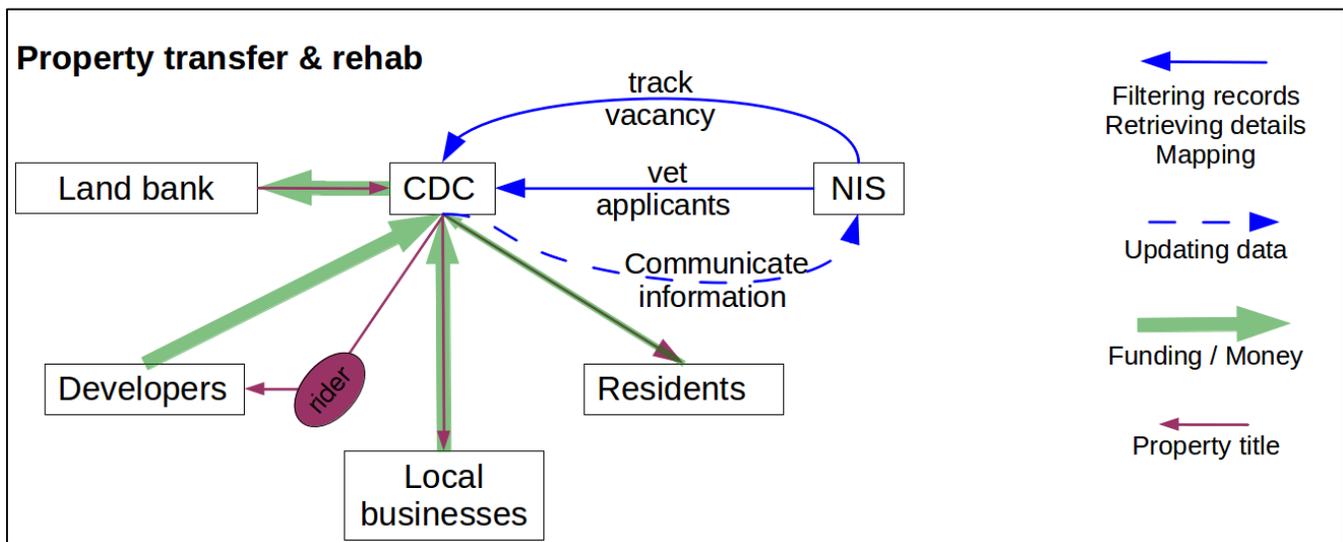
Figure 11: Relationship of NIS to Property Transfer and Rehab by CDC Staffers

In this figure, the development stakeholders are the two land banks (county and city), a given CDC, developers, business owners, and residents. The blue lines show that CDC staff members pursue three common tasks using NIS within this development function:

1) They track vacancy to identify houses and lots suitable for development

2) They vet applicants to determine which developers, business owners, and residents are priority matches for the available houses and lots based on the physical condition and tax status of the applicants' current properties

3) They communicate information from the tracking and vetting processes to coworkers and to staff in other organizations.

The green lines show that funding for houses and vacant lots flows from developers, business owners, and residents to the CDC and from the CDC to the land banks. The purple lines show that property title flows from the land banks to the CDC and from the CDC to the buyer. Staffers may add a rider to the property title that allows the CDC to reverse a sale should a developer not meet certain responsibilities by a deadline.

While grounded empirically, the diagram is only a model and—like all models—is a simplification. CDC staff members know their neighborhoods well and carry a mental map of vacant structures and knowledge about which local residents and business owners would likely

make responsible buyers and which would likely not. Data—even when available—do not necessarily drive every step in the development process. They may help staff members pursue past decisions based on gut intuition or sentimentality. In these cases, decisions are not *driven by* data but *followed with* data. As one CDC employee describes:

> "We didn't locate the house through NEO CANDO or the web app. A staff member saw a person working on the house. They were going to flip it. We decided better we should buy it. We then used the web app to find the owner of a nearby house that needed to be demolished." (#17, 10/19/2011)

The above quote forms part of the vignette of "Lisa Smith" provided in the introduction to this research. The threat of an investor hoping to flip a property can, understandably, trigger an emotional response to protect the neighborhood. In this example, CDC staff members identified the rehab target through serendipity and only later employed data—and indirectly at that—through another development function, demolition advocacy of a nearby eyesore.

Code enforcement

The City of Cleveland's Building and Housing Department partnered with CDCs to address problem properties and to catch potential problem properties early. According to the partnership, Concentrated Inspection Areas. CDC staffers are expected to spend two months per area and complete the whole city every three years. CDC staff do not have certification for inspections from the State of tate of are allowed to do an initial less formal inspection.

Many CDCs in Cleveland pursue code enforcement with a *physical development strategy* focused on improving the housing stock and stabilizing ownership as quickly and directly as possible. A few CDCs, however, approach this task through a *leadership strategy* or a *community participation strategy,* inviting local residents to "come out to the inspections." (#55, 10/21/2011)

Demolition advocacy

In some neighborhoods, advocating for the city, county, or current owners to tear down dilapidated structures is a major part of community development work. One CDC staffer explained that

> "Our neighborhood is distressed. It is not about rehabs—these houses are done. If there is

a wind they will come down… residents] 'I don't have a backhoe' [to knock down the building myself]." (#58, 3/2/2012)

In these parts of the city, CDC employees and—in a few case—residents advocate for their "fair share" of demolitions (#61, 4/17/2012) or opportunities to expedite the demolition of a particular property. A staff member at a different CDC describes finding such an opportunity using the NST web application:

> "There is a Cuyahoga County Tax Auditors website. But, it would only show whether the owner was behind on taxes or whether it was in foreclosure...The webapp shows the number of times the house has been in sheriff sales. After two sheriff sales with no purchasers, the county can take ownership and demolish. If not for the webapp, we would not be getting this house demolished until 2013. The city says they will demolish its log of houses before 2014, without giving specific dates for specific houses. The county moves faster and will give a specific date. We believe this house will be demolished before Nov 30th [2011]." (#17, 10/19/2011)

The description shows how the *breadth of information* in the NIS immediately opened up an opportunity that would have taken more time to investigate and may have remained overlooked entirely.

Hypothesis 3a (page 34) appears correct. NIS does not guide CDC staffers toward particular types of community development work or toward a particular workflow. The descriptions above suggest that CDC staffers use NIS to pursue the work they were doing before access to the system**. Hypothesis 3b** (page 35) appears largely correct—but not completely correct. While many CDCs focus on the physical development strategy through housing rehabilitation, code enforcement, and demolition advocacy—some pursue public participation. As the next section shows, staff in one CDC used the public participation strategy to effectively strengthen demolition advocacy.

Q4. Does NIS improve public participation and, if so, what factors mediate the improvement?

In this research, public participation is defined as a key component of political capacity in accordance with Glickman and Servon's (1998) work.

Political Capacity

NIS contributes to political capacity building only in CDCs in which staff use information to pursue two capacity building needs, *community participation* and *political leverage*[70]. The research revealed only one effective arrangement, in which CDC staff provided NIS-derived lists and tables to resident housing committee members (an instance of *community participation*) who employed the information in a neighborhood meeting (another instance of *community participation*) with key city officials present—resulting in *political leverage*. As discussed at the end of the earlier section on *strategies* and *functions* (starting on page 124), the strategy of public participation is most commonly associated with the function of community organizing. Staff in one CDC helped to organize a resident housing committee and provide committee members with information about local housing conditions and demolition rates. The information angered many residents, who believed the city was not giving them a "fair share" of demolitions. They organized a neighborhood meeting and invited city officials. One official who attended many of the meetings commented on their approach:

> "Everyone feels they are not receiving their fair share [of demolitions]...The bottom line: citizens have a right not to have blighted, unsafe structures next to them, behind them or on their street. This Housing Committee did an extraordinary job researching and documenting the need for accelerated action." (#61, 4/17/2012)

He estimates that the pace of demolition increased in this CDC's service area since the committee's formation and claims that the detail-oriented accounting and prioritizing of properties catalyzed action. It is not uncommon for CDC staff members or resident activists to count the total number of problem properties in a neighborhood and approach Building and Housing employees to argue for more demolitions. But, the need always exceeds the city's budget and prioritizing tens of thousands of potential targets takes time. He explains:

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[70] See Table 1 on page 13 for an overview of the capacities and capacity building needs.

"My experience...is such that neighborhoods with plans and strategies help focus and accelerate demolition activity...The research reinforced the need for demolition...But that reinforcement exists in many city neighborhoods. It was the focus [of this group] on specific properties that has helped focus my Department with results accelerating." (#61, 4/24/2012)

Committee members' attention to individual properties includes both demolition and historic preservation, a rare combination in Cleveland and one that city representatives respect. The same official explains that demolition priorities are necessary, but should not "represent a top-down approach from the Department's perspective" but include "neighborhood strategies and input" (#61, 4/24/2012).

Although NIS contributed to political capacity building in this particular example—it could not have done so if CDC staff members did not decide to pursue the *function* of housing rehabilitation with a *strategy* of public participation. Without this decision, there would not have been a housing committee of resident activists with the power to vote in city elections. The NIS information would have been politically less effective remaining in the hands of CDC employees, dependent on the city for CDBG funding. A poet and playwright once wrote that a key difficulty in leveraging the power of accurate information, is judging "in whose hands it will be effective" (Brecht 1966:133). The staff in this CDC judged well. The staff in other CDCs did not judge as well—or did not attempt to build political capacity through NIS. **Hypothesis 4a** (page 36) appears largely correct—but not completely correct. While staff in nearly all CDCs opted not to use NIS to increase public participation—staff in one CDC *did* opt to use NIS to increase public participation. **Hypothesis 4b** (page 37) is incorrect. Staff in this one CDC were successful. NIS helped them to increase public participation. The following section examines the impact of NIS on the other capacities: resource capacity, organizational capacity, programmatic capacity, and network capacity.

Q5. Does NIS improve CDC capacity and, if so, what factors mediate the improvement?

This section provides qualitative findings regarding capacity building separately for each sub-capacity. Quantitative finding for neighborhood rehabilitation tasks, which fall under *programmatic capacity,* are also discussed.

Resource Capacity

Resource capacity reflects the ability of CDC staff "to increase, manage, and sustain funding" (Glickman & Servon 1998, 506). While the capacity building framework contains five resource capacity-building needs (see Table 1 on page 13), this research focuses on only two, long-term operating support and development capital, as expressed in grant writing activity. This focus reflects both the urgency with which interviewees' write grants to fund CDC programming and the methodological challenges of pursuing some of the other capacity-building needs. Balanced portfolio risk, for example, would be difficult to assess without full access to an organization's financial records. Narrowly defining and measuring this sub-capacity leads to both mono-operation bias (page 188) and mono-method bias (page 188).

Twelve interviewees from seven different CDCs discussed grant writing and only one person denied using NEO CANDO for grant writing. This individual only applies to grants that do not require detailed demographic data about the population to be served. Two other interviewees from different organizations acknowledged that some grants do not require such detail, but they use NEO CANDO when applying to grants that do require such detail. Widespread adoption suggests that users prefer NEO CANDO to national sources, such as the U.S. Census website, which lacks locally defined geographies like wards and statistical planning areas (a proxy for neighborhoods) and to the websites of local agencies, which utilize different interfaces.

Most interviewees had either been using the system since they started writing grants or could not clearly recall any previous experience. Only a single interviewee could persuasively compare grant writing with NEO CANDO with grant writing without NEO CANDO:

> "I went to grad school at Case [Western Reserve University] so I have always used NEO CANDO. We used to have to get info from school districts and police departments before NEO CANDO had that data. I think writing grants with NEO CANDO takes less time. I

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don't know if it makes applications more successful. We are writing more grants—but our needs are greater too. We are also more involved in green space planning, playground design, parks design. [Now] we spend less time researching statistics, more time on other projects." (#65, 12/6/2012)

A single description of previously having to acquire data from school districts and police departments does not provide a clear picture of the impact of NIS on resource capacity. The user quoted above suggests that using NEO CANDO does not result in better grant applications or even more grant applications because staff reallocate time saved using the technology to programmatic efforts such as green space planning. This suggests capacity building occurs—if at all—via breadth of activities rather than quality or quantity improvements in one activity. While Cleveland offers a critical case for NIS in terms of the strength of the data system and the development system, the longstanding practice of the latter using the former in grant making raises a measurement problem. Few practitioners working in CDCs remember their previous way of looking-up statistics for grants well enough to offer a convincing comparison.

No interviewee claimed that NIS use led to more grant applications, better applications, or more funding—and one interviewee actually reported diverting time saved in grant writing to other pursuits rather than to additional grant writing. Therefore, the qualitative data collected does not provide any evidence that NIS builds resource capacity. Without such evidence, establishing a quantitative relationship between more NIS use and more grant writing or more funding—even if possible—would likely only be spurious.

Organizational Capacity

Organizational capacity reflects how "staff, boards of directors, and others carry out the functions of nonprofits" (Glickman & Servon 1998, 512). This includes coordinating work efficiently to achieve more with available resources (ibid). In their earlier paper (1998), the authors place the use of "management information systems" (MIS) within two organizational capacity subareas. They claim MIS will yield "increased efficiency and effectiveness" within fiscal management and will "control costs and ensure quality and affordability of projects" within project management. (ibid, 514-516). In their later paper (2003), the authors employ a different term, "financial information systems", and place it within a different capacity altogether—programmatic capacity—which will be addressed in the next section.

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The interviews in this research suggest that neighborhood information systems have yet to build organizational capacity, but may do so in the future in certain situations. The increase in "efficiency and effectiveness" that Glickman and Servon expect may not have occurred because information systems cannot produce these outcomes without corresponding changes in decision-making process that take better advantage of information system strengths. The discussion section on page 190 provides recommendations for adding NIS use to Heath and Heath's (2013) decision-making process, which seeks to mitigate common cognitive biases when addressing personal and organizational challenges. An important part of their process focuses on widening the frame of opportunities, which requires carefully noting and returning to those opportunities at the appropriate time. Employees in some CDCs have started to use NST's custom fields to make these sorts of notes and reminders.

The claimed benefits of NST's custom fields to the common task of intra-organizational communication make logical sense. But, the staff members of only a few CDCs report using these custom fields and starting to do so only recently. Eventually though they may coordinate work more efficiently, relying on each others' stored notes to guide their work, saving time by avoiding duplicate effort and past mistakes and potentially even yielding better decisions. While face-to-face discussions, paper notes, and emails all allow the exchange of information, only the custom fields allow the exchange to occur within the same workflow as—and simultaneously with—official property data. The NST interface facilitates a durable connection between human activity (a phone call with a resident, a decision to rehabilitate)—and a specific parcel.

Glickman and Servon note that CDC staff "must be of appropriate size, talent, and structure" but that "long hours, low pay, and inadequate fringe benefits contribute to a high burnout rate among CDC staff" (ibid). The CDC staff members pushing for the widespread use of custom fields in their organizations are young (definitely under 40 years old, likely under 30 years old), computer savvy, and have graduate degrees. While well-poised to use NIS, these staff members may overvalue the technology and undervalue Glickman and Servon's reference to "structure"—the organizational changes necessary to build capacity, including build capacity through technology. In interviews, these staffers expressed a desire for "data-driven" decision-making more often than older staff members. The problems this raises are discussed in the discussion section (page 190). These individuals also work in CDCs with an above average

number of full-time employees. The size of the organization makes sharing information between staff members especially necessary and the NST web application may allow this information to help in the future—possibly even after substantial employee turnover.

Programmatic Capacity

Assessing programmatic capacity building through neighborhood information systems requires reviewing the concept of *net benefits* in the DeLone and McLean framework. *Net benefits* in the 2003 framework encompasses both *individual* benefits and *organizational* benefits from the original 1992 framework. Individuals use technology and their aggregate benefits accrue to the organization. Interviewees widely reported experiencing a particular individual benefit from NIS—time savings. This section details the reason for time savings at the individual level and the form time savings takes at the aggregate (organizational) level. While not using the terms *selectivity* and *breadth of information* employed in this research, interviewees repeatedly report that being able to quickly select certain parcels for study and retrieve all desired information from a single source saves considerable time.

Times savings via selectivity

NEO CANDO and the NST web application provide selectivity tools unavailable in other websites that provide city and county data. For example, the Cuyahoga County Auditor website allows users to search only by a single last name, single parcel number, single AFN number (deed number), or single address. In contrast, NEO CANDO and the NST web application allow users to type or paste in a long list of parcel numbers. As one CDC staffer explained, "if it wasn't for NEO CANDO and NST, we would literally be typing in each address in the [County] Auditor's website" (#5, 10/24/2011). Before these tools existed, overwhelmed with the number of properties she had to research, a staffer in a different CDC once tried calling the city's prosecutor's office for help—only to be denied (#51, 11/11/2011), which emphasizes the importance of the current information systems..

Besides allowing parcel lists from outside the system to be pasted-in, NST provides convenient filtering of more than two hundred property variables to create lists inside the system:

> "If we have a model block and we want to know the number of vacant properties, I can
> use an address range and show owners, sale prices, tax mailing addresses, whether the

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owners are local." (#51, 10/25/2011)

Interviewees made clear that building lists of properties was more vital on a day-to-day basis than mapping. "[I] do not use the mapping function with NST," said one CDC staff person, "[I] write queries and get a table of matches" (#5, 01/18/2011). Even an infrequent user praised these tools:

> "I use the NST web application [only] 3 or 4 times a year to see what is going on [and] look for opportunities—see if properties have changed hands...I grab large portions of data for infill housing development [and other projects]...create a list and pull out of the data—filter out factors—I want to pull out and pull it into GIS." (#67, 5/15/2013)

The quotes above highlight the importance of working with multiple properties at once with phrases like "address range", "table of matches", "large portions", and "filter out factors".

Times savings via breadth of information

Breadth of information contributes to time savings in several ways. If the necessary data were not online before, then NST saves a CDC employee from making several phone calls or resorting to even slower means. One interviewee jokes that "[NST] gives me all the data that I need. I don't need to call all over Cleveland" (#10, 4/11/2011). Even if the data were online before, having all the information in one place saves time. Switching between websites and retyping parcel numbers would prove tedious even for websites with identical interfaces. However, the websites of the Cuyahoga County Land Bank, City of Cleveland Land Bank, Cuyahoga County Sheriff's Office, and Cuyahoga County Auditor all have very different interfaces. "[NST] is my one-stop shop for learning about a property", explains one interviewee, I used to use different websites, used took more skill to learn" (#51, 10/25/2011). Another interviewee claimed that the interface for NEO CANDO was more user-friendly than the interface of another university maintained service (NODICE) (#9, 2/8/2011).

Block club members often ask CDC staffers about houses that appear vacant. "Organizing staff dealing with vacancy will pull up the [Cuyahoga County] auditor's website. But the auditor's website doesn't tell you mortgage foreclosure or water usage." (#53, 11/11/2011). The NST web application allows development professionals to "track everything on a property in one swoop in all the tabs and not go to 6 or 7 websites" (#30, 10/11/2012). One interviewee acknowledges "we could use an Access database or Excel. But, NST

[automatically] lines up with the foreclosure docket and USPS postal vacancy" (#5, 7/11/2011).

There are shortcomings in the available data however. The NST web application does not include information about resident complaints to the city about problem properties. "This is when it gets tricky" explains one CDC staffer (#10, 2/20/12). In theory, the city places board-ups, condemnations, and—finally—the demolition contractor into the shared system. If the property a resident calls the city about moves toward demolition, CDC employees should be able to stop the process if they want to rehab the house.

Measure of time savings

Interviewees consistently report that the NST web application transforms days of work into just minutes of work:

> "I've been here 11 years. I was an intern and property research was my main job. Now I can do that in 5 minutes with NEO CANDO [likely referring to the NST web application]" (#51, 10/25/2011). "Where you really save time is processing a whole area. I would spend a week on a spreadsheet for multiple properties. Now it is just a few minutes." (#51, 11/11/2011)

> "An intern can get a full list [in NST] with all the columns in 45 minutes. I had to get addresses by walking the streets. It would take two days" (#42, 10/11/2011). "We would send out a mass mail and whatever came back was vacant. Now we have USPS vacancy data in NST." (#42, 11/10/2011)

> "[Before NST,] we would start with GIS and look at all properties. Map out areas...[look up] back-taxes, liens, take photographs to demonstrate it is a nuisance...[with NST] we had everything…within five minutes…I couldn't give an exact number of [time] saving. It would have taken all day!" (#48, 1/18/2011)

Whether time savings translates into increased capacity depends on what CDC employees do with the saved time. The next sections discuss particular programmatic capacity areas in more detail.

Housing Rehabilitation

To rehabilitate neighborhood housing, CDC staff members negotiate purchasing a home in need of repair from a private owner or public entity such as the Cuyahoga County Land Bank. Then, the staffers sell the property to a developer who brings the structure up to code and ready

for sale. This research examines, both qualitatively and quantitatively, the impact of NIS on this process, excluding the Cleveland Housing Network as a possible developer (see "Finding CDC property purchases" on page 81).

Qualitative analysis

Nearly half the interviewees discussing using NST in housing rehabilitation provide detailed comparisons with public agency websites (i.e. Cuyahoga County Auditor), proprietary databases (i.e. Metroscan), and desktop software (Excel and Access). They argue that NST allows them to do the same quality work faster. One interviewee summarized the technology's impact:

> "We do not end up with anything new or different. It is mostly a time saving aspect...We would have done all of our projects regardless of access to NST/NEO CANDO...[But] even though we may get the same answer—we get it faster." (#48, 1/18/2011)

Employees in three different CDCs reported reinvesting the time saved by using the NST web application (or part of the time saved) back into conducting more housing rehabilitation work:

> "We're trying to push more properties through rehab. The time savings allows me to be in the field and survey more. Strong churches and businesses are interested in expanding business or parking lots...In the past, I'm not sure we could pump out as many [planning] studies. NST gives us time to target our neighborhood." (#48, 7/11/2011)

> Because it saves me time, I can do more work. The main part of my job is selling vacant homes. We acquire 50 properties a year. The more I do, the better for the neighborhood." (#51, 11/11/2011)

> "You are able to get more accomplished with the extra time. Saved time allows you to update data in the app, [so] stabilization becomes more a functioning piece. You can get more accomplished in your neighborhood." (#10, 4/11/2011)

However, an employee in a fourth CDC, reported diverting the time saved by using the NST web application to other development functions:

> "I'm on the board for [different organizations]...NST frees me up for that. (#42, 10/11/2011) "My time saved with NST is focused on sustainability. We are looking at it as a neighborhood to create jobs, retrain, GED counseling. Somebody has to take on sustainability. I'm the champion of sustainability and I meet with heavy hitters in that area." (#42, 11/10/2011)

Since the majority of CDC employees report reinvesting time saved through the NST web application back into rehabilitating houses, there should be a relationship between the extent of NIS use and the amount of homes rehabilitated.

<u>Quantitative analysis</u>

This section reports the results of quantitative modeling of housing rehabilitation by CDCs in Cleveland. The models include independent variables that interviewees claimed either guided their decision-making or influenced rehabilitation outcomes. The independent variables represent neighborhood factors, private consumer (house buyer) factors, and organizational factors (CDC sub-capacities). The dependent variables represent CDC programmatic capacity outcomes in terms of the *quantity* of activity (number of homes purchased) and *quality* of activity (percent of purchases transferred and percent of purchases rehabilitated).

In interviews, CDC staffers asserted that there are two interrelated measures of success for single family rehabilitation activities. When a CDC purchases a property and transfers title to a new owner who pays taxes—that constitutes success. When a CDC purchases a property and physically improves it—that also constitutes success. Ideally, both of these outcomes occur together, but this research addresses them in separate models. Some CDC staff members rely on NIS to determine whether a prospective buyer already owns property in the city that is current on taxes and in good physical condition in order to assess whether he or she will steward the property under consideration responsibly. Table 18 (below) summarizes the independent variables and their hypothesized relationship with the dependent variables.

Table 18: Hypothesized Relationships between Independent and Dependent Variables

Type	Ind. Variable	Dependent Variables & Hypothesized Relationships		
		# Purchases	Transfer Rate	Rehab Rate
Neighborhood Factors	Owner occupancy rate	*Positive.* CDC staff seek to attract owner occupants and therefore focus on areas with high owner occupancy	*Positive.* Prospective owner occupants will want to live alongside other owner occupants. Owner occupants are	*Positive.* CDCs or new owners are more likely to invest in a house alongside other owner occupied houses,

		already.	more likely to pay taxes than absentee landlords.	which are presumably being well-maintained.
	Vacancy rate	*Positive.* Vacant and abandoned properties signal CDC staff to act and form the raw material for rehabilitation.	*Negative.* Prospective owners are less likely to buy in an area with many vacant and abandoned properties.	*Negative.* CDCs or new owners are less likely to invest in a house near vacant and abandoned properties.
Consumer Factors	Median house sales in private sales	*Unclear.* CDCs receive homes from the land bank at under market cost (suggests no relationship). But, high cost signals a functioning market without need for CDC action (suggests negative relationship)	*Positive.* High cost indicates a popular neighborhood.	*Mixed.* A CDC may not invest in an expensive home, but new owners may invest to improve value.
	Number of private sales	*Mixed.* Too few sales signal a static market requiring CDC action. Many sales could mean a solid market—or flipping and the need for CDCs to vet buyers.	*Positive.* Many sales indicate a popular neighborhood.	*No relationship.* High sales suggest owner need not invest and low sales suggest owner should not invest.
CDC Factors (Capacities)	CDBG Funding (Resource	*No relationship.* CDCs receive property at a reduced price. CDC	*No relationship.* Transfers require employees and	*No relationship.* For same reasons as purchases.

capacity)	boards may limit purchases. CDBG money rarely directly used for purchases.	research—not funding.	
Number of employees (Organizational Capacity)	*Positive.* Identifying suitable houses requires computer research, phone calls, and legwork.	*Positive.* Identifying suitable buyers requires computer research, phone calls, and legwork.	*Positive.* Rehabbing requires phone calls, and legwork and selecting the right house initially (research).
NIS use (Organizational Capacity)	*Positive.* NIS helps staffers identify more houses suitable for rehabilitation.	*Positive.* NIS helps staffers check if buyers paid taxes on other properties.	*Positive.* NIS helps staffers identify good rehab targets.
Strategic Investment Initiative (SII) (all capacities)	*Positive.* SII members receive funding and technical + legal advice about housing development.	*Positive.* SII members receive funding and technical + legal advice about housing development.	*Positive.* SII members receive funding and technical + legal advice about housing development.
Year		*Unclear.* Learning may lead to more purchases over time (positive). However, success in early stages may lower purchases over time. (The data agree, suggesting a nonlinear relationship).	*Unclear.* Learning may lead to better decisions and more transfers over time (positive). However, later purchases have less time in this study to be transferred (negative).	*Unclear.* Learning may lead to better decisions and more rehabs over time (positive). However, later purchases have less time in this study to be rehabbed (negative).

The sections that follow detail three models, one for each dependent variable. Plots of the actual values of independent variables versus the estimated values produced by the models follow each section. Diagnostic plots to assess the models against regression assumptions are provided in Appendix B (starting on page 214). The residual versus estimate plot for the first stage of the purchases model shows the dual bands typical of binomial regression residual plots (Zuur et al. 2009:254). Visual inspection of the normal Q-Q plot for the second stage of the purchases model suggests that the residuals are not normally distributed, violating a regression assumption. Repeated efforts to correct this problem failed, including specifying a Poisson rather than Gaussian error term. Visual inspection of the residuals versus estimate plots for the transfer rate and rehab rate revealed heteroscedasticity, another violation. All of these problems likely stem from omitted independent variables, a topic for future investigation (see Chapter 8, specifically "Extraneous Variance in the Experimental Setting" on page 182). Still, the violations are not egregious and the models do shed needed light on the capacity building potential of NIS. The models also serve as a proof of concept for applying the sequential exploratory strategy described in Creswell (2009) specifically to conduct quantitative analyses that are guided by qualitative interviews with technology users in order to reveal any impact of the technology on work outcomes.

CDC Purchases

When potential private owners and for-profit developers view purchasing and renovating houses in a neighborhood as too risky, non-profit developers like CDCs act to improve the housing stock and jump-start the market (Rubin 2000). CDC staffers often see themselves as the developers of last resort. The *quantity* of CDC purchases therefore both reflect the weakness of the local housing market and the strength of the CDC to make the necessary purchases. A CDC's transfer rate and rehab rate, addressed later, serve as proxies for decision-making *quality*.

Most of the purchase data in a given year are zeros suggesting a two-stage model rather than a single-stage model (Bolker et al. 2009:11). This research employs a zero-inflated model in which the first stage captures factors that influence the decision to pursue housing purchase and rehabilitation *at all* while the second stage captures factors that determine how many houses CDC staff purchase. The purchases are recorded as a Boolean (yes/no) in the first stage and

resulting estimates down-weight the zeros in the second stage.

Based on interviews, I initially selected the variables below as potentially explanatory of CDCs home purchases.

Owner occupancy rate: The CDC interviewees expressed a distinct preference for owner occupants over owners who plan to rent the property—especially over absentee landlords living in other states. However, one interviewee explained that the preference was strong, but not absolute:

> "In the west side of Cleveland and more stable communities, we are partnering with rehabs. We want owner occupants…#30, 3/27/2013)

I hypothesize that CDCs will purchase more homes in neighborhoods where owner occupants tend to live. The owner occupancy rate is also highly correlated (.98) with the rate of single family detached housing so the variable signals that the neighborhood is composed of the target type of home. Since interviewees described considering owner occupancy as part of their initial strategy, it fits within the first stage of the model—and proved statistically significant.

Vacancy rate: CDC staff members focus their attention on vacant residential structures. Therefore, staffers operating in neighborhoods with higher vacancy rates should be both more likely to purchases at least one house for rehabilitation (1st stage) and also more likely to purchase many houses for rehabilitation (2nd stage). However, the vacancy rate is not effective at predicting whether a CDC will purchase at least one house, with a correlation of only .20 when purchases are recoded as Boolean. Even CDCs operating in low vacancy areas purchase homes, perhaps to address a lone problem property, to enter the housing market at market-rate, or to introduce needed low-income alternatives. Regardless of the reason, the vacancy rate did not prove statistically significant in the 1st stage of the model. The vacancy rate proved statistically significant in the 2nd stage of the model at the .05 level when time was excluded from the model, but only at the .10 level when time was included in the model.

Median house cost in private sales and number of private sales: I initially added these variables as a precautionary measure in both stages of the CDC purchasing model and they proved—unsurprisingly—not statistically significant. CDCs receive properties from the Cuyahoga County Land Bank at far below market rate so the median sales price and number of houses sold at that sales price are less of an issue.

CDBG Funding (Resource capacity): I added this variable as a precautionary measure in the second stage of the model. CDCs in Cleveland do not use CDBG funding to directly purchases houses for rehabilitation because doing so triggers additional federal and local housing quality standards. Moreover, CDC boards frequently limit—to reduce risk—how much the CDC may pay for a house and how many houses may be in the pipeline at once. CDC directors rely on CDBG funding to pay staff and losing this funding would likely cause many CDCs to cut payrolls drastically or shut down entirely. But, CDBG funding does not explain whether CDC staff make purchases for rehabilitation or how many purchases they make.

Number of employees (Organizational Capacity): For the second stage of the model, the community development literature argues—and interviewees for this research confirm—that larger CDCs perform more work than smaller CDCs. Interviewees described identifying houses to purchase though research (via NIS), walking the neighborhood, speaking with neighbors, and making phone calls. This work takes considerable time. The number of employees in a CDC should therefore positively affect the number of purchases (2nd stage). The number of employees and CDBG funding are moderately correlated (.54) and their inclusion in the same model could introduce multicollinearity problems and false findings of insignificance (false negatives). However, both these variables were also poor predictors of housing purchases when tested separately.

NIS use (Organizational Capacity): CDC staff members report that, prior to the NST web application, selecting houses to purchase and identifying and contacting owners proved a time consuming and arduous process. They claim that NIS makes the process less time consuming and less complex. If the alleged time savings are funneled back into the process of purchasing houses, CDCs with staff members who rely on these tools should—other factors being equal—purchase more homes.

Interviews suggest that neighborhood factors and consumer factors drive the fundamental decision whether to pursue housing redevelopment at all. For this reason, I did not place NIS use (or any organizational factors) in the 1st stage of the model. If CDC staff members decide to pursue housing redevelopment, then I reason that NIS use may impact the result. Therefore, I initially placed NIS use in the 2nd stage of the model.

The NIS coefficient in the 2nd stage was slightly negative and not close to statistically

significant. Perhaps more importantly, in all the models built for this research using multiple statistical techniques—the NIS coefficient was always negative and insignificant when the number of purchases was the dependent variable. The information NIS provides may convince users *not* to purchase the house as often—or more often—than it convinces users to purchase. Alternatively, time saved identifying homes to purchase may be routed to other CDC activities.

The responses of a few interviewees suggest interaction effects between the number of employees and NIS use. Larger organizations may receive more benefit from NIS and smaller organizations may receive less benefit from NIS. One interviewee explained that "I'd like to use it [NIS] more. But our staff is shrinking. We do a lot of door to door that doesn't require the computer. I've been honest and said [to NIS supporters] I'm having a hard time keeping all of my data in there" (#30,10/11/2012). However, no models created for this research showed statistically significant interactions between the number of employees and NIS use.

Strategic Investment Initiative (SII) Member (all sub-capacities): Membership in Neighborhood Progress Inc.'s SII includes many perks. Most relevant to the number of purchases, membership includes funding (resource capacity), and technical and legal assistance (organizational capacity, programmatic capacity). Additionally, membership includes a better relationship with NPI, a vital Cleveland non-profit organization with many contacts (networking capacity, political capacity). SII membership also implies a community development strategy premised on physical redevelopment rather than—for example—community organizing. I expected SII members to be more likely to purchase at least one house (1st stage) and more likely to purchase many houses (2nd stage). Membership was only statistically significant in the first stage.

Year: The year variable serves as a proxy for multiple unspecified variables, such as those measuring organizational learning, response to initial rehabilitation successes, policy changes, and neighborhood factors besides owner occupancy rate and vacancy rate. The number of CDC purchases increased between 2008 and 2010 and then decreased in 2011. Isolating the relationship of the known variables requires modeling this nonlinearity using both year and year^2. The regression will assign one term a positive coefficient, contributing to the initial increase in purchases. The regression will assign the other term a negative coefficient. The latter term will eventually overpower the first term and decrease the estimate in the final year of the

study. To avoid bias due to the particular years under investigation, the years are always recoded as 1 to 4 (1=2008 and 4=2011). This arrangement proved statistically significant only in the 2nd stage of the model.

The tables below summarize a two-stage model to explain CDC property purchases. To illustrate the process of model development clearly and transparently, each stage is divided into an initial model, which includes independent variables that did not prove statistically significant—and a final model, which includes only independent variables that proved statistically significant after all others were removed one at a time, starting with the least significant (highest p-value). Since multicollinearity can cause significant variables to appear insignificant and contribute to left-out variable bias, I checked that the variance inflation factor (VIF) was below the commonly recommended value of five (low multicollinearity) before removing variables that proved insignificant. The (independent) *variables* are listed in the first column. The coefficients for the *independent* and *autoregressive* versions of the model are listed in the second and third columns, respectively. Coefficients with a p-value below .10 (90% confidence level) are marked with a symbol noting the degree of statistical significance.

The first stage of the model is a logistic regression that uses neighborhood contextual factors to explain the decision of CDC staff members to purchase at least one property.

Table 19: Zero-inflated Model of CDC Annual Property Purchases--Stage 1 (Binomial), Initial Version

variables	Independent		autoregressive	
(Intercept)	-8.912	***	-9.396	***
Owner Occupancy Rate	0.064	**	0.059	**
Vacancy Rate	0.040		0.054	
Median Sales Price	-0.011		-0.009	
Number of Sales	0.001		0.001	
Strategic Investment Initiative	2.307	**	2.136	*
Year	4.519	**	4.692	**

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variables	Independent		autoregressive	
Year^2	-0.862	**	-0.888	**
@ p< 0.10	* p < 0.05	** p < 0.01	*** p < 0.001	

The coefficients represent the unit change in the log odds-ratio of a CDC purchasing at least one property in a given year. For example, a 1% increase in the owner occupancy rate increases the log odds-ratio of at least one property purchase by 0.059 in the autoregressive model. Is that a strong effect? This formulation is exceedingly difficult to interpret. Exponentiating the coefficients (taking the inverse of the log) produces odds-ratios, which are more intuitive. In the R programming language, the exponential function is called "exp()". Exp(.059)=1.061. This means that for each 1% increase in *owner occupancy*, the odds of a CDC purchasing at least one property increases by a factor of 1.061 or 6.1%. There is no upper limit to the factor. Hypothetically, a one point increase in an independent variable could increase the odds of purchase by a factor of a thousand, a million, or even more.

Removing the independent variables that did not prove statistically significant at the 90% confidence level one at a time and rerunning the model, resulted in the more parsimonious solution below.

Table 20: Zero-inflated Model of CDC Annual Property Purchases--Stage 1 (Binomial), Final Version

variables	independent		autoregressive	
(Intercept)	-7.681	***	-7.508	***
Owner Occupancy Rate	0.061	***	0.059	***
Strategic Investment Initiative	2.465	**	2.365	**
Year	4.262	**	4.224	**
Year^2	-0.821	**	-0.818	**
@ p< 0.10	* p < 0.05	** p < 0.01	*** p < 0.001	

For this stage in the model, regression without adjustment for repeated measures produces nearly the same coefficient estimates as generalized estimating equations. The reason is that the autoregressive component turns out to be extremely small, with an alpha (α) of only 0.159. This means that within each CDC, the number of properties purchased in 2008 are estimated as having a correlation with the number of properties purchased in 2009 of α^1=0.159, with those purchased in 2010 of α^2=0.025, and with those purchased in 2011 of α^3=0.004. Forcing the outcome variable into a Boolean eliminates some of the correlation between years. As hypothesized, the autoregressive element pulled explanatory strength away from the most static independent variables like *Owner occupancy rate* and *Strategic Investment Initiative* in the form of slightly lower coefficient values. However, the difference was far less than anticipated.

Table 21 assists in assessing the impact of the independent variables on the odds that a CDC will purchase at least one property. Multiplying the marginal unit change by the range the independent variable exhibits in the dataset provides an intuitive way to assess its impact. The range is simply the highest value the variable takes in the dataset minus the lowest value the variable takes in the dataset. Table 21 provides an interpretation of the each variable's impact.

Table 21: Interpretation of Stage 1 Model Coefficients using Autoregressive Correlation Structure

Variables	Unit Change in Log Odds-Ratio	Unit Change in Odds Ratio	Difference Between Min and Max in Dataset	Max Impact of Independent Variable in Dataset
Owner occupancy rate	0.059	1.061	72.1 (Percentage)	Odds of purchase increase by 438% or by a factor of 4.4.
Strategic Investment Initiative	2.365	10.644	1.00 (Boolean)	Odds of purchase increase by a factor of 10.6

Year			4.00	Odds of purchase
	4.224	68.306	(Study period)	increase by a factor of 273.0
$Year^2$			$4^2-1^2=15$	Odds of purchase
	-0.818	-2.266	(Study period)	decrease by a factor of 34.0

The *Year* and *Year²* variables perform the heavy lifting in this model, affecting the odds of property purchase far more than *owner occupancy* or *SII*. Unfortunately, while statistically significant, these two variables are theoretically dull. They represent the fallout and slow recovery from the foreclosure crisis not adequately represented by more precise variables.

Each percentage point increase in the owner occupancy rate contributes, on average, to only a 6.1% increase in the odds ratio for purchasing property. This translates to Bellaire Puritas Development Corporation having greater odds than the Historic Gateway Neighborhood Corporation (holding other factors constant) by a factor of only 4.34, despite having an owner occupancy rate *seventy-one percentage points higher*.

SII captures both neighborhood and CDC factors. While SII neighborhoods contain vacant structures, they also contain amenities. Staff members in Neighborhood Progress Inc. believe a real estate-based approach to community development may stabilize conditions in these neighborhoods. Relatedly, staff members in CDCs located in SII neighborhoods are willing and able to purchase properties and work with contractors and developers.

The second stage models the number of properties purchased, weighted by the estimates from the first stage, which are probabilities (between 0 and 1) that a given CDC will purchase property in a given year. This stage includes more independent variables because I theorize that organizational factors play a large role in determining whether a CDC can capitalize on opportunities presented by neighborhood factors[71]. Like many count variables, the number of purchases is right-skewed and requires a Poisson error term rather than the typical Gaussian error

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[71] The *Year* and *Year²* variables actually capture city and national forces as well—everything contributing to the overall trend in the data but *not* captured elsewhere.

term (or Binomial error term from the first stage) to avoid violating regression assumptions—or at least to reduce the severity of such violations. Table 22 (below) summarizes the initial results for the second stage of the model.

Table 22: Zero-inflated Model of CDC Annual Property Purchases--Stage 2 (Weighted by Step 1 Estimates), Initial Version

variables	independent		autoregressive	
(Intercept)	-3.424	**	-3.048	@
Vacancy Rate	0.071	@	0.015	
Median Sales Price	-0.001		-0.002	
Number of Sales	0.001		0.002	@
Com. Dev. Block Grant Amount	0.000		0.002	@
Number of Employees	-0.007		-0.026	
NIS Total Queries	0.265		-0.397	
Strategic Investment Initiative	0.575		-0.044	
Year	2.542	**	2.707	***
Year^2	-0.515	***	-0.502	***
@ p< 0.10	* p < 0.05		** p < 0.01	*** p < 0.001

Using the actual number of properties purchased and down-weighting the CDCs and year without a purchase (through the stage 1 estimates) drives the correlation estimate much higher than in the first stage. Within each CDC, the number of properties purchased in 2008 are estimated as having a correlation with the number of properties purchased in 2009 of α^1=0.893, with those purchased in 2010 of α^2=0.797, and with those purchased in 2011 of α^3=0.712. Therefore, the independence correlation structure and autoregressive correlation structure provide very different estimates. While the *vacancy rate* proved statistically significant at the

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90% confidence level in the former, it was not so in the latter. Conversely, *number of sales* and *CDBG funding* proved significant in the latter and not in the former. ***Since failure to achieve statistical significance at the 90% confidence level destined an independent variable for stepwise elimination from the model in this research, the correlation structure employed here determined the trajectory of model construction.*** While both final Stage 2 models in Table 23 (below) include the same variables to enhance comparability, they would not have included the same variables if stepwise elimination had been applied using identical criteria in each case.

Table 23: Zero-inflated Model of CDC Annual Property Purchases--Stage 2 (Weighted by Step 1 Estimates), Final Version

variables	independent		autoregressive	
(Intercept)	-2.100		-3.507	*
Number of Sales	0.002		0.002	*
Year	2.492	**	3.340	***
Year^2	-0.466	***	-0.615	***

*@ p< 0.10   * p < 0.05   ** p < 0.01   *** p < 0.001*

All of the CDC level independent variables eventually flickered out of statistical significance during model building. As with the first stage, the coefficients for the remaining variables must be exponentiated to ease interpretation.

Table 24: Interpretation of Stage 2 Model Coefficients using Autoregressive Correlation Structure

Variables	Unit Change in Log Count	Unit Change in Count (as a multiple)	Difference Between Min and Max in Dataset	Max Impact of Independent Variable in Dataset (Ceteris paribus)

Number of Sales	0.002	1.002	1295	Each private sale increases the number of CDC purchases by 0.2% for a maximum increase of 259% or a factor of 2.6
Year	3.340	28.219	4.00 (Study period)	Each year the number of purchases increase by a factor of 28.2 for a maximum increase by a factor of 112.9
$Year^2$	-0.615	1.850	$4^2-1^2=15$ (Study period)	Over the four years, the number of purchases also decreases by a factor of 27.8.

As with the first stage, the two year (time) variables have a major impact on the overall shape of the model over the period under investigation. But, they do not contribute anything to explaining difference between cases during the same year. The number of sales in a neighborhood does very little to explain why some CDCs purchases many properties and other purchase few properties. Figure 12 displays the actual data (black solid line) versus the autoregressive model estimates (gray solid line) and traditional model estimates (gray dashed line).

On average, the autoregressive model is off by 3.4 purchases. Since many CDCs do not purchase any property in a given year, calculating the average error as a percentage poses a problem because the denominator is zero in these cases. If we replace the zero with 0.49 to indicate the *near* purchase of *one* property but the decision not to—the average percentage error is 275%. Very high. Ignoring the instances with zero purchases altogether, the average error becomes 4.8 purchases (slightly higher), but the average percentage error becomes *only* 90% (much less). This means that the model often estimates that a CDC will make twice as many or half as many purchases as it actually makes. As Figure 12 shows, the model predicts the number of purchases of Bellaire Puritas, Westown, and Old Brooklyn relatively well. But, it radically underestimates high achieving CDCs like Slavic Village and Collinwood Nottingham. There are likely key variables affecting CDC purchase volumes that did not surface in the interviews or the

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literature review. Alternatively, the number of purchases CDC staffers make is subject to a great deal of chance and coincidence that cannot be modeled effectively.
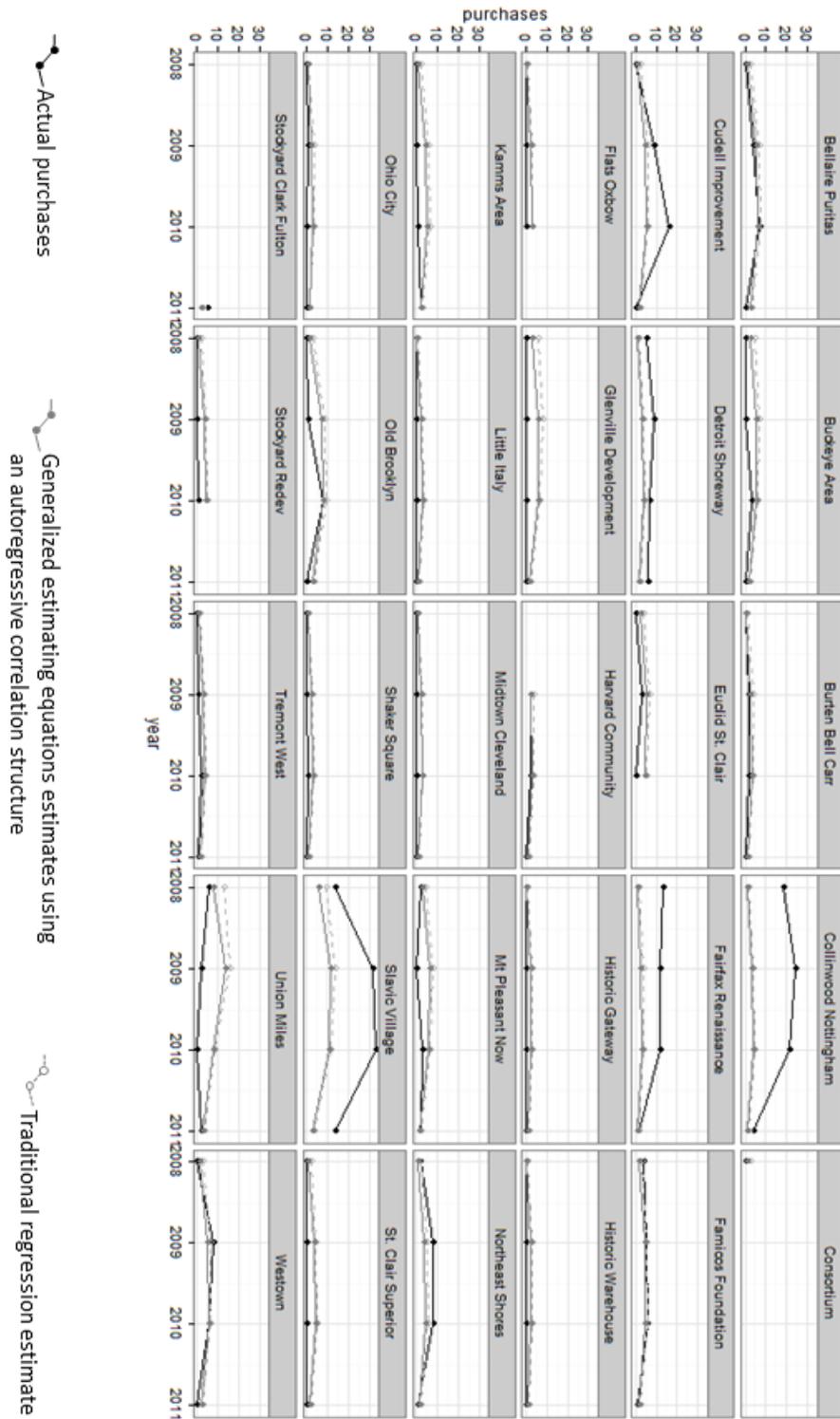
Figure 12: CDC Property Purchases and Model Estimates

While Community Development Block Grants are the greatest funder of CDC budgets nationally, the amount received did not prove explanatory of higher rates of property acquisition. There are three likely reasons why more CDBG money does not relate directly to more purchases. First, CDCs can purchase from an inventory of properties at lower than market cost from the Cuyahoga County Land Bank—so less money is actually required. Second, CDC governing boards often establish purchasing limits to reduce risk to the organization. Regardless of the funding available, CDC employees are prohibited from spending more than, say, $5,000 for a house and from having more than twenty houses in production at a time. Third, spending CDBG money to purchase a house triggers federal housing quality standards (HQS) requirements and city Green Building requirements. Meeting these requirements increases rehabilitation costs, potentially resulting in a home too expensive for low and middle income buyers (or resulting in a home packaged with a subsidy most CDCs cannot afford to offer). CDBG funding can be both vital to a CDC for paying salaries and not contribute to its property purchases.

The models provide very little support for the qualitative finding that *vacancy drives purchases*. The residential vacancy variable based on the American Community Survey proved significant at the 90% confidence level using traditional regression, but compensating for repeated measures removed the significance. Generalized estimating equations with an autoregressive correlation structure down-weight similar purchasing volumes from the same CDC instead of attributing them to relatively constant independent variables such as vacancy. Did Slavic Village staffers continue to purchase at high volumes in 2009 through 2011 because that is what they did in 2008? Or, did they continue to purchase at high volumes because the vacancy rate remained high and they saw an opportunity to acquire homes cheaply and sell to responsible buyers?

The large discrepancies between the actual values and the estimates in several cases— including Slavic Village—suggest that the model is missing vital information about these organizations such as important partnerships (outside the Strategic Investment Initiative), the priorities of the director, and staff training and experience. An older CDC staff person explained that "there are gaps between someone my age and someone coming out of college regarding

using technology" (#30, 10/11/2012). Indeed, a few of the younger staffers trained with ArcGIS and even with NEO CANDO in college (#55, 10/21/2011; #65, 12/6/2012). Such training may help these staff members accomplish more with the same number of NIS queries—or even derive accurate information from other sources without submitting a single query.

Although there are clearly missing variables, the models are sufficient to argue that using NIS does not directly result in more purchases. At first glance, this would seem to clash with the qualitative finding that staffers routinely use NIS when selecting properties to buy and attest to its usefulness. However, if the system provides reasons *not* to buy roughly as often as it provides reasons to buy—a perfectly plausible scenario—then more queries will not yield more purchases. According to interviews, NIS enables CDC staffers to conduct background research more quickly and therefore consider more options (see the qualitative analysis starting on page 141). Therefore, the system may improve programmatic capacity in the area of housing development by improving the *quality* of purchases and not the *quantity*. This research considers two quality measures, (1) the percentage of purchases transferred to a responsible owner and (2) the percentage of purchases physically improved

CDC Transfers (Percentage of Total Purchased)

When CDC staff members purchase a house, it usually was vacant and possibly abandoned. Transferring (usually by selling) that house to a new owner who then pays city taxes on the property constitutes a successful instance of community development, according to interviewees. Unlike the number of CDC purchases, which rose in 2009, plateaued in 2010, and then fell in 2011, the CDC transfer rate zig-zags. Instead of capturing this movement with complex polynomial techniques, I added the year and year^2 with the hope that they would explain at least some of the variability—but with the expectation that they would not prove statistically significant and be dropped from the final model.

The transfer rate is a ratio rather than a count and not as right-skewed as the number of purchases. Therefore, the model employs the same Gaussian error distribution and identity link function common to traditional linear models. Data rows representing an organization and year without a house purchase are removed, since only purchased houses may eventually be transferred or rehabilitated. A transfer rate or rehab rate of zero can occur when a CDC purchases properties but does not transfer or rehab any of those properties by the close of the

research period. The identity link function means that the coefficients do not need to be transformed before interpretation.

Table 25 (below) summarizes the initial model for the percentage of properties that a CDC purchased in a given year that are now owned by a person or company current on city property taxes.

Table 25: Model of Percent of CDC Annual Purchases Transferred to a Responsible New Owner, Initial Version

Variables	independent		autoregressive	
(Intercept)	-1.138		1.948	
Owner Occupancy Rate	0.974	*	1.007	*
Vacancy Rate	0.430		0.336	
Number of Sales	-0.018		-0.019	
Median Sales Price	0.996	@	0.937	@
Com. Dev. Block Grant Amount	-0.006		-0.011	
Number of Employees	0.111		0.087	
NIS Total Queries	35.799	***	36.031	***
Strategic Investment Initiative	-21.449	@	-19.996	
Year	5.375		5.241	
Year^2	-2.921		-2.806	

@ $p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

A very low estimated correlation (0.125) between transfer rates of the same CDC from year to year explains the similarly between the independent and autoregressive models. The Strategic Investment Initiative is the only independent variable that proved statistically significant at least at the 90% level in the independent model but not the autoregressive model. ***As with purchases, final transfer models based on the assumption of independence would have included different***

variables. The year and year^2 did not come close to statistical significance. Stepwise removal of the least significant variables in the autoregressive model yielded the final models shown next in Table 26.

Table 26: Model of Percent of CDC Annual Purchases Transferred to a Responsible New Owner, Final Version

variables	independent		autoregressive	
(Intercept)	-7.370		-4.478	
Owner Occupancy Rate	0.816	**	0.768	*
Median Sales Price	1.215	***	1.151	***
NIS Total Queries	17.302	@	22.143	**

@ p< 0.10	* p < 0.05	** p < 0.01	*** p < 0.001

The final model includes both neighborhood factors (*owner occupancy rate* and *median sales price*) and an organizational factor (*NIS total queries*). The estimated correlation between transfer rates of the same CDC from year to year was slightly higher in the final autoregressive model (0.348) contributing to different significant levels for the owner occupancy rate and NIS coefficients.

In the final autoregressive model, a one percentage point increase in the owner occupancy rate corresponds to—all other factors held constant—a 0.768 percentage point increase in the transfer rate. The range for neighborhood owner occupancy for CDCs that purchased at least one property covers 55.6 percentage points. Owner occupancy has a maximum impact on the transfer rate of 55.6*0.768=42.7 percentage points. This finding reaffirms an earlier one: CDCs operating in jurisdictions with high owner occupancy rates tend to purchase more houses—and therefore have them available for sale. The finding also shows that CDCs can locate people who want to buy such properties and pay taxes on them—likely owner occupants themselves.

Every $1,000 increase in median sales price corresponds to a 1.151 percentage point increase in the transfer rate. The range for median sales prices covers $91,600. Sales price has a maximum impact on the transfer rate of 91.6*1.151=105 percentage points. This exposes a weakness in the model apparent also from the plots in Figure 13—four of the estimates exceed a

100% transfer rate. Ideally, model estimates should remain within the logical constraints of their domain. CDC staffers cannot possibly sell more properties than they buy. The large impact of median sales price suggests that new buyers prefer to live in neighborhoods with desirable (expensive) houses *and* that such buyers pay their property taxes.

An increase of 1,000 NIS queries corresponds to a 22.143 percentage point increase in the transfer rate. The range for NIS queries covers 2,350 queries. NIS queries have a maximum impact on the transfer rate of 2.350*22.143=52 percentage points. Since *only* transfers to new homeowners current on taxes are included in the transfer rate calculation *and* CDC staff members report using NIS to check if prospective buyers have paid taxes on other properties they may own before selling to them *and* the regression coefficient is sizable and statistically significant—I argue for a causal connection. ***NIS contributes to programmatic capacity building, helping staffers identify responsible owners for CDC purchased properties.***

There exist several threats to the validity of this finding. While the NIS queries included in these quantitative models concern residential properties (as opposed to social demographics or neighborhood characteristics), they are not necessarily tied to the specific residential properties included in the transfer rate or to properties owned by prospective buyers. It is exceedingly difficult to determine from the log files whether CDC staff members used NIS to vet the current owner of a specific transferred property. Also, the CDBG funding year is the finest temporal unit employed in the analysis. Many queries occurred a few months before a given transfer or—even worse—a few months *after* a given transfer. A more cautiously worded finding would be that CDCs issuing more NIS queries tend to have higher transfer rates, all other factors being equal. Still, the qualitative and quantitative results together lead me to proceed beyond association and to argue for causality. But, the model should not be misinterpreted as deterministic. NIS likely helps vet prospective buyers, but repeating the same query mindlessly will not magically increase transfer rates.

Membership in the Strategic Investment Initiative was associated with a statistically significant *decrease* in the transfer rate in the independent model but not in the autoregressive model—which resulted in its removal. Regardless, as a major Neighborhood Progress Inc. initiative, it is worth hypothesizing why the coefficient was negative. SII member CDCs might sell more often than non-SII member CDCs to new owners who are not current on their taxes. Or, SII member CDCs might purchase property and then wait longer to find the right owner. An

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interviewee knowledgeable about activities in many CDCs provides circumstantial evidence for this behavior. "Some of the CDCs", she explains, "may have been doing the work of the county land bank in the past [before the land bank existed]. CDCs would pick up and hold houses until they could find qualified buyers." (#75, 6/24/2013). The single CDC she provided as an example—Slavic Village—is a SII member.

Figure 13 displays the actual data (black solid line) versus the autoregressive model estimates (gray solid line) and traditional model estimates (gray dashed line). The autoregressive model performs moderately well for CDCs maintaining a relatively steady transfer rate above 40% and below 90%, such as Bellaire Puritas, Slavic Village, and Westown. It performs poorly when estimating transfer rates that fluctuate greatly such as that of Mt Pleasant Now, estimating very low rates such as Burten Bell Carr, and estimating very high rates such as Kamms Area Development—with an estimate above the plotting window. On average, the autoregressive model estimates are 23.5 percentage points off of the actual transfer rates.
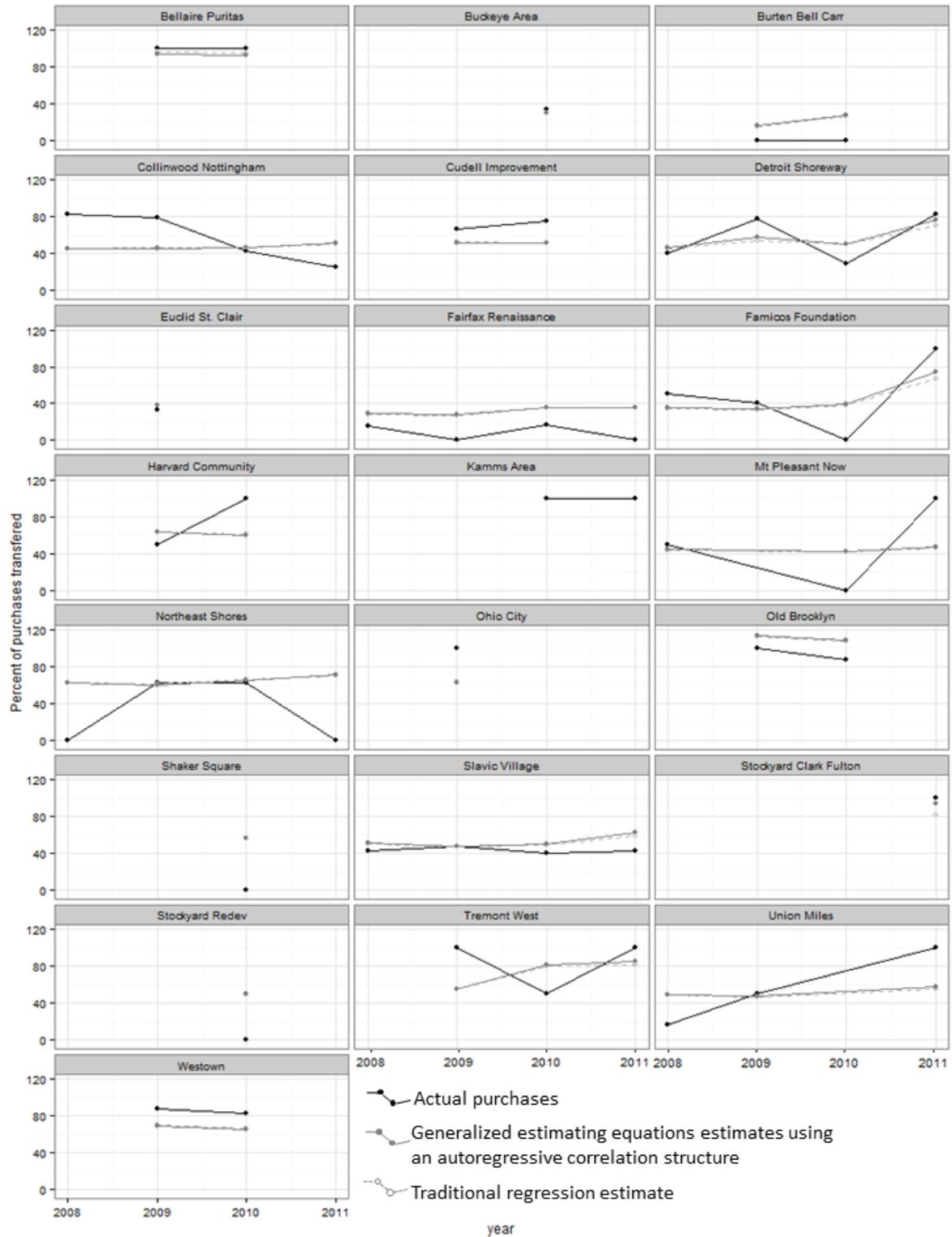
Figure 13: Percentage of CDC Purchases Transferred and Model Estimates

<u>Home rehabilitation rate (Percentage of Total Purchased)</u>

The houses that CDC staff members purchase often need repairs in order to pass inspection and may need extensive work before becoming attractive to prospective buyers. In their initial state, these houses lowered surrounding home values and likely also the morale of local owners and residents. Interviewees described a completed housing rehabilitation as indicating a successful instance of community development. In this research, a rehabilitation (*rehab*) is defined as a residential property purchased by a CDC during the period under investigation (July 1, 2007 to June 30, 2011) and physically improved after purchase by any party before the close of the period. Physical improvement includes completion of any of the permits listed in the methods section of this research. Early purchases have more time for rehabilitation than later purchases. While the approach is the same as that taken previously for the transfer rate, rehabilitating property may take more time than finalizing a property transfer. The research design therefore contributes to the sharp decline in the rehab rate from a high of 50% in 2009 to a low of 5% in 2011, the final year of this study. The average transfer rate roughly follows the same curve as the number of purchases, rising in 2009, plateauing in 2010, and falling (sharply) in 201l, suggesting the year and year^2 modeling approach employed for purchases will prove statistically significant.

The rehabilitation models use the Gaussian error distribution and identity link employed for the transfer rate, the most common employed in linear regression. Table 27 summarizes the initial models for the rehab rate achieved by CDCs, according to building permit data.

Table 27: Model of the Percentage of Annual CDC Purchases Rehabilitated, Initial Version

Variables	Independent		autoregressive	
(Intercept)	-40.453		-40.606	
Owner Occupancy Rate	1.109	**	1.108	**
Vacancy Rate	0.971		0.976	
Median Sales Price	0.964	@	0.968	@
Number of Sales	-0.049	*	-0.049	*
Com. Dev. Block Grant Amount	0.040		0.040	

Variables	Independent		autoregressive	
Number of Employees	1.055	*	1.057	*
NIS Total Queries	18.114	*	17.990	*
Strategic Investment Initiative	-35.597	***	-35.636	***
Year	12.425		12.382	
Year^2	-6.434	*	-6.426	*

@ p< 0.10   * p < 0.05   ** p < 0.01   *** p < 0.001

A very low estimated correlation (0.007) between transfer rates of the same CDC from year to year explains the similarity between the independent and autoregressive models. The coefficients and their level of significance match nearly perfectly between the models. Year proved insignificant but year^2 proved significant and negative, responding to the aforementioned drop in the transfer rate over time.

Table 28: Model of the Percentage of Annual CDC Purchases Rehabilitated, Final Version

Variables	Independence		autoregressive	
(Intercept)	-0.731		-0.842	
Owner Occupancy Rate	1.520	***	1.522	***
Number of Sales	-0.044	***	-0.044	***
Number of Employees	1.070	**	1.075	*
NIS Total Queries	16.369	*	15.908	@
Strategic Investment Initiative	-29.825	***	-29.790	***
Year^2	-3.162	*	-3.158	*

@ p< 0.10   * p < 0.05   ** p < 0.01   *** p < 0.001

The final model includes two neighborhood factors (*owner occupancy rate* and *number of*

private sale), two organizational factors (*number of employees* and *NIS total queries*), and a combination factor (*Strategic Investment Initiative* membership). The estimated correlation between rehab rates of the same CDC from year to year was higher in the final autoregressive model, but still tiny (0.021). However, this correlation was sufficient to downgrade the level of significance of both the number of employees and NIS total queries.

In the final autoregressive model, a one percentage point increase in the owner occupancy rate corresponds to—all other factors held constant—a 1.522 percentage point increase in the transfer rate. The range for neighborhood owner occupancy for CDCs that purchased at least one property covers 55.6 percentage points[72]. Owner occupancy has a maximum impact on the rehab rate of 55.6*0.768=84.6 percentage points. Owners are likely willing to maintain property in which they live, especially if neighbors are maintaining their property as well.

Each private sale *reduces* the rehab rate by 0.044 percentage points. The range for the number of private sales is 35 to 1,295 with a spread of 1,260. These sales have a maximum impact on the rehab rate of 1,260*0.044 = -55.4 percentage points. People who purchase a house from a CDC in a neighborhood with many private (non-CDC) sales may believe that they do not need to invest further in order to sell the house at a future date.

Each CDC staff member increases the rehab rate by 1.075 percentage points. The largest CDC had an estimated 50 fulltime employees and the smallest had an estimated 1.67 fulltime employees[73] for a difference of 48.3. The number of fulltime employees has a maximum impact on the rehab rate of 80.7 percentage points. CDC staffers inspect properties extensively on site prior to purchase, assessing their potential for rehabilitation. These efforts did not register in the property purchase models because they likely often result in the decision *not* to purchase a property—similar to offsite research via NIS. However, these efforts register in the rehabilitation model because CDCs with more employees are likely able to conduct more thorough property inspections. Staffers may also initiate work themselves before selling the property, communicating with contractors and developers and insuring that each property's potential for rehabilitation is realized.

An increase of 1,000 NIS queries corresponds to a 15.908 percentage point increase in

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[72] As mentioned previously, the range for owner occupancy for the entire dataset covers 72.1 percentage points.

[73] The partial employee arises from interpolation between estimates in 2005 and 2012.

the transfer rate. The statistical significance of this variable decreased from the initial model and from the independent version. NIS is only significant in the final autoregressive model at the .10 level (90%). The range for NIS queries covers 2,350 queries. NIS queries have a maximum impact on the rehabilitation rate of 2.350*15.908=37.4 percentage points. NIS appears to be more effective at vetting potential buyers for their tax compliance than for determining, explaining, or predicting which properties will be rehabilitated. Since the NIS in Cleveland actually provides CDC staffers tax compliance information and not (*of course*) the future state of properties—this outcome makes perfect sense.

On average, membership in the Strategic Investment Initiative *lowers* the rehabilitation rate by 29.790 percentage points. As discussed above for the transfer rate model, SII members may purchase property and then wait for the right owner. The rehabilitation model suggests that they do not significantly invest in the property during the wait.

Due to the design of the research and analysis, properties purchased later have less time to be rehabilitated. The negative year^2 coefficient translates to a CDC in year four (2011) having a rehabilitation rate $3.158*4^4 - 3.158*4^1 = 47.4$ percentage points lower, on average, than the same CDC in year one (2008). Figure 14 shows the actual data (black solid line) versus the autoregressive model estimates (gray solid line) and traditional model estimates (gray dashed line). The models perform reasonably well for Collingwood Nottingham, Cudell, Mt. Pleasant, and Slavic Village. They fail to capture the more dynamic rehabilitation rates of Detroit Shoreway, Famicos, and Union Miles. On average, the autoregressive model estimates are 21.5 percentage points off of the actual rehabilitation rates.
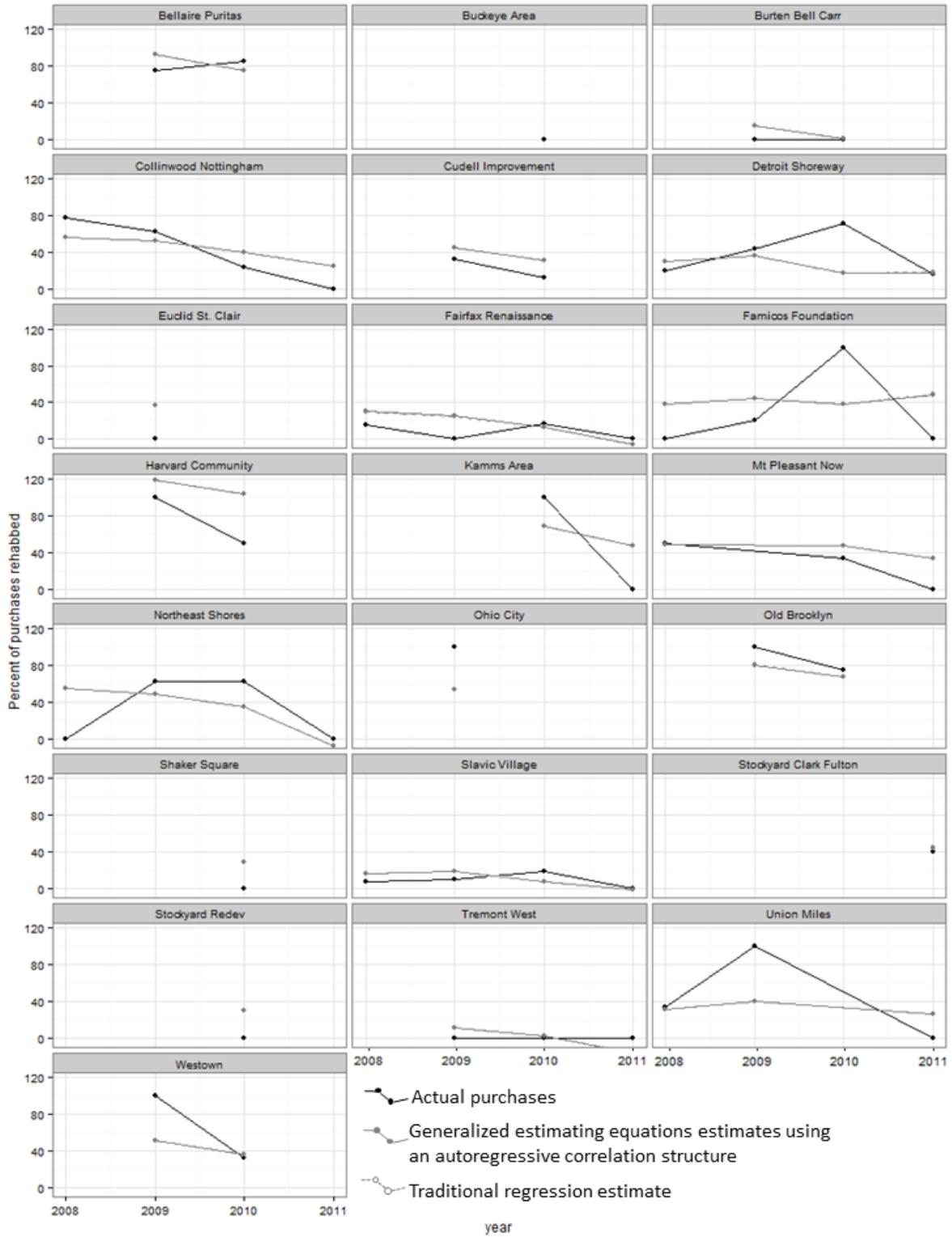
Figure 14: Actual Rehab Rate of CDC Purchases and Model Estimates

Network Capacity

Interviewees described many ways in which NEO CANDO and the NST web application help them establish more effective partnerships with other organizations. This section provides details, but does not model the process quantitatively. The results align well with Glickman and Servon's (1998) framework, strongly suggesting that NIS builds *network capacity* by allowing CDC members to achieve three capacity-building needs (See Table 1 on page 13): establishing strong relationships with other organizations, engaging in mutually supportive programs, and promoting the CDCs' agendas externally. The Cleveland Code Enforcement Partnership provides a lens with which to see how NIS allows CDC members to achieve these needs.

The Cleveland Code Enforcement Partnership ties two municipal departments (Building and Housing and Community Development) and fourteen CDCs together into a mutually beneficial arrangement that better addresses vacant and abandoned housing, despite the city's shortage of code enforcement officers due to budget limitations. Importantly, to maintain CDBG funding, CDCs must take on more contractually binding responsibility without a commensurate boost in the amount of money received. CDC staff and local residents only "benefit" from the point of view that the arrangement positions the nonprofits to take on unmet city responsibilities in a more organized and efficient manner than would have occurred without the partnership. The improvement occurs—in part—because NIS eases a common task —*communicating information*—that overlaps with multiple CDC functions (see "common tasks" starting on page 112 and "communicating information" on page 117). CDCs communicate their demolition and rehabilitation interests through the NST web application, fulfilling the network capacity building need of promoting an organization's agenda to external parties, such as city employees. One interviewee familiar with the partnership explained that the NST web application is the "intermediary for the partnership," allowing the city departments to share data with the CDCs and vice versa (#47, 8/11/2011). More generally, a CDC staff member explained that "NST is a way to communicate with other organizations" and "eliminates [an] unneeded phone call" (#10, 11/4/2011).

It is difficult to tease apart the impact of this new technology (NIS) from the impact of new municipal priorities and policies that urge city departments to work more closely with CDCs on code enforcement activity. One interviewee describes how the combination of impacts makes

CDC demolition advocacy far more effective, sometimes turning years of effort into weeks of effort.

> "[There is] no block now between the city and the CDCs. We are meeting and our concerns are heard...There was this one particular building, demolished]. The problem before was organization...No one can find the file. It was like 'who has the file?'. Maybe it is on the computer now. It is so much better. " (#58, 3/2/2012)

In this example, the NST web application provided the same "file" to both CDC employees and to city employees. Sharing a base of information allows all parties to agree—at the very least—on which parcel they are discussing and its current status.

Communicating effectively, however, requires both parties to pay attention. Employees at the Department of Building and Housing have demolished structures that were not on CDC staffers' demolition lists. One staffer exclaimed in an interview, "Now there are even buildings coming down that we were not notified of—not on my list. They are bypassing me. I want them to prioritize my list" (#58, 3/2/2012). It remains unclear from the data collected whether city representatives have their own demolition priorities that trump local concerns or whether city representatives are simply unaware of local concerns. City representatives have taken steps toward demolishing CDC rehabilitation targets—sometimes even completing the demolition. A staff member at a second CDC explained that sometimes "I don't know if the city is looking at our data" (#10, 2/20/2012).

The interviews provide some evidence that NIS has improved the network capacity of CDCs in regard to their relationships with other non-profit organizations. It has not only strengthened the relationship between CDCs and the city, but also between CDCs and Neighborhood Progress Inc. These relationships require a shared store of information to further discussions about problem properties. Before NIS, city departments and NPI built this store by separately requesting ad-hoc lists of parcels and conditions from CDCs. Now, all parties independently pull the information they need from NIS. One interviewee described how, "when the webapp came, 2/20/2012). Only one CDC staff member claimed that NIS may help coordinate activities with non-profit organizations besides NPI. She explained that

> "In the coming year, we are hoping to partner with our many social service organizations and non-profits. I anticipate that we will use NEO CANDO to better understand the gaps in services in our community and where the greatest need is. This will allow these

organizations to partner to better serve our stakeholders and develop programming and resources to meet those needs." (#25, 2/3/2011)

The current research does not provide sufficient evidence to argue that NIS improves—or does not improve—the network capacity of CDCs outside the framework of the code enforcement partnership.

Political Capacity

NIS contributed to political capacity building only in one CDC as discussed in the answer to research Question #4 (see page 133).

Chapter Summary

This chapter has examined the impact of NIS on capacity. **Hypothesis 5** (page 38) is clearly incorrect. While neighborhood and organizational factors help explain capacity building—so does NIS use for two outcomes: residential property transfers to owners who pay property taxes and residential rehabilitations. However, findings always come with caveats and Chapter 8 acknowledges relevant threats to validity.

Chapter 8: Threats to Validity

Shadish, Cook, and Campbell (2002) define *validity* as "the approximate truth of an inference" and assert that assessments of validity ultimately entail "fallible human judgments" (p. 34). They define *threats to validity* as "specific reasons why we can be partly or completely wrong when we make an inference about covariance, about causation, about constructs, or about whether the causal relationship holds over variations in persons, settings, treatments, and outcomes" (p. 39). The purpose of this section is to provide the reader with sufficient—and sufficiently organized—information to make informed judgments about the validity of findings in this research. Both quantitative research and qualitative research are subject to threats to validity, but the nature of those threats and their remedies can differ greatly (Creswell 2009; Shadish et al. 2002). However, this section prioritizes providing a practically organized synthesis of threats over attention to nuanced differences between them. It places Creswell's validity procedure for qualitative methods (2009:190–193)[74] within the structure of Shadish, Cook, and Campbell's most recent validity typology for quantitative methods (2002:33–102). Table 29 provides a summary of the typology.

Table 29: Four Types of Validity

Type of Validity	Description
Conclusion Validity[75]	The validity of inferences about the correlation (covariation) between treatment and outcome

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[74] Creswell does not provide as detailed a typology for qualitative research as the one he provides for quantitative research and this latter typology is less detailed than the one provided by Shadish, Cook, and Campbell.

[75] Shadish, Cook, and Campbell refer to this type of validity as "Statistical Conclusion Validity," but qualitative researchers also makes cause and effect claims and these must also be subjected to an examination of validity—even though the claimed relationships are not statistical. For this reason, I have generalized the name by removing the word "statistical".

Internal Validity	The validity of inferences about whether observed covariation between A (the presumed treatment) and B (the presumed outcome) reflects a causal relationship from A to B as those variables were manipulated or measured.
Construct Validity	The validity of inferences about the higher order (theoretical) constructs and their representation as specific variables.
External Validity	The validity of inferences about whether the cause-effect relationship holds over variation in persons, settings, treatment variables, and measurement variables.

(Shadish, Cook, and Campbell 2002, 38, Table 2.1 with reformatting)

The subsections to follow address each type of validity and its particular threats in more detail in the order that they appear in Shadish *et al.*(2002). Several threats are especially large in this research: unreliability of measures (page 176), extraneous variance in the experimental setting (page 182), ambiguous temporal precedence (page 184), selection (page 185), construct confounding (page 188), mono-operation bias (page 188), mono-method bias (page 188), interaction of the causal relationship with units (page 189), and interaction of the causal relationship with settings (page 189).

Conclusion Validity

The first type of validity concerns whether—and how strongly—the presumed cause and effect covary. There are nine potential threats.

Low Power[76]

Quantitative research can suffer from low *statistical* power resulting in a false negative. Multiple years of data increase the effective sample size of this study beyond the thirty organizations under investigation, increasing power. Extending the definition of a CDC to include organizations not receiving CDBG funding would have increased power further but may have included very different types of organizations and complicated analysis. I corrected for

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[76] Shadish, Cook, and Campbell refer to this threat as "Low Statistical Power," but a similar concept exists for qualitative research. The word "statistical" has therefore been removed.

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covariates such as CDBG funding levels and employed statistical methods appropriate to the data as Shadish, Cook, and Campbell recommend. But, key factors such as the strength of the treatment (amount of NIS use) and variability of the treatment (differences in NIS use) remained outside of my control, reducing validity.

In qualitative research, collecting information from too few individuals can result in inaccurate conclusions (false negatives, false positives, incorrect themes). While the term *triangulation* often refers to employing both qualitative and quantitative methods (Jick 1979) it can also refer to converging perspectives from different respondents (Creswell 2009). For this reason, I quantify the breadth of interview coverage when reporting key findings. Table 17 on page 125 shows that the individuals interviewed about the use of NIS to pursue public participation for historic preservation all worked in the same CDC. These particular findings should be read with more skepticism than those with broader support. I offer the number of distinct CDCs instead of the number of total staff members interviewed to permit readers to more readily assess validity. Employees in different organizations are less likely to provide the same responses as employees in the same organization, a product of their *independence*, which is explored more in the next section.

Violated Assumptions

Research can suffer from *violated assumptions*, especially violation of the independence assumption. In quantitative research, including multiple years of data poses such a threat. Traditional regression assumes that each data point stands equally distinct from all others. But, data points for the same CDC are more related to each other than to data points from other CDCs. Employing generalized estimating equations reduces this threat by accounting for the correlation between data points from the same CDC. Including both the Detroit Shoreway Community Development Organization (DSCDO) and its Stockyards, Clark Fulton, Brooklyn Centre office (SCFBC) as separate CDCs, however, may also violate the independence assumption. SCFBC has its own director, field staff, and CDBG funding but shares accounting staff with DSCDO, its parent organization. They may also share a similar organizational culture and community development approach. Violating independence biases the results toward Type I error (Shadish, Cook, and Campbell, 2002, 48) and threatens the quantitative finding that NIS contributes to higher property transfer rates (page 159) and higher rehabilitation rates (page 165).

Semi-structured interviews with CDC staffers support the current quantitative findings though, buffering against this threat. In the future, creating comparison models with DSCDO and SCFBC merged into a single unit of analysis along all covariates would permit quantifying the independence threat.

Fishing

Fishing refers to collecting or analyzing data in a way that biases the outcome, possibly by highlighting extreme or unusual cases. In quantitative research, sifting through a dataset to find statistically significant effects suggested by the data themselves, can threaten statistical validity. I took several steps to avoid fishing. The independent variables for each model were suggested by the literature, interviews with practitioners, and common sense. Instead of an exhaustive (all combinations) search for the most significant set of independent variables, I started with a short list of independent variables and dropped the least-significant variable one at a time until either all remaining variables reached statistical significance or all variables proved non-significant. I calculated the variance inflation factor before removing insignificant variables in order to avoid accidently removing a significant variable showing as insignificant due to multicollinearity.

An earlier version of this research with outcomes based on CDBG monitoring reports employed an exploratory all combinations analysis. Further investigation revealed that the reports did not include all properties CDCs purchased and rehabilitated, rendering the exploratory results meaningless. I then created the aforementioned system to identify CDC residential property purchases, transfers, and rehabs (page 80) and did not revisit the all-combinations approach to model building.

Asking leading questions in semi-structured interviews produces a similar threat to validity as fishing in quantitative research. I avoided asking leading questions, reducing the potential for bias due to fishing.

Unreliability of Measures

The *unreliability of measures* can lead to Type I or Type II error, especially in longitudinal studies (Shadish et al. 2002:49, citing Willett 1988). I report herein on the reliability of measures used in this research as Shadish *et. al.*(2002) recommend to reduce threats to

validity. But, in this research, I did *not* employ multiple measures of the same conceptual construct or latent variable modeling as they *also* recommend. The quantitative research may suffer from multiple sources of unreliability, including: (1) Estimation of staff size; (2) Margin of error in American Community Survey data; (3) Attribution of a NIS query to a CDC; and (4) Imputed CDC outcomes. The qualitative research may suffer from multiple sources of unreliability as well, including: (5) oversimplification and (6) insufficient review by stakeholders and external auditors. Each measure merits individual attention.

Estimation of staff size

Estimates of the number of fulltime CDC staff members each year are based on a linear interpolation between a 2005 estimate and 2012 estimate with the former coming from CDBG monitoring reports when available and the latter (or in some cases both) coming from short phone interviews with CDC staff members or the CDC's website. This method likely produces better estimates than the staff sizes reported in IRS 990 forms, which are—in some instances—outrageous. But, the method remains imperfect. The 2005 estimates, when coming from phone interviews, are subject to recall error. All estimates are subject to differences in defining fulltime and part-time employees between organizations. Linear interpolation between two points produces fractional full-time employees, which cannot actually occur. Either a CDC has 11 fulltime employees or 12 fulltime employees—never 11.5 full-time employees. Some CDCs may have lost many employees all at once between 2005 and 2012 but linear interpolation eliminates this possibility. This (unmeasured) sudden drop in staff size would have likely resulted in a corresponding (measured) drop in CDC activities and outcomes. The mismatch between independent and dependent measurements would lead to a Type II error, understating the contribution of CDC staff size in explaining outcomes.

Margin of error in American Community Survey data

Two independent variables, the vacancy rate and owner occupancy rate, come from the U.S. Census' American Community Survey and have corresponding margins of error that are ignored in this research. Researchers routinely include margins of error in the calculation of t-tests to see if one population differs significantly from another population. Researchers often ignore margins of error in more complex statistical models, though "error-in-variable models"

exist for special purposes (University of Michigan CSCAR, 3/21/2013). Not accounting for error in the independent variables biases those variables toward a coefficient of zero (under estimation regardless of direction) and non-significance (Type II error). The ACS variables may therefore have a larger impact on CDC activities than the models currently suggest.

Attribution of a NIS query to a CDC

The relationship between NIS use and CDC residential purchases, transfers, and rehabilitations would be invalid should NIS queries be routinely assigned to the incorrect CDC. Users, especially student interns working temporarily in a CDC, may change jobs or hold multiple jobs at the same time. The logfile analysis performed in this research only links a user ID number with the employer *currently* listed in the corresponding anonymized user profile. If the employer currently listed is not the current—or only—employer, the analysis will not accurately represent the amount of property research conducted by a particular employer. Poverty Center staff request users to make new accounts upon changing jobs, which helps insure that the logfiles store accurate information. However, there is no way for Poverty Center staff to enforce this request. Some users may continue to use the same account after starting a new job. Failing to update the profile would cause all new queries to accrue to the previous employer. Updating the profile would cause all previous queries to accrue to the new employer. I designed and implemented a procedure to estimate how often NIS queries were misattributed to CDCs.

Since CDCs are turf-based organizations, a query attributed to a CDC should fall within its service area. Queries that are outside the service area of the CDC currently listed in a user's profile—may signal a mismatch. The NST web application's logfiles contain a copy of the query submitted to the system, but not a copy of the result[77]. Users rarely specify a specific parcel of interest, instead relying on criteria (such as an address range) for the system to match. The query does include a list of *ugroups*, subdivisions of the city that programmers in the Poverty Center created to improve system performance by reducing the number of records to be searched based on a user's identity. Ugroups are imprecise and change over time. Users in neighboring CDCs are often assigned to some of the same ugroups.

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[77] The older NEO CANDO system does not store the query in the logfile so the accuracy of attributing queries to a particular CDC cannot be verified using this method.

A random sample of 10,000 rows from the NST logfile[78] for 2010 to 2011 returned 9,981 queries from CDC staff or interns. Approximately 11% (1,077) of these involved parcels outside the service area assigned in my research, suggesting measurement unreliability. CDC staff members may enter an incorrect address or investigate properties just over their service areas. The extent and frequency of the violation determines whether the query represents a threat to validity. Upon further investigation, only 97 of the 9,981 queries (about 1%) suggest a few users *may* have been misattributed during some years in this research. This small number of queries across multiple CDCs should not affect the results greatly.

Imputation of CDC outcomes

A master list of CDC property transactions would have made it unnecessary to search property records for CDC related purchases, transfers, and rehabs. Therefore, no list exists to test the completeness of the search methods employed herein. CDBG annual monitoring reports systematically underestimate actual purchases and rehabs. Thankfully, a project manager for a CDC generously provided a spreadsheet with parcel numbers for the 121 single family houses his organization facilitated the sale of between 2008 and 2012. According to tax records, 45 of these properties were last purchased before July 1, 2007 or sold after June 30, 2011, leaving 76 property transfers within the time frame of this study. Removing those involving the Cleveland Housing Network leaves 21 eligible properties. The search method I employed identified 27 such properties. The additional six properties may have been incorrectly attributed to this CDC instead of a related CDC. While unreliability remains, the property search reasonably estimates CDC activity relying on information available publically in many jurisdictions. The method will, however, completely ignore efforts by CDC staffers to facilitate property deals without taking title. The extent of these "third party" transactions in Cleveland remains unknown though interviews suggest that no CDC relies on them exclusively.

Oversimplification

Qualitative research requires presenting "*discrepant information* that runs counter to the themes…[since] real life is composed of different perspectives that do not always coalesce"

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[78] There are roughly 35,000 NST queries in the logfile complete enough for analysis

(Creswell 2009:192). Similar to when movie editors once manually cut film by hand, the researcher must consider whether very different findings would have resulted by including the interview material left "on the cutting room floor". Quotes from interviewees that ran counter to prevailing themes in this study are still included in the write-up, for example:

- While CDC staff members often integrate public participation with programmatic activities, a staff member in one CDC said that his organization does not promote "issue organizing" (page 125). Since the NIS in Cleveland provides information especially suited to housing development and rehabilitation, the finding that at least one CDC does not connect public participation with neighborhood issues suggests that NIS is not—and cannot—be used to improve public participation around housing development and rehabilitation in that jurisdiction.

- Three CDC staff members interviewed reported explicitly reinvesting time saved using NIS back into core CDC development activities, but a fourth reported using the saved time to cultivate her interest in sustainability (page 141). The latter quote suggests that even if NIS were to save CDC employees time, housing development and rehabilitation efforts may not increase in every case.

- CDC staff members generally focus on owner occupied housing, but one interviewee acknowledged partnering in her lowest income census tract with a developer known for producing rental units (page 145). This qualitative finding suggests why the regression coefficient for owner occupied housing was not always statistically significant in the quantitative models and not higher even when significant.

But, despite a conscious effort to report discrepant information, the chance for over simplification remains very real. I focused on identifying emerging themes, insuring that they enjoyed broad support in terms of individual interviewees and CDC representation, and including counter quotes. I did not conduct a systematic review of quotes excluded from the final write-up. While not explicitly recommended in any qualitative methods texts I have encountered, such a systematic review may prove helpful in avoiding oversimplification.

Insufficient review

Both individuals close to the subject under investigation (including interviewees) and far from

the subject under investigation but familiar with qualitative methods should review the findings to verify—and recommend how to improve—their validity[80]. Some outside review of preliminary findings occurred while conducting interviews and during conference presentations, but review of this material outside of the dissertation committee remains incomplete and unsystematic. While conducting interviews, I checked that I understood statements that were particularly complex or that ran counter to prior findings. In follow-up interviews, I repeated sections of that interviewee's past statements and shared preliminary findings in order to receive clarifications and additional material. No interviewee in Cleveland, however, has read a full draft of this study. I intend to send several interviewees who have expressed interest copies after my dissertation defense in order to inform the next version of this work, which will likely take the form of multiple journal articles. Attendees at the Community Indicators Consortium (CIC) conference in 2012 and the Association of Collegiate Schools of Planning (ACSP) conference in 2012 and 2014 provided limited but useful feedback after my presentation. I sent several full papers out and received only one comment—which was to use less jargon. I have tried to simplify and clarify my use of language in this manuscript.

Restriction of Range

Defining the primary outcome variable as the number of residential properties purchased in a year resulted in a large number of zeros in the dataset. This could produce a *floor effect,* an error caused by a surplus of inaccurate minimum values. The inaccuracy would have occurred if, for instance, CDC staffers were in the process of purchasing at least one property and that effort went undetected. I did not investigate this possibility since it is difficult to determine from property records. Restricting the range of an independent variable in this way tends to weaken its relationship with the dependent variable, leading to a Type II error (Shadish, Cook, and Campbell,2002, 49). I assumed in this research that the zeros represent accurate data drawn from administrative records and model them responsibly with a zero-inflated model. I did not compare the results of a single stage model with a two stage model in order to quantify the differences in such approaches, though this may be a topic for future study.

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[80] Creswell (2009, 191-2) refers to "member checking", "peer debriefing", and use of an "external auditor"

Unreliability of Treatment Implementation

This threat to validity overlaps somewhat with the unreliability of measures discussed previously. In retrospective studies such as this one, control of the treatment is—by definition—impossible. I did not randomly assign staffers in some CDCs to use NIS and others in different CDCs not to use NIS. I did not specify how many NIS queries staffers should submit, how they should specify the query criteria, or how they should interpret and apply the results. Still, the qualitative methods employed herein are less prone to this threat to validity because the interview protocol called for addition probing about the specifics of information use.

The quantitative methods employed herein rely on the annual number of NIS queries from computer logfiles, which likely include queries that CDC staffers submitted by accident and queries that returned results which were never carefully reviewed. The research proceeded under the assumption that the ratio of *useless* queries versus *useful* queries is equal across organizations within a given year and that useful queries *are all equally useful*. Such assumptions will be necessary in quantitative studies of the impact of information systems until researchers identify better estimates of information use.

Extraneous Variance in the Experimental Setting

Unaddressed differences between interviews and unmeasured covariates can result in incorrect findings—including the finding of no clear trends. Generally, in qualitative data collection, the researcher finds that some participants are more generous with their time and more forthright in their responses than other participants. In this particular study, the number of questions greatly outpaced the amount of time most participants volunteered. To save time, I asked a number of core questions and then focused on questions that remained poorly or incompletely answered by other participants. There are therefore extraneous sources of variance between interviews (duration, amount of trust, participant mood and stress level) which may have colored responses and uncollected responses to questions that were never asked.

Regardless, the uses of NIS emphasized in this study reflect achieving sufficient responses from interviewees that the last few responses for a particular question provided little to no additional information. Qualitative researchers, especially those employing a grounded theory approach, refer to this phenomenon as "saturation" (Dey 1999:116). Focusing on questions with

less saturated responses took precedence over searching for potentially discrepant examples, which both increased the breadth of the study and the threat of oversimplification (page 179).

The quantitative models in this research include the independent variables interviewees mentioned as influencing decision-making about housing rehabilitation. However, as described in detail after each model, they explain the outcome of some CDCs far better than the outcome of others. This suggests that an omitted variable (or several omitted variables) may be necessary to explain the outcome in *all* cases. Omitted independent variables are the greatest threat to the validity of the quantitative models in this research. The explanatory power assigned to NIS may actually be more properly assigned to an omitted independent variable or variables. Formal education in planning or another field that emphasizes data analysis may be highly correlated with NIS use and contribute to the volume and success of CDC housing rehabilitations. The culture and priorities within different CDCs must also impact the distribution of resources to activities such as housing rehabilitation and therefore impact annual outcomes. Qualitative findings about the decision-making process in some CDCs remained incomplete (or nonexistent) for other CDCs and were not part of the quantitative models.

Heterogeneity of Units

This research includes *all* organizations receiving CDBG funding during the time period under investigation, resulting in the inclusion of a wide assortment of organizations (see Table 5 on page 60). Including very different units tends to make outcomes more variable and more difficult to explain. In quantitative research, measuring units along multiple dimensions to control for differences through statistical techniques as employed in this research improves the models—but often insufficiently, as previously discussed.

But, heterogeneity of units also makes both qualitative and quantitative findings more generalizable since one should not generalize beyond the conditions investigated. In this particular study, the wide assortment of CDCs also made the process of qualitative data collection more engaging and contributed to the richness of the qualitative findings. I do not consider the heterogeneity of units a major source of error beyond exposing the aforementioned problem of omitted independent variables. In fact, I would like to open the investigation in the future to both organizations receiving CDBG funding and those not receiving CDBG funding.

Inaccurate Effect Size Estimation

The regression coefficients generalized estimating equations produce—as with other forms of regression—describe the average marginal change that occurs in the dependent variable when a particular independent variable changes by one unit and all other independent variables remain constant. Several researchers have identified conditions under which generalized estimating equations may produce biased estimates (e.g. Pepe and Anderson 1994) but this area of investigation still appears incomplete and the necessary diagnostic tools are not widely available. I cannot, therefore, comment on the likelihood of this threat to validity.

Internal Validity

Internal validity refers to the degree of support for a causal relationship between the treatment (A) and outcome (B) in the units under analysis. Such an inference requires that:

1. A precedes B in time

2. A covaries with B (covered under *conclusion validity* above)

3. There are no other plausible explanations

(Shadish et al. 2002:53)

There are eight threats to internal validity, focused primarily on temporal order and alternative explanations.

Ambiguous Temporal Precedence

Uncertainty about the order of events plagues the quantitative findings far more than the qualitative findings. In interviews, CDC staff members described which tasks involved NIS and how those tasks were performed. Since many of the respondents continue to perform these tasks on a daily basis, there is little possibility of error in their details. CDC staff members use NIS to find suitable rehabilitation candidates and then purchase some of those candidates. CDC staff member *also* purchase properties for rehabilitation and then track progress in NIS, such as the issuance of permits and the demolition of nearby nuisance properties. They often use NIS *both* before and after making a particular purchase in reference to that purchase. While these details add to the richness of the qualitative results, they make the direction of causality in the quantitative results harder to determine. Shifting the date of queries to align with outcomes six

months later imperfectly addresses the threat.

For example, the qualitative findings reveal that CDC employees use NIS to identify responsible new owners for rehabilitated properties ("Vetting Applicants" on page 116). The related quantitative model found that the number of NIS queries significantly and positively explains the percentage of annual CDC purchases transferred to responsible owners, defined as owners current on property taxes ("CDC Transfers" on page 159). Though the logfiles specify the CDC associated with the query and the time of the query, they only rarely specify a property—and never specify a purpose. *All, some,* or *none* of the queries assigned to a particular CDC may involve vetting potential owners *before* transferring property. Similarly, *all, some,* or *none* of the queries assigned to a particular CDC may involve checking up on a property and its owners *after* transferring property.

Relying on logfiles provides accurate estimates of NIS use frequency, but no information about purpose and outcome—and therefore no information about temporal order. A sensitivity analysis that randomly defines some queries as having occurred after the outcomes and removes those queries may reveal how tenuously quantitative findings rest on assumptions about temporal order.

Selection

Defining a community development corporation as an organization that receives CDBG funding led to the inclusion of the Historic Gateway Neighborhood CDC, the Historic Warehouse District CDC, and the Little Italy Redevelopment Corporation, which all focus on commercial activities, do not use NIS, and do not redevelop residential properties. Failure to conduct interviews with any employees in these CDCs may have influenced the qualitative results through similar means as *oversimplification* except—continuing the film editing analogy on page 179—instead of landing on the cutting room floor, the film was never shot. Since NIS use and all outcomes were zero for these organizations, the impact of organizations using NIS and producing outcomes may be viewed by some readers as exaggerating significance in the quantitative models. I hold that any valid selection criteria for evaluating the impact of NIS on CDC outcomes would have to include all the organizations receiving CDBG funding *at the very least* and that these three organizations are rightly part of this research. Omitting them in the

qualitative side is a source of weakness and including them in the quantitative side is a source of strength.

History

The threat of *history* refers to incidents that may have occurred between application of the treatment (NIS use) and measurement of the results (CDC outcomes). In this research, threats posed by *history* have already been covered under *extraneous variance* (page 182).

Maturation

The quantitative models ignore learning occurring within organizations when staff members overcome new challenges and when they participate in training opportunities. This raises a credible threat related to omitted variables such as employee skills and experience. Additionally, staff members in the two organizations that gained CDBG funding for the first time during the study (Detroit Shoreway's SCFBC office and Harvard Community Services) may have learned more than staff members in other organizations. However, since the majority of the CDCs were well-established organizations, maturation likely poses less of a threat than omitted variables. Importantly, the critical case research design assumes that sufficient time has passed for CDC staffers to learn how to benefit from NIS. The findings for organizational capacity suggest that this process is still underway.

Regression

Regression analysis identifies the mean impact a unit change in an independent variable has on the dependent variable, holding all other independent variables constant. A related threat to validity in quantitative research, *regression to the mean*, occurs whenever there are imperfectly correlated variables (independent and dependent) and a *nonrandom* sample. Since this research includes *all* organizations that qualify as CDCs and not a sample of the CDC population in Cleveland—especially not a sample defined by very high or very low measures— the results should be moderately protected against the regression to the mean threat. But, measures in a particular year may be usefully thought of as representing a sample of all years under investigation. A low outcome one year would likely be followed (*statistically* speaking) by a value closer to the overall mean in subsequent years. Regression analysis may incorrectly

attribute this return to the mean to an independent variable. The likelihood and potential impact of this risk were not investigated.

Attrition

CDCs dropped out of the study when they lost CDBG funding or went out of business. The year before dropping out, these CDCs often showed no NIS use and no residential property outcomes. Interviews were not conducted with employees from CDCs that dropped out of the study. The potential impact of attrition was not investigated.

Testing

The *testing* threat refers to the possibility that the very act of conducting research (giving a "test") can impact results. During interviews, NIS-specific questions revealed to interviewees the focus of the research and they may have been inclined to exaggerate the effect of NIS in order to give the confirmation they assumed I wanted. The interview protocols, however, called for specific examples of NIS benefits and descriptions of the mechanism(s) within NIS delivering those benefits. Probing for such details and discounting unsupported claims reduced the threat of testing. The testing threat cannot occur during retrospective analysis of administrative records and logfiles since the participants were unaware of the study at the time of recording. In fact, the study did not exist at the time of recording.

Instrumentation

No changes in the measurement of quantitative variables occurred during the study. Focusing on interview questions with answers that remained open instead of asking the same battery of questions to each interviewee may be viewed as a change in instrumentation. This threat to validity was addressed previously (see "extraneous variance" on page 182).

Construct Validity

The task of connecting measurable variables to theoretical and socially relevant categories is both a requirement and a central task for research (Shadish et al. 2002:65). Construct validity concerns the strength of those connections. There are fourteen threats to construct validity. Several involve subject reactions to treatment, which do not apply to this research. Three

relevant threats are briefly introduced below.

Construct confounding

As Table 11 (page 78) shows, whether a CDC participates in Neighborhood Progress Inc's (NPI's) Strategic Investment Initiative (SII) affects both its *resource capacity* and its *network capacity* because participants receive both funding and access to a larger number of professional contacts. When this Boolean variable acts within a quantitative model, it could represent either theoretical construct or both theoretical constructs. Similarly, the number of NIS queries submitted by CDC staff in a year represents the construct *information use*, which is part of another construct, *organizational capacity*. Construct validity also concerns case selection. Although the term "CDC" is employed widely in the community development field, it remains only loosely defined. Including only organizations that received CDBG funding focuses the study on relevant cases.

Mono-Operation Bias

Constructs that are operationalized through a single variable may not capture the richness of the underlying theory. For example, *resource capacity* is measured only by the amount of CDBG funding a CDC receives and its only capacity building outcome, grant writing, remains only sparsely described in terms of process and unmeasured qualitatively or quantitatively (see page 135). This research did not find a relationship between NIS use and resource capacity. This could reflect a Type II error caused by poor operationalization.

Mono-Method Bias

When a construct is measured by a single method, that method becomes part of the construct. For example, self-report bias can plague a construct measured only through interviews such as *resource capacity, networking capacity,* and *political capacity.* Triangulation via multiple interviewees does not reduce the risk. *Programmatic capacity*, supported by both qualitative and quantitative research enjoys protection against this source of bias.

External Validity

External validity concerns the extent to which a causal relationship identified through

empirical research holds in contexts similar to those originally studied and in contexts different than those originally studied. There are five threats to external validity. Two are explored below.

Interaction of the Causal Relationship with Units

Developers at Case Western Reserve University created the NST web application so that CDC staff members could pursue neighborhood stabilization activities. But, this does not mean that the system automatically contributes to CDC capacity building or that it could never contribute to capacity building in a different kind of organization. Still, the link between the technology and the units (users) under investigation cannot be ignored. In the nomenclature of science and technology studies, the NST web application delivers an *affordance* carefully tuned to property research. It would be more reasonable to generalize the findings from this research onto the employees of a real estate company or lawyers in a title research firm with access to the NST web application than onto employees in a new CDC focused on new commercial and retail construction. Grant writers in nonprofit organizations across Cleveland likely rely on NEO CANDO to support assertions of program need and program impact even though they do not work in a CDC. But, there were no findings concerning grant writing to generalize.

Interaction of the Causal Relationship with Settings

The critical case research design employed in this study limits the generalizability of the findings. By definition, the results of this study are based on elements of the setting such as the unusually strong neighborhood information system and the unusually strong community development system. The findings provide an example of the impact NIS can have on CDC capacity building in a setting conducive to such a relationship. But, these findings must be generalized onto other cities and contexts very cautiously.

Summary of Threats to Validity

This chapter has provided a practically organized synthesis of threats to validity by placing Creswell's validity procedure for qualitative methods (2009:190–193) within the structure of Shadish, Cook, and Campbell's most recent validity typology for quantitative methods (2002:33–102). As shown, the research suffers under some degree of threat in each subarea of validity: conclusion, internal, construct, and external. Three threats loom especially large—all

against the quantitative side of the research: unreliability of measures (page 176), omitted variables (part of extraneous variance in the experimental setting on page 181), and ambiguous temporal precedence (page 184). However, the qualitative side of the research mitigates these threats to a degree. The direction and significance of the coefficients are trustworthy—far more trustworthy than their exact value. CDCs with staff members who use NIS often are also likely to use NIS specifically to vet potential new owners, and—because of this use—likely to have higher transfer rates to new owners who pay their taxes. But, the impact of NIS on the transfer rate may be much smaller or much larger than the impact discussed under Table 26 on page 161. The next and final chapter reviews the findings and their implications.

Chapter 9: Discussion of Findings

This research represents the first case study of information system use within the field of community development informed by both science and technology studies (STS) and management information systems (MIS). This discussion chapter is divided into five sections: integration of disparate bodies of knowledge; contributions to bodies of knowledge; practical implications for decision-making with NIS; recommendations to NIS developers and funders; and conclusions and future research.

Integration of disparate bodies of knowledge

The crosspollination of theoretical constructs from disparate bodies of knowledge yields fertile grounds on which to sow new research programs. This work provides both a useful integrated theoretical framework and two approaches for building such frameworks from different sources and for different purposes. Since the 1990s, scholars in management information systems have been calling repeatedly for application of their models to a wider range of systems and contexts, especially application of DeLone and McLean's (1992, 2003) model. Also since the 1990s, scholars focused on the capacity of nonprofit organizations, including community development corporations (Glickman & Servon 1998), have acknowledged the potential for information systems to contribute to capacity building. A few scholars and practitioners coming to information systems through the geographic variant (GIS, PPGIS, and NIS) have been aware of the management information system literature, but have yet to empirically apply MIS models in their own research (e.g. Nedovic-Budic 1999). Despite wide recognition of the need for dialogue between these disciplines, little dialogue has occurred. The barrier, I believe—has been theory. It is a daunting task for any scholar to build theory outside his or her own field. Community development activities driven in part by turf-based nonprofit organizations (CDCs) might look like another planet to a management information system scholar focused on global for-profit retail firms. Similarly, the underlying functionality of a multifaceted information system might appear equally foreign to an urban planning or social work scholar focused on grassroots public participation and capacity building. Luckily, scholars

have already generated useful theoretical frameworks in their own fields of expertise. The primary contribution of this research has been to draw several of these frameworks into a new, more comprehensive whole. While the findings from this research should be generalized cautiously, its theoretical framework (Figure 3 page 41) may prove immediately useful to scholars examining the impact of technology on public participation and capacity building in a range of contexts.

The research illustrates two approaches to combining disparate theoretical frameworks, which I call *routing* and *refined replacement.* In Figure 3, elements of the upper part of the framework (DeLone and McLean 2003) are connected to the lower part of the framework (Chaskin 2001) through *routing,* depicted as gray lines and arrows. DeLone and McLean's information success model defines a number of independent and dependent variable relationships. These requirements are *routed* from Chaskin's community capacity building framework in the form of Characteristics and Neighborhood Context (both sources for independent variables) and Outcomes (dependent variables). Sawicki and Craig's (1998) concept of data democratization and Glickman and Servon's (1998) CDC capacity building framework enter into the Characteristics subcomponent through *refined replacement.* Chaskin's original concept for the subcomponent included "access to resources" and "ability to solve problems" (Figure 1 on page 11). The final framework defines information as the "resource" under investigation and CDC capacity as a more robust conceptualization of "ability". Researchers may find these two approaches, *routing* and *refined replacement* useful in building integrated frameworks in their own work.

Contributions to bodies of knowledge

This section describes the findings' substantive and methodological contributions to bodies of knowledge integrated in the theoretical framework. The bodies of knowledge are covered in the same order as in the literature review (Chapter 2) with particular attention to the gaps highlighted in Table 3 on page 28 in the columns labelled "needed topic" and "needed method".

Science and Technology Studies (STS)

This work responds to a call by science and technology studies (STS) scholars to examine

the impact of information access within organizations and to examine divergent technological impacts across organizations. The findings suggest that an improvement in information access may improve the capacity of an organization by allowing staff members to more easily perform the tasks they already perform, if the information is carefully tailored to those tasks. This may seem self-evident, but pundits often claim that information technology will improve outcomes without identifying which outcomes is to be improved or how it is to be improved. The NST web application was designed to allow CDC staff members to more easily perform parcel-level tasks common to a physical development strategy for community development, especially residential rehabilitation. The findings reveal that users indeed enjoy an *affordance* when pursuing that type of work under certain conditions.

The research revealed many differences in how CDC staff members used NIS and the impact the systems had on their work. How people work, such as querying only a few properties at once or querying many properties at once can impact the benefits they receives from the information system. Several respondents preferred the traditional county and city websites for looking up a single property, but all agreed that NIS offered considerable time savings when looking up many properties. This shows that CDC staffers choose to use NIS in some situations and not others even though it is always available to them. Moreover, even CDC staffers who use the system routinely have not changed their approach to community development to realize the full potential of NIS. Some CDCs do not rehabilitate many properties at once or even compare many options before rehabilitating a single property. Similarly, CDC staffers in only one CDC in Cleveland decided to adopt a grassroots approach to community development and employ NIS accordingly to build political capacity. A staff member at this CDC witnessed a successful grassroots effort at another CDC and decided to duplicate that effort. The outcome was hardly guaranteed—despite information access and computer skills. Vital to this particular case, he encountered support within the organization and in the neighborhood and was able to build a committee that had never existed previously. This shows that NIS outcomes rely on more than NIS. CDCs previously focused on commercial projects did not switch to residential projects to enjoy potential benefits from NIS. In some cases, focus on commercial projects reflects CDC priorities in the face of many potential avenues for development. In other cases, focus on commercial projects reflects the lack of residential development opportunities due to the historic growth of the neighborhood. NIS cannot change organizational priorities or neighborhood

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history.

Participation, Capacity, and Capacity Building

Scholars examining participation, capacity, and capacity building have yet to evaluate the contribution of information systems and have also called specifically for a focus on political capacity and networking capacity (Glickman & Servon 2003). The fundamental contribution of this research toward these gaps is an integrated theoretical framework and a detailed example of its empirical application. The findings also offer substantive contributions. In response to the specific call for focused research, NIS helped staff members in one CDC increase public participation and political leverage, both prerequisites for *political capacity* (Glickman & Servon 1998). NIS also enabled staff members in CDCs and city agencies involved in the Cleveland Code Enforcement Partnership to communicate more effectively, evidence of *networking capacity* building.

The findings extend beyond the specific call for gap filling and add to what is already known about previously researched sub-capacities. NIS builds *programmatic capacity* for purchasing and rehabilitating vacant and abandoned housing. CDCs with staffers who submit more NIS queries sell a higher percentage of CDC-owned properties to new owners who pay taxes. CDCs with staffers who submit more NIS queries also purchase a higher percentage of properties that are eventually rehabilitated. These findings begin to fill gaps in knowledge concerning both the neighborhood impacts of capacity building and the societal impacts of information technology by (1) suggesting a method to define locally desirable impacts—interviews with residents and development professionals; (2) implementing this method and revealing more property tax paying owners and more physical rehabilitation as locally desirable impacts; and (3) linking NIS use with these outcomes both qualitatively and quantitatively. The research focuses on whether NIS contributed to CDCs doing more or better work—not whether that work proved sufficient to change the neighborhood[81]

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[81] Thank you to Seema Iyer, Associate Director of the Jacob France Institute, which houses the Baltimore Neighborhood Indicators Alliance (a NNIP partner), for this astute observation and phrasing (private communication 7/16/2014).

This research did not find evidence that using NIS results in *resource capacity* building or *organizational capacity* building. Cleveland's role as a critical case for NIS together with a failure to detect an impact on resource capacity and organizational capacity does not bode well for these causal relationships—or, alternatively, does not bode well for the theoretical framework and methods employed herein. The impact of NIS on resource capacity proved impossible to isolate because interviewees could not provide a point of reference to establish a counterfactual. In the literature review, I identified conflating *use* with *impact* as a weakness of previous NIS research. I cannot now claim that the widespread use of NEO CANDO by CDC employees for grant writing *is* its impact. The option remains tempting though because *they are professionals*. If CDC employees use NIS for grant writing, it should have an impact on their capacity to win grants. But, such reasoning dismisses the need for evaluation. Constructive work on resource capacity may require identifying a new NIS or a new NIS user in order to establish a base case and then return a year later. Organizational capacity may prove even more difficult to measure. CDC employees in Cleveland discover uses for custom fields in the NST Web App through trial and error. The benefits of this experimentation may take years to accrue and may take the form of increased interdepartmental collaboration and increased retention of institutional knowledge despite high staff turnover.

Geographic Information Systems (GIS), Public Participation Geographic Information Systems (PPGIS), and Neighborhood Information Systems (NIS)

Regardless of their variant of interest, geographic information system scholars have noted a lack of in depth evaluations that consider the impact of use on users and their organizations. The study described herein provides an in depth evaluation of system use on user outcomes. The clear separation of system use from system outcomes and focus on impacts is itself a contribution to those scholars and practitioners more interesting in technological impacts than technological adoption. PPGIS and NIS research often examines public participation and capacity building and therefore the findings discussed previously are equally relevant here as well. Moreover, the mixed-methods approach may offer more persuasive evidence of impact than the case study approach more common in PPGIS and NIS work.

The evaluation draws on an innovative dataset of outcomes imputed from multiple years of administrative records. Scholars interested in nonprofit community development organizations may wish to familiarize themselves of potential linkages between American Community Survey tables, IRS 990 forms, CDBG and other funding compliance forms, and city property records.

Management Information Systems (MIS)

MIS researchers have called for investigations of diverse use scenarios, more attention to change processes, collection of rich qualitative data, and multi-level (individual & organizational) analysis. This research represents the first application of an MIS model to the field of community development. CDC employees do not resemble the profit-focused and efficiency-focused information systems users commonly described in the MIS literature and they sometimes do not operate within a functioning housing market. CDC employees are focused on future social gains that accrue from attracting new resident owners who pay property taxes and from rehabilitating once dilapidated housing. They often focus on low income homebuyers rather than seeking homebuyers who can provide the highest profits. In fact, the Cuyahoga County Land Bank restricts the fees CDCs can charge new buyers for properties originating from its inventory at below market prices. CDCs also receive properties from banks and individuals at below market prices—sometimes even for free. Therefore, findings from this research clearly add a new perspective to the more traditionally business focused MIS literature.

The research provides insights into workflows and change processes involving information systems. Qualitative interviews revealed common tasks (see Table 16 on page 113) executed with NIS that overlap multiple development functions. Two of these functions have been diagrammed with the actors, tasks, and relationships to NIS clearly indicated (grant writing on page 124 and residential rehabilitation on page 129).

MIS researchers have called for the development of multilevel models and application of qualitative and mixed-methods to help fill gaps in the literature. This research demonstrates a way to combine individual level and organizational level analysis by using qualitative methods for the former and quantitative methods for the latter. Researchers considering a mixed-methods approach might find the *sequential exploratory strategy* (Creswell 2009) followed herein useful. Interviewing and observing technology users and building quantitative models based on those

interviews and observations can produce useful evaluations of the nature, magnitude, and requirements of technology benefits. Qualitative methods may be employed to establish a counterfactual and triangulate an impact through multiple respondents. This technique might permit an evaluation to proceed even without longitudinal quantitative data or may supplement such data when they exist.

Parameterized coding might also prove useful to scholars heeding the MIS call to qualitative and mixed-methods work. . This technique allows researchers to iteratively turn quotes into themes and themes into variables. Moreover, it facilitates chaining these variables together and capturing complex phenomena and interactions. While I focused on information systems, all these methods, techniques, and approaches should translate to a range of different technologies including broadband, wireless, cell phones, and social media making them pertinent not only to MIS researchers but to STS researchers as well.

Practical implications for Decision-Making with NIS

The emphasis on data quality, data breadth, and data-driven decision-making on NNIP partner websites draws attention away from the need for sound decision-making processes. Although partner websites frequently mention the need for collaboration and public participation, the term *data-driven* implies that human beings only need to buckle-up for the ride and click "start". Data sit on a hard drive, appear on a computer screen, or hover over an audience during a presentation. But data do not drive. Studies reveal that successful decisions depend on more than data alone. After analyzing 1,048 business decisions, researchers found that data, modeling, and formal analysis accounted for 8% of the success rate, organizational variables such as capital availability accounted for 39% of the success rate, and the decision making process accounted for 53% of the success rate (Lovallo and Sibony 2010).

The findings herein provide strong evidence that, despite the need for and use of data, community development decisions are not *data-driven*. They are *human-driven*, *context-based,* and—at best—*data-guided.* CDC employees conduct windshield surveys, walk house-to-house, speak with residents and developers, and go to court. CDC employees query, enter and interpret data—and finally incorporate all these data into decisions—decisions ultimately made by human beings. Despite hyperbolic assertions to the contrary, this finding likely surprises no one. Unlike equity trades, 73% of which automated systems initiated in the United States (Anon 2009) and

which requires multivariate analysis of means to optimize a *single* end (profit), planning decisions require multivariate analysis of *both* ends and means. Planning decisions are wicked problems that cannot be optimized (Rittel and Webber 1973) and therefore cannot be data-driven. Instead, planners rely on data to frame problems and argue for and against solutions (Dryzek 1989). NIS provide data but do not require that framing or deliberation occur.

This final chapter offers an exploratory example of integrating data access with decision-making that ties NIS use with the WRAP decision-making process (Heath and Heath 2013). The WRAP process is designed to counter cognitive biases that impair decision making. It is named after the first letter of the first word of its four steps (widen, reality-test, attain, prepare). The next paragraphs introduce each step, the cognitive bias the step counters, and practical tools drawn from Heath and Heath's (2013) book. I then offer examples of how community development professionals can use NIS to apply some of the tools.

The first step is to **widen the options** under consideration, which counters narrow *this-or-that* or *yes-or-no* framing common to decision-making. Tools for widening options include avoiding false dichotomies, forcing brainstorming by imagining all current options as impossible, and pursuing multiple options at once—via separate teams if possible. NIS excels at finding *all* parcels that meet specific criteria and will return parcels that users may not have thought pertinent. Lisa Smith, in the introductory vignette, might have benefited from this step since she used the NIS only to check if she should buy a specific house—or not. Several CDC employees already cast a wide net when looking for properties to rehabilitate. Users can also develop criteria separately, identify matching parcels, and then meet to compare and contrast findings. This technique is not currently practiced. But, the time savings that NIS provides when processing multiple properties along multiple criteria makes this step of the WRAP process more plausible to implement now in (frequently understaffed) CDCs than before NIS existed.

CDC employees in Cleveland already use creative thinking in their use of NIS. They widen their data options by using a parcel-based system to learn about people, vetting potential buyers based on the physical condition and tax-status of properties the potential buyer already owns. They did not ask the simple binary question, "Should we buy a background report on this potential buyer—or not?" Instead they asked, "How else can I get more information about this person?"

The second step is to **reality-test assumptions**, which counters the tendency to seek information that confirms preexisting notions. Tools for reality-testing include arranging for constructive disagreement (*e.g.* devils' advocate), seeking disconfirming information, trusting average outcomes over more optimistic calculations, collecting qualitative data from individuals close to the problem under investigation, and exploring the feasibility of options through small experiments. CDC directors may wish to reality-test ideas by routinely assigning employees to use NIS to find fault with an emerging plan. Many CDC employees already reality-test assumptions through windshield surveys and discussions with residents that can result in challenges to NIS data. Funders and developers can offer users tools to switch from parcel data to pertinent neighborhood and city summaries. For example, suppose a CDC employee identifies a parcel that she believes, after rehabbing, could be easily sold to a new owner occupant. Before proceeding to acquire the parcel, she may want to check how many similar parcels owner occupants have purchased in the last three months in her neighborhood and across the city. She may also want to check how many similar parcels sit in CDC inventories, unsold. Providing one-click access to this information would facilitate its inclusion in the decision-making process.

The third step is to **attain distance before deciding**, which counters the torrent of emotions that often accompanies decision-making and distorts information. Tools for attaining distance include imagining how one will feel about a decision 10 minutes, 10 months, and 10 years into the future, imagining how an outsider or successor may view the situation, and imagining the advice one would give to an associate facing the same situation. Reviewing core priorities can also provide distance from and perspective for specific decision-making instances. Unfortunately, NIS cannot currently and perhaps never will be able to emulate or predict human feelings about particular decisions. However, NIS developers may program NIS to prompt users with a number of questions to explore the impact of emotions on their decision making. Such questions may have helped Lisa Smith, the CDC employee from the introduction, realize that her encounter with an investor she judged irresponsible had resulted in a narrow focus on a single house instead of a broader investigation. Users may also wish to compare current NIS property search criteria against core priorities to insure that the former conform to the latter. Such a review may reveal, for example, that after many iterations, the current criteria appear well-suited for market rate rehabilitations in conflict with a core priority to enable low-income homeownership.

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The fourth and final step is to **prepare to be wrong**, which counters the overconfidence that decision-makers express in their own predictions about the future. Tools for this step include imagining a range of future scenarios from extremely negative to extremely positive, imagining that an option fails and predicting why, inserting tests to reveal the existence of a problem or time points to assess progress, and insuring that all participants trust the fairness of the decision-making process. NIS do not offer robust scenario planning functions though some users in Cleveland CDCs insert elements of plans into the NST web application's custom fields along with follow up dates for revisiting options. NIS developers may wish to expand on this usage by allowing users to maintain multiple lists of parcels and proposed actions. One list may record acquisition and demolition priorities in a hypothetical worse housing market and another list may record acquisition and demolition priorities in a hypothetical better housing market. Parcels with the same proposed action in either market might be the safest bets. NIS developers might also provide users with custom notifications on specific parcels or areas. The NIS would email the user when parcel-level changes trigger a notification—for example, if any three houses on a block sold with mortgages or with owner occupants. Such sales may indicate an improving market and the need to revisit a more optimistic scenario.

Recommendations to NIS Developers and Funders

Leaders in funding organizations such as government agencies and private foundations seeking to improve public participation and programmatic capacities of nonprofit organizations like CDCs should control their expectations concerning the role of technology and act strategically. This research provides evidence that some claims of NIS proponents hold true in Cleveland. But Cleveland is a critical case and the lessons may not transfer easily. Moreover, data cannot directly change facts on the ground. According to the qualitative and quantitative findings, the decision to purchase and renovate residential property is based on the number of such properties in the neighborhood, the condition of such properties, the owner occupancy rate, and the strength of the local submarket (median sales price, number of sales). Access to information does not immediately change any of the hard underlying realities. NIS funders and developers may not have the expertise necessary to aid users in incorporating data access into an effective decision making process. Scholars and practitioners who apply lessons from psychology and other fields to decision-making may prove helpful. Importantly, this research

does not provide any evidence that NIS can help build completely new capacities within organizations.

Only a single factor—widely known but only cursorily studied in this research—predicted that an organization would acquire a new programmatic capacity. The factor was fiscal threat. New CDBG funding contracts between the Cleveland Department of Community Development and local CDCs require many of the latter to fulfill Code Enforcement Partnership activities. CDCs that had never had code enforcement officers suddenly needed them. When CDC directors learned their organizations may not be eligible for CDBG funding unless they agreed to conduct code enforcement activities—they found a way to conduct those activities. This "capacity building" had little to nothing to do with technology. There are likely ways, though, of building programmatic capacities up from scratch without threatening grantees with bankruptcy.

For example, interviews with CDC staff members suggest that some organizations cultivate an ethic of *serving* residents while other organizations cultivate an ethic of *empowering* residents. Switching from the former to the latter may require that funders convene a series of sessions between CDC directors and professional consultants experienced in guiding clients through a critical (re)evaluation of mission, strategies, and tactics. The directors of data intermediaries may also benefit from critical reevaluation of the information technologies they offer to users. The directors of data intermediaries may wish to re-envision their organizations as not just democratizing data but providing a platform for partnerships.

This research reveals the potential of data intermediaries to improve working relationships between disparate institutional actors. Usually data intermediaries add value to pre-existing data and store them, allowing users to bypass the original source altogether. Instead, the Poverty Center's NST web application serves as the technology platform for the Cleveland Code Enforcement Partnership, enabling CDC employees and city employees to communicate more clearly and precisely by attaching comments to specific parcels. This finding renders the claims of several NNIP partners that initially appeared up in the clouds suddenly more grounded. For example, the Piton Foundation website says that the organization "uses information and communication to bring people in Denver closer…through a deeper understanding of the collective challenges they face." (see Table 14 on page 99). This research shows how such

claims are plausible *and testable*. Interviewees in Cleveland quantified which data were available prior to the NST web application and the time and effort required to receive those data. The interviewees then quantified which data the NST web application made available and the time and effort required to receive those data. The change described was significant and persuasive.

Neither the Poverty Center nor the NST web application *caused* this cooperation to occur. A complex set of events—the mortgage foreclosure crisis, rise of vacant and abandoned properties in Cleveland, loss of code inspectors, and historic precedent of a city-CDC partnership –brought the parties together. Representatives of the Department of Housing, Department of Community Development, and the majority of Cleveland's CDCs all had something to gain from better code enforcement. The partnership was not one of equals though. The Department of Community Development's control over a resource the CDCs desperately need—CDBG allocations—all but assured that CDC staffers would bear the brunt of the labor. Still, even after the intention to partner and underlying roles were established, the effort may have failed if the NST web application had not provided an appropriate channel of communication and radically improved data access.

Most partnerships can flourish without the help of a data intermediary. Face-to-face communication, email, a shared calendar, and an occasional spreadsheet prove sufficient to keep partners abreast of activities, events, and details of interest. These partners may still rely on the same data intermediary to support their separate grant writing, analysis, and reporting endeavors. But when partners must often and asynchronously share information about thousands of multivariate items (i.e. properties), a data sharing platform offers many advantages—as presented in this research.

The amount of data available to community development professionals and laypeople is increasing rapidly, due in part to the efforts of NNIP and its partners. But tools enabling users to collaboratively incorporate these data into multifaceted, multiyear plans are in their infancy. In a more mature form, such tools would allow users to transform a subset of a data warehouse's inventory into a curated exhibit to guide plan writing and then to supplement the written report through live links. A similar approach could someday lead to self-updating program evaluations in which newly collected data move through a pipeline of statistical functions and conditional logic, finally refreshing a pre-established report. Moving in this direction will likely require that

data intermediaries take the following steps (in order of importance):

1. Provide a user interface and database storage for user annotations. These may look like the NST web application's twenty custom fields, the comments available on many blogs, or the revisions pages on Wikipedia.

2. Add a login and flexible group settings that allow users to share their annotations with some users but not with all users. Formal governance arrangements (like the Cleveland Code Enforcement Partnership), neighborhood planning processes, institutional affiliations, geographic areas, and ad-hoc alliances may all serve the basis of a group in terms of data sharing.

3. Allow users to construct and save simple sort and filter queries through an intuitive menu system.

4. Allow users to write, save, and run more complex queries. The query language should be common, stable, and well-documented, such as SQL.

5. Allow users to display query results graphically and assemble several graphics together into a dashboard.

The addition of a login may conflict with the definition of data democratization that some data intermediary directors and software developers hold dear. These individuals define information access as unchecked and anonymous. Should such conflicts arise, one solution would be to provide users with the *option* of a login that makes the annotation tools available.

Conclusions and future research

This research shows how data, relationships, city policies, neighborhood conditions, activist residents, and the hard work of city and CDC employees result in capacity building and changes on the ground—parcel by parcel. Many CDCs in Cleveland partner with the city to conduct code enforcement. Their staffers access and share code enforcement data better than ever before because of NIS. Employees in several CDCs have learned to use NIS to insure that their residential parcels go to responsible owners who pay property taxes. Staff in one CDC mobilized a housing committee through which residents advocated for their "fair share" of demolitions using NIS data. When I started this research, I anticipated finding very little qualitative or

quantitative evidence that NIS had an identifiable impact. The research *did* reveal the potential for technology to build network capacity, political capacity, and programmatic capacity in specific situations.

A pressing need for information, a mature neighborhood information system, and a strong community development system together define the critical case research design for NIS (see page 47), but not all the criteria may be required to realize some impact on public participation and capacity building. A pressing need for information is most important, since without urgency potential users are unlikely to take the time to learn NIS. This research showed that the impact of the technology was dependent—in part—on the prior availability of information. Places where information has historically been difficult to find may have a very low bar for the level of NIS necessary to realize an impact. For example, if potential users currently must drive to an office and sort through piles of paperwork to find a property owner's tax address—even a rudimentary webpage should have a considerable impact on programmatic capacity. While a coordinated community development system involving government agencies, nonprofit organizations, and for-profit developers offers the ideal setting for the implementation and constructive use of NIS, a single strong CDC might be able to build programmatic capacity in isolation—and even build political capacity given sufficient interest in strengthening public participation. Improving network capacity though likely requires peer organizations ready and willing to use NIS.

In future work in the same vein as this research, parcel-level, employee-level, and organizational-level findings might be traced upward to fill the gap in knowledge about societal impacts of capacity building and of PPGIS. Such an effort would start with a rehab or a new tax payer tied—in part—to neighborhood information system use. It would then investigate other residents' willingness to invest in their own property after seeing the nearby rehab or investigate increases to city-wide property tax collection due to the presence of new taxpayers.

The term *data-driven* is here to stay, although it falsely suggests that information and technology push forward specific—and better—outcomes. They do not. The path for information systems and technology to improve participation and build capacity therefore must begin with dedicated institutional staff and residents who together *decide* that participation and higher capacity are desirable ends.

Appendices

Appendix A: The Grammar of Parameterized Coding

The need to capture detail and nuance concisely gave rise to a coding approach I call *parameterized coding*. Without this technique, every theme or detail requires its own code, causing at least two problems:

1) Adding a code to a span of text takes time, whether in qualitative coding software or on paper with colored markers. Adding five codes takes about five times as long as adding one code.

2) Adding multiple codes to a single interview quote describing a complex instance of NIS use may lead to ambiguity. For example, consider coding for only three factors (NIS name, CDC activity, and impact) for the hypothetical quote:

> "We use NEO CANDO for grant writing and the NST web application for finding owners. I'm not certain that NEO CANDO leads to winning more grants but NST definitely helps find homeowners more quickly."

This may produce the following codes: NEO CANDO, NST, grant_writing, find_owners, uncertain, and more_quickly. These codes fail to capture that *NEO CANDO* and *NST* are both NIS, *grant_writing* and *find_owners* are both activities, and *uncertain* and *more_quickly* are both claimed impacts. Prefixing each code with an appropriate short word adds meaning to the individual codes. For example, the code *nis:NEOCANDO* emphasizes that "nis" is a variable with a fixed number of valid values—such as the value "NEOCANDO". However, these prefixes do not convey that the quoted text describes two distinct syntactical chains linking NIS use, CDC activity, and claimed impacts (or lack thereof). To address this problem, some qualitative software packages permit creating two identical quotes from the same span of text that can be coded separately. *Parameterized coding* permits this solution, but usually makes it unnecessary. *Parameterized coding* permits formally and concisely describing very complex NIS use scenarios in a single long code where subcomponents are separated by punctuation according to a standardized grammar. Table 30 summarizes the grammar for those codes prefaced in the

database with a "t|" to signify code-type *technology use*

Table 30: Code grammar for an instance of technology use

Part	Time	Technology	Development Function	Database Function	Assess-ment	Compare
Element	p = past n = now f = future	neo = NEO CANDO nst = NST web application nis = either system ot = other software low = low-tech (paper) na = no NIS by choice	ge = general / all sf = single family mf = multi family sa = site assembly ce = code enforce da = demolition advocacy fp = foreclosure prevention sl = side lot exp. rp = resident partic hp = historic pres. gr = grant writing ma = map assets pl = other planning pr = other program	id = identifying matches re = retrieving details up = updating data map = mapping	tf = tech failed of = other failure tl = tech limited ad = adequate (default) ts = time savings bd = better decisions pn = possible now, not before	comp = before/after comparison offered
Separator	Ends with a colon ":"	Ends with a colon ":"	Multiple functions separated by a dash "-". Ends with a colon ":"	Multiple functions separated by a dash "-". Ends	Ends with a colon ":" if the next field exists.	This is an optional element.

				with a colon ":"		

A quote describing how a CDC staffer currently receives calls from residents concerned about problem properties, looks-up the property in the NST web application, and shares information with the resident without entering any information from the call into the system or assessing the system would be coded as *t/n:nst:rp-ce:re:ad*. The final element "ad" signifies that the process appears "adequate" as it neither elicited praise nor derision from the interviewee. Since the quote does not compare a workflow using NIS with a workflow not using NIS, the code does not include the optional "comp" at the end.

Table 31 below summarizes the grammar for those codes prefaced in the database with a "s|" to signify code-type *subject*

Table 31: Code grammar for other subjects

Part	Heading	Sub-Heading 1	Sub-Heading 2
Element	Process = lengthy sections about processes within a CDC including development functions.	Same Development Function elements as the "t" code type above plus: "data" = data sharing "change" = process change "turnover" = staff change	freq = frequency with which staff performs the process increase, decrease, *or* change = adjustment between 2006 and 2012 performance of process problem = challenge associated with the process success = description of success for the process
	collaboration = distinct organizations working together	Same Development Function elements as the "t" code type.	history = retrospective of the relationship problem = challenge associated with collaboration
	tech = about the development of a technology (NEO CANDO or NST) more than its use	Same Technology elements as the "t" code type above.	

Part	Heading	Sub-Heading 1	Sub-Heading 2
	funding = about	cdbg = Community Development Block Grant lihtc = Low Income Housing Tax Credits npi = Neighborhood Progress Inc. nsp = Neighborhood Stabilization Program other = other funding sources private = private foundations	problem = challenge associated with funding reporting = monitoring required by funding
	goal = purpose of success criteria for a given Development Function	Same Development Function elements as the "t" code type above plus "data" for quotes about data sharing.	transfer = finding responsible owner as goal (usually for single family) improve = investment as goal (usually for single family)
	cdc	jurisdiction = about service areas and other CDC geographies	change = adjustment (usually to jurisdiction)
	training	npi = Neighborhood Progress Inc. (teaches, not CWRU) nst = NST web application	yes = completed training no = did not complete training

Part	Heading	Sub-Heading 1	Sub-Heading 2
	targeting	neighborhoods houses	
Separator	Ends with a colon ":"	Ends with a colon ":"	Optional. Ends with a colon ":"

For example, the interview quote: "People drop in with questions about nearby properties about twice a week. I also receive phone calls. Mostly random residents...Calls have increased from residents…" was coded as s|process:rp:freq:increase. This code signals that the process of resident participation, as measured by frequency of contact, increased in the CDC, according to the interviewee.

Appendix B: Interview results by Development Function

P=person

O=organization

Total=Total number of interviews

The following are not mutually exclusive

 Confirm=Confirm NIS use

 Proof=Provide evidence of benefit

 Deny/Qualify=Either deny benefit or qualify the benefit

For example, thirteen people discussed single family rehab or new construction in interviews. Twelve of those people reported using NIS for this activity. Five of those provided proof that NIS was helpful.

Table 32: Interview results by Development Function

Development Function	Total		Confirm		Proof		Deny/Qualify	
	P	O	P	O	P	O	P	O
single family (rehab/new)	13	9	12	8	5	3	2	2
code enforcement	12	7	11	7	5	3	6	3
resident outreach & participation	11	6	8	5	0	0	8	5
grant writing	8	5	7	5	1	1	2	2
demolition advocacy	8	5	7	5	2	2	4	2
multi,commercial & assembly	8	4	7	3	5	2	2	2
other programming	6	4	4	3	1	1	4	2

foreclosure prevention	5	5	3	3	0	0	3	3
sidelot expansion	5	3	2	2	1	1	3	1
planning	3	3	0	0	0	0	3	3
historic preservation	3	1	3	1	0	0	3	1

Total of 49 people from 28 different CDCs

This table only includes assertions made by a CDC staff person about operations at his or her own CDC. It does not include assertions made by a CDC staff person about the operations at other CDCs (including a past employer) or assertions made by a staff person at another nonprofit or a city agency.

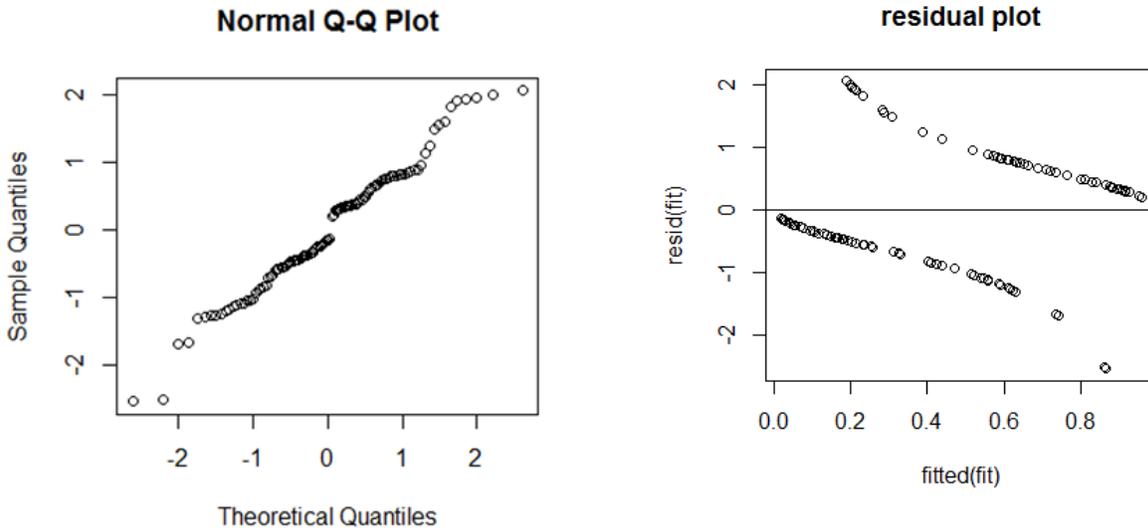# Appendix C: Regression Diagnostic Plots

Normal Q-Q Plot

residual plot

Figure 15: Diagnostic Plots for Zero Inflated Model of CDC Housing Purchases, Step 1 (Binomial) with Autoregressive Correlation Structure
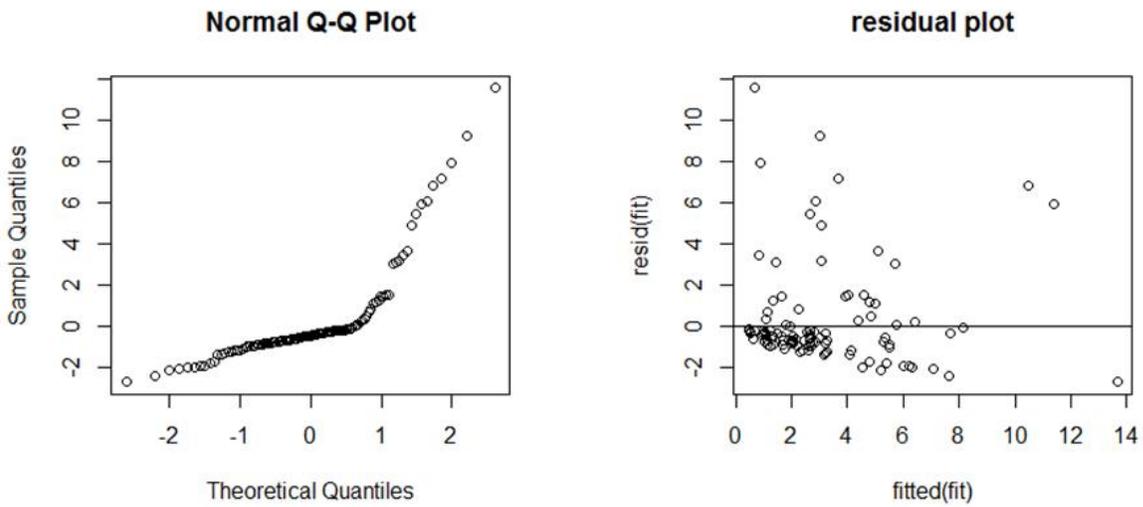
Normal Q-Q Plot

residual plot

Figure 16: Diagnostic Plots for Zero Inflated Model of CDC Housing Purchases, Step 2 (Weighted by Step 1 Estimates) with Autoregressive Correlation Structure
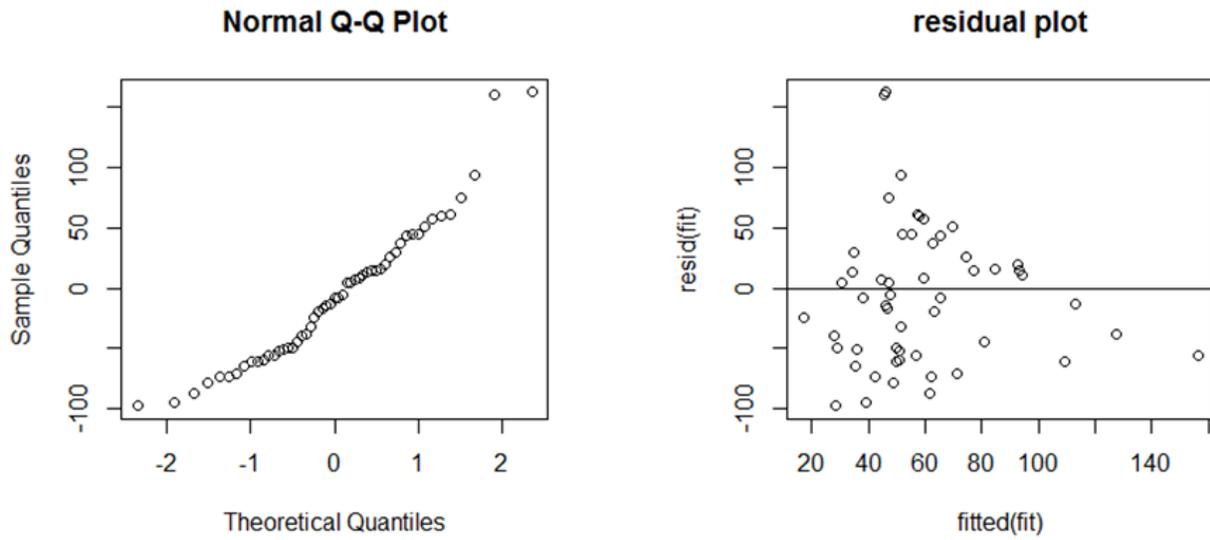
Normal Q-Q Plot

residual plot

Figure 17: Diagnostic Plots for Model of CDC Housing Transfers (Autoregressive)
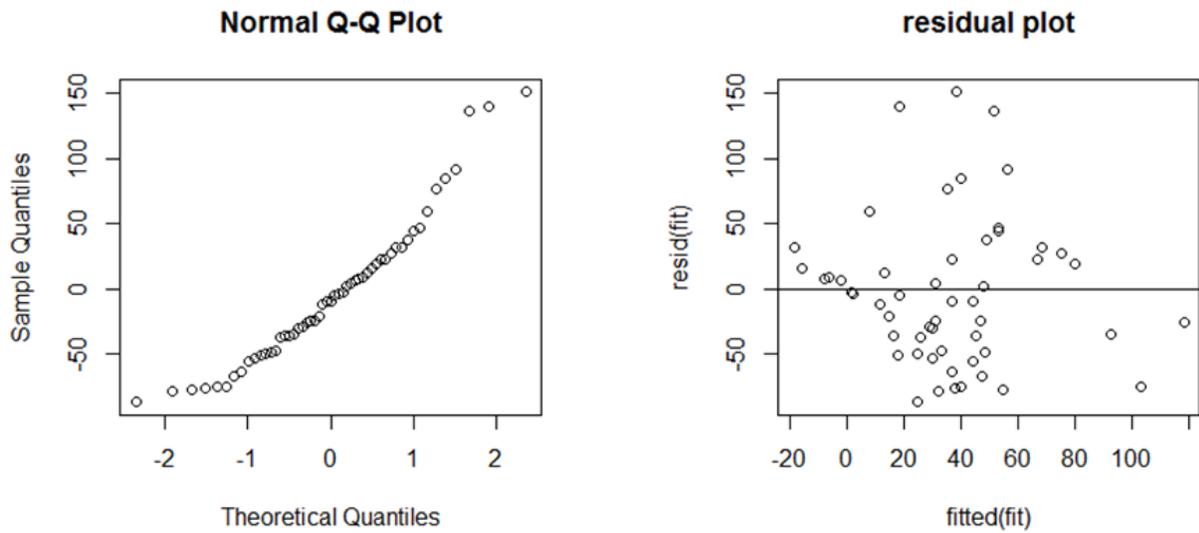
Normal Q-Q Plot

residual plot

Figure 18: Diagnostic Plots for Model of CDC Housing Rehabs (Autoregressive)

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