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Expanding the Network Evaluation Toolkit: Combining Social Network Analysis & Qualitative Comparative Analysis

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Expanding the Network Evaluation Toolkit:

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ABSTRACT

Collective action networks are complex systems of interrelated individuals or groups that come together for a common social change purpose (Ernstson, 2011). Researchers have used social network analysis (SNA) to examine the relationship structures and characteristics of collective action networks. However, determining whether collective action networking produces outcomes has been challenging because networks are complex, affected by context, and produce interdependent data. I addressed these challenges by pairing SNA with qualitative comparative analysis (QCA), a configurational comparative method. Using QCA, researchers can tease out which conditions are necessary or sufficient to produce an outcome. I analyzed a collective action network of community-based resource management groups in Hawaii using SNA. Then, I analyzed the same network using an explanatory mixed methods case study. Finally, I used QCA to integrate the quantitative SNA data with qualitative case study data to determine what conditions were necessary and sufficient to achieve the network's desired outcomes. Finally, I reviewed the results from using these different methods to explore how QCA can be a useful tool for evaluators to add to their network evaluation toolkit.

KEYWORDS: Network evaluation, collective action network, social network analysis, qualitative comparative analysis, community-based resource management

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CHAPTER ONE: INTRODUCTION

As co-founder and director of a nonprofit organization, I wanted to know whether the work into which we were pouring time and resources was producing the intended social changes. Our organization theory of change was grounded in collective action networking. The theory was that bringing together people and organizations to address desired social change would produce better results than was possible when working in isolation (Ernstson, 2011; Holley, 2012; Kania & Kramer, 2011; Ostrom, 2009; Plastrik et al., 2014). The drive to discover whether collective action networking produced better results led me to the field of evaluation, in which I have specialized since 2012. Through those years, I have continued to try to answer the core question of whether networking produces desired outcomes. What I thought would be a straightforward search has taken me on an archeological dig through research methods. I have learned that I am not alone in this search to discover the appropriate methods to answer the question of whether networking produces desired outcomes. The field of evaluation has suffered from a lack of methodological clarity about how to evaluate networks.

In this chapter, I present the crux and significance of the problem affecting network evaluation. I explore prior literature to describe the key concepts related to the problem, the developmental progression of my understanding of the problem, and the

gaps in the literature. I conclude this chapter with how the information explored herein has led to the purpose and key questions under investigation in this research and, therefore, how this research can contribute to the knowledge base for several audiences.

Description of Research Problem

Nonprofit organizations, government agencies, and foundations are investing heavily in collective action networking, which may be framed as networking, collaborating, coalition-building, collective impact, or similar terms (Brown et al., 2020; Varda & Sprong, 2020). For example, the National Skills Coalition created Skills2Compete as state-based coalitions to increase workforce development opportunities and outcomes. State coalitions engage cross-sectoral partners such as funders, lawmakers, educational institutions, community-based organizations, and businesses with a common goal to improve job preparedness for adults (Leung, 2016). These networked approaches have become more common over the past 30 years and have been called "the norm to address public health and social problems" (Wolf et al., 2020, p. 9); "a mainstay of community-based health promotion efforts" (Kegler et al., 2020, p. 140); and even a "best practice in solving complex problems" (Varda & Sprong, 2020, p. 67).

The purpose of investing in collective action networking is to increase opportunities for social change while reducing barriers through sharing information, increasing efficiency, limiting redundancy, improving policy and practice, and targeting support and funding from multiple sources to the same issue (Kania &

Kramer, 2011; Plastrik et al, 2014). Through working together, network partners are supposed to find and implement solutions to persistent, wicked problems that they would not be able to solve on their own. Wicked problems are complex, evolving, and seemingly entrenched, with multiple layers of overlapping problems and subproblems that people define and understand differently (Weber & Khademian, 2008). Poverty, climate change, and racism are wicked problems, for example. Wicked problems often have been defined by their complexity:

> The social and political complexity associated with such problems can be overwhelming. Participants or stakeholders in the problem are numerous, with a variety of worldviews, political agendas, educational and professional backgrounds, programmatic responsibilities, and cultural traditions. And the participants come and go depending on the way in which a wicked problem affects individuals, organizations, or groups of people at any given point in time. (Weber & Khademian, 2008, p. 336)

Because of the complexity of wicked problems, it has been difficult to empirically connect the strategy of collective action networking to outcomes despite the investment by nonprofit organizations, government agencies, and foundations. Cabaj and Weaver (2016), in an article reviewing the state of collective impact, concluded, “The jury is still out on the ability of [collective impact] efforts to generate deep, wide, sustained impact on tough societal challenges” (p. 12). In a literature review about coalition evaluation, authors sought attributable outcomes in 55 articles and concluded, “The same challenges which limited the field a decade ago remain…with limited to no examination of how the coalition(s) influenced program effectiveness” (Kegler et al., 2020). Given the urgency and importance to people’s lives to reduce the grip of wicked problems, along with the investment in collective

action networking to do just that, one might expect a more robust connection between networking and the desired social change outcomes.

Why is the connection between collective action networking and social change outcomes elusive? To make the connection would require an understanding of the collective action network, an understanding of the outcomes, and an understanding of links between them. Just as wicked problems are complex, collective action networks are complex. Evaluating them is complicated, as many authors in a coalitions-focused issue of *New Directions for Evaluation* acknowledged (Brown et al., 2020; Hilgendorf et al., 2020; Kegler et al., 2020; Price et al., 2020; Stachowiak et al., 2020; Varda & Sprong, 2020). Just like wicked problems, network scenarios are complex and affected by shifting contexts (Carolan, 2014; Ernstson, 2011).

Complexity in network scenarios affects the research methods evaluators can use to study them. In my own search to establish whether networking leads to outcomes, I learned that I could not use inferential statistical approaches for the network contexts in which I worked. The networks were small, and the data were interdependent—both characteristics that would have led to questionable results from inferential statistical analyses (Borgatti et al., 2018; Carolan, 2014). Qualitative methods did not establish a clear causal link between networking and outcomes. Social network analysis (SNA) was tailor-made for research about networks and complexity. SNA produces information about the structures and patterns of interconnectivity between groups (Borgatti & Halgin, 2011). Neither small sample sizes nor interdependency present a problem for SNA. Using SNA, I gained clarity about

whether networking was increasing connectivity. However, SNA could not determine whether increased connectivity was important to producing the desired outcomes.

I had almost given up when I learned about a method with which small and medium sample sizes could be used in complex situations. Qualitative comparative analysis (QCA) is a case-based research method rooted in mathematical set theory, Boolean algebra, and the logic of agreement and difference (Ragin, 1987). Ragin (1987) developed QCA to unravel causal complexity and utilize both qualitative and quantitative data. The result of QCA is a causal pathway that identifies the conditions that are necessary and sufficient to produce an outcome (Ragin, 1987; Ragin 2005). With this research, I explored the methodological question of whether SNA could be combined effectively with QCA to establish a clear empirical connection between collective action networking and social change outcomes.

Review of Relevant Scholarship

Given the collective action networking context and the complexity of typical network scenarios, this was research was grounded in both (1) collective action theory and (2) systems and complexity theory. Collective action theory provided framing for the situational context, meaning that the research questions, data collected, and results both reflected and contributed to the established knowledge about collective action. Systems and complexity theory provided framing for the methodological context, meaning that the research methods, questions, and approaches were designed to be appropriate for complex systems. SNA and QCA, as the foci for this study, have been established as acceptable methods to study complex systems (Borgatti et al., 2009;

Mello, 2021; Ragin, 1987). The relevant scholarship for collective action theory, systems and complexity theory, SNA, and QCA is described below.

Collective Action Theory

Prior research about collective action theory has provided a definition and variables of collective action. Collective action theory addresses the behavior of individuals in interdependent situations (Ostrom, 2009). While some researchers have hypothesized that individuals in interdependent situations will behave in ways that prioritize their own interests over the collective interests of a group, even to their long-term detriment, other researchers have identified situations in which people have self-organized for mutual benefit (Kim & Bearman, 1997; Ostrom, 1990, 2009). Collective action theorists have worked to uncover the variables that distinguish between self-interested behaviors and mutually beneficial behaviors. While research continues, Ostrom (2009) has compiled some of the variables:

- The structure of connectivity between group members
- Whether individuals are compelled to participate
- Historical actions
- Face-to-face communication
- The nature of the collective benefit
- Who bears the costs of collective action toward a common benefit
- A sense of personal contribution to a collective benefit
- The number and heterogeneity of individuals

Collective action networks come together to affect social change. Collective action theorists hypothesize that, depending on the variables above, participants in a network may contribute, "free-ride" or cheat, or opt out entirely (Ostrom, 2009, p. 6). But Kim and Bearman (1997) argued that the free-ride element of collective action theory ignored a key network dynamic, which is that networks raise participants' consciousness and build consensus that spurs participants to trust and action (also Kim, 2018). So, when evaluating networks through a collective action theory lens, one should consider the role of trust, consciousness-building, and consensus-building in addition to Ostrom's (2009) named variables. It has been suggested that some of these variables can be described using SNA; specifically, networks with greater density, degree centralization, and multiplexity are more likely to engage in collective action (Crossley & Ibrahim, 2012).

Systems and Complexity Theory

While collective action theory provides framing for the "what" (a network), systems and complexity theory provides framing for the "how" (methods). The research methods must be appropriate to the context. In this case, the network context is a system including boundaries and links. A system is a bounded set of parts and the links between those parts (Hummelbrunner, 2011). Collective action networks are bound by the collective action motivating the network. The parts are the participants of the network, whether these are individuals, groups, and/or organizations. The links are the relationships between them. The participants share common interests or functions that also are interrelated and comprised of nested layers (Jolley, 2014; Walton, 2014).

The participants also affect the system itself and the other parts of the system, which creates a co-evolutionary dynamic (Walton, 2016). I will revisit this interdependent nature of networks later, as it affects the research methods that are appropriate to use with networks.

Hummelbrunner (2011) described the characteristics of links in a system. For a network, understanding the relationships between participants requires considering the purpose for the different relationships in the system, including for the network overall and for each link in the network. Power dynamics affect all the actual and possible links, including the boundary of who is included in the system and who is kept out.

Evaluating a system is complex. Considering the characteristics of a system, evaluators must investigate the parts of the system, the amalgam, the patterns of interaction, the role and effects of power, and the feedback effects throughout the system. Evaluators must do this within a context that is emergent, adaptive, unpredictable, dynamic, and nonlinear (Hummelbrunner, 2011; Jolley, 2014; Walton, 2014). Evaluation has borrowed elements of theory from the fields of economics, sociology, psychology, ecology, technology, and more to develop evaluation approaches appropriate for complex systems. Systems thinking and complexity science, also called complex adaptive systems or the complexity of systems, have been adapted for evaluation from these other fields (Gates, 2016; Walton, 2016). Although the evaluation of complex systems has been receiving increased attention (Gates, 2016; Walton, 2014; Walton, 2016), a singular approach to this evaluation context has

been elusive (Walton, 2014). What is clear is that complexity affects every step of an evaluation (Gates, 2016; Walton, 2016).

Hummelbrunner (2011) suggested that evaluators approach the evaluation of complex systems by thinking systematically rather than using a stepwise set of rules or actions: “Thinking systemically is about making sense of the world rather than merely describing it, a sense-making process that organizes the messiness of the real world into concepts and components that allow us to understand better” (p. 397). Cabrera et al. (2008), Hummelbrunner (2011), and Walton (2014) contributed suggestions about the process of sense-making evaluators of systems should use. I have combined and summarized the suggestions here:

- Defining the boundaries, level, and unit of analysis of a system
- Describing the context in which the system exists
- Describing the interrelationships present in the system, including who benefits and how, who controls resources and how, who makes decisions and how, and what expertise is valued or ignored
- Describing the distinctiveness of interrelationships, including both what they are and what they are not
- Unpacking motivations, behaviors, values, and feedback effects throughout the system
- Using participatory methods to understand participant perspectives
- Using case study and comparison designs
- Using mixed methods and multiple methods (also Kallemeyn et al., 2020)

- Attending to evaluation timing because systems are nonlinear. Identifying discreet variables and parsing out attribution in such conditions is challenging, at least in part because the nonlinear nature of systems confounds temporal precedence (Jolley, 2014; Kallemeyn et al., 2020; Mowles, 2014).
- Framing evaluation in social science theory to help "organize the messiness" (Hummelbrunner, 2011, p. 397)

These suggestions are not a prescriptive approach to evaluation using systems and complexity theory, but they provide guidance on how to operationalize systems and complexity theory in research and evaluation practice. Using systems and complexity theory as the methodological frame for this research added clarity about the research methods, questions, and approaches I used. Next, I review two methodological approaches, SNA and QCA, that others have found useful in evaluating complex systems.

Social Network Analysis

My own search for evidence about the effectiveness of collective action networking led me to SNA, which offers multiple benefits to network evaluation but falls short of answering the question about whether collective action networking produces social change outcomes. SNA has been cited as a method appropriate for complex contexts, and it is tailor-made for collective action networks (Gates, 2016; Kallemeyn et al., 2020; Varda & Sprong, 2020; Walton, 2014). The unique contribution of SNA is that it provides an understanding of the structures and patterns

of relationships within a system (Bodin & Prell, 2011; Borgatti & Foster, 2003; Brandes et al., 2013; Durland & Fredericks, 2005; Lawlor & Neal, 2016). I have used SNA to better understand the structures of networks and the effectiveness of different networking strategies (e.g., gatherings, workshops, site visits, communication) toward increasing connectivity. Unfortunately, SNA could not help me understand outcomes about factors other than relationship structures and patterns. Connectivity in a network may have increased, but to what end?

Some researchers have attempted to use SNA to link networking to non-relational outcomes, but their use of SNA data is questionable. Some have used SNA statistics as independent variables for inferential approaches to research and outcome evaluations, which may appear to be a logical solution (Daly et al., 2013; Kegler et al., 2020; Maglajlic & Helic, 2012; Popeier, 2018). Importantly, the interdependence of SNA data may create instability in inferential models (Bodin et al., 2017; Brandes et al., 2013; Carolan, 2014; Chung et al., 2008; Fredericks & Durland, 2005; Hollstein, 2014; Popeier, 2018). Importantly, the most common inferential statistical tests such as regression, correlation, and ANOVA were developed from probability theory and are meant to be employed when random sampling is utilized. Random sampling typically is not used in evaluations involving SNA (Carolan, 2014). If SNA data are both interdependent and non-random, then using such data with inferential statistical tests is a practice researchers should avoid if they care about the accuracy of the results.

Other researchers have combined SNA and qualitative data, which produced interesting results but still fell short of establishing an empirical connection between

networking and non-relational outcomes. In these studies, SNA helped to tell the story of relationship structures and patterns, while qualitative data from interviews, documents, focus groups, and/or observations added context and meaning (Berthod et al., 2017; Bodin et al., 2017; Cvitanovic et al., 2017; Maglajlic & Helic, 2012; Marshall & Staeheli, 2015; Martínez et al., 2003; Pitts & Spillane, 2009; Sandström & Carlsson, 2008). Several authors discussed challenges with their studies due to complexity and results that were not as enlightening as researchers had hoped. For example, in a study combining ethnographic methods with SNA, the authors concluded that interorganizational networks "are still in need of an appropriate research methodology" and urged future researchers to continue mixed methods research with SNA and ethnography or other qualitative methods (Berthod et al., 2017, p. 315). Similarly, Bodin et al. (2017) were confounded by what they described as an "entanglement of cause-and-effect pathways" that were further complicated by "a substantial amount of 'noise,' which further amplifies the need for more empirical research" (pp. 309-310). Although SNA has been useful in revealing relationship structures and patterns, it has not conclusively helped researchers or evaluators establish a connection between those relationships and social change outcomes. Evaluators and researchers may be able to use QCA, which I describe next, to fill this analytical gap.

Qualitative Comparative Analysis

QCA is a promising method with several benefits to untangle the methodological conundrum of how to connect collective action networking to social

change outcomes, based on the purpose for which QCA was created and the results it produces. Ragin (1987) developed QCA to be used in situations where "causal complexity" frustrated traditional inferential statistical approaches (Mello, 2021, p. 1). Causal complexity refers to complex situations in which there are multiple pathways to an outcome or combinations of conditions that might contribute to an outcome (Mello, 2021). Using data from multiple cases that have achieved a certain outcome to varying degrees, the analysis teases out which conditions those successful cases had in common (Kahwati & Kane, 2020). My research tested the methodological idea that I could enter into a QCA algorithm data including SNA data from network groups that achieved outcomes to varying degrees to determine whether networking was connected to desired outcomes.

That desired result to connect networking with outcomes is the primary benefit of QCA as a network evaluation tool. QCA does not suffer the same constraints regarding sample sizes and data independence that inferential statistics approaches do (Kahwati & Kane, 2020). Whereas traditional inferential statistical tests utilize linear algebra, QCA utilizes Boolean algebra, mathematical set theory, and the logic of agreement and difference. Nor does QCA require random sampling, again because it does not involve inferential statistics, which were derived from probability theory. Sample sizes and random sampling also are not an issue because the purpose of QCA is not to statistically generalize to a population but to explain the conditions that were necessary or sufficient for an outcome. Nor is QCA constrained to a single method or type of data; it works with both quantitative and qualitative data.

My research focused on the methodological combination of SNA and QCA as two tools used in concert to explore the connection between networking and social change outcomes. I aimed to add a methodological approach to evaluators' toolbox that could produce more robust evidence about the value of collective action networking.

Gaps in the Literature

QCA has been used in many fields, including evaluation, but has not been paired often with SNA. While English-language evaluation journals have published a handful of articles about QCA, the most significant contribution came in 2020 with Kahwati and Kane's book about using QCA for mixed methods research and evaluation. Throughout the book, the authors incorporated many examples of evaluations and research that used QCA, but QCA was never used with SNA. In a review of methods used to evaluate the effectiveness of coalitions, Kegler et al. (2020) found that SNA, quasi-experimental design, case study, multiple case study, cross-sectional study, and others had been utilized. The authors did not mention studies using QCA.

I found three prior studies that paired comparative case studies with SNA (Bodin et al., 2017; Sandström & Carlsson, 2008; Velastegui, 2013). Only Velastegui (2013) utilized QCA and SNA, though she did not ask an evaluative, outcomes-oriented question. Rather, she was interested in whether teachers' structural positions in a network were causally linked to their leadership and influence. These examples hinted that SNA is methodologically compatible with QCA. None of the studies

combined SNA and QCA to answer an outcomes-oriented evaluation question, and they did not answer the question of how networking connects to outcomes.

Research Objectives

The purpose of this research study was to discover whether combining SNA with QCA could produce informative results about the contribution of collective action networking to desired outcomes. For the purposes of this study, I used the word "contribute" in the context of evaluation. For evaluators, contribution is a determination of whether certain activities *helped to* affect the observed outcomes. Contribution, in this context, is different from attribution, which implies that activities were shown to cause the outcomes (Almquist, 2011). I endeavored to determine whether networking contributed to, or *helped to* affect, outcome achievement by participating groups, recognizing that other activities and circumstances also may have contributed to, or helped to affect, outcome achievement by those groups.

For this research, I undertook a series of three scaffolded studies. In the first study, I used a quantitative, descriptive, nonexperimental design focusing on the structures and relationship characteristics of a network. In the second study, I used an explanatory mixed methods case study. The quantitative data from Study 1 stood as the initial quantitative strand for the mixed methods case study. I used information from the quantitative strand to inform the development of an interview protocol and interviewee list for the qualitative strand. Qualitative data, including interviews and archival documents, provided context and explanation for the quantitative results. I used QCA to integrate the quantitative data (including SNA) and qualitative data,

teasing out the conditions that were necessary or sufficient to achieve network outcomes. Finally, the third study featured a comparison of Study 1, the quantitative study using SNA, to Study 2, the explanatory mixed methods case study using QCA with SNA. Through these three scaffolded studies, I answered the research questions below.

Research Questions

Based on the problem and gaps in the literature, the research questions guiding this research were as follows:

Study 1: Social Network Analysis

- To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?
- To what degree were intended outcomes achieved by the E Alu Pū network and member groups?

Study 2: Quantitative Comparative Analysis

- For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?
- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

Study 3: Comparing Findings from Study 1 with Findings from Study 2

- How can SNA and QCA be combined effectively to explore the connection between collective action networking and social change outcomes?

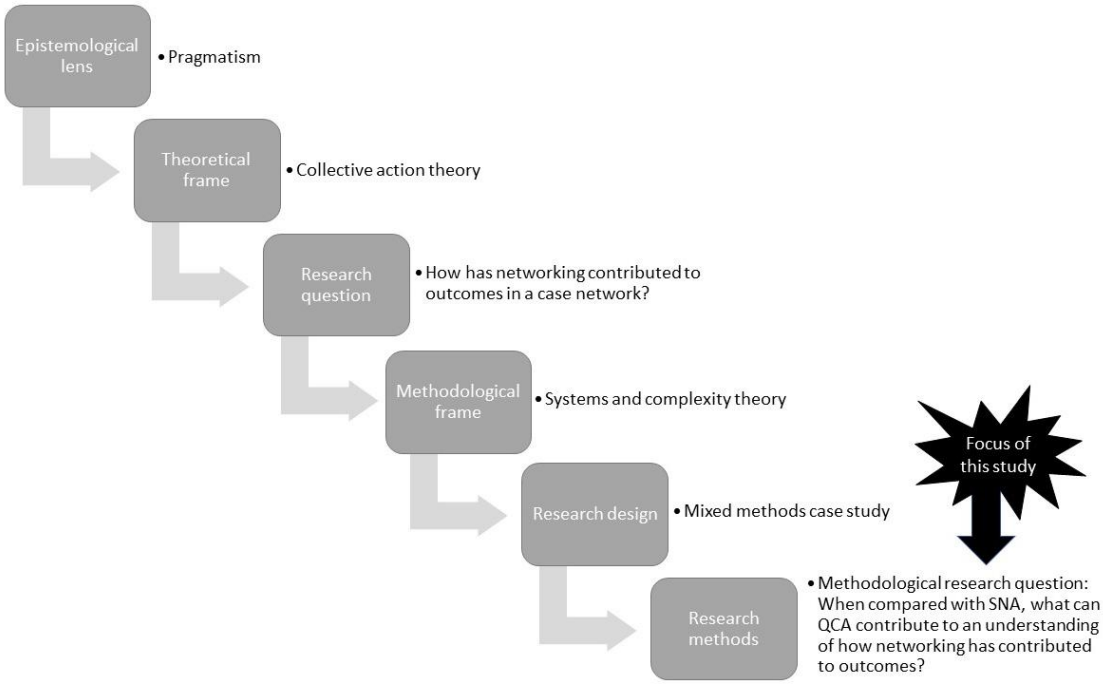
The research was driven by the overarching methodological question about the contribution of combining SNA and QCA to evaluate collective action networks. By conducting the first study that focused on network characteristics and relationships, I was able to evaluate a network using standard survey techniques with SNA results. By conducting the second study that provided context and explanation for the case, I gathered the case data required for QCA and concluded the study by using QCA to integrate the quantitative and qualitative data. By comparing the results of SNA with the results of QCA, I was able to examine what combining these tools contributed to an overall understanding of the outcomes of a collective action network.

Figure 1 summarizes the problem described in this chapter and how it led to the research questions. The overall epistemological lens for this study was pragmatism, a pluralistic worldview that emphasizes the research question as opposed to methods and welcomes all types of data to help answer the question (Creswell & Plano Clark, 2018). The problem was situated within the theoretical frame of collective action theory. The initial question I set out to answer as a nonprofit co-founder and director was whether networking contributed to outcomes. In selecting the research methods used to answer the question, I considered systems and complexity theory. Based on the inherent complexity of the research scenario, I chose explanatory mixed methods case study as the research design. This design integrated quantitative and qualitative data to examine the case of a specific network. To answer the question about how networking contributed to outcomes, I needed to understand the network, the outcomes, and any link between the two. I used SNA to examine the network, and I explored quantitative

and qualitative data to examine the outcomes. From there, I incorporated SNA into QCA to see whether the combination could establish a clear connection between collective action networking and outcomes achievement.

Figure 1

Path from Problem to Methodological Research Question



Contribution of the Study

My research contributes to the knowledge base for five audiences: the case network and its stakeholders, evaluators (both practitioners and researchers), network facilitators and funders, network scientists, and mixed methods researchers. First, the case network under consideration for this study, E Alu Pū, will benefit from the results

about its own networking and outcomes. The study has provided an opportunity for the network coordinator and facilitating organization, network member groups, funders, partners, and other stakeholders to learn about intended and unintended outcomes, in addition to how the networking strategy has affected member groups and conditions. The results have become part of the network's story while surfacing opportunities for improvement.

Second, the tools and models available to evaluators for network evaluation are not sufficient to address the key evaluation question of merit determination. Evaluators have been using methods improperly or doing the best we can with the models available. This research has the potential to influence evaluators to adopt QCA as a tool to combine with SNA for a better approach to network evaluation.

Third, network facilitators and funders invest in a networking model because they believe it will produce better results than non-networking models. Because data about networks is complex and taken from a small number of interdependent observations, there is a dearth of rigorous, credible evaluation to support such considerable investment in networks. This study resulted in findings about whether networking contributed to outcomes in a case network, and it can contribute a possible method to affirm whether the investment in networks is supported by the evidence.

Fourth, the study built upon the research base about the different dimensions of networks. QCA has added another layer of empirical integrity to the interpretation of SNA data. This can further inform the network researcher community, and it may

continue to push SNA from its use as a data analysis tool toward its use as a social science method.

Fifth, the research should interest mixed methods researchers. The defining characteristic of a mixed methods study is the integration of quantitative and qualitative data (Creswell & Plano Clark, 2018). SNA and QCA are both mixed methods. This research has provided evidence about the use of QCA as a mixed methods integration tool. Also, because this research combined these two mixed methods tools in a new way for a new purpose, it has the potential to contribute to the knowledge base of these multiple audiences.

Chapter One Summary

Partners in collective action networking need to know whether they are contributing to the change they were created to produce. Even more, they need to know what they are doing that is contributing to change and what they are doing that is not so they can focus their limited time and resources toward what works. Funders, supporters, and partners of networks need to know how to better support networks and coalitions. Networks and their funders look to evaluators to discover this information, and evaluators have tried to deliver. However, evaluators have been using tools ill-suited to the task. This research sought to establish whether QCA combined with SNA could answer the important question of whether networking contributes to desired social change outcomes. The result can help other evaluators provide the evidence networks need to better serve their social change goals.

CHAPTER TWO: REVIEW OF THE LITERATURE

Evaluators strive to understand the value of organizations, programs, policies, and projects, but doing so can be difficult in the increasingly complex environments in which they work (Patton, 2015). A specific case of a complex environment for evaluation is that of collective action networks, in which groups or individuals work together to solve wicked problems that are seemingly intractable, evolving, and multilayered. In this case, wicked problems lead to wicked evaluation problems (Ernstson, 2011; Weber & Khademian, 2008). These problems include the shifting contexts and stakeholders evaluators must manage, nonlinear programming with unclear beginnings and endings, varying perspectives, and complicated relationships (Hummelbrunner, 2011; Jolley, 2014; Walton, 2014). Many traditional methods used for evaluation and research cannot effectively cut through this complexity to get to the core evaluation purpose of determining merit.

To help with these wicked evaluation problems, evaluators have turned to systems and complexity theory because these interrelated theories focus on the nature of systems and change within systems (Walby, 2007). A collective action network is a system, or "a whole made up of two or more related parts," along with the relationships between those parts (Cabrera et al., 2008, p. 302; see also Hummelbrunner, 2011). Systems theory has helped evaluators understand which

characteristics of a system to empirically observe, and complexity theory has helped evaluators understand which characteristics of change within a system to empirically observe. Cabrera et al. (2008) analyzed systems and complexity theory and summarized key elements that evaluators should consider when evaluating complex systems:

> Any evaluand can and should be viewed in the same way that transforms contextual patterns: as parts, wholes, and the relationships among them; as well as the relationships between the program and the larger, external forces with which it rests; distinctions must be made to set boundaries on the scope of a program and thus, establish criteria as to what can be measured to make assessments; and finally, the ability to take varied perspectives enables evaluators to better understand the richness of both a program's content and the system of which it is a part. (p. 302)

As seen in these descriptions of systems and complexity, relationships play an important role and deserve evaluators' attention (Popeier, 2018). Ignoring relationships in an evaluation—especially an evaluation of collective action networks—equates to studying an artificial environment that does not exist. Evaluators have adopted social network analysis (SNA) to understand relationships. SNA helps to reveal relational systems, the structure of relationships, the processes between participants, and the patterns revealed through those processes.

While SNA has been helpful, it does not enable evaluators to discover the key piece of information they are most interested in, which is whether the relational system and its processes contributed to outcomes or results. A possible solution to this problem is available by combining SNA with qualitative comparative analysis (QCA), a configurational comparative method. QCA was designed for use in complex

situations to determine the necessary and sufficient conditions for an outcome. If SNA and QCA are used together, evaluators may be able to determine what conditions come together to contribute to desired social change outcomes within complex environments.

What follows is a review of the most important constructs in this study. First, I describe networks and, specifically, collective action networks, which are groups that act collectively to produce social outcomes (Ernstson, 2011). I describe the different ways networks have been characterized in the literature to provide useful context when I then turn my attention to the evaluation of collective action networks. I then define SNA and review its development for the purpose of analyzing the structures and patterns of relationships in networks (Borgatti & Halgin, 2011). Then I review how SNA has been used in evaluation, including the benefits and limitations of using SNA in evaluation. I then shift the focus to QCA. I define QCA and review its development. Then I review how QCA has been used in evaluation, including the benefits and limitations of using QCA in evaluation.

The purpose of reviewing these two methods is to contribute to the toolkit evaluators have available to evaluate collective action networks within their complex contexts. Evaluators have had difficulty determining the merit of collective action networks. Using SNA has brought new insight about the structures and patterns of relationships, but evaluators cannot use SNA to determine whether networking produced desired program outcomes about factors other than relationship structures

and patterns. QCA is a possible addition to the network evaluators' toolkit, enabling a determination of whether networking itself makes a difference.

Defining Networks

To begin to understand how networks can be studied, understood, and evaluated, I will first define them and then situate them within their field of study. Networks are complex systems, which affects the way researchers and evaluators study them. Within the larger body of research about systems is the study of systems that exhibit the characteristic of interrelationship (Brandes et al., 2013). Called a network, this type of system is defined broadly as one that consists of individuals or groups and the relationships between them (Borgatti & Halgin, 2011). A social network, using this broad definition, is a system of social or personal relationships such as a community of neighbors, an organization of colleagues, students in a class together, a group of friends, family members, and so on. (With the advent of web-based social networking technologies, a social network is also known as the links established through those tools—Twitter, Instagram, and Facebook, for example. Web-based social networks are not the focus of this study.)

To study a network system, researchers turn to network science, the study of relational data. Network science, the field within which SNA is seated, is a transdisciplinary field from which evaluators can bring into their work a different way of seeing. Researchers in disciplines such as management, public policy, epidemiology, ecology and conservation, education, anthropology, sociology, and more have contributed to network science (Bodin et al., 2008; Borgatti et al., 2009;

Borgatti & Halgin, 2011; Brandes et al., 2013). Many of these disciplines are rooted in scientific theories that focus on the individual and generalize to a population, so network scientists have had to learn a new way of looking at things. Network science incorporates the study of individual parts or elements of a network, the relationships between those elements, and the overall structure of the network (Brandes et al., 2013). Evaluators studying networks benefit from a similar ocular shift. To understand a network is to don a multidimensional perspective that understands that the parts of a network affect each other and create feedback throughout the system.

This new way of seeing began with researchers from at least the 1930s and has continued to the present. Understanding what these network scientists discovered provides a foundation upon which network evaluators today can build. At the foundation, then, are the multiple dimensions that network scientists have used to describe networks. These include formality, level, role, and relationship, each of which I will define below. To evaluate a network, an evaluator must understand the dimensional characteristics of that network. With enough data from enough networks from enough disciplines, network scientists will gain an understanding of how varying degrees of the different dimensions affect other aspects of a network such as trust, efficiency, motivation, equity, and so on. By studying networks and contributing to the larger network science conversation, evaluators can contribute important information about how the different dimensions of networks affect or reflect leadership, resiliency, and adversity that can quash or buoy a social change effort.

Dimensions Along Which Networks Differ

Formality of Networks

Networks can be formal (also called "realist") or informal (also called "nominalist") (Borgatti & Halgin, 2011; Guerrero et al., 2017). Formal or realist networks have more clearly established boundaries because of deliberate grouping, while informal or nominalist networks are systems of naturally occurring relationships among people or groups without an organizing hand (Borgatti & Halgin, 2011; Guerrero et al., 2017). Consider the faculty of a traditional brick-and-mortar university as an example. The faculty comprise a formal network that is bounded not by naturally occurring relationships but by an organizing body, the university. An informal network within the same faculty might be a friendship group that forms across colleges out of a shared interest. An informal network is bounded based on the researcher's interests (Borgatti & Halgin, 2011). For example, if researchers are interested in *friendship*, they will discover a different network from researchers who are studying the same individuals but who are interested in *communication*. Each network has a unique structure and is associated with different network characteristics for individuals and for the network. By determining the boundaries of the network, an evaluator might study a formal or an informal dimension of the network.

Levels Within Networks

Within a network, researchers can study individuals, often called an "ego network," subgroups, and whole network. Returning to the example of a university, researchers could study the *ego network* of individual faculty members and the

relationships between them. Or researchers could study *subgroups* of faculty within different colleges or departments or leadership positions. Or researchers could study the *whole network* of all faculty members at the university. To set boundaries, researchers depend on their research questions and their perspectives on the roles of networks.

Roles of Networks

The roles of networks are debated among network scientists, with some roles widely affirmed and other roles hotly debated. What network scientists agree about is that networks affect the flow of information and knowledge (Borgatti & Halgin, 2011). For example, a highly connected department chair at a university likely will play an important role in disseminating information to their network. On the other hand, network scientists fundamentally disagree about the *action* role of networks: Some say networks act to affect outcomes, and others say networks do not affect but rather are affected by context and the actors that comprise the network (Borgatti & Foster, 2003). This is a crucial difference. Consider graduate students who decide to form a group to study together for comprehensive exams. If these students perform better on comprehensive exams, the two camps of network scientists disagree about why this group was successful. One camp of network scientists, the structuralists, assert that the act of studying *together* produced the outcome of better comprehensive exam scores. In other words, the structuralists assert that the network structure itself produced the outcome. Another camp of network scientists, the connectionists, assert that good students connected because of their shared motivation to study. In other words, the

connectionists assert that the students' characteristics affected the network structure and, therefore, the outcome of better comprehensive exam scores. The structuralist-connectionist debate is like the old chicken-and-egg question: What came first?

Network scientists who align with the structuralist perspective believe that network theory indicates that different network structures affect outcomes with differing levels of effectiveness (Borgatti & Foster, 2003; Groce et al., 2019). However, researchers who align with the non-structuralist, connectionist perspective do not believe that it is theoretically feasible for networks to affect outcomes. These network scientists believe that the people or groups who comprise the network within a context affect both the outcomes and the network structure (Borgatti & Foster, 2003).

> From a theoretical point of view, comemberships, coparticipations, geographic proximities, and trait similarities can all be seen either as dyadic factors contributing to the formation of ties (e.g., meeting the other members of your club) or as the visible outcomes of social ties (as when close friends join the same groups or spouses come to hold similar views). (Borgatti & Halgin, 2011, p. 1170)

To provide evidence that might settle the chicken-and-egg question, the two camps, structuralists and connectionists, produce different types of studies: The connectionist camp produces studies about the causes of network structures (called theory of networks), and the structuralist camp produces studies about the consequences of networks (called network theory) (Borgatti & Foster, 2003; Borgatti & Halgin, 2011; Brandes et al., 2013; Fredericks & Durland, 2005). Evaluators should understand their own perspective and approach evaluation of networks with clarity about whether the function of networking acts to produce outcomes or whether the

network is acted upon by participants and context that produce outcomes. The research questions and interpretation of data will fundamentally shift depending on the perspective. Based on collective action theory, I am approaching this study from a structuralist perspective.

Relationships Within Networks

Further complicating matters is the fact that there are different types of relationships present in any network. Borgatti and Halgin (2011) described role-based or perceptual relationships that can be described by strength, intensity, and duration. Event-based relationships, on the other hand are "discrete and transitory" relationships that can be described by the number of interactions or frequency of occurrence (p. 1170). Examples of role-based relationships within a university setting are professor-to-student, faculty member-to-faculty member, student-to-financial aid, professor-to-research area, and so on. Examples of event-based relationships within a university setting are connections between prospective students and current students on interview day, new connections between short-term university event attendees, faculty publishing with different types of journals, and so on. Different types of relationships can result in different types of networks (Borgatti & Halgin, 2011), which loops back to the prior theoretical discussion about whether networks act upon or are acted upon.

Additional research about the theory of networks and network theory is needed to build upon the foundation of our understanding of network dimensions and complexity. It is possible that additional dimensions of formality, level, role, and relationship could be defined. It also is possible that new dimensions altogether could

be identified. Researchers also could address the debate in the current literature about whether networks are affected by context or affect context; new empirical evidence could indicate, as reason suggests, that both can be true.

Collective Action Networks

Now that we share an understanding of what networks are and the dimensions used to describe networks, we can attend to the specific type of network that is the focus of this study, the collective action network. Collective action networks are distinct from other types of organized groups in that the network develops formally or informally when people or groups of people come together for a common social change purpose that requires sustained effort (Christens, 2019; Holley, 2012; Plastrik et al., 2014). This type of network is called a "collective action network" because the people or groups in these networks act collectively to transform society (Ernstson, 2011). This type of network may be confused with a coalition or an organization, but these are different from a collective action network. A coalition tends to be more informal than formal, and the relationships tend to be temporary. Participants come together for a limited time, usually to advocate for a single outcome such as a policy change (Holley, 2012). On the other hand, an organization tends to be more formal, with hierarchical roles and established boundaries (Holley, 2012). Collective action networks can be distinguished from coalitions or organizations in that they exist beyond a single outcome and are sustained over a longer period. Also, their boundaries and hierarchies often are difficult to define, if not altogether absent (Holley, 2012). I

use the term “collective action network” and “network” interchangeably throughout this document to describe these social change–seeking networks.

Evaluating Collective Action Networks

As established above, collective action networks serve a unique purpose, which is social change (Ernstson, 2011). Understanding this purpose is important for framing an evaluation of a collective action network. If an evaluation is meant to determine merit (Davidson, 2005), then the merit of a collective action network, arguably, is determined by whether it is producing the desired social change. To understand how the network operates to achieve its social change purpose, evaluators can describe the dimensions of the network as described above. But beyond describing the network, what tools and processes can evaluators use to determine the merit of a network? Given the complexity of networks and the still-emerging nature of network science, perhaps it is not surprising that a tidy set of characteristics defining “successful” or “effective” networks has not been empirically identified (Bodin et al, 2017). Below, I briefly assess two trendy models and several methods that have been used for network evaluation.

In the last ten years, two groups of researchers have developed and heavily promoted two models of collective action networking that have been utilized for evaluation: the collective impact model and the PARTNER model. First, Kania and Kramer (2011) wrote about the collective impact model, claiming that successful networks shared five defined characteristics: a common agenda, shared measurement, mutually reinforcing activities, communication, and support organizations. Concerns

were raised because Kania and Kramer did not use empirical evidence from a systematic research approach such as grounded theory to create the model, did not root the model in the decades of collective action work that came before their 2011 article, and did not draw from any of the many well-established theories about social connection such as collective action theory (Varda, 2011). Varda and Sprong (2020) offered a competing model, called PARTNER, which stands for Program to Analyze, Record and Track Networks to Enhance Relationships. Varda and Sprong (2020) recommended that network success be measured by the strength of relationships, trust, value, relationship evolution, and achievement of shared goals. Both models lack attention to equity, context, power, and inclusion or exclusion, which have been cited as evidence of their deficiency (Holley, 2012).

Even though these models for network evaluation have been established, most evaluators have not utilized them for network evaluations. Popeier (2018) revealed what evaluators are using for network evaluation, and Bodin et al. (2011) proposed an improvement. First, researchers have used descriptive qualitative, quantitative, and mixed methods to describe network relationships or outcomes (Popeier, 2018). Reflecting the network science rift described above, some evaluators have explored how relationships in a program work, which is reflective of a connectionist point of view (Fredericks & Durland, 2005). Most have studied outcomes derived from networks, which is reflective of a structuralist point of view (Popeier, 2018). However, Bodin et al. (2011) decried the glut of descriptive research and called for empirical investigation and analysis.

Some may interpret the recommendation for empirical study and analysis by Bodin et al. (2011) as a call for the use of inferential statistics, but it is important to reconsider that interpretation. In fact, many quantitative studies have attempted to apply inferential statistics to the study of networks, which is troublesome (Popeier, 2018). Networks are, by their very nature, interdependent. Inferential statistics, which are rooted in linear algebra, are suited for independent observations. The interdependent nature of networks violates the assumption of independence critical to the proper functioning of traditional inferential statistics, especially because the interdependent characteristics of a network are typically the focus of interest (Bodin et al., 2017; Borgatti et al., 2018; Brandes et al., 2013; Fredericks & Durland, 2005; Popeier, 2018). While many evaluators and researchers have used inferential statistics with or without modifications to investigate networks, the results are questionable given the violation of independence of observations (Chung et al., 2008; Hollstein, 2014; Popeier, 2018).

Given this fundamental problem with using inferential statistical methods to study networks, researchers since the 1930s have been developing alternative methods. When Bodin et al. (2011) called for empirical investigation and analysis, they were, in fact, recommending that researchers interested in the effects of relationships use SNA to analyze systematically collected, empirical data using established, formal methods to parse out detailed variation (Bodin et al, 2011; also see Brandes et al, 2013; Fredericks & Durland, 2005; Maroulis & Gomez, 2008). Today, SNA is the most popular quantitative method used by researchers and evaluators to study networks

(Borgatti & Halgin, 2011; Popeier, 2018). To explore whether SNA is a sufficient, effective method for evaluating collective action networks, I next describe what SNA is, the history of its development, how it has been used in evaluation, and the strengths and limitations evaluators have encountered when using it.

Social Network Analysis

Defining Social Network Analysis

Network scientists debate whether to define SNA merely as a method of data analysis or as social science theory. Originally, SNA was developed as a method of data analysis used within the field of network science, which is based on social network theories. In its basic form, SNA combines graph theory and matrix algebra to analyze the relationships between actors in a system and the nature of the connection between them (Borgatti & Halgin, 2011; Fredericks & Durland, 2005; Groce et al, 2019). The unit of analysis in SNA is the interaction between actors (Fredericks & Durland, 2005). A network researcher is like an architect in reverse; instead of designing the structure, researchers study the intact structure and try to determine how it came to be that way and what difference the building materials and design of that structure have made. “According to this structural paradigm, observed behaviors and social life can be explained by structural relations and the patterns formed by these relations” (Popeier, 2018, p. 326). Based on this idea of patterns in social structure, network researchers can visualize and mathematically quantify relationships and the structures those relationships form (Sandström & Carlsson, 2008).

However, SNA has been elevated by some as a social science theory rather than merely a data analysis method. For example, Borgatti and Halgin (2011) argued that network researchers have contributed to social science theory concepts about structural equivalence, cliques, reciprocity, strong and weak ties, homophily, flow, and more (see also Bodin et al., 2011). Using its mathematical method should not erase its theoretical implications, they said, as math is used to reveal social structure theory. The debate continues about whether SNA is itself theory or method (Fredericks & Durland, 2005), as researchers continue to utilize SNA as both a framework to test theory and as a tool to develop theory (Borgatti & Halgin, 2011). For the purposes of this study, SNA will be used as it was originally intended: as a method of data analysis.

The Development of Social Network Analysis

As a method for data analysis, what has become known as SNA was first developed in the 1930s with hand-drawn graphs. It is now a robust analysis method with multiple software options, online applications, graphing programs, and methodological advances including the creation of types of SNA that can be used for inferential purposes (Fredericks & Durland, 2013). Beginning in the 1930s, sociologists created sociometry, which visualized social relationships. Sociometry was the first approach that became what is now known as SNA (Borgatti et al., 2009; Fredericks & Durland, 2013). Scientists developed matrix algebra and graph theory in the 1940s and 1950s. With the introduction of mathematical approaches, researchers uncovered the phenomenon of cliques and advanced the theory of social structures

(Borgatti et al., 2009; Fredericks & Durland, 2013). Through the first few decades of social structure studies in sociology and anthropology, the theory developed that there were deep, abiding patterns of social relationships that could be translated mathematically. In other words, these researchers purported that networks are both sociological and mathematical (Borgatti et al., 2009). By the 1980s, after researchers had developed an approach to visualizing webs of networks using graph theory, network science was an established field in the social sciences with a professional organization, academic journal and conference, and specialized software (Borgatti et al., 2009).

As SNA was incredibly tedious to complete by hand, the development of software starting in the 1970s enabled descriptive analyses, then structural analyses, then greater complexity with roles and subsets (Fredericks & Durland, 2013). These developments spurred the use of SNA by new fields and began pushing SNA out of the bounds of data analysis and into the sphere of social science theory. Physical scientists, management and economics researchers, epidemiologists, those studying public safety and national security, and more began using SNA and contributing to its theoretical and methodological development (Borgatti et al., 2009; Brandes et al., 2013; Fredericks & Durland, 2013; Groce et al., 2019). Development continues, and today researchers can produce statistical models of networks using exponential random graph modeling and can make statistical inference using forms of inferential SNA (Bodin et al., 2017; Borgatti et al., 2018; Chung et al., 2005; Fredericks & Durland, 2013; Sandström & Carlsson, 2008). These new modeling and inferential methods

contribute evidence for social science theories, further pushing SNA from its original boundaries as a data analysis tool and into the realm of social science theory. In evaluation, however, SNA has been utilized almost exclusively as a data analysis tool (Popeier, 2018).

Social Network Analysis in Evaluation

As SNA developed and spread into different fields, evaluators took note of the way it was being used to answer a variety of research questions. SNA especially has received attention within the field of evaluation as evaluators seek ways to understand complexity. Evaluators recognize the influence systems and relationships have on the organizations, policies, programs, and projects that they evaluate (Durland & Fredericks, 2005; Fredericks & Durland, 2005; Patton, 2015; Popeier, 2018). Many have turned to SNA to understand the roles relationships play between elements in a system (Durland & Fredericks, 2005; Fredericks & Durland, 2005; Popeier, 2018). SNA can contribute information assisting with different types of evaluation questions, as will be explored more below, with the essential feature that "the understanding of the phenomenon treats relational connectivity and dependence as central" (Brandes et al., 2013, pp. 11-12; also see Varda & Sprong, 2020). This feature is different from traditional research, in which the units of analysis are individual attributes. SNA can help evaluators to uncover how different relational systems are structured, elements that contributed to the composition of those structures (connectionist perspective), and whether different structures are associated with successful or unsuccessful outcomes (structuralist perspective) (Borgatti et al., 2009; Crona et al., 2011; Popeier, 2018).

While the benefits of using SNA are considerable, the main limitation is that evaluators cannot use SNA to establish whether networking produced desired social change outcomes.

Strengths of Social Network Analysis in Evaluation

Evaluators can use SNA to answer different types of evaluation questions, which is a primary benefit of the method. Evaluators can describe network structures at different levels, explore different network roles, and answer questions aligned with the structuralist or connectionist paradigms. Evaluators can focus their evaluation questions on the individuals in a network, subgroups within a network, or entire networks (Fredericks & Durland, 2005; Prell, 2011; Varda & Sprong, 2020). For example, an evaluator focused on the individual level might ask how an individual's relationships were related to their studying behaviors. An evaluator focused on the subgroup level might ask how peer groupings were associated with knowledge attainment. An evaluator focused on the network level might ask how the structure of a network successfully or unsuccessfully produced a flow of information in an educational program. An evaluator also can focus on more than one level to seek similarities and differences since the functioning of these different levels of a network affect one another (Prell, 2011).

These types of questions are common among evaluations that have incorporated SNA (Popeier, 2018). Evaluators also have used SNA to answer questions related to the different roles networks play. Popeier (2018) found evaluations that explored how networks affected the flow of information or goods, the interaction

between different elements of the system, social relationships and their ties, or more than one of these. Though the unit of analysis in SNA is relationships rather than individuals' attributes, evaluators have included attribute data as independent or moderating variables, with questions such as how diversity affects network structure and outcomes (Varda & Sprong, 2020).

Most often, evaluators who have used SNA have aligned with the structuralist perspective (whether or not they knew it), with interest in how the structure of networks have been related to the outcomes, achievements, successes, or goal attainment of networks (Bodin et al., 2011; Groce et al., 2019; Guerrero et al., 2013; Popeier, 2018). Evaluators' alignment with structuralism may be because they are focused on the outcomes of the activity of networking without awareness of the differing perspectives within the network sciences about the dimensional aspect of network role. Thus, at the individual level, evaluators strive to connect the network structure to the behavior of individuals as the outcome (Guerrero et al., 2013). At the network level, evaluators study the role of relational ties such as flow of information or resources through the whole network toward an outcome (Bodin & Prell, 2011). However, not everyone agrees with the validity of associating outcomes to network structure (Popeier, 2018; Varda & Sprong, 2020). The practice of linking network structure to external outcomes has been cited as a questionable practice (Popeier, 2018), as has using *process-oriented* data to draw *outcome-oriented* conclusions (Varda & Sprong, 2020). Popeier (2018) concluded, "Few evaluations have succeeded in linking observed network outputs with externally valued network outcomes in a

credible manner" (p. 346). This is an important issue for continued consideration and research, especially as evaluators have frequently used SNA in just this way.

Limitations of Social Network Analysis in Evaluation

Though evaluators have found SNA very useful to answer questions about the roles and effects of relationships, they should be aware that the method has discouraging limitations. As software accessibility has increased the popularity of SNA, evaluators who are not well-trained in social network theory or analysis may use the tools improperly (Popeier, 2018). The limitations include that SNA is fundamentally interdependent and descriptive in nature, that it was designed to tune out context, and that it cannot be used as is to correlate outcomes with network characteristics. I will review each of these limitations in turn.

Importantly, SNA produces quantitative *descriptive* data. As mentioned above, pairing SNA with statistical inference methods derived from linear algebra like regression is a questionable practice used surprisingly frequently to link network structure to outcomes (Popeier, 2018). Methods of statistical inference that are based on linear algebra require independence of observations and random selection for statistical validity. SNA data is *interdependent,* and random or non-random selection depends on the evaluation context. Entering the numerical output of SNA data gathered non-randomly into, for example, a regression model, violates two key criteria and renders results with questionable statistical validity (Bodin et al., 2017; Borgatti & Halgin, 2011; Maroulis & Gomez, 2008; Popeier, 2018). Evaluators may think about addressing the problem of dependence by counting one network or subgroup as a

sample of one, leading to very small-*n* SNA studies. Though SNA can handle small to large sample sizes, inferential statistical procedures including multilevel models such as hierarchical linear modeling, which can be used with SNA data, typically require larger sample sizes. Using small-*n* network data with linear inferential statistical or multilevel model procedures results in low statistical conclusion validity that must be addressed (Bodin et al., 2017; Maroulis & Gomez, 2008). Finally, inferential statistics are based on probability theory and should be used with random sampling, which is rarely the case in evaluations involving targeted networks (Carolan, 2014).

Next, using SNA by itself results in quantitative descriptive data and a sociogram or network map that illustrates the structure of the network. Evaluating outcomes requires additional data, including process data and outcome data (Bodin et al., 2017; Groce et al., 2019). Partially because using traditional statistical inference is not advised, establishing a causal link between a network and an outcome has proven elusive (Groce et al., 2019; Popeier, 2018). More recent developments in SNA have enabled statistical modeling of *interdependent* relationships. Exponential random graph models and stochastic actor-oriented models (used with longitudinal data) are two network modeling tools that create random models of networks that can be compared to real networks. The big idea behind these two modeling tools is that if a randomly formed network yields different results from an actual network, then the processes inherent in the actual network must be causing a different effect (Bodin et al., 2017). The procedures are quite complex (Popeier, 2018), and the results help

evaluators answer questions about network structure itself, which researchers can then link to outcomes.

Another difficulty in linking network structure to outcomes rests in the chicken-and-egg debate between connectionists and structuralists. When a network is associated with an outcome, connectionists are likely to interpret the result to mean (based on their understanding of theory) that individuals with certain pre-network motivational attributes came together and achieved the outcome. Structuralists, on the other hand, are likely to interpret the result to mean that the structure of the individuals' association with others in the network created the conditions that enabled the outcome. To tease out the causal pathways requires something that SNA alone cannot produce: context. In fact, SNA was designed specifically to ignore context so that the focus of analysis could remain on the relational structure, but this produces what many consider to be unacceptable gaps in understanding (Bodin & Prell, 2011; Bodin et al., 2017; Borgatti & Halgin, 2011; Brandes et al., 2013; Edwards, 2010; Fredericks & Durland, 2005; Maglajlic & Helic, 2012; Maroulis & Gomez, 2008; Marshall & Staeheli, 2015; Popeier, 2018; Sandström & Carlsson, 2008).

Also, though SNA is well-suited for complex, systems-oriented evaluation, the visual and quantitative output is decontextualized. The data is from a single point in time, divorced from the processes that contributed to the structures. Marshall and Staeheli (2015) decried SNA researchers for projecting a "quantitative explanatory certitude" (p. 57) that was theoretically dangerous and methodologically irresponsible. Pairing SNA with other methods, especially qualitative methods, can uncover how a

network formed and changed over time (Bodin & Prell, 2011, p. 365; Maroulis & Gomez, 2008); how participants viewed and experienced a network (Sandström & Carlsson, 2008); and the meaning of network relationships and characteristics (Popeier, 2018). For example, contextual information about the comparative timing of network participation and outcomes could prove critical in establishing temporal precedence, or whether networking came prior to or after certain outcomes were observed. Marshall and Staeheli (2015) cautioned, "The network representations provide order and straight lines to a world of messy relations…We know that as representations of infinitely more complex, subtle, and fluid relations, these network diagrams are but an abstract simplification" (pp. 64-65).

In summary, evaluators can use SNA to make better sense of evaluands that are involved in systems in which relational ties between individuals or groups play a role. Many evaluation questions about individuals, subgroups, and whole networks can be answered, as can questions about the role or purpose of networks. Where SNA has fallen short, however, has been in producing valid results linking network characteristics and activities to social change outcomes (Popeier, 2018). The necessary and sufficient conditions leading to achievement have been unclear. The inferential methods evaluators have used to test statistical hypotheses using SNA data are not widely accepted (Bodin et al., 2017; Borgatti & Halgin, 2011; Maroulis & Gomez, 2008; Popeier, 2018). Most SNA studies have been snapshot studies of single networks (Popeier, 2018). Additional longitudinal studies and network comparison studies could help to fill the gap in understanding the complicated relationship

between networks and outcomes (Bodin & Prell, 2011; Groce et al., 2019; Popeier, 2018). Evaluations in which evaluators use context-specific theories to trace network activities and outcomes also could produce more valid results (Popeier, 2018). Pairing SNA with methods that provide context was highlighted by many researchers as an essential approach to understanding SNA results (Bodin & Prell, 2011; Bodin et al., 2017; Borgatti & Halgin, 2011; Brandes et al., 2013; Edwards, 2010; Fredericks & Durland, 2005; Maglajlic & Helic, 2012; Maroulis & Gomez, 2008; Marshall & Staeheli, 2015; Popeier, 2018; Sandström & Carlsson, 2008).

Now that I have reviewed SNA, I next explore qualitative comparative analysis (QCA) as a possible method researchers and evaluators could use to address some of the limitations of using SNA. I define QCA, recount its development, and discuss the strengths and limitations of using QCA for evaluation.

Qualitative Comparative Analysis

Defining Qualitative Comparative Analysis

Defining QCA requires situating the method within a larger body of comparative methods called configurational comparative research (Ragin, 1998; Thiem, 2017). QCA is used by researchers who are trying to unpack complexity to tease apart multiple, co-occurring causes of outcomes (Ragin, 2005; Roig-Tierno et al., 2017; Sager & Andereggen, 2012). Kahwati and Kane (2020) provided a tidy definition of QCA:

> [A researcher or evaluator] uses set-theory, a branch of mathematics, to identify nonstatistical relationships among explanatory factors and an outcome using qualitative data, quantitative data, or both derived from the cases

> included in the analysis…and results from a QCA are expressed as solutions. (p. 8)

The methodological roots of QCA, which I describe next, rest in comparative case study research, the mathematical theory of sets, the logic of agreement and difference, and Boolean algebra (Ragin, 1987).

Comparative Case Study Research

Cases take center stage in QCA. Using case studies, researchers illuminate real-world behaviors in complex, real-world contexts; they describe and explain naturalistic settings (Yin, 2012). In comparative case study research, researchers compare cases, looking for patterns of similarity and difference (Ragin 1998) using and appreciating both qualitative and quantitative methods (Yin, 2012). Case studies are the most important component of a research project using QCA; in fact, the quality of a study using QCA is judged by whether the analysis provided new interpretation of the cases (Ragin, 1998; 2005). As Ragin (2005) wrote, "The purpose of QCA is to help researchers represent and synthesize what they have learned about their cases" (p. 34). Researchers who use QCA must know their cases intimately, seek comparative data across all cases to avoid flawed results, and return to cases repeatedly throughout the deliberately iterative QCA process (Pattyn, 2019; Schatz & Welle, 2016). Following case study data collection, researchers use QCA procedures to apply set-theory and the logic of agreement and difference to the cross-case analysis data so they can derive the conditions that are associated with outcomes (Befani, 2013; Kahwati & Kane, 2020;

Marx et al., 2014; Pattyn, 2019). Ragin (2005) argued that the very basis of case-oriented research is its set-theoretic nature.

Set-Theory, Logic, and Boolean Algebra

Set theory is a foundational mathematical theory that construes the entire mathematical universe as belonging to sets (Bargia, 2019). Combined with formal logic based on John Stuart Mill's logic of agreement and difference, researchers can deduce which conditions are grouped as sets with specific outcomes (Befani, 2013; Marx et al., 2014; Thiem, 2017). The formal logic, stripped to its most basic idea, is that there are both necessary and sufficient conditions present to belong in a set. If a set is defined as everyone who achieved a certain outcome, researchers can use QCA to elicit what conditions were necessary and/or sufficient for someone to belong to the outcome set. The pattern of these necessary and sufficient conditions is known as a "complex causal relationship" (Befani, 2013; Hollstein & Wagemann, 2014; Kahwati & Kane, 2020; Mello, 2021).

The purpose of QCA is to link causal conditions to outcomes (Marx et al., 2014). The method enables researchers to explore causal complexity, which incorporates the concepts of equifinality, conjunctural causation, and asymmetrical causation (Kahwati & Kane, 2020; Marx et al., 2014; Mello, 2021). Equifinality means that there are multiple ways to achieve an outcome. Conjunctural causation means that a condition may not lead to an outcome on its own but may lead to an outcome in combination with other conditions. Asymmetrical causation means that although a condition leads to an outcome, it does not mean that the absence of that condition will

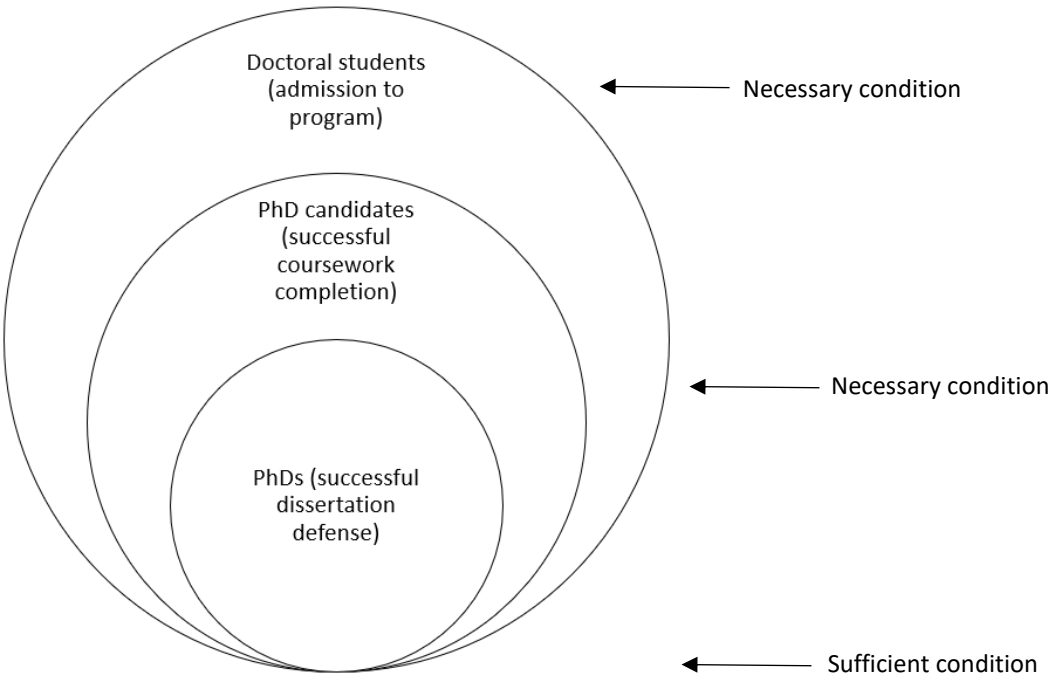
prevent the outcome (Befani et al., 2007; Hollstein & Wagemann, 2014; Kahwati & Kane, 2020; Marx et al., 2014; Mello, 2021; Ragin, 1998; Sager & Andereggen, 2012). The analysis of causal complexity results in a solution of necessary and sufficient conditions, where necessary conditions are those that must be present for the outcome to occur and where sufficient conditions are those that, singularly, are conjoined with the outcome.

See Figure 2, which illustrates a simple example of sets with necessary and sufficient conditions for a doctoral degree. At a traditional brick-and-mortar university, everyone who achieved a doctoral degree had been admitted to one of the doctoral programs at the university. Admissions to a doctoral program at the university was a *necessary* condition to the outcome of doctoral degree. However, admissions did not always result in a doctoral degree, so the condition of admission was not *sufficient* to the outcome of doctoral degree. With a sufficient condition, the outcome will always be present. At the same university, successful completion of coursework in the doctoral program earned people membership into a subset of PhD candidates. But not all PhD candidates earned doctoral degrees, so successful completion of coursework was a *necessary but insufficient* condition for membership in the subset of PhDs. Finally, all who successfully defended dissertations earned doctoral degrees, and everyone who did not earn a doctoral degree did not successfully defend. The condition of successful defense was always present for those who earned doctoral degrees. Therefore, successful defense was a *sufficient* condition to membership in the set of PhDs from that university. The result of this logic exercise is a string of

necessary and sufficient conditions that link to an outcome. In this case, the outcome was a doctoral degree.

Figure 2

Set with Subsets Showing Necessary and Sufficient Conditions for Membership



The doctoral program example above explored the case of one university. To systematically analyze the conditions present and not present across *multiple* cases, QCA employs Boolean algebra, "the algebra of logic" (Ragin, 1987, p. 85). The result, called the "solution," is the combination of conditions that, across cases, were necessary and/or sufficient for the outcome to occur. This string of necessary and

sufficient conditions is called a causal pathway, which is not to be confused with causal inference (Kahwati & Kane, 2020; Ragin, 1998; 2005). Although some mixed messaging exists about causality and QCA, which I explore below, the developer of QCA himself said that QCA was not created to establish causal inference but "to make sense of cross-case patterns and thereby aid the causal interpretation of cases, using theory and accumulated substantive knowledge as guides" (Ragin, 2005, pp. 33-34). To understand this better requires a brief review of why QCA was developed.

The Development of Qualitative Comparative Analysis

QCA was developed in the late 1980s by Charles C. Ragin, a political sociologist (Ragin, 1987). Ragin was a traditional quantitative methodologist by training and practice, specializing in interaction effects in regression. He was unsatisfied when applying those methods in several social science contexts (Marx et al., 2014). He grew increasingly frustrated by inferential statistics when he wanted to analyze multiple causal conditions leading to complex outcomes (Marx et al., 2014). In his search for solutions, he initially developed QCA to bring together the strengths of qualitative, case-oriented research approaches with quantitative, variable-oriented research approaches in a way that would enable the analysis of causal complexity (Befani et al., 2007; Cragun et al., 2016; Kahwati & Kane, 2020; Marx et al., 2014; Ragin, 1998; Sager & Andereggen, 2012). At the heart of this idea was this sentiment by Ragin (2005): "For many, if not most, case-oriented researchers, the idea that a single causal condition can have a net, independent effect across cases makes little sense" (pp. 34-35).

In his original iteration of QCA, Ragin relied on Boolean algebra, which required dichotomous data (Ragin, 1987). Since then, he and other researchers have developed tools and methods to expand QCA, and researchers now can analyze nominal, ordinal, interval, or ratio data (Marx et al., 2014). Goodness-of-fit tests have been developed, as have different versions of QCA to incorporate a temporal dimension (Kahwati & Kane, 2020). Software packages, including a QCA package for R, have been developed, which has led to a greater number of researchers from a wide variety of fields using QCA (Roig-Tierno et al., 2017). From a bibliometric review, 425 of 469 articles including QCA were published after the year 2000 (Roig-Tierno et al., 2017). Social science researchers, especially in Europe, have embraced QCA in fields including business and management, political science, sociology, environmental studies and sciences, public health, international relations, and more (Mello, 2021; Roig-Tierno et al., 2017). A website (www.compasss.org) is devoted to cross-case analysis, and researchers can attend conferences and workshops that heavily feature QCA. As QCA research expanded across fields of study and became more prevalent, evaluators grew curious about whether it could be applied usefully within the field of evaluation.

Qualitative Comparative Analysis in Evaluation

QCA is a relatively new method to evaluators, so it has not yet been used to evaluate networks. Analyses of published QCA articles have found about 20 relating to both QCA and evaluation (Gerrits & Verweij, 2016; Roig-Tierno et al., 2017), despite rapid growth in the number of articles in the social sciences starting in the late 2000s

(Mello, 2021). In one analysis, only seven of nineteen evaluation articles discovered were about studies for which evaluators used QCA; the others described QCA or mentioned the method as part of a broader topic (Gerrits & Verweij, 2016). Evaluators that have taken the leap have found that QCA can help them uncover conditions present with desired outcomes (Cragun, et al., 2016; Kien et al., 2018; Schatz & Welle, 2016; Warren et al., 2013), and QCA was recommended as an alternative to quantitative impact evaluation in appropriate international development contexts (Stern et al., 2012). The usefulness of QCA to evaluators is next explored through the lenses of its strengths and limitations.

Strengths of Qualitive Comparative Analysis in Evaluation

Evaluators' use of QCA reflects what it was designed to do well, which includes unpacking causal complexity, being useful in different types of contexts including small-*n* to large-*n* contexts, and offering an alternative when contexts do not adhere to inferential statistical assumptions. Questions evaluators can answer with QCA are about uncovering set-relations, those combinations of necessary and sufficient conditions that are related to outcomes (Hollstein & Wagemann, 2014; Schneider & Wagemann, 2010). QCA evaluation questions, in other words, target an increase in understanding the elements that are linked with something working or not working. It is better suited for learning than for accountability (Pattyn et al., 2019). In other words, as opposed to a goal of establishing causal attribution (desired for accountability), evaluators with a goal of program improvement and learning can use QCA to understand the conditions programs should replicate because those conditions

typically are present with desired outcomes. QCA offers a more systematic approach than do other qualitative methods that relate conditions to outcomes, including contribution analysis, logic models, and necessary condition analysis (Thiem, 2017). The primary benefits to using QCA are its flexibility and its ability to handle causal complexity, each of which I explore next.

First, evaluators will find a great deal of flexibility in the type of data they can use with QCA. It is inherently a mixed methods approach that brings together strengths of qualitative, case-oriented methods and quantitative, variable-oriented methods (Befani et al., 2007; Cragun et al., 2016; Hollstein, 2014; Hollstein & Wagemann, 2014; Kahwati & Kane, 2020; Marx et al., 2014; Mello, 2021; Ragin, 1998; Roig-Tierno et al., 2017; Sager & Andereggen, 2012). Case-oriented researchers typically want to learn from a relatively small number of cases that are applicable to the research questions. Variable-oriented researchers typically want to infer relationships between variables in order to generalize to a population. Comparing cases allows for the exploration of complexity, and QCA offers a systematic way to compare complex cases across several variables to discover whether conditions are necessary or sufficient to an outcome (Hollstein & Wagemann, 2014; Marx et al., 2014; Ragin, 1998).

Also, using QCA, evaluators do not have to meet inferential statistical assumptions (Downey & Stanyer, 2014; Kahwati & Kane, 2020). Rather, the assumptions of QCA are that the purpose of the study is *not causal inference but causal interpretation*, meaning that researchers or evaluators will use their extensive

case knowledge and grounding theory to inform their understanding of the patterns that emerge. This grounding in knowledge, theory, and causal complexity will inform their interpretation of conditions involved in outcomes (Ragin, 2005). Because evaluators are freed from the assumptions required by inferential statistics, they do not need to worry about sample sizes. QCA has been used for small-*n* case comparisons up to very large-*n* case comparisons, though it typically is used for small- to medium-*n* samples (Downey & Stanyer, 2014; Hollstein & Wagemann, 2014; Kahwati & Kane, 2020). Most QCA researchers use between 10 and 90 cases (Marx et al., 2014). Researchers have used samples of individuals, institutions, and even countries, so QCA offers great flexibility with the target population for samples as well (Cragun et al., 2016). In addition to using QCA for its applied purpose of tracking conditions to outcomes, evaluators and researchers can use QCA to analyze similarities and differences between cases, test existing theories, test new ideas to develop theories, and extend or refine theories (Befani, 2013; Cragun et al., 2016; Marx et al., 2014; Pattyn, 2019; Schneider & Wagemann, 2010; Stern et al., 2012).

Importantly, Ragin (2005) named causal complexity one of the assumptions of QCA. As described above, causal complexity recognizes that different outcomes may arise based on context. QCA is especially appealing to evaluators who align with realist evaluation, a type of evaluation through which evaluators seek to address causal complexity (Befani, 2013; Sager & Andereggen, 2012).

> The main value-added of QCA [for evaluators] is its achievement of the goals of realist synthesis in a systematic and comparative manner by providing context-sensitive conjunctural explanations for outcomes, while preserving the

> substance and the explanatory richness of the cases. (Sager & Andereggen, 2012, p. 72)

Evaluators who assume that different outcomes may occur based on contextual factors will agree with this basic philosophy of QCA. For contextually complex evaluands, the results of QCA can answer some evaluation questions better than variable-oriented research that produces mono-causal results (Befani et al., 2007; Gerrits & Verweij, 2016; Pattyn et al., 2019; Ragin, 1998; Roig-Tierno et al., 2017; Sager & Andereggen, 2012; Stern et al., 2012).

> [QCA] represents a shift from focusing causal analysis on variables taken out of their specific context. Locating variables in the context of the "case" and conducting within-case analysis alongside comparisons across cases has opened up major new opportunities for causal analysis that are still largely ignored in evaluation practice. (Stern et al., p. 27)

However, the purpose of QCA is not to replace variable-oriented approaches (Ragin, 2005). More about QCA and the causality debate is discussed below as a limitation.

Limitations of Qualitive Comparative Analysis in Evaluation

QCA has been viewed with suspicion by strictly qualitative researchers and by strictly quantitative researchers. Qualitative researchers doubt the qualitative integrity of a method that quantizes qualitative data and that uses algebra to analyze case study data (Cragun et al., 2016). Quantitative researchers doubt the integrity of a method that relies so heavily on a researcher's qualitative and subjective case knowledge to arrive at anything related to causality (Cragun et al., 2016). Next, I review the limitations of

QCA that evaluators face, including the causality debate, limits to generalization, analytical considerations, and intensity required.

First, according to set-theory and formal logic, QCA surfaces causal pathways, which are the conditions that lead to an outcome (Befani et al., 2007; Kahwati & Kane, 2020; Marx et al., 2014; Ragin, 1998, 2005; Sager & Andereggen, 2012). In the ongoing debates about QCA, this assertion has been a primary target for researchers who question the soundness of the method. These critics have used the failure of simulated data to produce the same results as real data as a primary indicator of the invalidity of QCA (De Meur et al., 2012; Marx et al., 2014). However, QCA supporters have countered that simulated data is inappropriate for QCA, just as it is not reasonable to use simulated data to test the veracity of case studies (De Meur et al., 2012; Marx et al., 2014). Cases are the heart of QCA, and researchers must be intimately knowledgeable about them (Mello, 2021; Ragin, 2005). QCA researchers return to cases repeatedly to update their analyses (Ragin, 2005; Schneider & Wagemann, 2010). Traditional quantitative researchers interpret this as a type of subjective fishing for results, while qualitative researchers consider this a necessary and effective analysis practice (Patton, 2015). QCA researchers understand updating analyses as responsible treatment of configurational comparative data (De Meur et al., 2012; Marx et al., 2014). Hollstein and Wagemann (2014) wrote:

> It should be pointed out that this does not have anything to do with data manipulation. Quite the contrary, it is a process of acknowledging evidence and using this evidence to reformulate the previous hypotheses, which could be referred to as “learning” in the most positive sense. (p. 249)

Critics also have complained that QCA has been touted as a replacement for regression analyses, although the developer of QCA has strongly refuted that (Ragin, 2005). The purpose of QCA, he said, is *not* to replace variable-oriented research and its methods to determine causal inference (Ragin, 2005). He also reiterated that QCA produces causal interpretation, not causal inference. He clarified that causal interpretation is the result of case knowledge and theory applied to causally complex QCA results, while causal inference is the statistical result of experimental hypothesis testing (Ragin, 2005). Mixed messages abound, however, when QCA researchers use the term "causal inference" to describe the product of QCA (Befani, 2013; Thiem, 2017). In fact, Thiem (2017) wrote in an article published by an evaluation journal, "It is undisputed that the purpose of QCA is causal inference" (p. 421). Ragin has written repeatedly that inference is, in fact, *not* the purpose (Marx et al., 2014; Ragin, 1998; 2005).

At the crux of the debate is the old paradigmatic battle between quantitative researchers and qualitative researchers. Ragin sought to bridge the two methodologies with QCA, but QCA has been judged based on both constructivist values and post-positivist values (De Meur et al., 2012; Ragin, 2005). In response to critics who reject QCA based on the standards of post-positivist, variables-oriented research—specifically regression analysis—Ragin (2005) wrote:

> QCA is based on the algebra of sets, not on linear algebra, the basis of regression analysis. QCA's analytic engine is fueled by set-theoretic relations, not correlation…Set-theoretic relations concern explicit connections, while correlations are symmetrical; set-theoretic relations are well-suited for questions about necessity and sufficiency, while correlations are not. (p. 37)

To stay out of the paradigmatic brawl, Kahwati and Kane (2020) recommended that, at a minimum, researchers and evaluators avoid the term "causal inference" when referring to QCA, especially because it can "be a flashpoint for peer reviewers" (p. 12).

Another debate concerns whether researchers can generalize the findings from QCA. Some researchers confidently state that one should not generalize findings from QCA, especially given the philosophy of causal complexity (Befani et al., 2007; Kahwati & Kane, 2020; Roig-Tierno et al., 2017; Sager & Andereggen, 2012). Yin (2012) addressed the question of generalization in case study research, differentiating between statistical generalization and analytic generalization. He wrote, "Analytic generalizations depend on using a study's theoretical framework to establish a logic that might be applicable to other situations" (p. 18). Some QCA researchers mirrored the idea that results that uncover patterns of what does and does not work across cases might be applicable to other, similar cases (Befani, 2013; Gerrits & Verweij, 2016; Pattyn et al., 2019; Schneider & Wagemann, 2010; Stern et al., 2012). Evaluators should very carefully consider the limits of generalization when they use QCA.

Evaluators also should be aware of the limitations produced by several analytical complexities when they use QCA. Primarily, the method is sensitive to cases and the number of conditions. Sensitivity to cases means that the inclusion or exclusion of specific cases can change the results because the method incorporates context (Kahwati & Kane, 2020; Marx et al., 2014; Sager & Andereggen, 2012). Because the process is so bound to the evaluator's case knowledge, bias is a threat to

validity (Sager & Andereggen, 2012). The evaluator must understand the cases very well; deliberately determine, based on theory and the evaluation questions, which cases to include and exclude; and execute the analysis process with fidelity and transparency so that a future researcher with the same case data in hand could replicate the analysis (Sager & Andereggen, 2012).

Another limitation is that QCA is sensitive to the number of conditions because of the use of Boolean algebra, which necessitates that only a handful of conditions be included in an analysis (Marx et al., 2014; Mello, 2021; Schneider & Wagemann, 2010). Using many conditions results in many possible combinations of conditions, which become uninterpretable (Kahwati & Kane, 2020; Marx et al., 2014; Mello, 2021; Pattyn et al., 2019; Schneider & Wagemann, 2010). This constraint is not unique to QCA, but researchers and evaluators must consider this when deciding whether to use QCA.

As may be clear from the preceding discussion about strengths and limitations, QCA is an involved method. Researchers begin by gathering case information until they are intimately knowledgeable about the cases, and they continue to build upon and utilize that knowledge throughout the analysis process (Marx et al., 2014; Pattyn, 2019; Ragin, 2005; Schatz & Welle, 2016). Meanwhile, they also are knowledgeable about the social science theory they are using, and they continue to build upon and utilize that knowledge to make decisions throughout the analysis process (Befani et al., 2007; Ragin, 2005; Sager & Andereggen, 2012). Gaps in data create problems by limiting the potential for comparing across cases (Pattyn et al., 2019). For the analysis

to provide what is needed for evaluation, cases must include those that achieved the outcome and those that did not achieve the outcome so that conditions leading to the outcome can be discovered (Schatz & Welle, 2016). Finally, each outcome the evaluator wishes to explore requires unique analysis, as the process only manages one outcome at a time. That means for each outcome, the evaluator must select the appropriate cases and conditions and iteratively conduct the analysis (Pattyn et al., 2019).

Despite these limitations, evaluators have been encouraged to use QCA as an approach that can provide causal interpretation with smaller sample sizes and within highly complex conditions. If the approach is done with fidelity and transparency, evaluators can yield results that unearth conditions that are necessary and sufficient to the outcome of interest (Gerrits & Verweij, 2016; Pattyn et al., 2019; Sager & Andereggen, 2012; Schatz & Welle, 2016; Stern et al., 2012; Thiem, 2017). QCA was developed to systematically analyze comparative case studies, and "the basic motivation behind a QCA should always be to learn more about cases" (Schneider & Wagemann, 2010, p. 400). The method works best for that purpose.

QCA was introduced in this chapter as a possible method to pair with SNA. Now that the individual examination of SNA and QCA is complete, what follows is an examination of whether the two methods are complementary.

Bringing Two Methods Together

The main question of this study is whether QCA can be paired effectively with SNA to establish a clear empirical connection between networking and outcomes. The

purpose, values, and underlying mechanisms of both SNA and QCA indicate that the methods will be compatible and complementary. A brief review of prior research that paired social networking and case study methods provides further evidence. Here, I briefly describe those prior studies and discuss how they indicate high methodological compatibility.

I found three prior studies that paired comparative case studies with SNA, only one of which paired SNA with QCA (Bodin et al., 2017; Sandström & Carlsson, 2008; Velastegui, 2013). None of the studies paired SNA with QCA to answer a question about the non-relational outcomes of networking, so that methodological question remains unanswered.

- Bodin et al. (2017) used a mixed-methods approach with exponential random graph modeling (EGRM) and comparative case studies to explore collaboration in ecosystem-based management. EGRM enables inferential testing of whether an actual network has characteristics different from a randomized network model. The researchers' methodological contribution was combining EGRM with case study data to answer a question about whether different network characteristics were associated with a different outcome.
- Sandström & Carlsson (2008) studied a policy network using an explanatory mixed methods case study. They began with SNA, which they confirmed using comparative case study data. The researchers'

methodological contribution was the use of qualitative case study data to confirm descriptive SNA data.

- For a dissertation study, Velastegui (2013) used SNA to uncover individuals' structural positions in a network and then successfully used QCA to identify pathways to becoming leaders and influencers. The researcher's methodological contribution was pairing SNA and QCA to study relationship structures.

For evaluators interested in the question of whether networking was associated with an outcome, the approaches these researchers used fell short. The purpose of using QCA is to unearth those causal pathways for interpretation. To that end, QCA has been used with network studies that relied on qualitative network data, including interviews and ethnographic data (Hollstein & Wagemann, 2014; Coburn et al., 2012). In these studies, the authors successfully contextualized social network data with a qualitative approach, and QCA enabled the authors to link the network data to the outcome of interest.

The use of comparative case studies and SNA in the examples above indicates that case-based methods and SNA are compatible. Neither SNA nor QCA is limited by sample sizes or statistical assumptions, so the methods can be used together without those strictures. Both approaches were designed to work within the complexity of systems, seek relational connections, and value qualitative and quantitative data. SNA and QCA can be used in situations of complexity, which almost always describes systems (Hummelbrunner, 2011). Both SNA and QCA unpack relationships. SNA

does so for relationships between actors, and QCA does so for relationships between conditions that arise from cases. Set theory, upon which QCA is based, is essentially about relationships between sets. Networks consist "of a set of relations that apply to a set of social actors, as well as any additional information on those actors and relations" (Prell, 2011, p. 31). A network essentially is a system that is well-suited for set-theory treatment. Finally, both SNA and QCA are perfect for researchers who recognize the value of quantitative and qualitative methodologies and approaches, and both SNA and QCA are inherently mixed methods (Cragun et al., 2016; Edwards, 2010; Hollstein & Wagemann, 2014; Popeier, 2018). SNA is a tool designed for the specific task of unpacking the complexity of relationship structures, while QCA is a tool designed for the specific task of unpacking the conditions present with outcomes. The evidence suggests that the two tools are complementary, with QCA filling the gaps left by SNA to answer the question of whether networking produces outcomes.

Rationale for the Current Study

Rooted in the prior research and unanswered questions, the purpose of this research was to determine whether SNA could be combined effectively with QCA to address whether collective action networking contributed to social change outcomes. For the purposes of this research, I referred to *contribution* as it is used within the field of evaluation. For evaluators, contribution is a determination of whether certain activities *helped to* cause the observed outcomes, as opposed to attribution, which implies that activities were shown to cause the outcomes (Almquist, 2011).

I employed a scaffolded series of three studies to explore the contribution QCA could make to the evaluation of networks. First, I used a nonexperimental, descriptive, quantitative approach including SNA to study the structures and relationship characteristics of a network. Second, I used an explanatory mixed methods case study (similar to Sandström & Carlsson, 2008) to examine the intended and unintended outcomes that network groups achieved. For this mixed methods study, I began with the quantitative strand, using the descriptive quantitative data including SNA from Study 1. Based on the results from the quantitative strand, I developed an interview protocol and selected participants for semi-structured interviews, in addition to reviewing archival documents about the case network. I concluded the explanatory mixed methods case study by using QCA to integrate the quantitative (including SNA) and qualitative data. For the final study, I compared the results gleaned from Study 1 using SNA with the results gleaned from Study 2 that combined QCA and SNA. This comparison led to the conclusion about the contribution of SNA and QCA to a fuller understanding of the case network and outcomes.

The questions guiding this research are as follows:

Study 1: Social Network Analysis

- To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?
- To what degree have intended outcomes been achieved by the E Alu Pū network and member groups?

Study 2: Quantitative Comparative Analysis

- For the E Alu Pū network and member groups, what intended and unintended outcomes have been achieved?
- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

Study 3: Comparing Findings from Study 1 with Findings from Study 2

- How can SNA and QCA be combined effectively to explore the connection between collective action networking and social change outcomes?

With answer to these questions, this research can contribute to the knowledge base for five audiences:

1. The case network and its stakeholders will benefit from learning about the products of a networking strategy and experiences of the network member groups.
2. Evaluators, both practitioners and researchers, can benefit from a clear method for integrating SNA and QCA to evaluate network outcomes.
3. Network facilitators and funders can benefit from improved information about networking that can affirm whether the investment in networks is supported by the evidence.
4. Network scientists can benefit from a method that can provide a new layer of information to build upon the current understanding of the different dimensions of networks and aid in the interpretation of SNA data.

5. Mixed methods researchers can benefit from new information about two mixed methods research tools, SNA and QCA. They also can benefit from new information about whether QCA can be an effective tool for mixed methods integration.

Because this study combines two methods in a new way for a new purpose, it can contribute to the knowledge base of these multiple audiences.

Chapter Two Summary

SNA and QCA are mixed methods that both arose from a need to analyze data that is steeped in complexity and related to other data. Researchers began developing what is now SNA in the 1930s, while QCA was developed in the late 1980s. Although SNA has had 50 more years of development, researchers have not created methods to adjust SNA for contextualization. Newer developments in SNA like exponential random graph models and stochastic actor models are expanding how researchers can use SNA by enabling inferential treatment of interrelated data. Still, the types of questions researchers can answer with those models are limited. In response, most researchers and evaluators using SNA have addressed its limitations by pairing SNA with other methods. Using SNA as part of a mixed methods approach is typical. In past studies that have combined SNA with comparative case approaches, authors have been able to address the structure of relationships and their importance (Bodin et al., 2017; Coburn et al., 2012; Sandström & Carlsson, 2008). What has not been explored is what QCA can contribute to quantitative SNA via systematic comparative case analysis that results in necessary and sufficient conditions to outcomes. SNA and QCA have been

suggested by other researchers as a pairing worth exploring (Marx et al., 2014; Serdült & Hirschi, 2004). They are theoretically complementary. Based on the discussion throughout this paper, they appear methodologically aligned. What has been lacking is an empirical example of using the two methods together for network evaluation. Prior to this study, the key question remained unanswered: Can SNA and QCA be combined effectively to establish a clear empirical connection between collective action networking and social change outcomes?

CHAPTER THREE: METHODOLOGY

Social network analysis (SNA) is a preferred method to evaluate collective action networks, a type of network defined by people coming together for a shared social change purpose (Ernstson, 2011). However, using SNA reveals a small, focused window into the network. Networks are complex and operate as systems, and some researchers have lamented that by using SNA, they excluded important contextual information (Borgatti & Halgin, 2011; Brandes et al., 2013; Maglajlic & Helic, 2012). Other researchers have warned that using traditional inferential statistics with SNA data violates the assumption of independence of observations (Bodin et al., 2017; Brandes et al., 2013; Chung et al., 2008; Fredericks & Durland, 2005; Hollstein, 2014; Popeier, 2018). Evaluators have been left with limited and often unsatisfying options to understand whether networking is connected with intended social change outcomes. One of the options evaluators have used is mixed methods, producing a more well-rounded understanding of networks by incorporating contextual information. Still, for program directors and funders who want evaluators to be able to help programs identify what program elements are associated with outcomes, adding contextual information may not go far enough. A method called qualitative comparative analysis (QCA) can help to fill the gap, as it was designed for causal interpretation of conditions and outcomes in complex situations in which context is relevant.

To address the need for evaluative information to assess the outcomes of collective action networking, I tested a new combination of methods for network evaluation. I compared results from the evaluation of a case network using survey data including SNA to results from the evaluation of the same case network using SNA combined with QCA. This chapter describes the methods and methodologies I used. Beginning with the research purpose, questions, and design overview, I then explain the three interwoven studies that comprised this research: (1) a quantitative study of a network using SNA, (2) an explanatory mixed methods case study using the SNA data with QCA, and (3) a comparative study of the results from the first two studies.

Research Purpose and Questions

The purpose of this study was to determine whether SNA could be combined effectively with QCA to establish whether collective action networking contributed to social change outcomes. I am using the word "contribute" here as it is used within the field of evaluation: as a determination of whether specific activities influenced or played a role in the observed outcomes (Almquist, 2011). To achieve the research purpose, I employed a series of three scaffolded studies focused on a case network called E Alu Pū (Hawaiian that translates roughly to "move forward together"). The network was comprised of 36 community-based resource management groups based throughout the Hawaiian Islands.

In **Study 1,** I gathered archival survey data and analyzed it using descriptive statistics and SNA to examine the relationships, structures, and outcomes for the network and member groups. In **Study 2,** I used an explanatory mixed methods case

study design. For the initial quantitative strand, I referred to the same survey data from the case network in Study 1 to examine relationship structures and patterns in addition to outcomes. Then, based on those quantitative results, I gathered qualitative data using interviews and organizational documents to explore intended and unintended outcomes for the case network and member groups. The reason for using both forms of data to support the case was to develop an in-depth understanding of the network and its member groups. I then integrated the quantitative and qualitative results using QCA to discover any conditions that were necessary or sufficient to the network's intended outcomes. Finally, in **Study 3,** I compared the results from Study 1 with the results from Study 2 to explore what this new combination of methods contributed to network evaluation. The research questions that guided this study were as follows:

Study 1: Social Network Analysis

- To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?
- To what degree were intended outcomes achieved by the E Alu Pū network and member groups?

Study 2: Quantitative Comparative Analysis

- For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?
- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

Study 3: Comparing Findings from Study 1 with Findings from Study 2

- How can SNA and QCA be combined effectively to explore the connection between collective action networking and social change outcomes?

In Table 1 below, I provide a summary of the research, linking the research questions to the various components of the study. Then, through the remainder of this chapter, I describe the research design choices I made to answer these research questions, including details about how I handled each of the three studies.

Table 1

Research Matrix Summarizing the Study

Research questions	Indicators	Data sources	Data collection methods	Data analysis methods
To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?	Relationship and structure measures	KUA	Archival survey data	Social network analysis
To what degree were intended outcomes achieved by the E Alu Pū network and member groups?	Outcome variables	KUA	Archival survey data	Frequency counts, descriptive statistics
For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?	Comments linking networking and outcomes	E Alu Pū, KUA	Interviews, documents, archives	Constant comparative analysis
For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?	Relationship and structure measures, outcome variables, comments linking networking and outcomes	E Alu Pū, KUA	Archival survey data, interviews, documents, archives	Qualitative comparative analysis
How can SNA and QCA be combined effectively to explore the connection between collective action	Results from Study 1 and Study 2	SNA results, QCA results	SNA, QCA	Comparison of SNA results and QCA results

Research questions	Indicators	Data sources	Data collection methods	Data analysis methods
networking and social change outcomes?				

Research Design Overview

For this research, I compared two studies to draw a conclusion about the value of integrating QCA with SNA for network evaluation. The studies built upon each other and overlapped, as illustrated in Figure 3. Overall, I used mixed methods for this research. I employed a nonexperimental descriptive design for the first study, an explanatory mixed methods case study for the second study, and then compared results from the first two studies. Below, I discuss the purpose of and justification for these decisions.

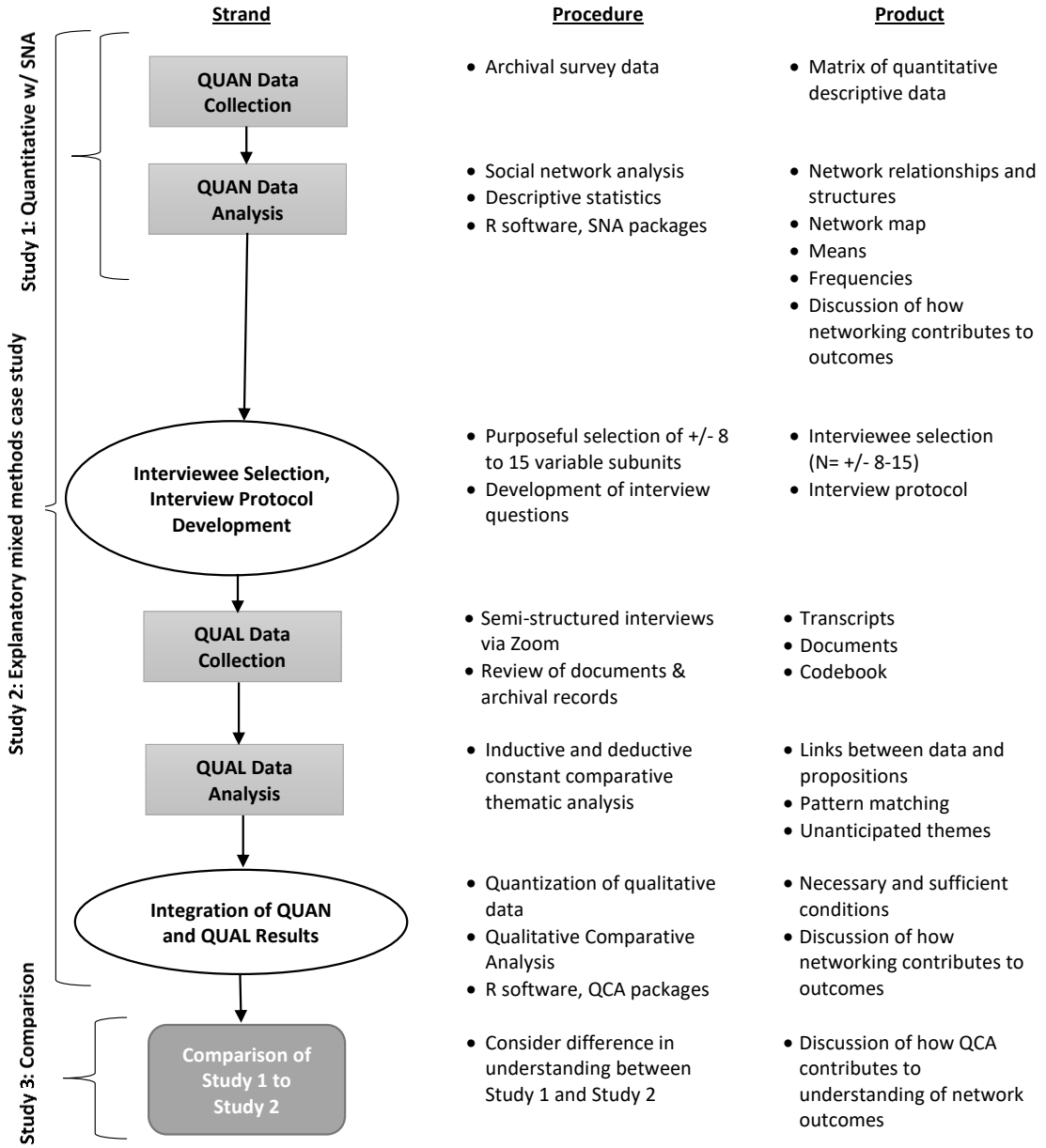
First, for this research, I used mixed methods, a research method "in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry" (Tashakkori & Creswell, 2007, p. 4, as reported in Creswell & Plano Clark, 2018, p. 4). Mixing methods is more than simply combining qualitative and quantitative data. Instead, using a mixed methods design is related to a world view or paradigm that honors "multiple ways of seeking and hearing, multiple ways of making sense of the social world" (Greene, 2007, p. 20, as reported in Creswell & Plano Clark, 2018). Given my goal for this study to improve methods in the service of social change, the paradigmatic flexibility of mixed methods aligned well.

Second, I used a quantitative, nonexperimental, descriptive approach for the first study. Gliner, Morgan, and Leech (2017) described nonexperimental approaches as those that do not use active intervention or manipulation by researchers. In addition, descriptive designs do not use independent variables, compare outcomes between groups, or determine strength of relationship between variables (Gliner et al., 2017). Because I was not aiming to infer results to a broader population, predict trends, compare groups, or correlate variables, a descriptive, nonexperimental design sufficed.

Third, I used an explanatory mixed methods case study for the second study. I discussed the reasons for using mixed methods above, so here I briefly will explain why I am using a case study, specifically a mixed methods case study, and more specifically an explanatory mixed methods case study. A case study, according to Yin (2014), "investigates a contemporary phenomenon (the 'case') in depth and within its real-world context," which is often complex with "many more variables of interest than data points" so that it "relies on multiple sources of evidence" (pp. 16-17). Case studies work well with research questions that ask "how" and "why" about phenomena over which the researcher does not have control (Yin, 2018). All these case study characteristics were true for this research. Some researchers have been critical of SNA

Figure 3

Procedural Diagram for Three Scaffolded Studies



because it does not incorporate contextual factors (Borgatti & Halgin, 2011; Brandes et al., 2013; Maglajlic & Helic, 2012). Using a case study with SNA helped to

create a more well-rounded understanding of the phenomenon of collective action networking than using a singular qualitative or quantitative design (Creswell & Plano Clark, 2018; Gerring, 2017; Yin, 2014). Importantly for this research, case studies provided the rich, varied data about outcomes and conditions that I needed for QCA.

Further, the purpose of a mixed methods case study is to develop an in-depth description and understanding of a case and its complex, multifaceted characteristics using both quantitative and qualitative data (Creswell & Plano Clark, 2018). The quantitative and qualitative strands each provided unique information necessary to fully understand the case. Both SNA and QCA are inherently mixed methods (Cragun et al., 2016; Edwards, 2010), and QCA was an effective case study integration tool. I used QCA as it was intended, to integrate quantitative and qualitative data from multiple cases to derive necessary or sufficient conditions for the desired outcomes.

Finally, the concept of an *explanatory* mixed methods research design centers around the timing and role of the quantitative and qualitative strands. In explanatory mixed methods studies, the quantitative strand occurs first. Based on the quantitative findings, a qualitative strand is designed to elucidate the quantitative results (Creswell & Plano Clark, 2018). To begin to understand the case network, I first needed to understand the network structures and characteristics. I relied on qualitative data, though, to contextualize and explain the network and the outcomes. To integrate the two strands, I first quantized the qualitative data before I analyzed the quantitative and quantized qualitative data together using the algorithmic functions of QCA.

To summarize the research design, the study began with the selection of the case and, for QCA, identification of the outcomes and conditions upon which I decided to focus. Researchers using QCA may change or revise the conditions being studied during the analytic process, but identifying the conditions before beginning the study enables researchers to collect the appropriate data (Mello, 2021). The remaining procedures for the three scaffolded studies are illustrated in Figure 3. In the first study, I used a quantitative, nonexperimental, descriptive approach. I analyzed the E Alu Pū network using archival survey data that asked member groups about their connections and outcomes. This study resulted in conclusions about network relationships, structures, and outcomes. In the second study, I used an explanatory mixed methods case study, again focusing on the E Alu Pū network. I used the same survey data and analysis from Study 1 for the quantitative strand. The quantitative results informed the development of an interview protocol and selection of participants to interview for the qualitative strand. I conducted interviews and reviewed documents to round out data collection for the qualitative strand. For the integration step of this mixed methods case study, I first quantized the qualitative data for use with QCA. Then using QCA, I derived the necessary or sufficient conditions for the desired network outcomes. In the third and final study, I compared results from the prior two studies to understand what this new combination of methods contributed to collective action network evaluation.

Study 1: Quantitative Study with Social Network Analysis

As illustrated in Figure 3, the first study for this research project involved the same steps, procedures, and products as the quantitative strand of the second study. In

this chapter, I refer to this component of the research project jointly as the "quantitative study." For the quantitative study, I utilized a nonexperimental descriptive design that incorporated archival quantitative survey data. This study answered two questions:

- To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?
- To what degree were intended outcomes achieved by the E Alu Pū network and member groups?

I chose not to use an experimental or quasi-experimental research design, which bears explanation. The purpose of experimental and quasi-experimental research designs, as opposed to descriptive designs, is to infer results from an experiment to a larger population and to statistically determine the relative importance of certain variables in producing certain outcomes. However, the purpose of this study was not to compare the results for one group with another group, nor was it to infer results from this study to a larger population. Even more relevant, data from collective action networks is interdependent and, thus, violates a basic criterion for using most inferential statistical tests (Bodin et al., 2017; Borgatti et al., 2018; Brandes et al., 2013; Chung et al., 2008; Fredericks & Durland, 2005; Hollstein, 2014; Popeier, 2018). In other words, using most types of inferential statistics to analyze interdependent network data will not produce reliable results. Given this constraint and the purpose for this study, descriptive quantitative data sufficed.

I analyzed the data using descriptive statistics and frequency counts with SNA (a descriptive mixed methods technique). Below, I review the quantitative research design decisions I made to answer the research questions, including participant selection and sampling, the variables of focus, and data collection and analysis strategies with special attention to SNA.

Participant Selection

Participants in this study were the groups that were members of the E Alu Pū network. The network comprised 36 groups that were signatories to a membership document called the ʻAe Like. The signatories included a nonprofit organization called Kuaʻāina Ulu ʻAuamo (KUA), which acted as the network's "backbone" support or coordinating organization (Kania & Kramer, 2011). I selected the member groups because they have participated in E Alu Pū and were represented in the archival survey and participation data that KUA provided for this research. In the participation data, member groups were represented by the names of their *poʻo,* or designated representatives, for E Alu Pū. While some survey data was anonymous, the survey data I analyzed with SNA included the names of *poʻo*, community groups, and stewardship sites. (The *poʻo* who completed a non-anonymous SNA survey in 2021 also provided informed consent under IRB# 1688548-1).

Inclusion and Exclusion

Only groups who were members of E Alu Pū were included in the research. These were the groups who signed the ʻAe Like. Groups that participated in E Alu Pū activities but did not sign the ʻAe Like were excluded from the research. Although

networks may benefit from partners who sit on the periphery, the network members provided the most complete, most reliable information about whether collective action networking made a difference.

Participant Characteristics

Most E Alu Pū groups were situated in and represented communities that were predominantly Native Hawaiian or were mixed race with Native Hawaiian as the predominant cultural affiliation. Though KUA does not ask individuals to report their racial or ethnic identities, the *poʻo* have self-identified as Native Hawaiian, mixed race, Pacific Islander, Asian, white, and more. All the groups were situated in Hawaii, and all the *poʻo* lived in Hawaii. Most lived in and represented rural, tightknit communities where they had ancestral ties. All the groups and all the *poʻo* were involved in community-based resources management in Hawaii. Some were *limu* (seaweed, or marine algae) practitioners, as *limu* is a food, medicinal, and cultural staple. Others managed traditional Hawaiian fishponds. Still others were nearshore subsistence fisherfolk, while others were taro farmers. Many participants were multifaceted practitioners—a nearshore fisher who also managed a taro patch and hunted, for example. For many participants, it was their cultural and ancestral ties that led them to engage in traditional and cultural practices of community-based resources management.

Sampling Procedures and Sample Size

The quantitative study centered on this single network with its member groups. Because of this laser focus, I aimed for a census of members. The goal was to include

each of the 36 network member groups. For SNA to work effectively, a clear definition about who is "in" or "out" of the network is needed (Prell, 2011; Yin, 2018). Also, the network should be well-established enough that network members have experienced varying degrees of outcome achievement. Also, understanding a network requires understanding the subunits, or the parts that comprise the whole. A missing network group can radically shift an understanding of the character of the network. Therefore, the census of one network (E Alu Pū) and its member groups (36 community groups plus KUA as the backbone) was necessary.

Measures and Covariates

Because the network and its member groups (rather than individuals) were the focus of this research, I did not collect demographic data about individuals. The covariates (like independent or predictor variables) available through archival and survey data were descriptive member group characteristics reflecting the networking strategies KUA staff used, which were gatherings, workshops, *huaka'i* (site visits), and direct support through facilitation or technical assistance. Program theory informed these choices. By "program theory," I mean the beliefs articulated by network members and KUA staff members that described how certain activities were designed to produce certain outcomes (Mertens & Wilson, 2019). The E Alu Pū program theory indicated that by providing networking via gatherings, workshops, *huaka'i,* and direct facilitative and technical assistance, network member groups would achieve certain outcomes. I used the following data as covariates:

- Number of years of participation
- Percent of gatherings, workshops, and *huaka‘i* attended

Variables

The data I had access to from participation data and archival surveys included both moderating variables and outcome variables at the member group and network levels. To frame these variables, I returned to the program theory, which indicated that providing networking via the strategies described above was meant to increase the connectivity between network member groups. The greater a group’s connectivity, according to program theory, the more likely a group would be to achieve the desired outcomes at the group level. The smaller a group’s connectivity, the less likely a group would be to achieve the desired outcomes at the group level. Likewise, according to program theory, providing networking via the strategies described above was meant to result in an increase in overall connectivity in the network, leading to the achievement of the same outcomes at the network level outcomes. According to program theory, desired outcomes included participation in advocacy activities, adoption of effective community-based resource management practices, and solidarity.

The member group and network-level moderating and outcome variables are detailed in Appendix A. Briefly, they included subunit moderating variables and outcome variables, and they included network-level moderating variables and outcome variables. The subunit moderating variables were related to network connectivity, which was measured using SNA; staff size, because groups with larger staff size may have been more likely to achieve outcomes; the degree of direct facilitative and

technical support provided by KUA, and how enthusiastic groups were about networking. The subunit outcome variables include the outcomes that E Alu Pū members have said they were trying to achieve and established effective community-based resource management practices. Then, the network-level moderating variables were about connectivity, measured using SNA. Lastly, the network-level outcome variables were the network outcomes of interest for E Alu Pū members.

Data Collection

No original data collection took place for the quantitative study. KUA provided archival data, including data from a network member survey deployed in January 2021 under IRB# 1688548-1. The survey, which was distributed via the online platform Survey Monkey, included questions about network members' connectivity to other network members, organizational capacity and practices, and outcomes. Because 36 groups were members of the network, the E Alu Pū Coordinator was striving to collect surveys from all 36 groups.

Quality of Measurements

The quantitative data will consist of archival participation and survey data. With documents and archival records, the primary quality concerns relate to omission, errors, and bias, which can be managed to varying degrees. The archival participation data has been tracked since the first E Alu Pū gathering in 2004. To manage errors or omissions in the data, I cross-checked archival records against each other, as KUA had planning and reporting documents for activities.

The main survey data I used was from an annual survey deployed to E Alu Pū groups in January 2021. Most of the questions that were included had been used in prior annual surveys and, thus, had been pilot-tested over time. To strengthen the survey, several steps recommended by Fowler (2014) were employed to increase quality of responses. First, a critical review of questions by two qualified individuals using a checklist of standards by Gehlbach and Artino (2018) was meant to detect common survey errors from double-barreled questions to typos. Second, individual cognitive interviews were conducted with three network participants who would not be asked to complete the final version of the survey as part of the census. Reliable survey questions are those that are interpreted the same way by all respondents, so cognitive interviews are used in survey research to discover different interpretations of questions and answer choices among respondents (Fowler, 2014). The survey was input to Survey Monkey, the survey deployment mode that KUA uses. Once in Survey Monkey, the survey was pilot tested by four people as a final effort to uncover any issues. The survey was finalized in Survey Monkey based on pilot-test feedback.

Instrumentation

KUA regularly gathered data through an almost-annual survey to network groups. Each time, each member group is asked to complete one survey to represent the group. The annual survey for 2020 incorporated questions about member sites (acreage, volunteers, full-time staff, outreach); types and degree of connectivity (using established SNA data collection techniques); perceptions of network health; use of effective community-based resource management practices; and perceptions about

KUA staff adherence to its core values. Both closed and open-ended questions were asked. Rating scale questions featured a sliding scale between 0% and 100% to increase variation in responses (Roster et al., 2015). Survey results contributed quantitative data about member group and network outcomes (SNA, frequency, and other descriptive statistics).

Conditions and Design

For the quantitative study, I employed a nonexperimental, descriptive design. Further, the study fell into the category of "naturalistic inquiry," which is a type of research in which a researcher examines "real-world situations as they unfold naturally in a nonmanipulative and noncontrolling way, being open to whatever emerges" (Johnson & Christensen, 2017, p. 419). In other words, it was not experimental, and I did not manipulate conditions. The purpose of the study did not necessitate the use of experimental or group-comparison designs. Also, neither random sampling nor random selection was appropriate given the nature of the study, which limited the types of statistical analyses that were advisable to use. Finally, network data was interdependent and violated the criterion for most types of inferential statistics. For all these reasons, a descriptive, nonexperimental approach was the most appropriate.

Data Diagnostics

Once the archival data was in hand, I inspected it for appropriate respondents per the inclusion criteria, nonsensical or self-contradictory responses, and missing data. First, I removed one group that was not one of the signatories to the E Alu Pū ʻAe Like and, thus, did not fit the inclusion criteria. Then, I flagged nonsensical or

unclear responses and determined whether the answers could be rectified (i.e., correcting a respondent's use of a zero instead of an "o"). Most challenging was dealing with missing data from nonresponses. Fowler (2014) suggested that the average response for an item could replace missing data for that item. However, because the census is small, substituting an average that could be inaccurate could have large and problematic effects. Although removing the observation in cases like this is also problematic because of the small census, it is the approach I chose, especially given the purely descriptive nature of the analysis. I did not perform any data manipulation or transformation.

Analytic Strategy

I used three strategies to analyze the archival participant and survey data: frequency counts, descriptive statistics, and SNA. For participation data, I used frequency counts and derived a participation rate for each group. For survey questions, I used either frequency counts (for questions such as rating scale questions) or descriptive statistics (for interval/ratio data such as numbers of volunteers).

I used Gephi 0.9.2 (Bastian et al., 2009), a free software, to analyze and visualize the network. The purpose of analysis using SNA is to describe the nature of interrelationships comprising the network at both the group member level and the network level. Analyzing social network data in evaluation contexts can facilitate understanding of whether efforts to build relationships have been successful, how connected different network members are to others in the network, who are the key connectors, who are sitting on the periphery of the network, which network members

are more likely to disseminate information to others, which members act as connectors, and more.

Social Network Analysis

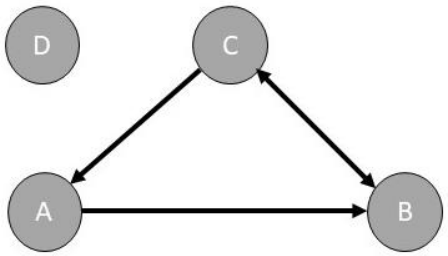
The E Alu Pū survey deployed in January 2021 included questions about connections within the collective action network. Each respondent answered three questions about their relationships with other groups in the network—with which groups their group shared information, worked on projects, and aided when needed. To supplement the SNA questions, KUA provided archival data about how long each group had been a member of the network, how many network events they had attended, and whether the group had participated in any network-wide actions such as public hearings or advocacy events at the state legislature. Respondents also answered open-ended survey questions about groups' adoption of any practices or strategies based on their network participation and about progress toward E Alu Pū goals.

Graph theory and matrix algebra come together in SNA to describe patterns of ties between nodes (in this case, network member groups). For example, Figure 4 visualizes a small network of four nodes and three ties: Group A reported sharing information with group B, group B reported sharing information with group C, group C reported sharing information with groups A and B, and group D neither received nor shared information with the other groups. When graph theory and matrix algebra are applied to patterns of relationships across an entire network, researchers can learn about the connectors, strong and weak ties, cliques, reciprocity, homophily, and more (Bodin et al., 2011; Borgatti et al., 2018; Borgatti & Halgin, 2011). Typically, SNA is

used to assess whether collaboration or connection is happening (Birk, 2005; Liou et al., 2015; Munoz et al., 2016; Shadle et al., 2018).

Figure 4

Network of Four Nodes (A, B, C, D) and Three Ties



Note. This digraph (a graph that depicts directional ties with arrows) displays which nodes share information with the others. The double-sided arrow between Node C and Node B indicate a reciprocal tie, meaning that Node B named Node C in this information-sharing network, and vice-versa. Node D is an isolate, meaning that it shares no information-sharing ties with the other nodes (Durland, 2005; Prell, 2011).

To understand a network requires analysis of both node-level and network-level data (Prell, 2011). Based on past research and collective action theory, the network-level characteristics I studied were average weighted degree, diameter, average path length, and density. For each network group, the group-level characteristics I studied were indegree and outdegree, harmonic closeness centrality, betweenness centrality, eigencentrality, and clustering. Node-level measures aided an understanding of the degree to which different groups in the network engage. Network-level measures aided an understanding of the degree of cohesion present in the network (Prell, 2011). Raw data from the survey of E Alu Pū groups was prepared

in an Excel spreadsheet; each tie between two nodes was listed (see example in Table 1). The data was analyzed using the Gephi version 0.9.2 (Bastian et al., 2009).

Table 2

Example of Raw SNA Data Showing Connections Between Groups

Originating Node	Tie Named
Group A	Group C
Group A	Group D
Group A	Group F
Group A	Group S
Group B	Group D
Group B	Group H
Group B	Group S
Group C	Group A
Group C	Group D

In most evaluation and research involving the use of SNA, the SNA results would suffice for results. Using the relationship characteristics mentioned, researchers and evaluators can describe the structure and relationships of a network. Some researchers have paired data about network characteristics with qualitative data to link network structures to effectiveness or to further describe a network (Coburn et al., 2012). A handful of studies have used QCA with network studies (Hollstein &

Wagemann, 2014). This research will contribute to these discussions. Next, I describe the second study, for which I used an explanatory mixed methods case study culminating in the integration of quantitative data and qualitative data using QCA.

Study 2: Explanatory Mixed Methods Case Study

Study 2, an explanatory mixed methods case study, described the case of a single network, E Alu Pū, with embedded subunits, or network member groups. Using an explanatory mixed methods design meant that I first conducted the quantitative strand, already described above as Study 1. Then I used the results of that quantitative strand in the execution of the subsequent qualitative strand (Creswell & Plano Clark, 2018). The qualitative strand answers these questions:

- For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?
- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

A case study is meant to describe a "phenomenon within its context from a variety of data sources" (Baxter & Jack, 2008). Case study is an appropriate method for situations meeting the following conditions, according to Yin (2014):

- The researcher is not manipulating variables. (I did not.)
- The context is relevant to understanding the phenomenon. (It was.)
- The research question is a *how* or *why* question. (They were.)
- The researcher uses a variety of sources to elucidate and describe the case. (I did.)

- There are unclear boundaries between context and the phenomenon under investigation. (There were.)

Below, I describe exactly how this study aligned with those conditions by elucidating the case study design, beginning with the research setting and case, type of case study, and proposition, followed by detail about the data sources, participants, data collection, and data analysis.

Research Setting & Case

For a case study, the most important early decision a researcher makes is how to bound the case, or unit of analysis (Gerring, 2017; Yin, 2018). The case for this study is E Alu Pū, a collective action network of community-based resource management groups in Hawaii. The network was brought together first in 2003 by an organization now called Kua‘āina Ulu ‘Auamo (KUA). KUA responded to a suggestion by an elder fisherman that Hawaiian island communities isolated from one another should gather to share and perpetuate traditional and contemporary strategies for resource management (Kua‘āina Ulu ‘Auamo, n.d.a). The network has grown from 12 community groups represented at the 2003 gathering to 36 community groups that are signatories of the E Alu Pū ‘Ae Like membership agreement as of January 2021 (A. Connelly, personal communication, December 1, 2020).

Though non-member groups sometimes participate in E Alu Pū activities, the unit of analysis for this case study was bound by the criteria of current E Alu Pū membership. “Membership” was defined as those groups that were signatories of the ‘Ae Like as of January 1, 2021. These groups comprise the current active network that

was the focus of the study. That is, they receive communications from KUA, are invited to participate in network events and activities including gatherings and workshops, have tools and resources from KUA at their disposal, and are supported by network coordination and facilitation.

The E Alu Pū Council, comprised of members selected by their peers and representing the different Hawaiian Islands, provides governance for the network. KUA facilitates and coordinates the Council and the network. KUA, which roughly translates to "backbone" (Kua‘āina Ulu ‘Auamo, n.d.b) is a backbone support organization, one of the essential elements of success for collective action networks, according to Kania & Kramer (2011). KUA manages the essential functions that hold the network together, freeing the network members to focus on site-based and collective work toward their shared goals. KUA staffs an E Alu Pū coordinator, responsible for gatherings and workshops, Council meetings, network communications, and more. With guidance and support from the Coordinator and Council, the network matured from a learning network to a collective action network that pursues a common agenda for social change (Ernstson, 2011). The network's overall vision is *‘āina momona,* which literally translates to "fat land" and which generally is translated to mean "abundance."

Type of Case Study

Using Yin's (2018) case study typology, the type of case study I conducted was an explanatory case study. This is distinct from an explanatory mixed methods study, which explains quantitative data collected initially with qualitative data collected

secondarily. An explanatory case study is meant to link program activities to outcomes (Yin, 2018). Technically, then, this study was an explanatory mixed methods explanatory case study. For the case study, I focused on a single case, E Alu Pū, with embedded subunits, the network member groups.

To further explain, I chose to conduct an explanatory case study because the question I was trying to answer were about the outcomes that emerged from networking activities. In other words, I was trying to establish whether there was a link between networking and outcomes, which is what an explanatory case study is designed to do (Yin, 2018). Based on experience, literature about community-based resources management, and the program theory, possible outcomes of collective action networking within the context of this case were identified previously (Blythe et al., 2017; Curtis et al., 2014; Gruber, 2010; KUA, n.d.c; Lozano & Heinen, 2016; Murphree, 2009; Sterling et al., 2017). Using those identified outcomes and an explanatory approach, I sought to uncover outcomes of networking.

Also, the study focused on the case of one network with embedded subunits, what Yin (2018) called an embedded case study. There were a couple of reasons for using an embedded approach. First, doing so ensured a smaller, more focused study than would have been possible with multiple networks. Networks are comprised of multiple people or groups, so adding more networks would generate exponentially more data and complexity, potentially to the point of meaninglessness. The second reason for using an embedded approach was that the variation in participation and outcomes was necessary to answer the research question about whether engagement in

networking contributed to outcomes. If the case study focused on one case without subunits, no variability would exist. A single, embedded case focused the study while yielding the variability needed to answer the research questions.

Proposition

Just as an embedded case with subunits helps to focus a case study, so does the use of a proposition. In case study research, the term "proposition" is used in a similar way that "hypothesis" is used in quantitative research (Yin, 2018). A proposition helps to focus a case study (Baxter & Jack, 2008) and often is used in evaluation contexts to help determine what types of outcomes emerged from an intervention (Yin, 2018). For this study, the proposition was that collective action networking contributed to outcomes. The proposition arose from experiences of collective action networks, prior research, social science theory, and program theory (Alexander et al., 2018; Bodin et al., 2017; Cabaj & Weaver, 2016; Ennis & Tofa, 2020; Ernstson, 2011; Groce et al., 2019; KUA, n.d.c; Lawlor & Neal, 2016; Maglajlic & Helic, 2012; Maroulis & Gomez, 2008; Ostrom, 1990; Ostrom, 2009; Plastrik et al., 2014).

Data Sources

The decisions to use a single embedded case with an explanatory case study directly affected the remaining case study design choices. Before describing the participants from the case and the process of data collection and analysis, I first describe my own positionality as a researcher. Because in qualitative research, the researcher is like an instrument and data source, my identity, experiences, and perspective affected every aspect of the study, from my relationship with participants

to my interpretation of results (Patton, 2015). From my description of myself as a researcher, I then describe other data sources, data collection, and data analysis to round out the qualitative strand of this explanatory mixed methods case study.

Researcher Description

My relationship with E Alu Pū began in 2004, almost at its beginning, and has continued unbroken since then. Briefly a volunteer, then program staff, then director from 2006 through 2011, I co-founded the organization now known as KUA. From 2012 to today, I continued to work with KUA as a consultant, with a primary focus on evaluation. As director and then as evaluator, my burning question has been the question at the heart of this study: Does networking make a difference? It is the question that drove me to return to graduate school and to specialize in evaluation. It is the question that frustrated me as I took statistics classes and learned that networks confound the criteria for interdependence that is foundational for traditional inferential statistics. It is the question that led me to search for research strategies befitting smaller groups. Training in and use of SNA served to answer only part of the question. After many years of searching for appropriate tools, I learned about QCA. Two intensive back-to-back one-week courses in SNA and QCA encouraged me to combine the two methods to see if I could finally discover the long-pursued answer to the question of whether collective action networking makes a difference.

My identity affects my understanding of this and any research. As a white woman in mid-life with a master's degree and a PhD pending the satisfactory completion of this research project, I am a member of a highly privileged group. I am

not Hawaiian, not a traditional Hawaiian knowledge expert, nor a practitioner of community-based resources management. I have not lived the experience of being crowded and forced out of the places of my ancestors with policies that enable stolen land and continued military occupation while privileging the desires of tourists, vacation homeowners, and developers.

My guiding policy is to work only where I am invited, and KUA and E Alu Pū continue to invite me. KUA was interested in the outcome of this research because they were interested to know whether QCA with SNA provides a better answer to our shared question about networking and outcomes. During this study, I incorporated practices consistent with credible and trustworthy qualitative research with the intent to ensure the relevance and accuracy of the research to E Alu Pū and KUA (Treharne & Riggs, 2014). I regularly consulted with the KUA staff including the E Alu Pū Coordinator to ensure the project is relevant to KUA.

Participants

Participants in this study were representatives of the 36 network member groups of E Alu Pū, plus KUA, along with closely aligned network stakeholders. Most E Alu Pū groups identified as Native Hawaiian and shared a common interest in perpetuating cultural and traditional resource management practices. Before Western contact, the Hawaiian Islands were home to about the same number of people who are residents of Hawaii today (McClenachan & Kittinger, 2012). Even so, research using modeling suggested that Native Hawaiians caught about 50% more fish prior to Western contact than modern fleets catch today (McClenachan & Kittinger, 2012).

They did this sustainably for hundreds of years. Resource management was decentralized, relying on local, intimate knowledge of resources (Jokiel et al., 2011). The members of each *ahupua'a* (traditional Hawaiian land division roughly equivalent to a watershed) took responsibility and had authority to care for the natural resources upon which they relied (Jokiel et al., 2011). Since Western contact in 1788, the illegal overthrow of the Hawaiian Kingdom by the United States in 1893, and contemporary state-controlled management based on the concept of common-pool resource use (Ostrom, 1990), fisheries in Hawaii have declined precipitously (Jokiel et al., 2011). E Alu Pū seeks a return to effective community-led resources management that holistically promotes communities' desire to practice culture, harvest healthy and plentiful food, and sustain the relationship between people and between people and place. To achieve this, the goals of E Alu Pū, determined collectively by network member group participants using empowerment evaluation (Fetterman, 2014), were as follows:

- Increase community voice in resources management.
- Perpetuate traditional Hawaiian resource management practices.
- Effectively manage the natural and cultural resources at community-based sites.
- Speak together as one to change systems affecting natural and cultural resources.

Each network member group was comprised of multiple individuals. This study did not target the individual level, however, but the group level. Each E Alu Pū group

has assigned a representative, called a *po'o* (leader). The *po'o* agree to represent the will of their groups by discussing decisions and carrying the will of the groups forward to E Alu Pū. KUA is represented in E Alu Pū by the E Alu Pū Coordinator. The *po'o* primarily interact with other *po'o* and, thus, are the conduit for connection throughout the network. They are asked to complete and submit an annual survey to the E Alu Pū Coordinator, and they are the main points of contact for questions and conversations relevant to the network and their community-based sites. Because of the role the *po'o* play in E Alu Pū, I asked them to represent their groups as participants for this study.

Another important voice in the study was closely aligned stakeholders. For example, E Alu Pū has benefitted from the investment of several core partners, including foundations that have provided funding consistently since 2003. One can assume that these investors in the movement have remained committed because they perceive the achievement of certain outcomes or benefits. In addition to funders, staff at resource management organizations have worked with KUA in various capacity through the years. Including their voices in the study was designed to close gaps and improve understanding related to the link between networking and outcomes.

Documentation and Archival Records

In addition to participants discussed above, archival KUA and E Alu Pū documents were the final sources of qualitative data. Since E Alu Pū was founded in 2004, reports have been written about events such as gatherings and workshops, and evaluation reporting began 2008. These reports provided de-identified data about network members' experiences with the network. Also, in 2016, the network

coordinator began making annual phone calls to each network *po'o*. De-identified thematic results from those discussions provided information about network members' perceptions of the network. Additional KUA documents provided context and detail.

Researcher-Participant Relationship

As described above, I have had a long-term relationship with the E Alu Pū network, having co-founded and directed the organization and having been a consultant since 2012. In 2017, I worked with the E Alu Pū Coordinator to facilitate an empowerment evaluation (Fetterman, 2014) process that led to the establishment of shared goals and measures for E Alu Pū. I had direct contact with E Alu Pū group representatives and the E Alu Pū Council during this process. I also have created the surveys used to evaluate network gatherings and workshops, in addition to the almost-annual surveys used to inform work planning for KUA and action strategies for E Alu Pū. Although network member groups who joined E Alu Pū after 2011 do not know me well and may not be aware of my past role as co-founder and director, most groups have heard my name and know that I am connected to KUA. Because of the growth of the network over time, the groups who know my history comprise less than half of the network today.

I am separated from the network by geographic, temporal, cultural, and relational distance, so participants may not have felt pressure to provide answers I wanted to hear as they might have with someone they know very well. At the same time, KUA staff members speak about me as a part of their team, so network group members may not have distrusted me as they might have an outsider new to the

network. That familiarity may have affected groups' willingness to participate in the study.

Participant Recruitment

I considered working with four different networks for this study. After discussing the potential study with three network coordination teams and completing background research about all four, two were considered viable candidates. The viable candidates were active in content areas in which I had some expertise, and they were well-established enough networks that it was likely that network groups had varying degrees of success in achieving outcomes. I presented information about the potential combination of SNA and QCA to KUA staff members, who consistently expressed curiosity about evidence that could help them assess their networking strategies during an in-person work-planning staff retreat in January 2020. KUA staff members agreed that they would like KUA to participate in this research. Because E Alu Pū is the most well-established network that KUA facilitates and because the E Alu Pū Coordinator was confident that network members would be willing to provide the needed information, I selected E Alu Pū as the case for this research.

Recruitment Process

Since the case network was determined, all 36 network member groups plus KUA were included through the archival records and documentation provided by KUA, which generated and owns the data. Based both on the quantitative study results and the historical documents from KUA, I developed a list of potential interviewees and discussed them with KUA staff. To develop the initial list, the results from the

quantitative study informed the selection of participants. First, recruitment of network member groups was determined according to the quantitative data based on three dimensions: variation in participation, connectivity, and outcomes. In other words, I interviewed member groups for which the data indicated higher and lower participation according to the archival participation data, stronger and weaker connectivity according to results from SNA, and greater and lesser achievement of outcomes according to the quantitative results. Member groups represented these dimensions in complex ways. For example, a group may have had high participation during certain years and low participation in other years, or a group may show weaker connectivity and greater achievement of outcomes. I considered variation within groups and variation between groups as I selected interview participants. Directed by this variation, I interviewed the *po'o,* or leaders, of these network member groups, including the E Alu Pū Coordinator.

Additional stakeholders such as foundation staff, agency staff, policymakers, and organization partners also were selected for interviews. I selected these stakeholders based on variability in the type of organization and the length of their relationship to KUA and E Alu Pū, which represented a degree of investment in networking.

For the participants I knew personally, I sent an email to each with a personalized request to participate in an interview. For the participants I did not know personally, the E Alu Pū Coordinator asked permission via email to connect us. For

those that consented to be connected, the coordinator introduced us over email. From there, I emailed to request their participation in an interview.

Participant Selection

I interviewed 15 people, by which time I had reached saturation, the situation occurring when no additional themes are uncovered by additional interviews (Creswell, 2012). I used purposive variation sampling, which means I selected interviewees who represented groups with variation as described above (Patton, 2015). The reason I utilized variation sampling was to capture and represent different perspectives about the value of networking and different perceptions about the outcomes that emerged from networking. For example, if I spoke with *poʻo* who all were highly connected to and engaged in the network, I likely would have heard positively skewed information about the value of networking.

I interviewed the E Alu Pū Coordinator and KUA's Executive Director. For network member groups, I reviewed the data from the quantitative study and selected groups displaying variation in participation in and connectivity within the network, in addition to variation in the outcomes their groups achieved. For other stakeholders, I reviewed the data from archival documents and selected interview participants from different types of organizations and with different histories with E Alu Pū and KUA.

Data Collection

Case studies typically draw data from multiple sources. Yin (2018) named documentation, archival records, interviews, observation, participant observation, and physical artifacts as common sources of evidence used in case studies. For this case

study, I collected data from documents, archival records, and interviews. Though my original plans included data collection through observation and participant observation, these plans were thwarted by the COVID-19 global pandemic.

Setting and the Effect of COVID-19 on Data Collection

Given the importance to case study research of studying a case within its real-world context (Yin, 2018), I originally designed this study to include in-person interviews, site observation, and participant observation of E Alu Pū gatherings and events. In-depth in-person discussions and observations could have produced nuanced data about each subunit that could have been used to develop a more refined assessment of conditions and outcomes for each. The COVID-19 pandemic irretrievably affected gatherings, travel, and in-person data collection, forcing virtual data collection. Because of restrictions related to the pandemic, I used archival documents and held interviews over Zoom. All E Alu Pū groups were affected by the pandemic, and network activities moved online in March 2020. Virtual data collection became another adjustment to the real-world COVID-19 context for E Alu Pū groups.

The one element I was not able to reproduce well in a virtual environment was participant observation of network gatherings and workshops, activities for which the network traditionally has come together about twice per year. All network activities were conducted online beginning in March 2020 as the pandemic took hold of the world. KUA staff are continuing to hold virtual-only events through the foreseeable future. To replace the in-person observation I had hoped to implement, I used archival reports from past events that embedded photos and videos.

Data Collection Procedures

Interviews

I conducted semi-structured interviews 15 participants, including (1) *po'o* representing groups that have participated in and connected with the E Alu Pū network to varying degrees and achieved varying degrees of outcomes, and (2) stakeholders who represent different organizations that have varying relationships with E Alu Pū. The purpose of using interviews rather than another approach such as focus groups was to understand more deeply and richly the variability in what network participants perceive as the value and benefit of networking, whether their perceptions aligned with the intended outcomes or surfaced different outcomes. I used a semi-structured interview protocol (Appendix B) but dug more deeply into relevant topics that participants raised (Patton, 2005). I conducted interviews using Zoom and record them when I received permission to do so from interviewees. Zoom produced automated transcripts from recorded interviews, but Zoom's algorithms had difficulty transcribing Hawaiian pidgin and place names. I listed to the recordings as I reviewed the transcripts to create corrected versions. Given the iterative nature of qualitative research, I borrowed from phenomenology and conducted follow-up interviews with two participants for the purposes of clarification and elucidation (Creswell, 2013). After each interview, I responded reflexively, which Patton (2015) described as deep, systematic awareness and reflection (p. 70).

Documentation and Archival Records

KUA has created reports from gatherings (36 reports), emails from KUA to E Alu Pū (archived from 2015 through 2020), archived data from annual surveys (6 surveys between 2013 through 2020), staff meeting notes (archived from 2019 and 2020), staff updates about activities related to the desired outcomes (archived from 2017 through 2020), and themes from the Coordinator's annual phone calls to the *po'o* (archived from 2017 through 2020). All the documents and archives are stored on a Google Drive shared just with KUA staff and selected contractors. To carefully track the research pathway for others to follow, Yin (2018) suggested that case study researchers create a bibliography of documents. I followed this recommendation, entering each record into a database including a number for the record, the name of each file, where the document was stored, the date (if available) of the event recorded in the document, and the subject matter of the document.

Data Analysis

Data analysis consisted of multiple rounds of thematic analysis with each record, reflexive response during analysis, pattern-matching to determine whether the proposition that collective action networking contributes to outcomes is supported by the data, and thematic analysis of the reflexive data to understand how my perspective may have affected the analysis. In addition to reflexivity, I employed several strategies, described below, to ensure methodological integrity.

Data-Analytic Strategies

As I collected the qualitative case study data, I analyzed it during multiple rounds with each record. First, I used constant comparative thematic analysis, a type of inductive qualitative analysis for which I coded and analyzed data simultaneously. “By continually comparing specific incidents in the data, the researcher refines these concepts, identifies their properties, explores their relationships to one another, and integrates them into a coherent explanatory model” (Taylor & Bogdan, 1984, p. 126). Beginning with this inductive approach helped to surface concepts from the data without constricting them to specific, predetermined codes or categories (Creswell, 2012). Using constant comparative analysis, I compared data with other data, seeking whether the new information aligned with the concepts that were forming (Taylor & Bogdan, 1984).

While constant comparative analysis typically is associated with grounded theory, Fram (2013) described using constant comparative analysis deductively with a conceptual model or framework. In that case, the researcher “during the theoretical coding stage, uses such an understanding [of a concept in the framework] to find evidence in the data that reflects this understanding” (Fram, 2013, p. 4). Spring-boarding from that idea, I reviewed the data during a second round of constant comparative analysis, seeking evidence that reflected the program theory for networking at KUA. During both rounds, I employed reflexive writing to my reactions to and perceptions of the data. As Patton (2015) wrote:

> Reflexivity reminds the qualitative inquirer to be attentive to and conscious of the cultural, political, social, linguistic, and economic origins of one's own perspective and voice as well as the perspective and voices of those one interviews and those to whom one reports. (p. 70)

From these inductive and deductive rounds of analysis and with the resulting concepts I found, I next moved into pattern-matching, a process of comparing what emerged from the data with the patterns expected from the proposition that collective action networking contributes to outcomes (Yin, 2018). The result of pattern-matching was the identification of patterns that aligned with the proposition and patterns that did not align with the proposition (Yin, 2018).

Methodological Integrity

To demonstrate that the findings from this study were warranted, I employed several strategies that provided quality control for interviews and for the review of documents and archival records. I also used several techniques commonly recommended for qualitative and case study research, described below.

First, the quality of interviews rests with several factors, including rapport, linguistic appropriateness, and proper interpretation (Roulston, 2010). Through a background in journalism followed by community development, I have 30 years of interviewing experience and have developed rapport-building qualities. Also beneficial to rapport-building, the interviews were built upon the foundation of my long history with E Alu Pū. I was not a stranger, even if I had never before personally met several of the people I interviewed. That history also supported the development of linguistically and locally appropriate questions.

My history with E Alu Pū did not fully eliminate my outsider status, however. To address this, the E Alu Pū Coordinator reviewed the interview protocol I developed and provided feedback about linguistic norms. Also, throughout each interview, I sought clarification and understanding to ensure that my interpretations were accurate (Roulston, 2010). Through these steps, the interviews elicited the information needed to contribute to understanding.

Next, the primary quality concerns with documents and archival records relate to omission, errors, and bias, which can be managed to varying degrees. Documents are produced for a purpose other than research, and they may not contain the naked truth (Yin, 2014). Yin (2014) suggested that case study researchers consider the purpose of each document and filter the information therein through the lens of that purpose. To manage errors or omissions in the data, I cross-checked archival records against each other through constant comparative analysis.

Overall, the quality criteria I used were credibility, trustworthiness, and confirmability. Credibility in qualitative research has been considered the parallel to internal validity in quantitative research, meaning that the results are trustworthy (Patton, 2015). To enhance credibility or validity, I incorporated triangulation, the inclusion of multiple viewpoints, participant engagement, and reflexivity (Patton, 2015; Treharne & Riggs, 2014; Yin, 2018). Triangulation from multiple sources of evidence to establish a convergence of ideas increases construct validity through "multiple measures of the same phenomenon" (Yin, 2014, p. 121; also see Patton, 2015). In other words, using multiple sources of evidence resulted in "the development

of *converging lines of inquiry"* (Yin, 2014, p. 120). In much the same way, using multiple sources of evidence increased construct validity (Patton, 2015). In this case, the multiple sources of evidence were KUA staff, network member group representatives, aligned stakeholders, archival records, and documents. Participant engagement through member-checking and providing interview transcripts helped to ensure that findings and interpretations accurately reflected participants' understanding. While providing transcripts to interviewees helps to ensure accuracy, I employed member-checking with KUA, which was a process of sharing results and conclusions so that KUA staff members were able to provide contextual information, cultural interpretation, correction, and even ideas for additional analyses (Creswell, 2013).

Also, to combat bias, or looking for what you hope to find, Yin (2014) suggested that case study researchers secure assistance from two or three "critical colleagues" to offer outside opinions about what the understanding of the case the researcher is developing during data collection (p. 76). I shared results with two colleagues, one of whom was knowledgeable about E Alu Pū and one of whom was not. Also, built into the dissertation process has been the review of the work by multiple experts. These critical colleagues suggested alternative lines of inquiry and interpretations, contributing to the credibility of the results (Patton, 2015, p. 668).

For the quality criteria of confirmability, I incorporated Yin's (2014) suggestion to develop a case study database to track all activities, documents, reflexive responses, and notes as a "chain of evidence" (p. 127) that would enable a different

researcher to follow my path from questions to conclusions. This supports the reliability of the case study (Yin, 2014).

Finally, some would argue that my experience with and knowledge about the case is an advantage (Eisner, 2017; Mello, 2021). Others might argue that my experience with the case ran the risk of producing an unmanageable amount of subjectivity. Patton (2015) argued, "Philosophers of science now typically doubt the possibility of anyone or any method being totally 'objective'" (p. 725). As I have been over the last decade or so of trying to solve this riddle of connecting networking to outcomes, I aimed to be truthful and fair rather than totally objective. Using the quality-control methods I described here helped me, I believe, to produce meaningful, credible results.

Most evaluators or researchers using a case study design with SNA would stop here. Now that I have thoroughly described the procedures for the quantitative strand and the qualitative strand of the explanatory mixed methods case study, I will turn to an overview of integration in mixed methods and review the place of integration in ensuring the methodological integrity of the mixed methods case study. From there, I will review QCA and provide a detailed description of how QCA was utilized in this study to integrate the quantitative and qualitative data.

Integration of Quantitative and Qualitative Data

In mixed methods research and evaluation, quantitative and qualitative data must be integrated before interpreting results (Creswell & Plano Clark, 2018). Bazeley (2010) defined integration as:

> The extent that different data elements and various strategies for analysis of those elements are combined throughout a study in such a way as to become interdependent in reaching a common theoretical or research goal, thereby producing findings that are greater than the sum of the parts. (p. 432)

Without integration, the quantitative and qualitative results are unconnected. The purpose of integrating the quantitative strand and qualitative strand was to develop an in-depth description and understanding of the case and its complex, multifaceted characteristics using both types of data (Creswell & Plano Clark, 2018). Integration helped me to answer this research question:

- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

Methodological Integrity for the Case Study

For the findings of the case study to be warranted, I utilized a handful of strategies to increase methodological integrity. Creswell and Plano Clark (2018) discussed validity threats to both explanatory mixed methods studies and mixed methods case studies. They suggested the use of several techniques to alleviate those threats, and integration is cited as one of the critical techniques (Creswell & Plano Clark, 2018). I incorporated the following techniques:

- Design the qualitative strand to provide context and explication of the quantitative strand.
- Use the quantitative results for selection of the qualitative strand participants.

- Address results that are contradictory through returning to the data to recheck the analysis.
- Bound the case tightly and clearly.
- Interpret the case using the integrated quantitative and qualitative results rather than results from one or the other.

Next, I provide detail about how I adhered to this last bullet item using QCA for integration.

Mixed Methods Integration Using Fuzzy Set QCA

QCA has been hailed as a fundamentally integrative method because both quantitative and qualitative data are used in the same algorithm that produces the analysis (Bazeley, 2010; Hollstein, 2014). During case study analysis, researchers search for patterns, build explanations and alternative explanations, use logic modeling to link activities to outputs and outcomes, and use cross-case analysis to tease out the common results (Yin, 2018). QCA is a combination of these. Researchers establish the conditions based on understanding the cases, including activities, outputs, and outcomes. Applying the QCA algorithm across subunits results in patterns of conditions that are associated with an outcome. Clearly, QCA does not offer something brand new, but it "renders them explicit, standardizes them, and offers a powerful analytical instrument" (Hollstein & Wagemann, 2014, p. 246).

Introduction to QCA

QCA is a comparative analysis method based on Boolean algebra, set theory, and the logic of agreement and difference in which necessary and sufficient conditions

are framed as relationships between sets (Hollstein & Wagemann, 2014). QCA can be used to establish causal pathways for small and medium sample sizes and with both quantitative and qualitative data (Kahwati & Kane, 2020; Mello, 2021). The method can be used in situations of causal complexity, including when there are multiple combinations of conditions that lead to an outcome (i.e., conjunctural causation); when there are multiple pathways that lead to an outcome (i.e., equifinality); and when different conditions lead to an outcome when compared with conditions that lead to a non-outcome (i.e., causal asymmetry) (Hollstein & Wagemann, 2014; Mello, 2021). These causally complex situations are especially difficult for traditional variables-based inferential statistics to handle, which is one reason that social scientist Charles Ragin was motivated to develop QCA in the 1980s.

Ragin (1987) envisioned QCA existing outside of the paradigm debate of "quantitative versus qualitative." The analysis is completed via an established algorithm and tests of fitness that require quantization of qualitative data, characteristics that evoke quantitative statistical techniques. It is worth repeating Hollstein and Wagemann's (2014) reminder that "Boolean algebra places a greater emphasis on the *qualis* (Latin for 'how is it?') of a phenomenon than on its *quantum* (Latin for 'how much is it?')" (p. 249). The techniques used in QCA are meant to "reduce complexity and thereby contribute to a better understanding of the pattern under analysis" (Hollstein & Wagemann, 2014, p. 248). In other words, QCA is a tool to help researchers uncover patterns that elucidate a case. The critical characteristic of QCA is that it is rooted in the researcher's case knowledge based on careful case

examination and theory (Hollstein & Wagemann, 2014; Mello, 2021; Ragin, 1998). This characteristic, in addition to the practice of repeatedly updating the analysis based on what has been learned and its fundamental focus on different explanations for causes, evokes qualitative traditions. Hollstein and Wagemann (2014) summarized the position of QCA in the qualitative/quantitative paradigms this way: "In contrast to other mixed methods designs, it not only combines several methodological approaches but also borrows principles from various methods in order to arrange them into a new methodological strategy. As such, QCA is an integrated mixed method" (p. 249).

The basic use for QCA is to discover the conditions that are present with a certain result, based on criteria that the researcher elevates from situational and theoretical knowledge. If everyone who has achieved an outcome has completed Task A and everyone who has not achieved the outcome has not completed Task A, then logically, we could conclude that Task A is a necessary condition for achieving the outcome. For example, completing required coursework in a PhD program is usually a necessary condition for achieving the outcome of earning a doctorate degree. However, not everyone who completes the required coursework obtains a PhD degree. The condition of completing required coursework, therefore, is a necessary condition but not a sufficient condition. Additional conditions are required to achieve the outcome.

Process of QCA

The QCA process for determining which conditions are necessary and/or sufficient for a result was originally established by Ragin in the 1980s. Though

researchers since then have developed new techniques that have helped to expand the usefulness of QCA, its basic logic remains intact. Essentially, a researcher using QCA must have significant knowledge of the context, including the outcomes of interest and different conditions thought to contribute to the outcome (Ragin, 1987; Mello, 2021). The researcher gathers data about different cases, some of which have achieved the outcome and some of which have not. This variation is essential to uncover which conditions were necessary or sufficient to outcome achievement (Ragin, 1987; Mello, 2021).

After the researcher has data that includes the needed variation, a process called calibration is completed (Kahwati & Kane, 2020; Mello, 2021). Effective calibration requires the researcher's substantive and theoretical knowledge, as it is a process of determining how thoroughly the case exhibits each condition. The most common strategies for calibration in QCA are crisp-set QCA (csQCA) and fuzzy-set QCA (fsQCA) (Kahwati & Kane, 2020; Mello, 2021). Crisp-set QCA, the original approach to QCA developed by Ragin (1987), treats each condition as dichotomous. Using attainment of a doctoral degree as an example again, a researcher might determine that students who have completed 100% of required coursework are members of a condition set called "completion of coursework." Students who have completed less than 100% of coursework are not members of the condition set.

Not all conditions are so easily dichotomized, however, which is why fsQCA was developed. For example, if a researcher has decided to use "regular exercise" as a condition to losing weight, that researcher will have to determine, based on prior

research, what constitutes membership in the set of "regular exercisers." Perhaps the researcher will decide that 120 minutes of exercise per week constitutes full membership in the condition, whereas 90 minutes constitutes partial membership and less than 60 minutes constitutes no membership. Using fsQCA, set membership in a condition can be more nuanced. Mello (2021) urged researchers to use fsQCA over crisp-set because the binary nature of crisp sets tends to oversimplify, resulting in larger set membership. While crisp sets should be used when appropriate for the data, fuzzy sets are preferred when possible because they reflect greater complexity and nuance in set membership (Mello, 2021; Schneider & Wagemann, 2010).

With the process of QCA calibration, each condition can subsume multiple criteria for set membership, including both quantitative and qualitative data (Kahwati & Kane, 2020; Mello, 2021). Researchers and evaluators must clearly state the criteria they use, which should be justifiable based on substantive and theoretical knowledge (Ragin, 1987). Traditional qualitative researchers and traditional quantitative researchers react squeamishly to calibration (De Meur et al., 2012; Ragin, 2005). Qualitative researchers balk at the idea of quantizing qualitative data (Patton, 2015), and quantitative researchers balk at the idea of the researcher's subjective determination of criteria setting and the use of qualitative data (Sager & Andereggen, 2012). Mixed methods researchers, on the other hand, see combining the two as "an intuitive way of doing research that is constantly being displayed throughout our everyday lives" (Creswell & Plano Clark, 2018). Essentially, fuzzy-set calibration is a

more systematic, deliberate, transparent way of organizing information into an ordinal scale.

Once calibration is complete, the researcher creates what is called a "truth table," a term that sets some people on edge (Kahwati & Kane, 2020). The controversial name notwithstanding, a truth table essentially is a matrix showing the degree to which each case has membership in each condition and outcome. As an example, Table 3 is a fictional truth table of people who have and have not achieved the outcome of doctoral degree and their degree of membership in several conditions. The table illustrates that completion of coursework, successful dissertation proposal, successful dissertation defense, and submission of graduation paperwork are all necessary conditions of earning a doctoral degree. Everyone with a doctoral degree had membership in all those conditions. But those conditions, individually, were not sufficient. From this truth table, we can conclude that all the conditions are necessary but were not sufficient for membership in the outcome of "doctoral degree."

For this study, each condition will be calibrated based on a rating scale for use in fuzzy-set QCA. Details about how outcome and contributory conditions were identified and calibrated, and how set membership will be determined, follow.

Table 3

Fictional csQCA Truth Table for the Outcome of Achieving a Doctoral Degree

	Completed coursework	Successful dissertation proposal	Successful dissertation defense	Submission of graduation paperwork	Doctoral degree
Chase	1	1	1	1	1

Keani	1	1	0	0	0
Maya	1	1	1	1	1
Joy	0	0	0	0	0

Study Outcomes

E Alu Pū members have determined what outcomes they seek to achieve from coming together as a network. This study focused on three outcomes: (1) E Alu Pū groups are decision-makers in resource management in Hawaii; (2) E Alu Pū groups are effective managers of natural and cultural resources; and (3) E Alu Pū groups display solidarity for one another. QCA requires comparison, and E Alu Pū is only one network. Therefore, outcomes will be assessed based on member group achievements. For each desired outcome, E Alu Pū and KUA have identified evaluation measures or indicators based on the groups' experiences, cultural values, and the feasibility to assess indicators. These indicators, in large part, align with empirical research about collective action theory, and they align with empirical research about effective community-based resources management. Appendix C displays the indicators associated with each desired outcome and the prior research that has informed those indicators.

The literature about community-based resources management cites additional outcomes, especially increased native biodiversity and biomass (Dressler et al., 2010; Guber, 2010; Murphee, 2009). Many variables contribute to environmental change, and E Alu Pū groups have limited control over many of those. Groups also have limited capacity to monitor and research vast environmental variables. E Alu Pū

groups have decided to focus on the outcomes they have developed because they are actively working together toward those outcomes and because they can evaluate their progress toward those outcomes (again, refer to Appendix C).

To assess the degree to which each group has achieved each of the three outcomes, the indicators for the outcome were compiled (Kahwati & Kane, 2020). The detail about how I made decisions about how thoroughly each member group achieved each outcome is presented in the results chapter. To summarize here, though, I used four possible values for each outcome and condition, which is called four-value fsQCA (Kahwati & Kane, 2020; Mello, 2021).

Study Conditions

Based on literature, the program theory, and substantive knowledge of cases, general causal conditions of interest were identified that could be related to desired outcomes from networking. (See Appendix C for a table of outcomes and their respective indicators.) As was true with the outcomes, additional causal conditions exist. For example, according to prior research, land tenure and sustained funding are two conditions of successful community-based resources management (Gruber, 2009). A land tenure system does not exist in Hawaii, however, and cultural norms prevent asking about or sharing information about sustained funding. Although 501(c)(3) nonprofits will have IRS Form 990 on file, groups that are not 501(c)(3) nonprofits will not. Funding data will not be available for all groups, so it was left out of this analysis. Instead, the number of full-time staff members was a proxy indicator for

funding. The causal conditions selected were narrowed from a longer list that included conditions that were not as relevant to the specific context of E Alu Pū and Hawaii.

For each outcome, a maximum of five conditions could be studied with each outcome because of the exponential increase in the number of possible causal configurations with the addition of each condition. With two conditions, for example, a group would either meet set membership criteria for condition 1 only, condition 2 only, or both conditions 1 and 2. With five conditions, there become 32 possible configurations of conditions for 36 network member groups. A QCA rule of thumb is to avoid a possible number of configurations that is greater than the number of cases (Kahwati & Kane, 2020).

Fuzzy Set Calibration

Each condition was comprised of a composite of its indicators. Thus, for each condition, each group was assigned a single number based on the outcome indicators (see Appendix C). I provide detail about calibration in the results chapter.

Set Configurations

After all network member groups were assigned scores for each outcome and condition, analysis proceeded using specialized QCA software. For this research, I used open-source R software (R Core Team, 2019) with R Studio (RStudio Team, 2020) and two specialized QCA packages: QCA (Duşa, 2019) and SetMethods (Oana & Schneider, 2018). To conform to established good practices for using QCA, the analysis first uncovered any conditions identified as "necessary," or those always present when an outcome occurred (Mello, 2021; Schneider & Wagemann, 2010).

Goodness-of-fit for each condition was assessed using consistency, which is the proportion of configurations made of the same conditions that have resulted in the outcome (Mello, 2021). Mello (2021) recommended a threshold of .90 for consistency to accept the condition as "necessary."

QCA Result

The next step in the analysis was to create the "truth table" as described earlier in this chapter. The truth table, the "core of QCA" (Mello, 2021, p. 145), indicated the fsQCA scores for each outcome and condition for each group so that patterns could be detected. The result of a truth table is a causal pathway that identifies the conditions, whether sufficient or necessary, for the outcome. The purpose, however, is not to merely receive and report the result. Developing the truth table is more of an iterative process, as is common with qualitative data analysis, for which the researcher returns to the data to learn more and may alter the analysis based on what is learned. Mello (2021) suggested that a preliminary truth table be constructed during early phases of analysis to provoke deeper thinking about the selection of conditions. Kahwati and Kane (2020) suggested that calibration, conditions, and even case selection could be revisited based on preliminary truth table analysis. This approach is not unique to QCA but is common to qualitative research and mixed methods: "The cases evolve throughout the study. This philosophy holds that many perspectives are available and that they need to emerge during the research process to fully describe the complexity of the case" (Creswell & Plano Clark, 2018, p. 117). QCA, as a case-oriented method, and mixed methods case study both utilize an evolutionary process of analysis.

All revisions, these authors counseled, must be made based on substantive and theoretical knowledge rather than a haphazard approach (Kahwati & Kane, 2020; Mello, 2021). Researchers work with truth tables to arrive at solutions, which are the identification of sufficient conditions and combinations of conditions, through an algorithmic process called minimization (Kahwati & Kane, 2020). The solution identifies the necessary, sufficient, and combinations of causal conditions for the outcomes.

For those who blanch at the word "causal" used with such a fundamentally qualitative process, it is worth repeating that "causal" in QCA relates to causal complexity including conjunctural causation, equifinality, and causal asymmetry (Hollstein & Wagemann, 2014; Mello, 2021). QCA can be used to describe a causally complex relationship between condition and outcome sets, but "to allow for causal attribution, set theory should be embedded in a theory of causation and a theoretical rationale should be provided as to how the cause brought about its effect" (Mello, 2021, p. 69). In other words, "causal" has different meanings depending upon the theory being applied. "Causal" in QCA does not refer to causal inference, nor does it imply causal attribution (Ragin, 2005).

Methodological Integrity for QCA

"Perfect set relations can rarely be found in the social sciences" (Mello, 2021). Still, as researchers have developed QCA, they have established practices that are used to assess the methodological integrity of QCA results. To adhere to these practices, I carefully documented conditions and their treatment throughout the analysis, was

transparent about my data sources in case other researchers want to inspect them, provided the R script (Appendix D) for inspection, detailed my calibration methods and decisions, and used directional terms for set names (e.g., *engaged* public, *severe* damage).

A primary threat to integrity in QCA research is the temptation to perform the analysis by rote, mechanically following the steps without engaging with the data. Mello (2021) urged researchers to stay true to the "*case-based nature* of QCA" (p. 189). Case selection, conditions selection, calibration—all are rooted in substantial, meaningful case knowledge. Approaching QCA with the idea that data can be plugged in and run through the analysis in hopes that R will spit out meaningful results is paving a road of trouble. The best way to produce credible, meaningful results is to use QCA as it was intended.

Study 3: QCA As a Network Evaluation Tool

After mixed methods integration using QCA was complete, I investigated what I learned from Study 1, the quantitative study using SNA, and what I learned from Study 2, the case study using QCA. Through this, I answered the methodological research question about combining SNA and QCA to explore the connection between collective action networking and social change outcomes. Collective action theory provided framing for the results, as I determined which tool(s) were appropriate for the task of addressing each of these collective action dimensions named by Ostrom (2009) and Crossley and Ibrahim (2012):

- The structure of connectivity between group members

- Whether or not individuals are compelled to participate
- Historical actions
- Face-to-face communication
- The nature of the collective benefit
- Who bears the costs of collective action toward a common benefit
- Personal contribution to a collective benefit
- Number and heterogeneity of individuals
- Trust
- Consciousness-building
- Consensus-building

I also determined which of the tool(s) were appropriate for the task of addressing each of the named dimensions of systems and complexity theory (Cabrera et al., 2008; Hummelbrunner, 2011; Walton, 2014):

- Boundaries, level, and unit of analysis for the system
- Context in which the system exists
- Interrelationships present in the system and distinctiveness of interrelationships
- Motivations, behaviors, values, and feedback effects
- Nonlinear timing

Using the theoretical dimensions listed above, I presented the results in a table for a side-by-side comparison before describing the understanding gained about networking outcomes from combining SNA and QCA.

Chapter Three Summary

To answer the research questions about networking outcomes and the contribution of QCA, I conducted three scaffolded studies. For the first study, I employed a quantitative nonexperimental descriptive design and analyzed archival survey data with descriptive statistics, frequencies, and SNA. For the second study, I utilized an explanatory mixed methods case study. I inductively and then deductively analyzed data from interviews, documents, and archival records using constant comparative analysis to uncover the patterns in the data. I then took the extra steps to integrate the quantitative and qualitative data using QCA, which required quantizing the qualitative data. For the third study, I compared the results from Study 1 with results from Study 2 to discuss what combining SNA and QCA contributes to network evaluation.

CHAPTER FOUR: RESULTS

In this chapter, I relay the findings from three scaffolded studies. For Study 1, I used a survey with social network analysis (SNA) to discover the relationship structures and characteristics of the E Alu Pū network, along with outcomes achievement. For Study 2, I used an explanatory mixed methods case study that culminated in the integration of qualitative and quantitative data via qualitative comparative analysis (QCA) to determine whether I could connect networking to the intended outcomes. For Study 3, I compared the results from Study 1 and Study 2 to answer the overarching methodological research question about whether the SNA and QCA could be effectively combined to fill an important gap in network evaluation methods. The underlying motivation for the study was to discover whether this methodological approach could provide evidence about whether a collective action network was producing desired social changes. The research questions that the results were meant to answer are as follows:

Study 1: Social Network Analysis

- To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?
- To what degree were intended outcomes achieved by the E Alu Pū network and member groups?

Study 2: Quantitative Comparative Analysis

- For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?
- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

Study 3: Comparing Findings from Study 1 with Findings from Study 2

- How can SNA and QCA be combined effectively to explore the connection between collective action networking and social change outcomes?

The heart of this research was the desire to find the right evaluation tools for the complicated task of network evaluation. Evaluators have used SNA in inappropriate ways such as using SNA statistics as variables in regression models. We need to fill the gap in our evaluation toolkit with methods that are appropriate to the networking context so that we can produce trustworthy, accurate results. I examined whether the two tools of SNA and QCA could combine to complement each other and fill the gap.

For the remainder of this chapter, I review the results from each of the three studies in turn. I begin with the descriptive quantitative results, including SNA, from archival survey data. I describe how I used the results from the first study to select key informants for the second study. I then present the results from the case study, which was designed to surface intended and unintended outcomes along with case data needed for comparative analysis with QCA. I share the results of mixed methods integration using QCA, which derived conditions sufficient to the outcomes under

investigation. Lastly, I present the results from Study 3, a simple comparison of the results from each type of analysis used to answer the research questions.

What unfolds throughout this chapter is that the three scaffolded studies resulted in a holistic picture of the case network, E Alu Pū, including the degree to which the network and member groups were achieving different outcomes. E Alu Pū was well-connected, with efficient information-distribution paths in its network structure. However, this well-connected network would benefit from additional connectivity, as only one-quarter of all the possible connections to share information and work together have been realized. Patterns in the data indicated that as the network grew, provided advocacy training, and organized its membership, it won a somewhat tenuous seat at decision-making tables. Also, network members recounted that they have learned and implemented resource management practices because of their participation, and they benefit from the sense of community and shared experience. Finally, combining the complementary mixed methods tools of SNA and QCA produced causal pathways between networking and outcomes. I found SNA and QCA to be appropriate tools for network evaluation, as they were effectively combined to fill the gap connecting collective action networking and social change outcomes.

Results From Study 1: Social Network Analysis

To put the case network into context, I begin this section with a description of E Alu Pū using the common dimensions of networks that I reviewed in chapter 2. I then summarize network member group attributes. Next, I report results for research question 1 about network structures and relationship characteristics. Finally, I report

results for research question 2 about the intended outcomes at the network level and the site level.

E Alu Pū comprises 37 groups—36 community groups and one backbone organization, Kua‘āina Ulu ‘Auamo (KUA), which facilitates and coordinates the network. Data for this analysis came from archival data including surveys completed by E Alu Pū member groups from 2013 through 2020 and member group participation data from KUA. Participation data was available for every E Alu Pū member group (100%). Archival social network data was available for 34 of the 37 network groups (91.9%), so SNA reflects a partial, nearly complete network. Archival survey data was available for 35 of the 36 community groups (97.2%), so one group was removed from the descriptive analysis of attributes and outcomes.

E Alu Pū Member Group Attributes

In chapter 2, I reviewed the dimensions along which networks differ, including formality, network role, and network levels. Regarding formality, E Alu Pū is a formal network, meaning that it has clearly established boundaries (Borgatti & Halgin, 2011; Guerrero et al., 2017). The network is comprised of primarily Native Hawaiian community groups that are reclaiming stewardship of places where they have lineal or social ties by using approaches consistent with community-based resources management (CBRM). The purpose of the network is to affect social change, so it is defined as a collective action network (Ernstson, 2011). Regarding network role, E Alu Pū was created to generate connections and learning that produce outcomes. Of the different camps of network researchers, structuralists investigate outcomes produced

by the action of networking.[1] Because E Alu Pū was created to produce outcomes, I treated this study as a structuralist. Regarding network levels, I studied the network at two levels: (1) the network as a whole and (2) the network member groups. I did not study the network at the levels of individual people, so a member group is considered a "node" in network parlance.

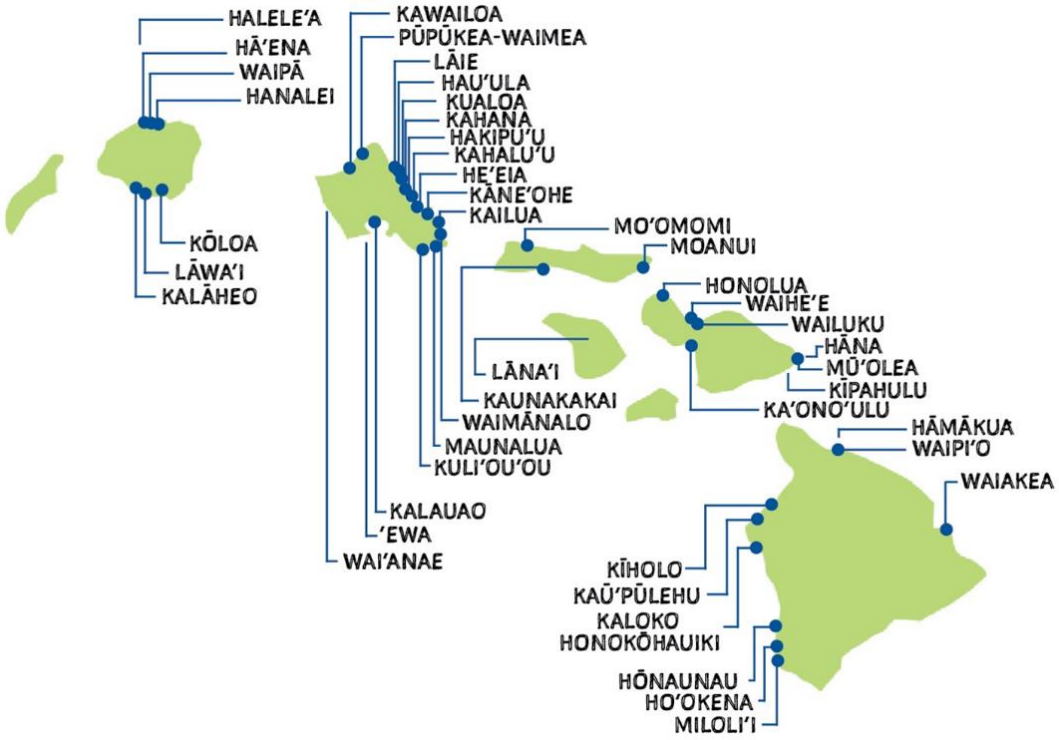
Member groups are located on Kauaʻi (*N* = 5), Oʻahu (*N* = 15), Molokaʻi (*N* = 2), Maui (*N* = 6), Lānaʻi (*N* = 2), and Hawaiʻi (*N* = 7) (Figure 5). Groups have as their primary focus nearshore marine fisheries and reefs (*N* = 19); watersheds (*N* = 15); and *wahi pana,* or cultural and historical resources (*N* = 15). Groups also focus on native plants (*N* = 12); *limu,* or native seaweeds (*N* = 11); *loʻi,* or taro fields (*N* = 11); agricultural resources (*N* = 10); freshwater resources (*N* = 6); and *loko iʻa,* or fishponds (*N* = 5).

Group characteristics vary widely, from well-established groups to new groups (range = 45 years, median = 16.5 years). They care for small spaces to large spaces (from 2 acres to 15,125 acres, median = 20 acres). The total area under community-based resource management by E Alu Pū groups is 32,035.8 acres. Groups have participated in E Alu Pū for an average of 11 years, with 16% of groups having participated for 5 years or fewer and 27% having participated for the network's entire

[1] As reminder from chapter 2, connectionists believe that it is theoretically unfeasible for networks to produce outcomes (Borgatti & Foster, 2003; Groce et al., 2019).

Figure 5

By-Island Composition of E Alu Pū



Note. More than 36 communities are shown on the map because groups who participate in E Alu Pū but have not signed the ʻAe Like (formal membership agreement) are included. (From "Network Weaving for Self-Determination: Reclaiming Stewardship of Hawaiian Lands and Waters," by M. Tamanaha, N. Rozet, & D. Gowensmith, October 24, 2020, slide 13. Presentation to the Midwest Eco Conference. Copyright 2020 by Kuaʻāina Ulu ʻAuamo.)

17 years. Participation in the network has grown over time. The first network gathering involved 12 community groups with 21 people, and the last gathering in 2019 prior to the COVID-19 global pandemic involved 36 community groups with 184 people. Table 4 displays participation rates for E Alu Pū groups, which affects their connectivity within the network. Figure 6 illustrates the increase in the number of

people from the member groups participating over time. Participation is related to the degree to which groups have opportunities to connect with other groups. Next, I will turn to the connectivity measures that social network analysis yielded.

Table 4

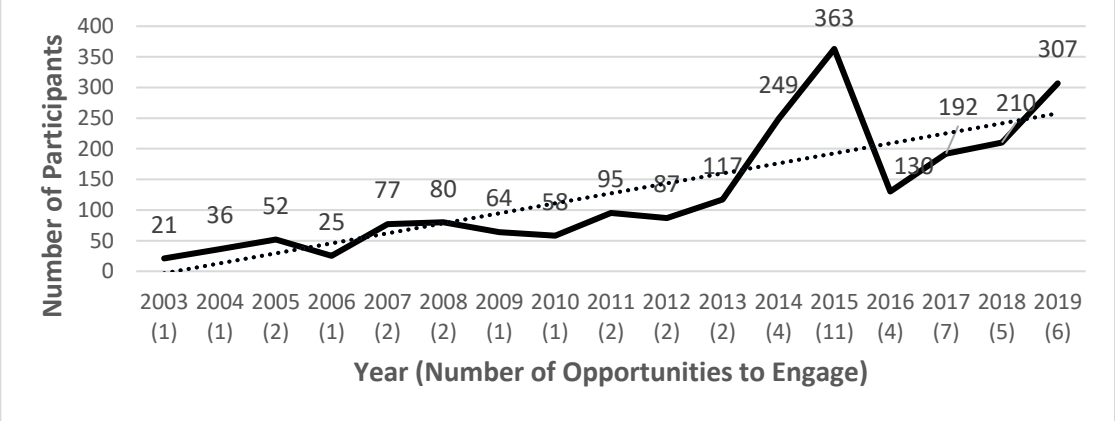
Participation of E Alu Pū Groups

	Years Participating	Proportion Attendance
A	17	100.0%
B	17	59.3%
C	17	64.8%
D	16	63.0%
E	9	55.6%
F	17	66.7%
G	17	51.9%
H	6	25.9%
I	16	51.9%
J	7	24.1%
K	3	11.1%
L	10	44.4%
M	17	37.0%
N	13	18.5%
O	3	7.4%
P	8	37.0%
Q	15	27.8%
R	15	55.6%
S	3	11.1%
T	15	33.3%
U	17	53.7%
V	14	44.4%
W	2	7.4%
X	6	22.2%
Y	14	40.7%
Z	13	29.6%
AA	16	50.0%

	Years Participating	Proportion Attendance
BB	7	42.6%
CC	8	29.6%
DD	7	42.6%
EE	2	5.6%
FF	7	3.7%
GG	17	33.3%
HH	17	66.7%
II	10	40.7%
JJ	2	9.3%
KK	17	37.0%

Figure 6

Member Groups' Participation in E Alu Pū Activities Over Time



Research Question 1: Network Structures and Characteristics

With the first research question of this study, I asked, "To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?" To answer this question, I used archival survey data that was available for 34 of 37 E Alu Pū member groups, including KUA (91.9%). Because not every group was represented in the archival survey data, the results were

indicative of the large majority of member groups, but not the full network. In the surveys, groups selected which other E Alu Pū groups they shared information with outside of network events and which other E Alu Pū groups they worked with on projects outside of network events. Making connections outside of network events is indicative of the degree to which the network is self-generating, a desirable state in which network groups connect with each other to solve problems and support each other outside of KUA's direct influence.

From the archival data, I created a directed, weighted edge matrix. An "edge" is the term in SNA for a connection or relationship. An edge matrix is formatted to convey a directed relationship[2] named by one group to another group in each row, as in the example in Table 5. The edge matrix portrayed groups that shared information and/or worked on projects with other groups outside of network events. A weighted matrix conveys the strength of the relationship by a standard of the researcher's choosing, based on the research question. In this case, a weight of "1" indicated that the group listed one type of connection—either sharing information or working together. A weight of "2" indicated that the group listed two types of connections—both sharing information and working together. This type of edge matrix is described as a directed, weighted matrix.

[2] An undirected relationship shows a connection between two groups without specifying which group named the other.

Table 5

Example Directed, Weighted Edge Matrix

Group Naming the Connection	Group Named as a Connection	Weight
Group A	Group C	2
Group A	Group F	1
Group A	Group G	1
Group B	Group C	2
Group B	Group G	1
Group C	Group A	2
Group C	Group B	2

I analyzed the edge matrices using Gephi version 0.9.2, an open-source software specializing in network analysis and visualization (Bastian et al., 2009). The social network measures for the E Alu Pū network are displayed in Table 6. The social network measures for each node are displayed in Table 7.

Table 6

Social Network Statistics for E Alu Pū

	Diameter[1]	Average Path Length[2]	Average Degree[3]	Average Weighted Degree[4]	Density[5]
E Alu Pū	3	1.7	9.1	12.8	.25

[1]Diameter: Steps to traverse from one end of the network to another (efficiency)
[2]Average path length: Average number of steps by shortest path across the network for all pairs of nodes (flow of information)
[3]Average degree: Average number of edges per node (connectivity)
[4]Average weighted degree: As average degree, but considers weights of relationships (connectivity)
[5]Density: Proportion of actual edges to all potential edges (connectivity)
Source: Cherven (2015)

Of note in Table 6 is the short diameter (3) and average path length (1.7), meaning the network was highly efficient and could disperse information efficiently throughout. The weighted degree (12.8) and density (.25) indicated that if the desire

was for network groups to share information and work together outside of network events, there was room to improve. Density indicated only 25% of the potential connections for sharing information and working together have been realized. It has been suggested that networks with greater density and degree are more likely to engage in collective action (Crossley & Ibrahim, 2012).

Of note in Table 7 is the crucial position of Group A as indicated by the measures of hub (.42), authority (.33), and closeness centrality (1.0). The network's structure would be foundationally affected by the removal of this group. Other strong hubs were Group D (.33) and Group G (.34). Other strong authorities were Groups T (.26), U (.25), and Y (.23). Group D had high betweenness (96.86) and thus was an important node that formed bridges or connections between other nodes. Very well-connected, as indicated by harmonic closeness centrality, were Groups D (.85), S (.74), U (.72), and V (.74). Finally, there were clusters that may benefit from additional integration: Group 0 (.80), Group Z(.83), Group EE (.83), and Group GG (.83).

Table 7

Social Network Statistics for Nodes

Node	Weighted Indegree[1]	Weighted Outdegree[2]	Eigenvector Centrality[3]	Harmonic Closeness Centrality[4]	Betweenness Centrality[5]	Authority[6]	Hub[7]	Clustering[8]
A	46.00	53.00	1.00	1.00	365.71	0.33	0.42	0.21
B	11.00	17.00	0.34	0.68	11.75	0.13	0.20	0.41
C	16.00	13.00	0.42	0.61	7.62	0.17	0.12	0.54
D	14.00	33.00	0.40	0.85	38.15	0.18	0.33	0.29
E	5.00	6.00	0.21	0.56	1.30	0.08	0.07	0.62
F	15.00	11.00	0.41	0.58	9.34	0.15	0.10	0.44
G	22.00	36.00	0.64	0.85	96.86	0.19	0.34	0.31

Node	Weighted Indegree[1]	Weighted Outdegree[2]	Eigenvector Centrality[3]	Harmonic Closeness Centrality[4]	Betweenness Centrality[5]	Authority[6]	Hub[7]	Clustering[8]
H	20.00	9.00	0.60	0.58	13.61	0.22	0.10	0.42
I	11.00	18.00	0.36	0.65	14.13	0.10	0.17	0.38
J	2.00	16.00	0.09	0.69	0.00	0.03	0.23	0.56
K	12.00	5.00	0.46	0.51	5.44	0.16	0.07	0.58
L	9.00	6.00	0.38	0.57	1.98	0.14	0.09	0.62
M	9.00	4.00	0.32	0.56	6.99	0.11	0.07	0.47
N	14.00	8.00	0.53	0.58	9.85	0.22	0.09	0.54
O	8.00	0.00	0.27	0.00	0.00	0.10	0.00	0.80
P	7.00	3.00	0.35	0.50	2.46	0.15	0.03	0.51
Q	5.00	0.00	0.21	0.00	0.00	0.08	0.00	0.75
R	16.00	13.00	0.46	0.64	10.99	0.21	0.16	0.46
S	9.00	23.00	0.31	0.74	25.82	0.14	0.24	0.34
T	26.00	15.00	0.69	0.64	24.79	0.26	0.14	0.35
U	26.00	22.00	0.60	0.72	36.87	0.25	0.23	0.39
V	19.00	23.00	0.52	0.74	37.56	0.19	0.25	0.33
W	9.00	11.00	0.31	0.59	2.15	0.13	0.12	0.61
X	15.00	22.00	0.46	0.68	22.99	0.18	0.21	0.42
Y	19.00	21.00	0.54	0.67	24.11	0.23	0.16	0.44
Z	5.00	6.00	0.19	0.57	0.45	0.06	0.08	0.83
AA	6.00	14.00	0.26	0.67	5.23	0.12	0.18	0.43
BB	8.00	11.00	0.32	0.58	0.88	0.12	0.11	0.71
CC	5.00	0.00	0.25	0.00	0.00	0.11	0.00	0.75
DD	13.00	8.00	0.42	0.58	3.10	0.17	0.10	0.60
EE	4.00	0.00	0.17	0.00	0.00	0.08	0.00	0.83
FF	14.00	0.00	0.44	0.00	0.00	0.15	0.00	0.52
GG	3.00	0.00	0.16	0.00	0.00	0.07	0.00	0.83
HH	9.00	9.00	0.35	0.57	1.27	0.13	0.08	0.64
II	12.00	10.00	0.45	0.57	3.81	0.17	0.07	0.54
JJ	13.00	13.00	0.38	0.64	11.20	0.14	0.13	0.39
KK	17.00	15.00	0.45	0.64	12.57	0.18	0.16	0.41

[1]Weighted indegree: Number of times a node was named as a connection, considering weights of relationships
[2]Weighted outdegree: Number of times a node named others as a connection, considering weights of relationships
[3]Eigenvector centrality: Relationship to highly connected (i.e., influential) nodes
[4]Harmonic closeness centrality: A measure of how many steps it would take a node to reach all other nodes
[5]Betweeness centrality: A measure of forming bridges between nodes (how often a node lies between others)
[6]Authority: A measure of how many edges, or connections, point to a node
[7]Hub: A measure of how many edges, or connections, originate from a node
[8]Clustering: A measure of how nodes form subgroups or clusters within the network
Source: Cherven (2015)

Figure 7 compares the network measure of harmonic closeness centrality (a measure of connectedness) with the participation rate and length of membership for each group. Figure 8 portrays the E Alu Pū network as a sociogram.

Figure 7

Harmonic Closeness Centrality with Rate of Attendance and Years of Participation

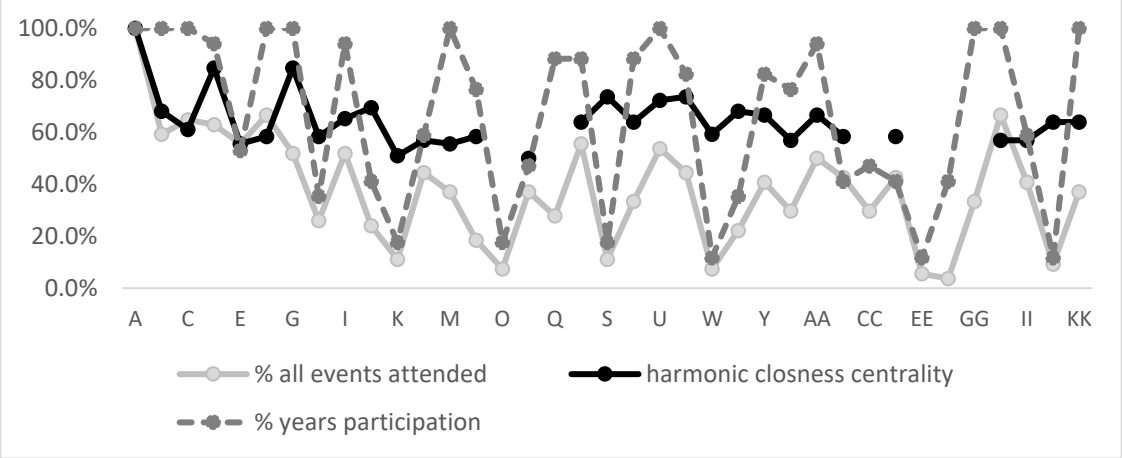
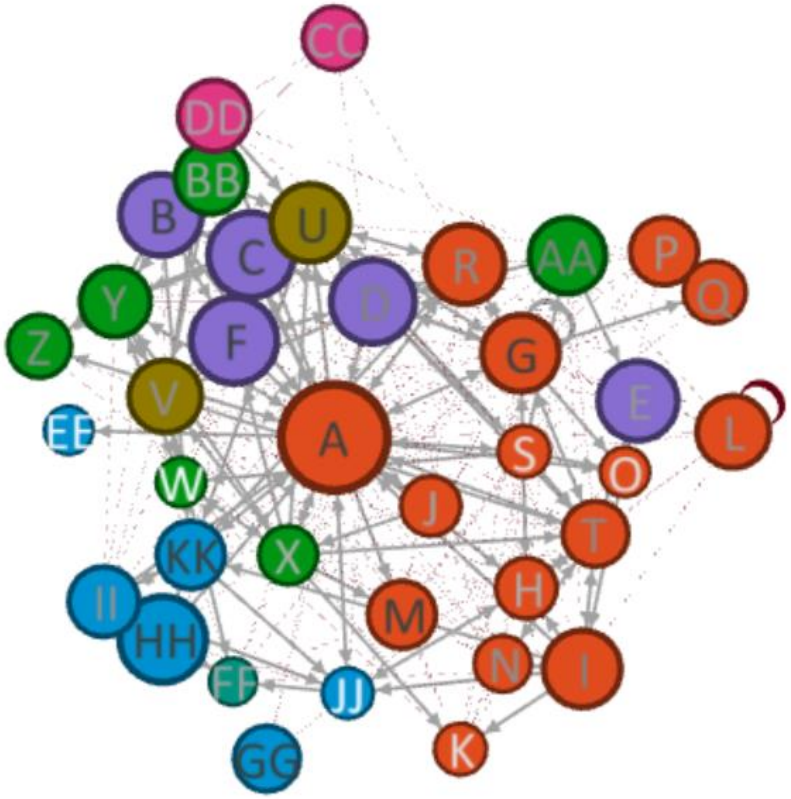


Figure 8

E Alu Pū Sociogram



Note. To read this graph, keep the following characteristics in mind. The node (circle) placement indicates harmonic closeness centrality, so the most central nodes are the most well-connected. The edges, or lines between nodes, indicate the weight of connection, so darker lines mean groups said they both shared information and worked with the group to which they are connected. Lighter lines indicate that groups said they did one or the other. The node color indicates the island on which the group is located (to maintain confidentiality, no key is provided). The size of each circle indicates attendance rate, where larger nodes mean higher attendance in E Alu Pū events. The color of the node label indicates years of membership, where darker letters mean longer membership. The image was created using Gephi 0.9.2 (Bastian et al., 2009) using the layout algorithm ForceAtlas 2 (Jacomy et al., 2014).

Research Question 2: Intended Outcomes

With the second research question of this study, I asked, "To what degree were intended outcomes achieved by the E Alu Pū network and member groups?" To answer this question, I again used archival survey data, which was available for 35 of the 36 community groups (97.2%), with varying response rates per question. Using surveys, KUA asked groups questions related to three E Alu Pū goals (see Appendix C): (1) to be decision-makers, (2) to be resource managers, and (3) to show up for each other, which I have termed "solidarity." Taken collectively, these data provide information about what has happened at the network level. Taken group-by-group, these data provide information about what has happened at the site level. The data do not include site-based information that would help to establish temporal precedence, or whether a desired outcome at a site occurred prior to or after the group's participation in E Alu Pū. Therefore, the data speak to conditions but not causes. This is important to note because if we want the appropriate tool to determine whether networking contributed to outcomes, the survey data was not sufficient. However, as I describe later in this chapter, the survey was an appropriate tool to gather data to be used with QCA. For now, though, I begin by reviewing the network-level outcomes first, followed by the site-level outcomes.

Network Level Outcomes

To Be Decision-Makers

To learn about decision-making, KUA asked groups whether they participated in public decision-making processes, defined as attendance at public hearings,

submission of testimony, and visits to elected or appointed officials. In response, 81.8% of groups reported that they participated. In addition, KUA tracked the number of policy decisions that the network advocates for to determine their rate of success. The network has advocated for three major policy efforts: (1) the adoption of community-developed laws governing the Hā‘ena Community-Based Subsistence Fishing Area, (2) the adoption of community-developed laws governing marine resources at Ka‘ūpūlehu, and (3) the adoption of community-developed laws governing the Mo‘omomi Community-Based Subsistence Fishing Area. Of these three, two (66.7%) have been successful.

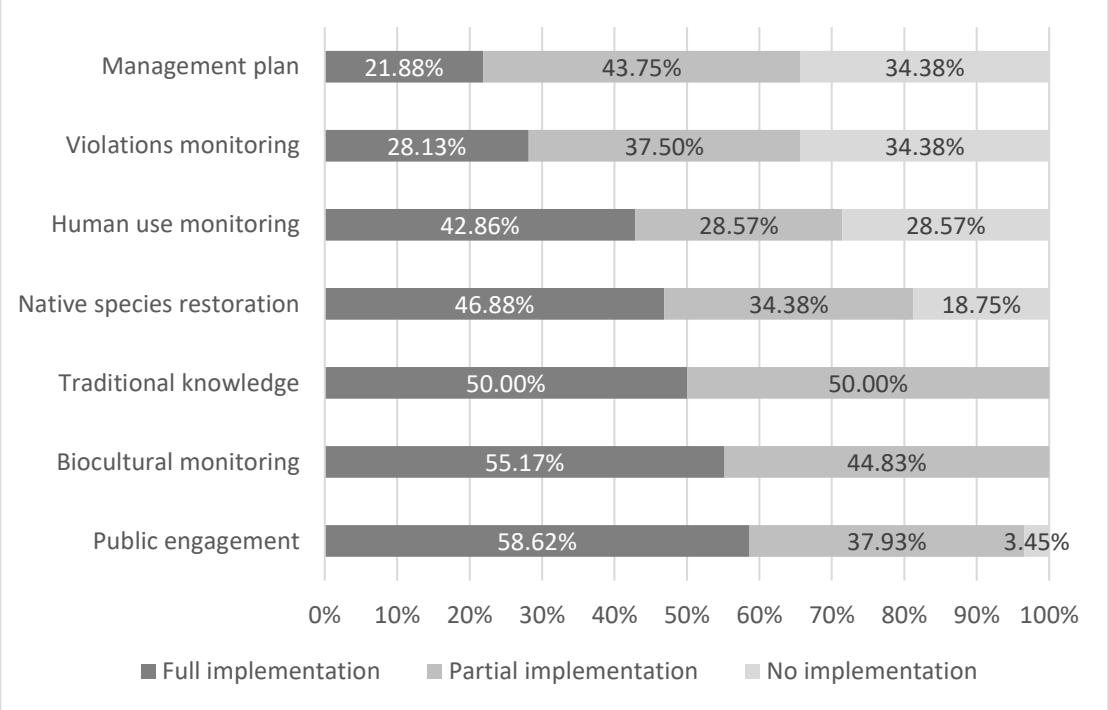
To Be Resource Managers

To learn about resource management practices, KUA asked groups how extensively they have adopted practices that peer-reviewed literature has indicated as effective for community-based resources management (Appendix C). With archival data for 34 of 36 community groups (94.4%), 55.9% had at least one type of formal or legal recognition of site stewardship (a county permit or a state area designation, for example). All groups were implementing the use of traditional knowledge to some degree, and all were implementing biocultural monitoring to some degree. A large majority were engaging the public through educational or outreach activities. Most struggled to fully implement management plans, and more than a third were not conducting violations monitoring. Figure 9 portrays the degree of implementation of these effective community-based resource management practices across the network.

Though survey data was not able to provide temporal precedence, KUA did ask members whether they were using new strategies or tools that they attributed directly to their participation in E Alu Pū. With 35 of 36 (97.2%) community groups responding, 60% of respondents said "yes," and 40% said "no." Sixteen groups (45.7%) were able to provide specific examples.

Figure 9

Degree of Implementation of Effective CBRM Practices Across E Alu Pū



Solidarity

To learn about solidarity, I used archival SNA survey data. KUA asked member groups if they ever sent out a *kāhea*, or called upon the network for assistance

and, if so, which groups responded to their calls. Only 37.1% of groups said they have called upon the network for assistance, but 91.4% were named as responding to requests for assistance from others. Most groups were named by multiple members as responding with help, which included writing public testimony on behalf of a group, attending a volunteer workday, providing specialized instruction or assistance, and more. Another way E Alu Pū groups showed up for each other was through working together on projects. Most groups, 88.6%, were named by others as working together on projects. Finally, I found public testimony from 62.9% of E Alu Pū groups supporting one community's Community-Based Subsistence Fishing Area legal designation in 2014[3].

The social network measures (Table 6) were also indicative of solidarity. Connectivity is especially measured by density[4] (.25,) and average weighted degree[5] (12.8) (Cherven, 2015). As described above, density indicated that 75% of possible connections to share information and work together were unrealized, leaving room for improvement. Average weighted degree also indicated room for improvement, as groups were not connecting across the entire network. These measures, along with the low percentage of groups that have asked for help, indicated that network member groups have not leveraged the strength available within the network.

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[3] Some current member groups were not members in 2014 and thus were not called upon to submit testimony.

[4] The proportion of actual edges to all potential edges

[5] Average number of edges per node

Site Level Outcomes

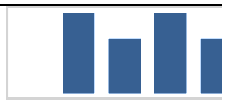
I relied on the same archival survey data to assess how thoroughly sites were achieving the stated site-based desired outcomes. To maintain confidentiality, I consolidated or collapsed the data for display rather than reporting the raw data individually for each group (Table 8). Each group's degree of participation in decision-making activities was a consolidation of attendance at public hearings, submission of testimony, and visits to elected or appointed officials. Each group's degree of implementation of CBRM effective practices was a consolidation of whether they had a formal site agreement, and the degree to which they collaborated with official resource management agencies, implemented a management plan, restored native species, used traditional knowledge, and conducted environmental monitoring activities. Likewise, I consolidated the number of acres each group was responsible for from a large amount (500 acres or more) to a small amount (19 acres or less) to retain confidentiality. I reported raw data for harmonic closeness centrality and proportion of event attendance, as groups cannot be identified by those numbers.

The sparkline bar charts included for each group in Table 8 provide an at-a-glance overview of the degree to which the group met the various indicators. Please note that sparkline bar charts should not be compared with one another because the scale for each is based on its individual row rather than a total available proportion of 100%. For example, Group C did not score a 100% for any indicator, but the height of the sparkline bar chart is the same as that of Group B, which did score 100% for two of the indicators.

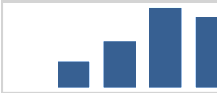
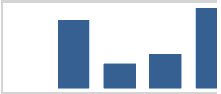
To summarize the results of Study 1, the survey including SNA provided instructive data about the relationship structures and characteristics of the E Alu Pū network, progress on desired outcomes at the network level and the site level, and areas for improvement. The study also exposed gaps that the tools—a survey and SNA—could not address in a networking context. Network survey data in this case could not be analyzed using inferential statistics due to violations of criteria related to random selection and independence of observations. Although the tools performed as they were intended to provide descriptive results, they were not designed to connect networking to outcomes. Next, I explore the results of Study 2 to determine what could be learned about intended and unintended outcomes, along with necessary and sufficient conditions, to connect networking to outcomes.

Table 8

E Alu Pū Groups, Desired Outcomes, and Additional Indicators

ID	Degree of participation in decision-making (in quartiles)	Degree of implementation of CBRM effective practices	Comparative proportion of acres stewarded (in quartiles)	Harmonic closeness centrality	Proportion of event attendance	Sparkline bar charts of proportionality
B	100.0%	68.8%	100.0%	68.1%	59.3%	
C	75.0%	68.8%	25.0%	61.1%	64.8%	
D	75.0%	87.5%	25.0%	84.7%	63.0%	
E	100.0%	56.3%	100.0%	55.6%	55.6%	

ID	Degree of participation in decision-making (in quartiles)	Degree of implementation of CBRM effective practices	Comparative proportion of acres stewarded (in quartiles)	Harmonic closeness centrality	Proportion of event attendance	Sparkline bar charts of proportionality
F	75.0%	100.0%	100.0%	58.3%	66.7%	
G	100.0%	68.8%	25.0%	84.7%	51.9%	
H	25.0%	75.0%	25.0%	58.3%	25.9%	
I	50.0%	68.8%	25.0%	65.3%	51.9%	
J	0.0%	56.3%	25.0%	69.4%	24.1%	
K	0.0%	100.0%	75.0%	50.9%	11.1%	
L	100.0%	43.8%	25.0%	56.9%	44.4%	
M	75.0%	87.5%	50.0%	55.6%	37.0%	
N	50.0%	56.3%	75.0%	58.3%	18.5%	
O	0.0%	56.3%	25.0%	0.0%	7.4%	
P	25.0%	81.3%	25.0%	50.0%	37.0%	
Q	50.0%	81.3%	50.0%	0.0%	27.8%	
R	100.0%	68.8%	75.0%	63.9%	55.6%	
S	25.0%	18.8%	50.0%	73.6%	11.1%	
T	50.0%	68.8%	50.0%	63.9%	33.3%	
U	100.0%	93.8%	100.0%	72.2%	53.7%	

ID	Degree of participation in decision-making (in quartiles)	Degree of implementation of CBRM effective practices	Comparative proportion of acres stewarded (in quartiles)	Harmonic closeness centrality	Proportion of event attendance	Sparkline bar charts of proportionality
V	50.0%	75.0%	50.0%	73.6%	44.4%	
W	75.0%	93.8%	25.0%	59.3%	7.4%	
X	50.0%	62.5%	25.0%	68.1%	22.2%	
Y	50.0%	68.8%	25.0%	66.7%	40.7%	
Z	75.0%	25.0%	75.0%	56.9%	29.6%	
AA	25.0%	43.8%	75.0%	66.7%	50.0%	
BB	0.0%	18.8%	50.0%	58.3%	42.6%	
CC	25.0%	6.3%	(Missing data)	0.0%	29.6%	
DD	50.0%	18.8%	25.0%	58.3%	42.6%	
EE	0.0%	56.3%	25.0%	0.0%	5.6%	
GG	25.0%	0.0%	50.0%	0.0%	33.3%	
HH	75.0%	62.5%	50.0%	56.9%	66.7%	
II	100.0%	100.0%	100.0%	56.9%	40.7%	
JJ	50.0%	37.5%	25.0%	63.9%	9.3%	
KK	100.0%	81.3%	25.0%	63.9%	37.0%	

Results From Study 2: Qualitative Comparative Analysis

For Study 2, I employed an explanatory mixed methods case study design. In this section, I report the results of the study, beginning with how the quantitative phase (Study 1) informed the qualitative phase. Then I share how the case study results complemented the quantitative results about the intended outcomes of networks, then went further to provide insight about unintended outcomes, plausible rival explanations, and factors that hindered outcome achievement for E Alu Pū groups. I next describe the integration of quantitative and qualitative data, which led to the creation of the data matrices that I used to run QCA. I explicate each step of QCA with the results from each step, finally arriving at the solution term or pathway for each outcome I studied.

For the case study, I reviewed 93 archival documents provided by KUA. The documents covered the entire history of the network and included spreadsheets of raw survey data, annual reports, strategic planning documents, gathering reports, charter documents, staff data tracking documents and spreadsheets, and notes from reflections at gatherings.

I also interviewed 15 people. To select interviewees, I considered information uncovered through the documents and the results from Study 1. The people I interviewed represented groups with variation in E Alu Pū participation, network connectivity, and outcome achievement. Regarding participation, interviewees' groups have participated from 17 years to 2 years, with rates of participation from 9.3% to 66.7%. Interviewees' connectivity, indicated by eigenvector centrality, ranged from

.16 to .60 (from a possible measure of 1). Interviewees' groups have achieved varying levels of outcomes, from groups that became inactive to groups that actively engaged many community members to care for large areas for which they secured special management designations. I also spoke with a representative from a group that used to be active in E Alu Pū but which did not sign the 'Ae Like membership agreement and has not participated in E Alu Pū for several years. Interviewees resided on five of the Hawaiian Islands. Aside from network group members, I also interviewed four individuals who were KUA collaborators, including representatives from funding partners and project partners. Finally, I interviewed two KUA staff members, including the E Alu Pū Coordinator, whom I interviewed formally twice. Next, I discuss what the case data revealed about the intended and unintended outcomes.

Research Question 3: Intended and Unintended Outcomes

With the third research question of this study, I asked, "For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?" I attempted to discover patterns that indicated whether and how intended and unintended outcomes were being achieved. Analysis of interviews and archival documents surfaced information not only about intended and unintended outcomes, but also about plausible rival explanations and factors that limit outcome achievement. Archival documents and interviews provided information about change over time and evidence of the network's contribution to outcomes. I describe the evidence I found for each of those in turn.

To provide context for the outcomes discussed below, one person who was involved at the origins of E Alu Pū described the original purpose of the network this way:

> There was this opportunity at the behest of Uncle Mac Poepoe and others to start bringing communities together. And the idea at the time was to kind of empower local communities and their desires for improved coastal and marine resource management by convening them and developing a network for learning and sharing, such that communities could come together around shared problems and develop shared solutions to them.

Evidence in early documents indicated that the convening partners and supporters of what became E Alu Pū intended for networking to translate into improved environmental conditions. For community participants, the desired outcomes seemed to be equally biological and cultural, however. From the first gathering report, for example, was this description of desired outcomes:

> Many people feel that one of the highest priorities for communities right now is to gather and preserve the knowledge of *kūpuna* [elders] about how things used to be and the ways that Hawaiians cared for the *ʻāina* [land] and ocean. Traditional ways and *kapus* [prohibitions] kept fisheries healthy and enabled people to use the resources without depleting them beyond sustainable levels. Passing wisdom of how things have changed from the past and showing the youth that they are responsible for the future makes our *kūpuna* [elders] one of the most valuable resources we have for ocean management in Hawaiʻi today.

Over time, the perspective about intended outcomes seemed to shift, as described by a representative of a long-term E Alu Pū partner: "You gotta have something in the near-term to be able to hang your hat on. And so first, things like inspiration, energy, conversation—you know, dialogue—those are going to be, I think, valid near-term indicators that we're making progress." Another described the challenge with intended environmental outcomes this way:

> If we're going to get to long-term biological outcomes, knowing that that's a super, super slow boil, knowing that if we could get rid of all of our insults to the nearshore marine environment tomorrow across the board, we still wouldn't see statistical improvements in fisheries in probably another two to three years from that point forward. So even in the most vacuous, pure scenario, if that's the case, with all the complexities of the world, and these added dimensions, you know, how are we going to paint this picture? It was really valuable for me to land on this…idea of, you know, short-term social indicators and long-term biological ones. Because you gotta have…a toehold to say, 'Yeah, we're doing okay. We're making progress.' And E Alu Pū is, I think, a really good indicator of that generally. Growth in numbers. Growth in voice.

The intended outcomes described in Table 9 are condensed from KUA's evaluation plan and goals E Alu Pū itself prioritized through an empowerment evaluation process. The desired outcomes today are more mature, nuanced, and holistic than the original desired outcome of improved environmental conditions. The intended outcomes have been adapted over time with the wisdom gained through

experience and the direct touch of E Alu Pū. They incorporate what one interviewee described as "social justice" and another described as "Native self-determination" as key elements comingled with intermediate environmental indicators.

Table 9

Evidence of Intended Outcomes

Intended Outcomes	Evidence From Qualitative Data
Network Level	
Decision-makers: E Alu Pū participates in decision-making processes, and the policy decisions that E Alu Pū advocates for are approved.	Many interviewees communicated a sense of increased power and voice by communities because of the work and reputation of E Alu Pū over the years. The importance of this was stated by a community participant, "We all know that one person asking for something is not as strong as hundreds of people from all over, you know, from different communities, supporting you. So, yeah, that's important to have that voice." Interviewees especially named the passage of two packages of marine regulations that were community-driven and E Alu Pū–supported as evidence of the network's power. More subtle, though, were changes in the willingness of the state Division of Aquatic Resources and others in power to work with communities. One partner said: > You know, arguably, prior to Hā'ena, there were zero community-driven ocean designations in Hawai'i, and now there are two. Is it still completely unacceptable that they take as long to establish? Each one is faster, and I think the next step…is [the Division of Aquatic Resources] having the courage and the bandwidth to process more at the same time. So you know, adding a lane to the highway, not just increasing the speed limit. With the increased voice has come increased opposition. Interviewees pointed to this, on one hand, as evidence of the effectiveness of E Alu Pū. On the other hand, one also cautioned that E Alu Pū has not determined how it will continue to adapt its advocacy strategies to compensate for the changing conditions. "Maybe we need more teeth in those ways," one person suggested. Several suggested strategies to improve how E Alu Pū raises its voice when it speaks on behalf of communities, urging that the network only speak when each

Intended Outcomes	Evidence From Qualitative Data
	community has done the work to ensure widespread local support for initiatives. A sample of direct evidence of this outcome follows: • From within E Alu Pū, KUA convenes a community of practice focused on advocacy, Lawai‘a Pono[6], which was called “context-shifting” by one interviewee and “movement building” by another. Through regular calls, the group follows policy at the state level and organizes responses. o One group adopted the Lawai‘a Pono approach locally. A representative attended Lawai‘a Pono calls, then met every two weeks during the legislative session with their community group to determine how the group would respond to bills. This became a space for discussion beyond what was raised at Lawai‘a Pono as the community members began bringing forward other policy proposals at the level of city council and neighborhood board. o Lawai‘a Pono tracked several bills during the 2021 state legislative session. Two (HB496 and SB690) would have restricted Community-Based Subsistence Fishing Areas, a priority resource management tool for E Alu Pū member communities. KUA organized calls with Lawai‘a Pono, legislators, and others including the Council for Native Hawaiian Advancement. Both bills stalled in committee. • KUA galvanizes network support for sites that are traversing the cumbersome process to pass rules packages. I found evidence in documents and interviews including event reports, newspaper articles, photographs, public records of public hearings, and written reports from the Division of Aquatic Resources that E Alu Pū was instrumental in the passage of rules for the Hā‘ena Community-Based Subsistence Fishing Area and the Ka‘ūpūlehu Marine Reserve. For example, public hearings for both of these rule packages were held on-island (Kaua‘i and Hawai‘i, respectively). KUA held gatherings directly prior to these hearings and provided training on writing testimony and delivering spoken testimony. o For Hā‘ena, the public written report from the Division of Aquatic Resources indicated that out of 161 oral and written testimonies received for the public hearing on October 3, 2014, in Hanalei, Kaua‘i, only one person was

[6] Lawai‘a Pono: Roughly translates to “responsible fisher”

Intended Outcomes	Evidence From Qualitative Data
	opposed. The report from the Division listed community organizations that supported the rules, and 31 E Alu Pū participating groups were named. After all written and testimony was received, 672 (99.1%) were in full support of the rules package. The rules were adopted as law in 2015. o In 2016, prior to the public hearing for the Kaʻūpūlehu Marine Reserve rules package (colloquially known as the "Try Wait" rules), KUA conducted a direct-action organizing workshop for E Alu Pū prior to the hearing. One person wrote that in response to the training, "I heard opposition to 'Try Wait' soften their position when testifying from their comments before the hearing commenced" because of the presence of so many Native Hawaiian persons from E Alu Pū in support. o The network also has supported rules for the Moʻomomi Community-Based Subsistence Fishing Area. Though the Moʻomomi rules have not been summarily rejected, interviewees indicated concern about their passage due to inter-community disagreement. The conflict on Molokaʻi, in fact, led to the creation of the aforementioned 2021 bills (HB496 and SB690). • E Alu Pū plays a role in advocacy through the transmission of strategies between participating groups. Area designations provide an example: The Community-Based Subsistence Fishing Area designation was encoded in Hawaiʻi law through efforts by the community of Moʻomomi in 1994. Through participation in E Alu Pū, the community of Miloliʻi was the second to receive the designation. Like Moʻomomi, Miloliʻi has been unsuccessful in creating a rules package with sufficient community support for adoption. Again, through participation in E Alu Pū, the community of Hāʻena learned about the designation and, with groundswell support from E Alu Pū, was successful. Kaʻūpūlehu learned and applied lessons from Hāʻena's experience, utilized support from E Alu Pū, and was successful in its own rules package adoption. Moʻomomi is trying again, as is Miloliʻi. Additional E Alu Pū communities are waiting in the wings, with Kīpahulu next in line. • KUA has become of member of the International Union of the Conservation of Nature (IUCN), a UN-style body that sets and promotes global agendas for conservation. KUA has engaged E Alu Pū groups in this global work. o KUA and E Alu Pū were part of a contingency of groups that successfully lobbied the IUNC's World

Intended Outcomes	Evidence From Qualitative Data
	Conservation Congress to be held in Hawai‘i in 2016, the first time the Congress has met on U.S. soil. Leading up to the Congress, KUA hosted what they called a Global Gathering with primarily indigenous representatives from more than 30 countries. The group discussed their role at the World Conservation Congress. One person wrote on the evaluation survey, “More strategising around IUCN participation please. Who is presenting from this gathering? How have indigenous people strategised to defend our rights in such meetings in the past?” o KUA has facilitated E Alu Pū member participation as IUCN World Conservation Congress delegates during policy-setting discussions and decision-making. Several interviewees expressed that participation in the IUCN was valuable to raise community voice to a new place of power and put pressure on Hawai‘i and U.S. decision-makers: “E Alu Pū is like this big network here in Hawai‘i locally, but then they’re like a pinprick globally, right? They’re a pinprick of light, and they’re gonna bring it! They’re relatively small globally, but they’re influencing at a global scale.” o One interviewee expressed skepticism at the attention given to international affairs, comparing it to leaving your own house burning while you leave to attend to someone else’s house.
Resource managers: E Alu Pū is recognized as a network of expert resource managers.	E Alu Pū is a movement borne out of a context of occupation and colonization by the U.S. Cultural systems were upended, and authority for resources management was removed from local control and delivered to centralized management agencies. Since this centralized system was introduced, Hawai‘i’s fisheries have declined precipitously (Jokiel et al., 2011). With centralized management came distrust of cultural forms of resource monitoring and management. I personally had a conversation with a member of the Division of Aquatic Resources staff in 2009 in which he claimed that giving the community of Hā‘ena a role to play in the management of local resources would lead to environmental devastation. This context is important because it informs this desired outcome to reclaim stewardship and reinstate E Alu Pū groups and participants as resource management experts. KUA and E Alu Pū strive to do this through means such as ensuring community voice is represented

Intended Outcomes	Evidence From Qualitative Data
	where decisions about resources are made, collaborating with agencies and Western-educated scientists, positioning *kilo*[7] as science, nominating E Alu Pū participants for recognition such as awards, positioning participants as place-based educators, and what was called the "transformative" transmission of information and knowledge between communities to help them successfully manage the biological and cultural resources at their sites. One person described that this shift in the culture of Hawai'i was occurring at least in part because of the influence of E Alu Pū: "We went from communities screaming to be heard, and now, institutions don't want to make a move without first consulting with them." A community member cautioned that what constitutes "expert resource management" must reside within each community rather than within KUA, E Alu Pū, or other supporting entities. He framed this within the pursuit of self-determination and said it was important to continue that community-driven approach: "Let the community decide what is important to them. You know, I mean, you're never to tell us, 'You should do this.' Instead, you always say, 'What do you think can be done, and how can we help you?' " A sample of direct evidence of this outcome follows: • A participant of the original E Alu Pū gathering, Henry Chang Wo Jr. was recognized as an expert *limu*[8] practitioner. He worked with his local high school and traveled where invited to help people restore *limu* grounds. He successfully won designation for the 'Ewa Limu Management Area and otherwise strove to bend the U.S. legal system to provide protection for the ecological systems and processes that support healthy *limu*. KUA documents reveal how his standing within the E Alu Pū network increased over time as his expertise was recognized, and now KUA facilitates a network dedicated specifically to perpetuating *limu* and its practitioners' knowledge. • KUA is working with community members and Natural Resource Data Solutions to develop a Kilo App, a phone-based application to help E Alu Pū and its other networks track their *kilo* activities and results.

[7] *Kilo:* Regular, consistent, long-term empirical observation, a foundational cultural Native Hawaiian resource management practice

[8] *Limu:* Marine algae, otherwise known as seaweed

Intended Outcomes	Evidence From Qualitative Data
	• KUA has successfully advocated for recognition via awards for several E Alu Pū groups, including the Hanalei Watershed Hui, Mālama Koloa, Hui Maka‘āinana o Makana, and Hui Mālama o Mo‘omomi. The two latter groups were awarded the prestigious UN Development Programme’s 2019 Equator Prize. • Per documents from KUA, KUA staff members have been invited to be members of, speak as experts, or recommend E Alu Pū participants to speak as experts with groups such as the University of Hawai‘i, public and private school classes, television programs such as “Outside Hawai‘i,” Hawai‘i Conservation Alliance, Conservation Council of Hawai‘i, Council for Native Hawaiian Advancement, Hawai‘i Department of Land and Natural Resources committees, Polynesian Voyaging Society, Office of Hawaiian Affairs, The Nature Conservancy – Hawai‘i, Conservation International – Hawai‘i, Kamehameha Schools, Hawai‘i Community Foundation, National Oceanic and Atmospheric Administration, and more. These invitations are indicative of the hosts’ recognition of E Alu Pū members as resource management experts. • Several partners who were interviewed pointed to changes at larger institutions as indicative of the influence of E Alu Pū. First, larger environmental nonprofits such as The Nature Conservancy – Hawai‘i and Conservation International were not utilizing community-engaged approaches when E Alu Pū began, but community engagement has become a primary strategy in the Hawai‘i-based work of both organizations. Also, since E Alu Pū began, the Division of Aquatic Resources has created several positions for community engagement. The latest is a position held by a former staff member of what is now KUA, who worked with several E Alu Pū community groups and was an E Alu Pū participant.
Solidarity: E Alu Pū shows up for, actively connects, and empowers its member groups.	People involved with E Alu Pū often use the word “magic” to describe the network and, especially, the gatherings. When unpacking the word “magic,” interviewees discussed the feelings of support, motivation, and inspiration they received from participating in the network. Interviewees also discussed the openness of E Alu Pū to anyone, regardless of status, as being one of the network’s special characteristics. Many interviewees conveyed the hope that inspiration and motivation will result in action. One person relayed the story of one E Alu Pū group that came for years without taking action. But eventually, the

Intended Outcomes	Evidence From Qualitative Data
	community was ready for a specific work project: "The idea is that E Alu Pū provides the space for people, and then when people are ready to move, E Alu Pū is ready to show up for you." One interviewee said that inspiration and motivation is "good enough"—even without resulting action—because it heals historic and racial trauma and strengthens participants mentally, emotionally, and socially. Key partners were not comfortable with this, however. They conveyed a clear desire for action as a response to inspiration and motivation. One of these people translated this motivation function of E Alu Pū to movement growth and empowerment in Hawai'i: > At one point, I believe [KUA] was, like, the only game in town, right? Now look at it, right? And I attribute that growth in part to E Alu Pū mainstreaming it, bringing it to the right communities, you know? And look at the capacity now! E Alu Pū is such a force that if an issue is important to one community, it's important to all the communities. And they'll make sure OHA[9] hears about it. They'll make sure the governor hears about it. They'll make sure the legislature hears about it. And, you know, KUA and the network continues to facilitate an increase on the supply end of interested communities wanting to do this work. At the end of one gathering, reported in archival KUA documents, a participant summarized the effect of solidarity like this: > A people cannot be sovereign without us taking care of our own resources. The political history of our people is something else, and that may take a longer time. We receive so much inspiration from [the hosting community]. It empowers me so that when I go home, I can continue my work and know that it's part of something much bigger than [my place]. I'm a big fan of this silent activism. I'm taking with me *mana*[10], inspiration from all you guys, and knowing that you guys are all out there doing what you're doing for your communities. It makes me feel we have a very solid future ahead of us. A sample of additional evidence for this outcome from interviews follows:

[9] OHA: Office of Hawaiian Affairs

[10] *mana*: spiritual power

Intended Outcomes	Evidence From Qualitative Data
	• "Part of what the network can do is provide safe harbor and strength and comfort and confidence when individual communities are going to put themselves out there." • "We can't do it alone. Not one single organization can do it alone, no matter how lean and mean and mighty and effective an NGO[11] might be, the problems we face are so huge...We've got to work together." • "The network, to me, has been the most powerful thing, the most empowering thing that I've seen for communities to not feel alone. [Feeling] they're alone in their challenges spirals to hopelessness. But when they see other communities and are linked to them, they're buoyed with hope." • "When I say 'magic,' what I mean is, I guess, the transformation of how people perceive their problems and their challenges." • "That's what I mean by the 'magic.' It's like this chain reaction of, like, 'Oh, what? You also have those challenges? Or 'Oh, that's how you solve them? Oh, wow! That's interesting! Maybe we should try something similar but adapted for our situation.' And next thing you know, they're volunteering in each other's community workdays and helping each other, trading tips, exchanging leads for funding." • "Our social networks are critical in our collective resilience. We do rely on each other, and I think that reliance grows the harder things get. Even though it's easier to turn inward sometimes. Sometimes just even the knowing that you're not alone and that you do have people to call on and you do have people that are experiencing the same thing. I think that's just important for continuity, for people to keep going." While many positive examples of solidarity were raised by interviewees, one person raised the issue of what happens when the sense of solidarity is betrayed. This person described specific examples of not being listened to within the network, which were painful and resulted in discouragement, isolation, and loneliness.
Site Level	
Decision-makers: Member groups participate in decision-making	KUA has not systematically tracked advocacy information from member sites, and interviews and documents provided scant evidence that groups engaged in site-based efforts to influence policy as a result of participating in E Alu Pū. Communities' efforts to create new rules

[11] NGO: Non-governmental nonprofit organization

Intended Outcomes	Evidence From Qualitative Data
process and successfully advocate for policy changes at their sites.	packages for their areas are the most publicized examples of site-based advocacy and can be connected to E Alu Pū influence, but many communities engage in quieter efforts. However, because KUA does not track these local advocacy efforts, sufficient data does not exist that speaks to whether communities engaged in advocacy as a result of their connection to E Alu Pū. However, one example of member group engagement in decision-making did surface: As described above, one community applied the Lawai‘a Pono model to their group, meeting regularly during the 2021 legislative session to respond to proposed bills. This same group was recently successful in an effort that took more than 10 years to expand a protected area designation. The group also was involved in a contested case to ensure adequate oversight and protections related to a new development impacting their area. In addition, archival documents produced a small amount of additional evidence like this: “We are organizing a water resolution for our [water source] and have brought it for support to the Association of Hawaiian Civic Clubs. It took us 3 tries (3 years) to get it passed.” These actions that communities take are often out of sight of KUA and E Alu Pū unless the community specifically requests assistance from the network.
Resource managers: Member groups effectively manage biocultural resources at their sites.	E Alu Pū has asked participants to report about the number of acres they are managing (more than 32,000 acres collectively), but they have hesitated to name effective resource management practices other than the use and perpetuation of traditional knowledge at sites. It also has not been feasible for communities to pay for the type of ecological research that would be published in peer-reviewed scientific journals. There are exceptions, of course. Because of the high-profile nature of the two communities that have successfully encoded community-driven rules as law, considerable scientific technical support has been offered to these groups. As a result, ecological gains have been reported for both Hā‘ena and Ka‘ūpūlehu. Concrete examples of effective resource management at sites were gleaned through documents and interviews. These examples primarily were about the application of lessons learned or knowledge gained from participating in E Alu Pū. Member groups contribute their expertise, so everyone is both a teacher and a learner. One person

Intended Outcomes	Evidence From Qualitative Data
	called E Alu Pū a "petri dish of lessons learned," and another celebrated it for its "cross-fertilization of ideas." Another said: > It's a space for lifelong learning. No matter your age. You're retired, you're like elite *kūpuna* status, but you still show up to learn. You know, whether it's the topic or to learn from those around you or to learn from the younger ones or to just hear stories and learn from stories. I think it's just such a beautiful thing. As an example, communities have adopted *limu* monitoring and propagation techniques. Many reported a newfound understanding about the ecological role *limu* plays because of E Alu Pū. Others reported learning how to conduct environmental monitoring, shore up rock wall, use traditional practices to *hānai ko'a*[12], work with state agencies and planning firms, start educational programs, engage youth in leadership roles, more effectively engage their community, organize site-based work days, create monitoring forms, manage volunteers, adapt to weather conditions as the climate shifts, improve their liability insurance coverage, learn specific individuals to call within government agencies, and so on. Similar to the dissemination of *limu* knowledge and stewardship practices, E Alu Pū demonstrated that it transmitted knowledge to member groups about how to collect and perpetuate traditional ecological knowledge (TEK). At the network's first gathering in 2003, the people gathered there said their top shared priority was to perpetuate TEK through passing knowledge from elders to youth. Only a few groups were doing this, and they became the content area experts to teach others. KUA immediately responded by establishing partnerships and raising funding to support this. Youth and elders were invited to the second gathering of the network in 2004, and they all received training and equipment to document TEK. Eight community groups received follow-up technical support, resulting in the photo and video documentation by youth of dozens of elders' resource management practices and knowledge. KUA also developed and disseminated several tools and resources. E Alu Pū established a youth council, and each gathering of the network was intentionally intergenerational to model cross-generational engagement. Network groups reported that they learned about resources and approaches to engage youth and document elders' knowledge. When we fast-forward to 2020, 100% of E Alu Pū groups that responded to the 2020

[12] *hānai ko'a*: Relationship-based Hawaiian management practice with a fish species known as *'ōpelu* that involves regularly feeding and protecting the school of fish until the season of harvest

Intended Outcomes	Evidence From Qualitative Data
	survey reported that they were gathering and using TEK in their site-based work. One person described that just by showing up in their spaces, community groups were improving the management of those places. To this person, the hours people spend in a place will contribute to the long-term goal of "*ʻāina momona*[13] through building *pilina*[14] with people and place." She described that showing up is a first step: "You get to know the *ʻāina,* and the *ʻāina* gets to know you." A representative of one community group described an approach that reflected this same sense of presence and relationship. She ran an educational program for children in a place that is very popular with tourists. The program wove environmental and Hawaiian cultural concepts. She said that by having the children practicing chants, observing marine creatures, and picking up litter tourists left behind, they were learning about their place while affirming their right to be there, to practice culture, and to have a healthy environment. Finally, for some groups, the main benefit to resources management from E Alu Pū participation was the catalytic action it spurred. One person was documented as reporting that her new organization had been able to shave months off their launch because of what they learned from E Alu Pū groups. Another said: I've seen it be transformative to those communities who…seem stuck, you know? And they're spinning their wheels, and this introduction to E Alu Pū kind of broadened their vision and made it more solid. They saw more possibilities out there. That's what I mean by the "magic."
Solidarity: Member groups respond to *kāhea* issued by KUA or other member groups, connect with one another, work with one another, and	In every gathering and annual report, E Alu Pū participants described feelings of connection and support they received from being a part of the network. When asked whether this translated to action, interviewees mainly pointed to helpful connections made. For example, one group was put in contact with another group, which was able to describe how a permit was secured. The first group was able to secure their own permit by following the other group's advice. Additional evidence of this outcome follows: • "I definitely felt like E Alu Pū was a second family."

[13] *ʻāina momona*: literally "fat land," translated to mean "abundance"

[14] *pilina*: relationship

Intended Outcomes	Evidence From Qualitative Data
empower one another.	• Another person said she felt she had found "long-lost family" when she met another community group for the first time. She described regularly connecting with the group outside of E Alu Pū events. The relationship led to sharing ideas and strategies, she said, including the adoption of aquaponics systems in her community, which is on a different island from the group to which she so strongly connected. • A participant wrote, "The relationships forged in the [network] spills over into our everyday lives and work. We remain in contact with some of the groups and plan to partner with them for educational and other activities."

Evidence of Unintended Outcomes

Several themes arose from the case study that fell outside the intended outcomes. These outcomes included engagement across all generations, youth leadership development, the pure pleasure of social interaction, the fun of seeing other people's places, and the "healing work" accomplished by how the network is managed and that addresses historic and racial trauma. Four unintended outcomes—two positive and two problematic—necessitate additional description.

Economies of Scale

The network has been an efficient way to disperse resources, whether that be information or money or assistance or supplies. For example, KUA has built a lending library of supplies and equipment that member groups can use, saving groups money and scaling up impact for foundations providing financial support.

Regional Networks

Several regional networks have developed "as a spinoff of E Alu Pū," one interviewee said. Two were generated by The Nature Conservancy – Hawai‘i, one by

Kamehameha Schools, and several by the Hawai‘i Conservation Alliance. These regional networks provided further evidence, one person said, that networking is useful because they are replicating the E Alu Pū model at the local level. On person claimed that regional networks will spark new innovations that will then be shared with E Alu Pū, as E Alu Pū also sends ideas and information into the regional networks. “When [regional networks] plug into a statewide network, I think that informs that statewide network better because it’s really grounded in those regions,” one person said.

Shame

Two groups reported feeling shame when they thought about E Alu Pū because of obstacles they were experiencing in their own communities. Because each group is given the opportunity at gatherings to report accomplishments and progress, not having anything to report felt like failure to these groups. Both groups reported feeling isolated within their community challenges, as though they were the one group who was experiencing such problems. “It’s hard for communities to say that we’re in a funk,” one person reported. “There was shame associated with that.” The person added, “Maybe the network has grown to a point where it celebrates the successes of communities, and not so much the challenges.” This person suggested that a culture of safety around being stuck could be nurtured to help groups speak freely about troubles in addition to celebrations.

Outside Assistance

E Alu Pū has shown up in force to support communities attempting to change fishing laws in their places. Several people pointed to the need to learn lessons from

the stalemate in Moʻomomi. Specifically, one unintended outcome of support from E Alu Pū has been the accusation that E Alu Pū shows up even if there is not widespread support for policy within a community itself. When that happens, the opposition can cry interference. One person cautioned that this harms trust and becomes a disempowering dynamic, as the local community may think, as one interviewee said, "How come we can't take care of ourselves?" This not only harms the community, but also the tenuous power of E Alu Pū.

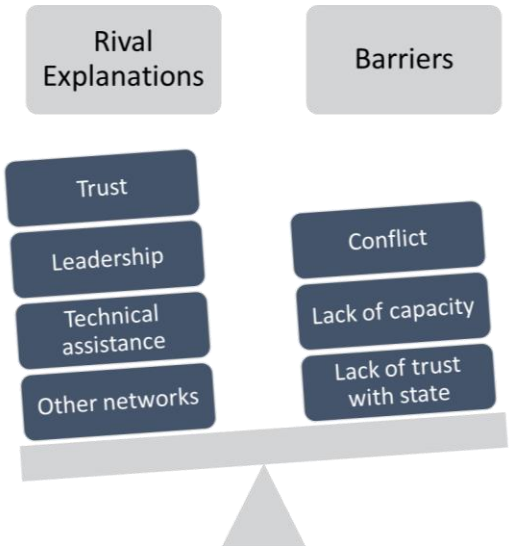
Plausible Rival Explanations

Yin (2018) encouraged the development of "plausible rival explanations" (p. 172) as part of pattern-matching for case studies, which are factors other than networking that could have produced the intended and unintended outcomes. This language is somewhat misleading in the case of E Alu Pū. The documents and interviews I reviewed for this study never indicated a theory or assumption that the outcomes sought by E Alu Pū, KUA, and KUA's collaborators would be achieved solely because of collective action networking. In fact, I found quite the opposite assumption. The network was described as one tool in the toolkit. Networking was described as putting protein powder in your smoothie to give it the boost of complete nutrition that you are looking for. The network was not meant to be the whole meal, in other words, but to complement the meal. The data surfaced several plausible rival explanations that, along with networking (per the evidence provided in Table 9), contributed to intended and unintended outcomes. The data also suggested that several

factors acted as barriers to outcome achievement. These rival explanations and barriers are portrayed in Figure 10.

Figure 10

Rival Explanations and Barriers to Outcome Achievement



Rival Explanations to Outcome Achievement

I found four overarching elements that, along with networking (Table 9), were connected to outcome achievement for E Alu Pū and member groups: Trust, leadership, technical assistance, and other networks. I provide a summary of each below.

Trust

Trust encompassed three distinct elements: Trust between E Alu Pū member groups, trust between groups and KUA, and what one person termed "openness by

design." Through surveys, E Alu Pū groups have said over the years that they trust one another. Trust has been cultivated carefully, as the network hit a rough patch early in its life when two opposing factions within the network developed in response to proposed legislation. Since surviving that very real threat to the network, KUA has taken steps to build transparency, ownership, and trust. These steps have included the development of a charter or membership agreement as well as decision-making by the network via a council selected by their peers.

Groups also have very consistently expressed trust for KUA via surveys. One person tied this culture of trust by comparing the KUA to a well-known canoe club on O'ahu, Hui Nalu, which is known for welcoming anyone regardless of paddling ability. The person said:

> I always saw TNC [The Nature Conservancy – Hawai'i] as, like, Outrigger, where they're like, "Okay, we'll take the ones with the most promise, and you get to race because we're here to win. We're here to get you across the finish line first, right? Versus, like, KUA, which is a lot more like Hui Nalu. They're like, "Okay, we're based on values. This is all-inclusive. You want to paddle? Come paddle. You want to race? Go race. You want to come just paddle? Come paddle." And it's always been a beautiful thing to me.

Leadership

Strong, capable leadership was mentioned by multiple people who were interviewed and in documents as a key indicator of whether a group would be able to achieve its goals. The qualities needed, according to one person, was "strong Native

Hawaiian leadership that bring those cultural values of *laulima*[15] and *aloha*[16]." Taking it further, one person described the need for two strong leaders or two necessary facets of strong leadership: cultural acumen and administrative acumen. The community must recognize the leader(s) as valid holders of cultural and administrative leadership for the group's efforts to be successful.

While other interviewees did not specifically name the requirement for these two facets of leadership, several described effective leadership through the same lens. For example, one organization was described as having capable leaders that stimulated the establishment and growth of respected cultural–environmental programs, but the organization lost its nonprofit status because of an administrative misstep. The nonprofit status was reinstated when a person with administrative acumen stepped in, and the group saw it would need a long-term solution for its administrative gaps.

Strong leadership was cited as equally important for entities working with E Alu Pū as well:

> I don't think E Alu Pū ever would have persisted or grown to where it is now without leadership like [certain persons]. There is literature *ad nauseum* on the importance of leadership…You know, to represent fifty-plus community groups and grassroots groups across the *pae 'āina*[17] is a position of, you know,

[15] *laulima:* working together

[16] *aloha:* love, compassion, kindness, grace

[17] *pae 'āina:* archipelago

> of leverage. So what do you do with that? And I think that's where the leadership comes in.

The leaders from those entities working with E Alu Pū must cultivate trust between the community with its partners, collaborators, and decision-makers. They must do so with caution and humility, too, from their position as supporters. Interviewees encouraged a humble style of leadership from those working with E Alu Pū. One network and KUA collaborator likened this type of leadership to coralline algae:

> Corals are branching and, you know, networky colonies. I like to think that your role, my role, [other person's roles]—you know, the conveners, the network supporter roles—we are like the crustose coralline algae on a reef. We're like that pink rock. We're kind of like the glue that holds the reef intact together until the coral grows over us and, like, takes hold, right? So I think we're the cement. And we have our useful life and then, when the network graduates and, you know, matures, they don't need that anymore. They'll be super thankful for that foundation because they can build on it.

Technical Assistance

Many of the people I interviewed spoke about the importance of technical assistance, which is available and utilized by many E Alu Pū member groups. Usually, technical assistance was supplied by an outside entity such as KUA, The Nature Conservancy - Hawai‘i, Kamehameha Schools, or a local partner providing assistance for particular projects or activities such as strategic planning or a biological study.

Technical assistance was named as important in groups' progress and success because it brought needed resources, capacity, and expertise to poorly resourced community groups.

On the other hand, several people cautioned against too much of a good thing. Technical support, one person said, needed to stay in the background to support the community without ever taking over the community's lead role. He said that if the community or those outside the community have any inkling that an effort belongs to the technical assistance group rather than the community, it could result in a loss of trust and power.

Another subtheme that arose from discussions about technical assistance was that KUA's technical assistance and direct support were not well-defined. In documents, the meaning of these terms seemed to shift over time. During one era, technical assistance took the shape of a full-time staff position dedicated to supporting community groups on one island with activities related to their groups' goals. Most recently, an interviewee named as technical assistance and direct support a wide variety of activities such as providing network-wide trainings, hosting online discussions, logistical arrangements at sites for network-wide events, fiscal sponsorship, grant subcontracts, coordination of site-based work days, development of a phone app, connecting community groups with experts, purchase of supplies or equipment, provision of supplies or equipment, reviewing draft documents, and answering questions via email and phone. Possibly because of the lack of definition,

community members I interviewed were not clear about what technical assistance was available from KUA today.

Paired with that uncertainty was a hesitancy to ask for help. One person said, "You know, local communities don't ask for help. Yeah, so they're not going to ask. They're not going to come to say, 'We need help.' It's hard enough to say, 'We're struggling.'" A couple of people indicated that if available technical assistance was made clear, it could help to normalize and destigmatize the act of seeking help.

Other Networks

KUA facilitates three statewide networks, a regional network, and a grant-centric network. From the documents I reviewed, many E Alu Pū groups are cross-fertilized between these various networks. In fact, some groups are members of more than two of KUA's networks. These different networks provide different types of programming, activities, and assistance, all of which work together to help build member groups' capacity and connections.

Factors That Limit Outcome Achievement

I found three overarching elements limiting outcome achievement for E Alu Pū and member groups: conflict, lack of organizational resources, and lack of trust with the state. I provide a summary of each below.

Conflict

Likely the most impactful, most painful element limiting outcome achievement that I heard about during interviews was inter-community conflict. Conflict was cited as massively disruptive, with the potential not only to shut down a single effort but

also to leave a community disempowered and discouraged to the point of giving up. Conflict appeared in two dimensions. In one, it showed up as disagreement about approaches or strategies or leadership. In the other, which was described as much more damaging over the long term, it showed up as people misrepresenting the community or being accused of misrepresenting the community. I focus here on this latter dimension, as it was the dimension most interviewees discussed at great length. Interviewees indicated that the pervasiveness of community conflict raises two key questions for E Alu Pū to grapple with: (1) Who represents the community? (2) How will you ensure broad community engagement?

Most community groups who are part of E Alu Pū are established groups with leaders recognized as members of the communities they represent. Factions within the community have not become evident until conflict has occurred and accusations of misrepresentation have been lobbied. “When it’s just one person acting as a messenger, it’s easy for things to get lost in translation,” said one person about the difficulty E Alu Pū faces in determining who represents the community.

In response to this type of conflict, several interviewees urged E Alu Pū to encourage and support increased community engagement. “E Alu Pū can’t *replace* site-based community organizing and conflict management,” said one interviewee. “[E Alu Pū support] doesn’t take the place of making sure that communities within and amongst themselves are straight first. To me, that was a hard lesson that I’ve learned.” This individual suggested:

> There's a certain insistent—gentle and kind and empathic but insistent nonetheless—voice that KUA can have or E Alu Pū can have to say, "Hey guys, you gotta get right with your community, right? You gotta shop this properly. You gotta do enough in-reach." Because then, and only then, are you truly and authentically a representative of that community and reaching out to partners who can enable whatever it is that needs to happen."

This interviewee urged communities to keep the door open for disagreement rather than getting "lost in the echo chamber." He asked, "Are we giving everybody at the table equal voice? Are we being as inclusive as possible?"

Another person suggested a way forward for E Alu Pū:

> I think some of where we're lacking is helping some of these community leaders in the community-building work that they need to do in their sites…I think it's an overstep for us to attempt to do community-building on their behalf in a community where we have no [standing]. But I think we do need to work on equipping them to build up more in their community.

Lack of Organizational Resources

Lack of organizational resources takes on several forms including lack of funding, interruptions in community leadership, and lack of technical assistance. Every community member interviewed was concerned about funding, and several wanted help but did not know where to turn. The most prevalent, most tricky lack of capacity discussed was interruptions in leadership. Many E Alu Pū groups are solely volunteer efforts comprised of community members who take on the *ʻāina* work in addition to

their full-time jobs and family obligations. This context contributed to several issues that created difficulty for communities. For example, a community leader experienced multiple family stressors and necessarily shifted her full attention to caring for her family while taking a break from her community work. In other cases, community groups were not able to recover from leadership transitions after an elder passed away or a leader took a new job requiring increased attention. These interruptions provoked an ebb and flow of participation in E Alu Pū and the community's site-based efforts that contributed to lost connections and momentum.

Lack of Trust with the State

One person who has been active in E Alu Pū since it was created said it was "part of the network's DNA" to distrust the state because of Hawaii colonial history, enduring power imbalances, mismanagement, and the perception of poor state follow-through on agreements. Many examples were provided as evidence that the state was a frustrating entity with which to work. Often, however, the state is the official resource management agency holding authority over areas where E Alu Pū member groups work and the laws governing those areas. E Alu Pū participants have decried, over all the years of the network's existence, the "lack of political will" to improve resources management and relationships with communities. Interviewees cited this lack of political will occurring in all levels of state government, from members of the legislature to specific staff members at the Division of Aquatic Resources.

Also, group members have accused the state of changing the rules of the game to shut communities out of resource management. For example, one group used

training and funds provided by KUA to E Alu Pū to develop an area plan. They sought guidance from and coordination with the state, which the state did not provide before rejecting the community's plan. More recently in this same community, "the state hired this big [planning] firm, but it's like nothing's happening." This has required the community to raise additional resources to contract "someone who's dedicated to pushing and nudging and, you know, making demands and bringing folks together and then working to implement" a plan with the state.

As another example of the state's changing rules of engagement, each group that has gone through the process to adopt a rules package governing a marine area has had to adhere to different conditions or criteria. Chapter 91 is the state of Hawai'i's legal chapter dictating how these laws must be made, but it has been applied differently in these different places. For two communities, for example, public hearings were held close to home. For a third, the state said public hearings had to take place statewide. These shifts continue to disrupt the attempt at trust-building work by E Alu Pū, KUA, other partners, and members of the state infrastructure.

From the case study, I learned about progress toward intended and untended outcomes for E Alu Pū and its member groups. Between the quantitative strand and the qualitative strand, patterns of evidence surfaced to connect participation in the network to outcomes. Additional factors such as leadership and barriers such as a lack of organizational resources also surfaced. The degree to which these different factors contributed to outcomes was not clear. As a leader or supporter of this social change effort, should I invest in networking? leadership capacity-building? trust-building with

the state? When I asked network groups to rank the level of importance of different factors, the results were dispersed. Some said community support was the most important factor to their success. Others said organizational resources. Some even said their participation in E Alu Pū was critically important. Could QCA help to fill this information gap? Next, I describe the results of QCA to explore whether the all the tools used thus far—survey, SNA, case study—came to order with QCA in a way that connected networking to outcomes.

Research Question 4: Integration of Qualitative and Quantitative Data Using Qualitative Comparative Analysis

With the fourth question of this study, I asked, "For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?" Thus, I have joined many other case study scholars in applying the logic of necessary and sufficient conditions to case study analysis in an attempt to identify conditions that contribute to outcomes (Goertz & Levy, 2007). Further, I have joined a handful of other mixed methodologists in applying the logic of necessary and sufficient conditions to the integration of quantitative and qualitative data required for mixed methods analysis (Creswell & Plano Clark, 2018; Kahwati & Kane, 2019). Uncovering the necessary and sufficient conditions is an exercise to surface patterns that fit any of four patterns of logic (Ragin, 1987):

- Conditions that are neither necessary nor sufficient.
- Conditions that are necessary but not sufficient.
- Conditions that are sufficient but not necessary.

- Conditions that are both necessary and sufficient.

A condition is considered necessary if it was present every time an outcome was present and, thus, was necessary for success but didn't guarantee success. A condition is considered sufficient if it alone can produce success. As Ragin (1987) reminded readers, "Neither necessity nor sufficiency exists independently of theories that propose causes" (p. 99). One might find that green grass, for example, was present every time an outcome occurred; unless green grass had been linked theoretically to the outcome, calling green grass "necessary" would be similar to making spurious correlations—a nonsensical, albeit accurate, connection.

The remainder of this section of the chapter is dedicated to the integration of quantitative and qualitative data and its further analysis using QCA to identify any necessary and sufficient conditions and combinations of conditions relevant to three desired E Alu Pū outcomes: (1) groups are decision-makers, (2) groups are resource managers, (3) groups act in solidarity with each another. The analysis began with data integration through a QCA process known as fuzzy set calibration, then continued through each step of QCA as described below.

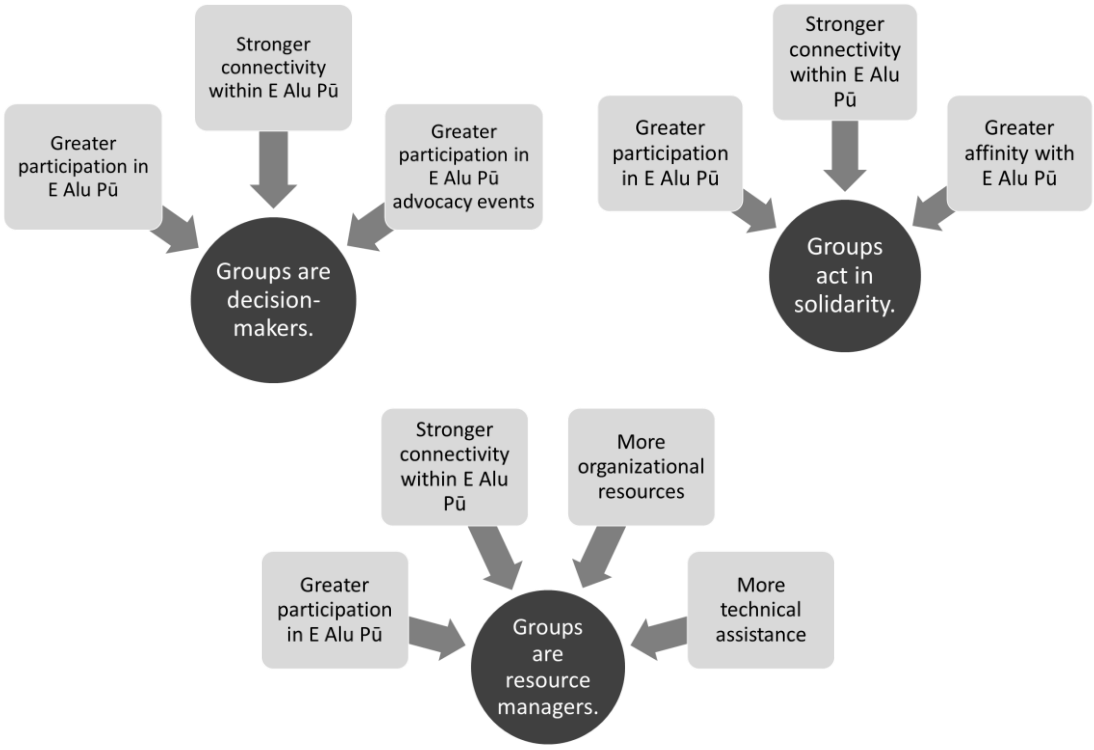
Four-Value Fuzzy Set Calibrations

In QCA, calibration is essentially a qualitative process based on a researcher's theoretical and case knowledge, and the process is fundamentally tied to set-theoretic methods (Kahwati & Kane, 2020; Mello, 2021; Ragin, 1987). Calibration, thus, is distinct from measurement, though researchers have the option to use measures in calibration criteria. Calibration is a critically important part of QCA analysis. The idea

is not to randomly assign scores based on even distribution of percentages or the average score of the group. “Such approaches miss the fundamental advantage of QCA, namely that *meaningful variation* can be separated from irrelevant variation” (Mello, 2021, p. 119). Good calibration practices include thorough documentation of the decisions made throughout the process, transparency about data sets used, reporting about calibration criteria and thresholds, and directionality should be included in the name of the set (e.g., *stronger* connectivity) (Mello, 2021) (Figure 11).

Figure 11

Three Outcomes with the Conditions Studied Using QCA



Note. For the outcome “groups are decision-makers,” KUA’s theory of change posits that E Alu Pū groups will participate in decision-making processes more if they

participate in E Alu Pū more, are more well-connected within E Alu Pū, and participate more in network advocacy events. For the outcome "groups act in solidarity," collective action theory and KUA's theory of change posit that groups will act in solidarity if they participate in E Alu Pū more, are more well-connected within E Alu Pū, and express greater affinity with E Alu Pū. For the outcome "groups are resource managers," KUA's theory of change and prior research about community-based resources management posit that groups will adopt effective community-based resource management practices if they participate in E Alu Pū to a greater degree, are more well-connected within E Alu Pū, have more organizational resources such as staff, and receive more technical assistance.

During calibration, I combined the raw quantitative and qualitative data from Study 1 and Study 2 to determine how fully each E Alu Pū member group fit the outcome sets and condition sets based on criteria I developed with input from the E Alu Pū Coordinator. (See Figure 11 for the conditions and outcomes used.) A set was defined simply by Kahwati and Kane (2020) as "a group of things that belong together in that they share a similar characteristic" (p. 23). I used four-value fuzzy set calibration for which a group could be considered fully outside the membership set, rather more outside the set than inside, rather more inside the set than outside, or fully inside the set (Kahwati & Kane, 2020; Mello, 2021). As is standard QCA practice, multiple sub-conditions informed the criteria for membership in the conditions and outcomes, based on theory, prior research, and KUA's theory of change (Kahwati & Kane, 2020; Mello, 2021). E Alu Pū groups' scores for each sub-condition was based on archival surveys and documents, and interviews.

Outcomes and Four-Value Fuzzy Set Calibration

Table 10 displays the four-value fuzzy set calibration information for the desired outcomes of decision-making, resource managers, and solidarity. I used the

criteria listed in Table 10 to place groups in their sets (fully out, rather more out than in, rather more in than out, and fully in). I checked the sets for each outcome against the raw data and my own case knowledge to ensure that sets were logical and reasonable. For decision-making, 7 groups were fully out, 5 groups were more out than in, 9 groups were more in than out, and 14 groups were fully in. For resource managers, 6 groups were fully out, 7 groups were more out than in, 9 groups were more in than out, and 13 groups were fully in. For solidarity, 10 groups were fully out, 10 groups were more out than in, 5 groups were more in than out, and 10 groups were fully in.

Table 10

Four-Value Fuzzy Set Calibration Criteria for Three Outcomes

Set Label	Concept for the Set	Calibration of the Set
DM_OUT (decision-making)	For greater participation in decision-making, groups reported that they submitted testimony, attended public hearings, and/or visited elected or appointed officials[18].	Scores were calculated based on the number of types of advocacy activities groups reported that they participated in: • Participated in none of the types of advocacy activities = fully out (0) • Participated in 1 type of advocacy activity = more out than in (.33) • Participated in 2 types of advocacy activities = more in that out (.67) • Participated in all 3 types of advocacy activities = fully in (1)
RM_OUT (resource managers)	For greater achievement of resources management, groups used the following evidence-based effective CBRM practices to a greater degree:	Scores were calculated based on the degree to which groups reported that they participated in the different effective CBRM practices:

[18] I originally included the initiation of legal processes such as lawsuits or contested cases, but this was too context-dependent to include in an analysis across the network. In other words, some groups had no need to initiate lawsuits or contested cases, so an absence of participation was more reflective of an accident of context than a lack of willingness.

Set Label	Concept for the Set	Calibration of the Set
	• presence of a legal site agreement granting some management authority • degree of collaboration with official resource management agencies • degree of scientific monitoring activities (including *kilo)* • degree of environmental restoration activities • degree of outreach and education activities	• Degree of participation score of less than 5 = fully out (0) • Degree of participation score of between 5 and 7 = more out than in (.33) • Degree of participation score of between 8 and 10 = more in than out (.67) • Degree of participation score of 11 to 13 = fully in (1)
SOL_OUT (Solidarity)	For greater achievement of solidarity, groups had greater "working together" sub-network indegree[19] and had greater *"kāhea"* sub-network indegree[20].	Scores were calculated based on the combined in-degree of both sub-networks: • A combined in-degree of less than 4 = fully out (0) • A combined in-degree of 4 to 6 = more out than in (.33) • A combined in-degree of 7 to 9 = more in that out (.67) • A combined in-degree of 10 or more = fully in (1)

Conditions and Four-Value Fuzzy Set Calibrations

The conditions I tested to see if they were necessary and/or sufficient for greater achievement of the different outcomes, illustrated in Figure 11, were (1) greater participation in E Alu Pū, (2) stronger connectivity within E Alu Pū, (3) greater participation in E Alu Pū advocacy events, (4) more organizational resources, and (5) more technical assistance. Table 11 displays the fuzzy set calibration information for these five conditions. For each condition, I used the criteria listed in Table 11 to place

[19] From SNA, number of groups naming a group when asked which groups they work with

[20] From SNA, number of groups naming a group when asked which groups responded to a call for help

groups in their sets (fully out of the set, rather more out than in, rather more in than out, and fully out). Then I checked the sets for each condition against the raw data and my own case knowledge to ensure that sets were logical and reasonable. For "greater participation," 6 groups were fully out, 10 groups were more out than in, 15 groups were more in than out, and 4 groups were fully in. For "stronger connectivity," 7 groups were fully out, 8 groups were more out than in, 12 groups were more in than out, and 8 groups were fully in. For "greater participation in E Alu Pū advocacy events," 14 groups were fully out, 5 groups were more out than in, 5 groups were more in than out, and 11 groups were fully in. For "more organizational resources," 13 groups were fully out, 9 groups were more out than in, 3 groups were more in than out, and 10 groups were fully in. For "more technical assistance," 12 groups were fully out, 8 groups were more out than in, 3 groups were more in than out, and 12 groups were fully in.

Calibration resulted in a data matrix for each outcome, provided in Appendix E, Appendix F, and Appendix G. Once calibration was complete, I was able to assess necessary conditions, described next.

Table 11

Four-Value Fuzzy Set Calibration Criteria for Five Conditions

Set Label	Concept for the Set	Calibration of the Set
PX_COND (greater participation)	For greater participation, groups had a larger rate of participation in E Alu Pū events.	Scores were calculated based on the following: • Participation in 15% of less of E Alu Pū events = fully out (0)

Set Label	Concept for the Set	Calibration of the Set
		• Participation in between 16% to 33% of E Alu Pū events = more out than in (.33) • Participation in 34% to 60% of E Alu Pū events = more in that out (.67) • Participation in 61% and more of E Alu Pū events = fully in (1)
Cx_COND (stronger connectivity)	For stronger connectivity, groups had a larger harmonic closeness centrality.[21]	Scores were calculated based on the following: • Harmonic closeness centrality of 0 to .51 = fully out (0) • Harmonic closeness centrality of .52 to .57 = more out than in (.33) • Harmonic closeness centrality of .59 to .67 = more in than out (.67) • Harmonic closeness centrality of .68 and more = fully in (1)
AdvPx_COND	For greater participation in advocacy events, groups participated more in E Alu Pū advocacy trainings and related events, and they participated in Lawai‘a Pono, an advocacy community of practice within E Alu Pū.	Scores were calculated based on the following: Participation in 0 to 1 E Alu Pū advocacy event = fully out (0) • Participation in 2 E Alu Pū advocacy events = more out than in (.33) • Participation in 3 to 4 E Alu Pū advocacy events, or participation in 5 events but not Lawai‘a Pono = more in that out (.67) • Participation in 5 or more E Alu Pū advocacy events plus Lawai‘a Pono = fully in (1)
OR_COND (more organizational resources)	For more organizational resources, groups had a greater degree of paid staff and volunteer hours.	Scores were calculated based on reported staff and volunteer hours. Staff hours and volunteer hours were divided into quartiles, for a

[21] While other social network measures are relevant to each group's position in the network, closeness centrality is the key measure of connectivity, as it indicates the distance from each node to all the other nodes in the network (Cherven, 2015). Because the data included several disconnected nodes (closeness centrality = 0), which causes problems in the calculation of closeness, I used harmonic closeness centrality, which addresses those problems (Cherven, 2015).

Set Label	Concept for the Set	Calibration of the Set
		rating of between 0 (none to comparatively low hours staff and volunteer hours) and 6 (comparatively high staff and volunteer hours): • Rating of 0 to 1 = fully out (0) • Rating of 2 or 3 = more out than in (.33) • Rating of 4 = more in than out (.67) • Rating of 5 or 6 = fully in (1)
TA_COND (more technical assistance)	For more technical assistance, groups received a greater degree of technical assistance from KUA and a greater degree of technical assistance from other organizations, when compared with other E Alu Pū groups.	Scores were calculated based on reported degree of technical assistance from KUA and other organizations: • Rating of 0 to 1 = fully out (0) • Rating of 2 = more out than in (.33) • Rating of 3 or 4 = more in than out (.67) • Rating of 5 or 6 = fully in (1)

Necessary Conditions

I used R (R Core Team, 2019) and RStudio (RStudio Team, 2020) with the QCA package (Duşa, 2019) and the SetMethods package (Oana & Schneider, 2018) to analyze the calibrated data matrices for necessary conditions (R script in Appendix D). A necessary condition is one that always is present when an outcome occurs. It does not guarantee the outcome, but the outcome does not happen without it. Consistency, or how consistently a condition was present with an outcome, is the primary measure used to determine whether a condition is necessary. If a condition was present every time an outcome was present, the consistency would be 1. If a condition was never present for that outcome, the consistency would be 0. Consistency for necessary

conditions should be .90 or more unless theory suggests differently (Kahwati & Kane, 2020, Mello, 2021).

In addition to consistency, two QCA measures were designed to help researchers assess necessary conditions: coverage and relevance. Only if consistency meets the threshold of .90, researchers then should review the measures for coverage and relevance (Mello, 2021). Coverage indicates how much of the outcome is accounted for, and the threshold is theory- and context-dependent (Kahwati & Kane, 2020; Mello, 2021). Relevance indicates how meaningful the condition is to the outcome, and the threshold is theory- and context-dependent (Kahwati & Kane, 2020). Numbers for coverage and relevance that are closer to 1 typically have been considered more desirable (Kahwati & Kane, 2020), and anything below .50 should be reviewed closely (Mello, 2021).

Finally, when assessing necessary conditions, results should be logically consistent, meaning that the condition and the counter-condition cannot both be necessary for the outcome, and the condition cannot be necessary for both the outcome and the counter-outcome. Given the threshold of .90, no single condition was found to be necessary for any of the three outcomes. In other words, no condition I studied was always present each time an outcome was achieved. The results for the tests of necessity are presented in Appendix H.

Truth Tables and Configurations of Sufficient Conditions

The next step in the analysis process, truth table analysis, has been called "the core of QCA" (Mello, 2021, p. 121). A truth table conveys all the possible

configurations of conditions used in the analysis of an outcome. The number of possible configurations is two to the power of *k*, where *k* is the number of conditions. Given this formula, this study contained between 8 and 16 possible configurations for each outcome. Each case was matched by the software to a configuration of conditions, and the result indicated which configurations were sufficient to achieving the outcome. A configuration is considered "sufficient" when the outcome is present whenever the configuration occurred. In other words, the configuration of conditions guaranteed the occurrence of the outcome, and the outcome did not occur without the configuration of conditions. As with necessity, sufficiency is measured by consistency. A standard threshold for consistency in sufficiency is .75 (Mello, 2021).

Paired with consistency in fuzzy set analyses is proportional reduction in inconsistency (PRI), which is a goodness-of-fit measure for how consistently the configuration also is present for the non-outcome. A standard threshold for PRI is .70, and a higher number equates with improved goodness-of-fit (Kahwati & Kane, 2020). When interpreting truth tables for sufficiency, then, one must consider both the consistency and the PRI, with higher numbers indicative of configurations with better fit to the outcome.

I reviewed the truth tables for two additional characteristics to assess their quality: First, case clustering toward only a few configurations may indicate a lack of diversity in the cases (Mello, 2021). The truth tables all indicated diversity in cases. The final quality check was a review of consistent configurations. If a truth table row contains cases that are contradictory in that some cases are in the outcome set and

some are out of the outcome set, additional review is needed. As Mello (2021) wrote, "Perfect set relations can rarely be found in the social sciences," and decisions were required about what to do with truth table rows that contained contradictory information. Several truth table rows for the outcomes of decision-maker and resource manager included contradictory cases. Appendix I contains the truth tables for the three outcome conditions.

A note about contradictory cases: Several authors (Kahwati & Kane, 2020; Mello, 2021) recommend analyzing QCA truth tables early in the analysis process to check whether the models of conditions-with-outcomes are sound. If they are not, researchers are instructed use theoretical and case knowledge to adjust the models.

When I first conducted QCA with my data, the truth tables included many inconsistent configurations, or configurations that contained cases in the outcome set alongside cases not in the outcome set. I became aware of two things from this. First, with my extensive case knowledge, I understood why the data for certain groups was producing unstable results. For example, one group has not participated in E Alu Pū very long but was very well-connected. I know the connectivity stems from the founder's job rather than through E Alu Pū participation, so I was able to address that anomaly in the model.

More importantly, I became aware that I had made a QCA rookie error of logic by applying the same four conditions universally for every outcome regardless of theory. Once I realized my mistake, I went back to the literature and KUA's program

theory to adjust the model for each outcome using only the conditions that could reasonably be connected to the outcome. With these changes, the results made sense.

Logical Minimization and Solution

I next conducted truth table analysis to arrive at the solution, or the configuration of conditions that were found to be sufficient for the three outcomes of decision-making, resource managers, and solidarity. This process entailed first reviewing the configurations from the truth table that met the .75 threshold, then minimizing those using an algorithm built into the QCA (Duşa, 2019) and SetMethods (Oana & Schneider, 2018) packages in R (R Core Team, 2019) to arrive at the solution. I used the parsimonious solution for each outcome.[22]

For the outcome of decision-making, the following conservative solution term was returned:

EAPPx_COND -> DM_OUT

This solution term, which is written per standard QCA practice, says that groups who are rather in the decision-making outcome set are those that are also rather in the set of greater E Alu Pū participation. The fitness measures for the components of this solution can be found in Table 12. The terms that meet the consistency threshold for sufficiency of .75 (Mello, 2021) are highlighted.

[22] When truth tables include rows without cases, the SetMethods package in R can make assumptions about what to do with those rows and thus deliver what is called a "parsimonious" solution.

Table 12

Measures of Fit for Solution Term for Outcome: Decision-Making

Term	Consistency[1]	PRI[2]	Raw Coverage[3]	Unique Coverage[4]	Cases
Greater E Alu Pū participation	.87	.83	.69		L,P; AA; E,BB,HH,II; B,C,D,F,G,I,R,U,V,Y,DD,KK

[1]How consistently the solution term was present.
[2]Proportional reduction in inconsistency, or how consistently the configuration is also present for the non-outcome
[3]The share of the outcome explained by the configuration.
[4]The share of the outcome exclusive explained by the configuration.

For the outcome of resource managers, the following conservative solution term was returned:

OR_COND + PX_COND*CX_COND -> RM_OUT

This solution term, which is written per standard QCA practice, says that groups who are rather in the resource manager outcome set are those that are also rather in the sets of more organizational resources OR greater participation and greater connectivity. The fitness measures for the components of this solution can be found in Table 13. The terms that meet the consistency threshold for sufficiency of .75 (Mello, 2021) are highlighted.

Table 13

Measures of Fit for Solution Term for Outcome: Resource Managers

Term	Consistency[1]	PRI[2]	Raw Coverage[3]	Unique Coverage[4]	Cases
More organizational resources	.93	.91	.66	.34	K,M,EE; W,X; P; F,V; N,Q; T; D,Y

Greater participation and greater connectivity	.84	.79	.52	.20	B,AA; C,G,I,R,U,DD,KK; F,V; D,Y
These configurations together	.86	.81	.86		

[1]How consistently the solution term was present
[2]Proportional reduction in inconsistency, or how consistently the configuration is also present for the non-outcome
[3]The share of the outcome explained by the configuration
[4]The share of the outcome exclusive explained by the configuration

For the outcome of solidarity, the following conservative solution term was returned:

PX_COND*Cx_COND + Cx_COND*AFF_COND -> SOL_OUT

This solution term, which is written per standard QCA practice, says that groups who are rather in the solidarity outcome set are those that are also rather in the sets of greater participation and greater connectivity or are those that are rather in the sets of greater connectivity and greater affinity with E Alu Pū. The fitness measures for this solution can be found in Table 14. The terms that meet the consistency threshold for sufficiency of .75 (Mello, 2021) are highlighted.

Table 14

Measures of Fit for Solution Term for Outcome: Solidarity

Term	Consistency[1]	PRI[2]	Raw Coverage[3]	Unique Coverage[4]	Cases
Greater connectivity and greater affinity	.92	.89	.70	.10	H,T,JJ; B,C,D,G,I,R,U,V,Y,KK
	.85	.79	.66	.06	F,AA,DD; B,C,D,G,I,R,U,V,Y,KK
These configurations together	.86	.81	.76		

[1]How consistently the solution term was present
[2]Proportional reduction in inconsistency, or how consistently the configuration is also present for the non-outcome
[3]The share of the outcome explained by the configuration
[4]The share of the outcome exclusive explained by the configuration

To close out QCA analysis, Kahwati and Kane (2020) refer to Schneider and Wagemann (2012) in recommending an assessment of robustness, similar in concept to sensitivity analysis in inferential statistics. I assessed robustness by removing sub-conditions for each of the outcomes, by changing calibration points, and by transforming all calibrations to crisp (dichotomous) sets to understand whether these changes created substantial differences in the results. With each of these changes, the basic results remained functionally unchanged. Regardless, no conditions were found to be necessary to the outcomes. Changing calibration points introduced model ambiguity (i.e., multiple solution terms) for the resource manager outcome. The solution terms altered somewhat with each change. Overall, the changes were not substantial and indicated adequate robustness in the analysis.

Overall, results from qualitative comparative analysis indicate the following:

- Participation in the E Alu Pū network was a sufficient condition for the outcome of participating in advocacy.
- A combination of affinity with E Alu Pū and connectivity OR a combination of participation in E Alu Pū and connectivity were sufficient for the outcome of solidarity.
- Either being a well-resourced community group OR a combination of connectivity and participation in E Alu Pū were sufficient for the outcome of adopting effective community-based resource management practices.

Results From Study 3: Comparison of Findings from Study 1 with Findings from Study 2

With the final research question, I asked, "How can SNA and QCA be combined effectively to explore the connection between collective action networking and social change outcomes?" This study considers the results of Study 1 and Study 2. I reviewed results through three lenses: (1) E Alu Pū program theory, (2) collective action theory (Crossley and Ibrahim, 2012; Ostrom, 2009), and systems and complexity theory (Cabrera et al., 2008; Hummelbrunner, 2011; Walton, 2014). I included these additional theoretical perspectives to inform other network researchers and evaluators who, of course, will not use E Alu Pū program theory but may use these other theoretical frameworks to ground their own network research. Finally, because descriptive survey analysis and case analysis were third and fourth types of analyses I used in Study 1 and Study 2, I included those in the comparative analysis as well

because I was curious whether they provided results that were equally, more, or less useful than QCA and SNA.

Tables 15 through 17 contains the results of this analysis. To summarize, SNA is the right tool for the job of measuring relationship structures and characteristics, but SNA by itself was not designed to link networking to outcomes. Was QCA is an appropriate tool to pair with SNA to establish that link between networking and outcomes? QCA did, indeed, link conditions including connectivity and network participation rate to certain outcomes. What the table below indicates, however, is the importance of the descriptive survey data, SNA, and qualitative case study data to provide the information required to build a deep enough understanding of cases to use QCA. All these tools have their appropriate uses and their limitations. QCA is the oven that bakes the mixture of these other ingredients. Without the other ingredients, though, QCA is an empty oven.

Table 15

How Different Analyses Informed Program Theory

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Program theory	Relationship structure for the E Alu Pū network	Diameter, average path length, average degree, average weighted degree, and density	No	No

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Program theory	Relationship characteristics of E Alu Pū member groups	Indegree, outdegree, eigenvector centrality, closeness centrality, betweenness, authority, hub, clustering	No	No
Program theory	Level of achievement of outcome: Resource managers	No	Calibration of case data provides rated differences among cases studied but cannot be compared outside of the cases studied.	Descriptive survey analysis Case analysis
Program theory	Level of achievement of outcome: Decision-makers	No	Calibration of case data provides rated differences among cases studied but cannot be compared outside of the cases studied.	Descriptive survey analysis Case analysis
Program theory	Level of achievement of outcome: Solidarity	Network connectivity and node-level connectivity, kāhea indegree and worked together indegree	Calibration of case data provides rated differences among cases studied but cannot be compared outside of the cases studied.	Descriptive survey analysis Case analysis

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Program theory	Unintended outcomes	No unless relationship structures were unintended	No	Case analysis
Program theory	Conditions linked to outcome achievement	No	Conditions and combinations of conditions sufficient to the outcomes	Descriptive survey analysis Case analysis
Program theory	Conditions linked to limited outcome achievement	No	Conditions sufficient to non-outcomes (not the purpose of QCA and should be reviewed with caution)	Case analysis

Table 16

How Different Analyses Informed Collective Action Theory

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Collective action theory (Kim & Bearman, 1997; Ostrom, 2009)	The structure of connectivity between group members	Yes	No	No
Collective action theory	Whether individuals are compelled to participate	No	No	Yes

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Collective action theory	Historical actions	No	No	Historical context and actions are typically reviewed in a case study.
Collective action theory	Face-to-face communication	Communication structures, yes. Face-to-face communication, no.	No, though a study could include communication as a condition or an outcome of interest.	This could be included as part of a case study or a survey.
Collective action theory	The nature of the collective benefit	No	QCA can help to identify the nature of conditions that provide a pathway to collective benefit.	Yes, the case study and the archival surveys both considered this.
Collective action theory	Who bears the cost of collective action toward a common benefit	No	No, though a study could include an analysis of cost as a condition of interest.	Though my study did not include this dimension, case studies are well-suited to this dimension.
Collective action theory	Personal contribution to a collective benefit	SNA could help to examine relational contributions.	QCA can help to identify this if contribution is a condition being studied.	Yes, the case study included information relevant to this dimension.
Collective action theory	Number and heterogeneity of individuals	SNA can help to identify clusters or cliques that	No	Yes, archival survey data provided this information.

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
		would be relevant.		
Collective action theory	Trust	SNA can illuminate patterns of trust, with the right questions.	QCA can help to identify the importance of trust if it is a condition or outcome of interest.	Yes, both the case study and the archival surveys incorporated trust.
Collective action theory	Consciousness-building	SNA could track the dispersion of consciousness over time.	QCA could illuminate whether consciousness is necessary or sufficient to an outcome.	Case studies are well-suited to surface this dimension.
Collective action theory	Consensus-building	SNA could track the growth of consensus.	QCA could study consensus as an outcome.	Both surveys and case studies could provide relevant information about consensus-building.

Table 17

How Different Analyses Informed Systems and Complexity Theory

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Systems and complexity theory (Cabrera et al., 2008; Hummelbrunner,	Boundaries, level, and unit of analysis for the system	For SNA, these are dimensions researchers determine *a priori.* SNA	No	For case studies, these are dimensions researchers determine *a priori.* Data

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
2011; Walton, 2014)		could bring new understandin g to the boundaries and level, however.		gathered during a case study could push the boundaries, however.
Systems and complexity theory	Context in which the system exists	Yes, SNA provided information about the relationship context of E Alu Pū.	No	Surveys can be designed to provide contextual information, but case studies are especially well-suited for this dimension.
Systems and complexity theory	Interrelations hips present in the system	Yes, this is a dimension that SNA handles extremely well. I learned about interrelations hips in E Alu Pū using SNA.	Yes, QCA provided insight about the interrelation ship of conditions, which was relevant to this dimension of systems theory.	Yes, the case study provided information relevant to this dimension. The archival surveys touched upon this but were less effective.
Systems and complexity theory	Motivations, behavior, values, feedback effects	No	QCA can help researchers study behavioral conditions that are linked to outcomes.	Case studies would be the most effective tool for this dimension.

Theoretical Perspective	Dimensions of Outcomes	Study 1: SNA	Study 2: QCA	Other Embedded Analyses
Systems and complexity theory	Nonlinear timing	Longitudinal SNA can illuminate change over time, but not nonlinear timing.	QCA can incorporate time, but it would be difficult to study nonlinear timing with QCA.	s

Chapter Four Summary

In this chapter, I explained how I arrived at results for each of three scaffolded studies to produce an understanding of how networking has contributed to outcomes for the E Alu Pū network and its member groups. From SNA, I learned about relationship characteristics and structures for both the network and for the member groups. Results indicated that E Alu Pū member groups were well-connected and had established efficient communications pathways throughout the network. However, the member groups would need to share information and work together more outside of network events to become a stronger, self-generating network.

From the surveys, I learned about the degree to which the member groups and the network were achieving desired outcomes. A large majority of groups participated in advocacy activities, responded to network groups' calls for assistance, worked with other groups on projects, used traditional knowledge, and provided outreach and education to the public. Groups struggled more with implementing management plans and gaining formal recognition of site stewardship. From the first study, I was not able

to establish a clear connection between networking and outcomes because SNA was not designed to do this and because the networking context required me to avoid the use of inferential statistical analyses with the survey data.

From the case study, I learned about intended and unintended outcomes. Qualitative data provided a pattern of evidence of growing political power tied to E Alu Pū, the transmission of resource management practices among groups, and a sense of solidarity from participating in the network. Unintended outcomes that people said were connected to E Alu Pū included funders that said they were scaling up and more effectively dispersing their support through the network, and partners that said the success of E Alu Pū inspired them to develop regional community-based resources management networks. Additional factors that groups named as contributing to outcomes were trust, effective leadership, technical assistance, and other networks. They said that conflict, lack of organizational resources, and lack of trust for the state hampered success. Member groups perceived that they received benefits from participating in E Alu Pū that helped them to achieve the desired outcomes. So, from the case study, a connection between networking and outcomes became clearer. What was still unclear, however, was the comparative importance of these different factors.

The key contribution of QCA was a determination of which combination of conditions contributed to achievement of target outcomes at the site level. Groups that achieved greater participation in advocacy had greater participation in the network. Groups that achieved greater solidarity had a greater affinity for and connectivity with E Alu Pū or had greater participation and connectivity. Groups that achieved more

thorough adoption of effective community-based resource management practices were either more well-resourced or had greater participation and connectivity.

From the methodological study, I learned that I needed all these methods in combination to gain an adequate understanding of outcomes achieved at the network level and the site level, and of *how* network member groups achieved outcomes collectively and individually. I needed SNA to reveal network relationship structures and characteristics. I needed archival survey data to reveal the degree to which groups collectively and individually achieved intended outcomes. I needed case study data to surface unintended outcomes, provide evidence for intended outcomes, and reveal facilitators and barriers for outcome achievement. I needed QCA to bring it all together and help make sense of it. Without information from each of those methods, I would be left with a gap in my understanding of E Alu Pū. I have gained a robust, holistic understanding of E Alu Pū, including a connection between collective action networking and social change outcomes.

CHAPTER FIVE: DISCUSSION

Evaluation of collective action networks, or groups that come together to affect social change, has proven challenging (Ernstson, 2011; Weber & Khademian, 2008). Evaluators have been perplexed by how to connect networking to outcomes because networks are complex systems that are contextually situated. This affects the way evaluators can research and evaluate them. For example, most inferential statistical approaches are inappropriate for networking studies because the people or groups that comprise networks are not independent from one another. Thus, networks violate the assumption of independent observations that is foundational and necessary for the application of the most common inferential statistical techniques (Borgatti et al., 2018; Chung et al., 2008; Hollstein, 2014; Popeier, 2018).

Network evaluators have studied networks by using social network analysis (SNA), and the method has effectively surfaced relationship dynamics within networks (Borgatti & Halgin, 2011; Fredericks & Durland, 2005; Groce et al, 2019; Popeier, 2018). SNA does not address social change outcomes related to those relationship dynamics, however (Popeier, 2018; Groce et al., 2019; Varda & Sprong, 2020). The purpose of this study was to explore the methodological question of whether SNA could be combined effectively with qualitative comparative analysis (QCA) to establish a clear empirical connection between collective action networking and social

change outcomes. It is a question of finding the right combination of tools to get the job done well.

For this research, I focused on a case network, E Alu Pū, members of which are mainly Native Hawaiian community groups that came together to reclaim stewardship of land and sea where they live and have lineal ties. Created in 2003, the network collectively has pursued social change at the state level and at their community sites. Past evaluations indicated that network members highly valued the collegiality of the network and appreciated the coordinating work of Kua‘āina Ulu ‘Auamo (KUA), the network’s backbone facilitating organization. KUA was keen to know whether the networking strategies they employed were affecting the desired outcomes of E Alu Pū. They felt comfortable working with me as a researcher because I have worked with them in various roles since 2004. The combination of KUA’s desire to understand networking outcomes and my long-standing relationship with E Alu Pū and KUA resulted in this research focused on the perplexing network evaluation question of how to establish a connection between networking and outcomes.

Based on the need to develop sound methodological solutions to the challenges inherent in network evaluation, which was an issue relevant to the evaluation of E Alu Pū, I designed three scaffolded studies. Study 1 addressed two research questions using a descriptive quantitative design that included SNA and survey research. Study 2 addressed two research questions using an explanatory mixed methods case study design culminating in QCA. Study 3 compared the results of Study 1 and Study 2 to

address the overarching methodological question about the value to network evaluation of combining SNA and QCA.

In this chapter, I discuss the results for each of the three scaffolded studies. First, I consider the implications of the descriptive quantitative results, including SNA, for E Alu Pū and KUA. Next, I consider the implications of the explanatory case study and QCA results for E Alu Pū and KUA. Then, I discuss the culminating research question about the value to network evaluation of combining SNA and QCA. Prior to concluding the chapter, I share the study's limitations, and its implications for several audiences and possible directions for future methodological research to advance network evaluation.

Discussion of Study 1: Network Structures and Relationship Characteristics with Intended Outcomes

Study 1 research questions were as follows:

- To what degree were various network structures and relationship characteristics present for the E Alu Pū network and member groups?
- To what degree were intended outcomes achieved by the E Alu Pū network and member groups?

Network theory indicated that networks comprise different levels, and understanding networks requires analysis at multiple levels (Fredericks & Durland, 2005; Prell, 2011; Varda & Sprong, 2020). Thus, each of the two research questions were directed at two levels—the network as a whole and member groups. The discussion below is organized by level. First, I discuss network structure and

relationship characteristics and intended outcomes at the network level. Then I discuss network structure and relationship characteristics and intended outcomes at the member group level.

Network Level Results

E Alu Pū is a Hawaii network of 36 site-based groups plus one backbone organization, KUA, that facilitates and coordinates the network. The purpose of the network is (1) to increase their effectiveness in managing local biocultural heritage through sharing knowledge and lessons and (2) to act collectively to expand opportunities for and remove barriers to community-based resources management. The member groups are based on six of the Main Hawaiian Islands, and the distribution of membership is consistent with island-by-island population sizes. Collectively across the *pae ʻāina* (Hawaiian archipelago), network members steward 32,035.8 acres.

E Alu Pū grew from 12 groups when it began in 2004 to 36 member groups in 2020, when the latest data was available. Once a member, groups tend to retain their membership. In fact, 27% of current member groups have participated since the beginning of the network. Overall, groups have participated in E Alu Pū for an average of 11 years, so longevity in participation is a strength of E Alu Pū. One may expect that the longevity of participation would affect relationship characteristics and network structures, and I discuss the SNA results next.

Social Network Analysis

SNA revealed a closely knit network that still has room for greater connectivity (see Figure 8). The network diameter (3) is the length of the longest path between the

most distantly connected groups in the network (Cherven, 2015). In other words, to reach even the most distantly connected groups, one needs to traverse only three connections in the network. People unfamiliar with SNA may still recognize this concept as similar to the idea of degrees of separation (Guare, 1990). This means that if an E Alu Pū member group has a problem or question, the group can be connected efficiently to another group with the information even if those two groups previously were not directly connected. Similarly, the average path length (1.7) is the average number of steps from any group to any other group throughout the E Alu Pū network (Cherven, 2015). This indicates that information can flow quickly across the network. The network also was relatively well-connected, with an average degree of 9.1, or the average number of relationships per member group. Network member groups had a high range of connectivity, however, from a single reported relationship for one member group up to 27 reported relationships for another group. So, while the average group had relationships with 9 other groups, the E Alu Pū coordinator and member groups could help connect the more isolated members. Finally, density (.25) indicated that only 25% of all possible relationships between member groups were occurring (Cherven, 2015). E Alu Pū is a well-connected network with ample unrealized potential to further connect. These relationship characteristics provided a picture of how networking may have connected member groups that were geographically dispersed across the Hawaiian Islands. However, the outcomes I was able to explore using SNA were limited to those relationship characteristics. I turned to archival

survey data to learn more about the desired outcomes the member groups had achieved collectively and individually.

Survey

From archival survey data, I was able to learn about the degree to which the E Alu Pū network overall attained desired outcomes related to advocacy, resources management, and solidarity (see Appendix C). For the advocacy outcome, a key goal of E Alu Pū, I found that a large majority (81.8%) of groups participated in advocacy. Also, the network has succeeded in two of its three collective advocacy efforts.

The goal to produce more effective community-based resources managers was more difficult to interpret, as baseline data for each group was not captured. If KUA gathered baseline data on each new member group, an evaluator could track trends related to the desired outcomes over time as groups participate in the network. Thus, the survey results were reflective of a point in time. Assessing progress on this resources management goal also was difficult because E Alu Pū member groups have not developed an agreed-to list of activities or strategies to define what *effective* community-based resources management means. Therefore, instead of using a list of effective community-based resources management practices curated by E Alu Pū, I utilized prior research about effective community-based resources management practices. I then culled the list of effective practices based on archival data that was available for E Alu Pū member groups. The effective practices I was able to include were as follows: site authority, collaboration with formal management agencies, environmental monitoring, environmental restoration, outreach and/or education, and

use of management plans. I also was able to review groups' use of traditional ecological knowledge, human use monitoring, and violations monitoring. Three key effective practices for which KUA did not have data were leadership, conflict, and community engagement and mobilization.

E Alu Pū member groups provided stewardship for 32,035.8 acres (with 94.4% of groups accounted for). Effective management for that large of an area is consequential, especially as the network has grown. Most member groups (55.9%) had some recognized authority for the sites they stewarded, indicated by a formal or legal agreement such as a state area designation or a memorandum of understanding with the formal management agency. Only 65.7% of member groups collaborated with formal management agencies. Since only one group owned the land they stewarded—and even that group was responsible to comply with laws governing land use—all groups could benefit from collaborating with management agencies.

With 91.4% of groups reporting, I found that groups were very active practitioners of resource management. Almost all respondents (94.3%) conducted environmental monitoring to some degree, though only 48.6% were doing so to the degree they desired. Similarly, 80% engaged in site-based environmental restoration, but only 42.9% were doing so to the degree they desired. Most respondents (88.6%) provided outreach and education, reaching a collective 97,296 people in 2019 (with only 22 groups, or 61.1%, reporting raw numbers). A management plan has been recognized as a key document promoting effective management, and 68.6% of respondents were using management plans. However, only 25.7% were fully

implementing management plans. A wide majority of respondents (94.3%) were using traditional ecological knowledge, a practice that E Alu Pū has identified as critical to their goals. Fewer than half of respondents (45.7%) said they were using traditional ecological knowledge to the degree they desired, however. For human use monitoring, 71.4% of respondents were conducting some monitoring, though only 28.6% were doing so to the degree they desired. Finally, for violations monitoring, 68.6% were monitoring, and 20% were doing so to the degree they desired. Overall, the results indicated that E Alu Pū member groups were actively engaging in many effective community-based resource management practices, but most groups were not able to implement those effective practices to the degree they desired.

To assess the third outcome of solidarity, I reviewed archival survey results and SNA results. KUA asked groups to rate their level of agreement from 0% to 100% on conditions related to healthy networks, including shared purpose and trust. With 83.3% of groups responding, their average level of agreement was 95.9% for "E Alu Pū has a clear shared purpose." With 77.8% of groups responding, their average level of agreement was 92.8% for "E Alu Pū participants trust each other." These high levels of agreement indicated solidarity among network groups, though those results alone were not sufficient to assess solidarity.

To continue assessing solidarity, I used SNA results. Specifically, I considered whether groups asked E Alu Pū for help, whether they responded when other E Alu Pū groups asked for help, and whether they worked with other member groups outside of network events. Twelve groups (33.3%) reported sending out a *kāhea,* or call for help,

to E Alu Pū, so it is possible that groups have underutilized the power of the network to come to their aid. The archival data did not provide evidence about why this may be the case—whether help was not needed, whether groups did not feel comfortable asking for help when they needed it, or whether another reason factored into their decision not to ask for help. On the other hand, 94.3% of E Alu Pū groups were named by others at least once as providing help when asked. The group that was named most by others as responding when asked for help had responded to six groups' *kāhea* (requests for help). Also, 88.6% of E Alu Pū groups were named by others at least once as working together outside of network events. While most groups were named by one, two, or three other groups as collaborating outside of network events, one group has worked with 10 other groups, and one group has worked with 11 other groups. A desired E Alu Pū outcome is for groups to show up for each other. The solidarity results indicated that some groups showed up for each other through responding to requests for help and working together outside of network events. Untapped potential exists within the network, however, for groups to ask for and receive assistance.

Network Member Group Level Results

E Alu Pū was formed to affect change at the network level, but also at the member group level. Therefore, I considered the SNA results and achievement of outcomes at the member group members level, and I used archival survey data to do so. The archival survey data was extensive, with more than 70 questions about a variety of dimensions related to the goals of E Alu Pū and KUA, including questions

about group characteristics, intended outcomes, network health, satisfaction with KUA, and connections between member groups. As was true for the network-level data, survey results illuminated a point in time rather than change over time. Therefore, I could not assess whether the achievement of outcomes was directly related to participation in the network with the survey data alone. Another difficulty in understanding how networking affected outcomes for E Alu Pū groups was presented by the unique context of each member site. The groups varied widely by the number of years they existed, the number of acres they stewarded, the degree to which they implemented practices, and the number of people they served.

Given the limitations, I was not able to determine whether KUA's strategies of networking, training, and technical assistance were factors in groups' achievement of outcomes based on the archival survey data. Overall, however, 60% of E Alu Pū groups said they were using new strategies or tools that they attributed to their participation in the network, and 45.7% provided specific examples. These included cultural and traditional information, resources for educational programs, technical environmental restoration knowledge, youth engagement ideas, conflict management practices, information about engaging in advocacy, and strategies for building trust relationships with government agencies. This lack of clarity about results was expected, however, because of the known limitations of SNA and surveys. In fact, it was this expected lack of clarity—based on lived experience—that inspired this research to find the right combination of tools to connect networking to outcomes.

Next, I discuss what I was able to learn about member groups from the SNA and survey data.

Social Network Analysis

Review of the individual member groups' network statistics surfaced a couple of interesting characteristics. First, Group A held a vital position in the network, with the highest indegree and outdegree, highest centrality, highest authority, and highest hub. If Group A were to exit the network, the group's removal would disrupt the network's overall structure. Second, 12 groups (32.4%) had relatively high clustering coefficients of .60 and more, indicating that they were connected with other interconnected groups. While it may not be surprising to see clusters due to island-based geographic clustering, KUA would like to see less clustering to support a more generative network. Therefore, an effort could be made to push clustered groups beyond their clusters. Finally, a handful of six member groups (16%) were considered "authority" groups, or groups that others seek out for information, as indicated by an authority coefficient of .60 and more. If an entity wanted to influence E Alu Pū, beginning with these six groups could be an effective strategy. The SNA data provided these insights about member groups' positions in the network, but SNA did not address member groups' achievement of desired social change outcomes. Again, this was expected because of the known limitations of SNA. Next, I discuss what I learned about member groups from the results of archival surveys.

Survey

To understand more about the achievement of outcomes for each group, I reviewed groups' responses related to each of three desired outcomes: advocacy, resources management, and solidarity. E Alu Pū has not established measures that define "success" or "lack of success" for the outcomes of interest, so I judged achievement as relative to other member groups. In other words, I considered whether each group was achieving more or less in terms of advocacy, resources management, and solidarity when compared with other E Alu Pū groups.

Archival survey data included groups' level of engagement in four types of advocacy activities: spoken testimony, written testimony, visiting officials, and initiating legal action (such as contested cases or lawsuits). With one exception, for every group that initiated legal action (nine groups), they also participated in the other advocacy actions. Not all groups needed to engage in legal action, though, and nine groups participated in all the advocacy actions except for initiating legal action. Six groups did not participate in advocacy at all. The results indicated that most groups took an all-or-none approach to advocacy: They either participated in most types of advocacy or did not participate at all.

KUA's theory of change and evaluation plan noted that site-based advocacy achievement would be indicated by groups influencing decisions affecting their individual sites. However, data was not available about groups' individual attempts to influence policy affecting their sites. If KUA wishes to determine whether groups are successful at advocating for decisions that contribute to their site-based goals and

blocking decisions that harm their site-based goals, KUA will need to gather that information for future evaluation efforts. Because this would entail a large amount of data collection, KUA alternatively could ask groups to report back about their site-based experiences with advocacy.

For resources management, I reviewed archival survey data about the degree to which each group was implementing various effective community-based resources management practices. Only two new patterns emerged related to the adoption of practices when viewed from the site level versus the network level. First, larger groups (those with more paid staff, especially) tended to engage more fully in environmental monitoring and restoration. Second, smaller groups (those with few to no paid staff), tended to report more frequently that they were not able to implement community-based resources management practices to the degree they desired.

For solidarity, I reviewed groups' SNA statistics and their responses to network health questions. A few groups were very highly connected, considered authorities in the network, and resisted clustering. These groups also tended to work with other member groups and respond to calls for help. With some exceptions, groups that were not well-connected tended not to work with others or respond to calls for help. Interestingly, six groups who were highly connected had lower incidences of working with others and responding to calls for help. Perhaps their connectivity was established outside of E Alu Pū. Or perhaps, as some collective action theorists have hypothesized, these groups' connectivity did not translate to showing up for fellow member groups (Ostrom, 2009). Conversely, four groups consistently showed up for other member

groups, but their connectivity statistics were just average. These groups were fulfilling an important role by showing up even though they were less well-connected. This could reflect some collective action theorists' hypotheses that groups organize for mutual benefit (Kim & Bearman, 1997; Ostrom, 1990, 2009). Regardless, KUA could dig more deeply into these dynamics, talking with the anomalous groups about connectivity and solidarity to increase both for the entire network.

To maximize these site-level results, KUA could review the survey results with individual member groups to help them determine what changes, if any, they want to adopt for greater effectiveness. KUA could provide resources or tools and could link inexperienced groups with experienced groups. Finally, KUA could focus trainings and technical assistance to help groups more readily adopt effective community-based resources management and advocacy practices, positioning the experienced groups as case studies and those groups' leaders as trainers and mentors. Connecting groups over shared work likely would serve KUA's solidarity goal while increasing groups' achievement in advocacy and resources management.

Overall, Study 1 provided useful information about participation and connections within E Alu Pū, and the degree to which the network and member groups achieved desired outcomes. Study 1 provided KUA with site-based information that could be used to support future achievement of desired outcomes with targeted assistance and connection. As expected, Study 1 did not provide empirical evidence to connect networking to the achievement of outcomes, however. Next, I discuss Study 2

to see whether this gap in linking networking to outcomes could be filled by using QCA.

Discussion of Study 2: Intended and Unintended Outcomes with Necessary and Sufficient Conditions

Study 2 research questions were as follows:

- For the E Alu Pū network and member groups, what intended and unintended outcomes were achieved?
- For the E Alu Pū network, what conditions were necessary and sufficient to achieve the intended outcomes?

Study 2 was an explanatory mixed methods case study that utilized Study 1 as the quantitative strand, which informed qualitative data collection and analysis, then concluded with QCA to integrate the quantitative and qualitative results. Below, I discuss the results of the qualitative strand, which addressed the research question about intended and unintended outcomes. Then I discuss the results of quantitative and qualitative integration using QCA, which addressed the research question about necessary and sufficient conditions.

Case Study

KUA's theory of change posited that by providing networking, training, and technical assistance, member groups would collectively achieve advocacy, resource management, and solidarity outcomes. Through the case study, I found that E Alu Pū achieved results related to those intended outcomes. The case study also surfaced a pattern of evidence that indicated that networking contributed to desired and

unintended outcomes. Network supporters were interested in environmental improvement that they recognized would take a "super slow boil," and they interpreted progress toward intended and unintended outcomes as progress toward environmental improvement. Network members participated because they believed in the value proposition of coming together to restore and perpetuate cultural and traditional practices tied not only to environmental health, but also to Native Hawaiian self-determination.

Outcomes where achieved, in part, because of KUA's approach to networking, which was participant-driven. While some collective action networks have been initiated and sustained by foundations, agencies, universities, or other power brokers, collective action theory and prior research about community-based resources management found that success was predicated on participant-driven efforts (Murphree, 2009; Ostrom, 2009). KUA came into being at the direction and request from E Alu Pū member groups, member groups sit on KUA's board, and member groups control network decision-making through a council of members selected by other members to represent all islands in the network. An E Alu Pū member representative said that KUA was needed precisely because this approach of taking direction from the communities it serves was unique. KUA's roles as facilitator, coordinator, liaison, codebreaker, and responsive listener resulted in a high degree of trust between KUA and E Alu Pū member groups. Trust was cited as a component critical to effective network functioning (Kania & Kramer, 2011; Plastrik et al., 2014) and effective community-based resources management (Gruber, 2010).

High trust and high alignment with the value proposition of E Alu Pū were two reasons groups have participated in the network for such a long time. Long-term participation is an important indicator that a network is on a path to outcomes achievement, as a network cannot achieve outcomes if participants leave before they learn and achieve together (Kania and Kramer, 2011; Plastrik et al., 2014). Expansion of the network also was important, especially in the early days, to expand effective management of biocultural resources through increased opportunities for and reduced barriers to community-based resources management. Today, with 32,035.8 acres in Hawai‘i being stewarded by E Alu Pū member groups, some members asked whether the network could grow too large for continued trust-based relationships to be established between groups. This is a question with which E Alu Pū will need to grapple. To maintain and build trust, the E Alu Pū Coordinator may have to be involved in disrupting clusters and connecting people across geographic and other boundaries.

Communities of practice within E Alu Pū also could serve to connect member groups across new pathways. For example, regional community-based resources management networks have formed out of E Alu Pū as a strategy employed by The Nature Conservancy – Hawaii to leverage the power of networking. Also, KUA formed Lawai‘a Pono, a community of practice from within E Alu Pū that connects groups across the islands that want to participate more effectively in advocacy. Another small subset of member groups generatively developed their own community of practice focused on aquaponics. Whether generated by outside facilitators, KUA

itself, or member groups, these sub-networks within E Alu Pū could effectively stoke trust and relationship-building. However, if care is not taken to ensure that these communities of practice continue to connect to E Alu Pū, the network could become increasingly clustered and, thus, weaker overall.

Another way to strengthen E Alu Pū could be to facilitate agreement about what effective community-based resources management practice looks like in Hawaii. For this study, I depended heavily on published research to assess the degree to which member groups have achieved community-based resources management outcomes. I found that all groups were actively pursuing many of the effective practices cited in the literature, with larger, well-resourced groups able to implement practices more thoroughly than smaller, less-resourced groups. Still, E Alu Pū contains deep knowledge within its own membership, KUA's access to published literature, and the network's relationships with similar groups across the globe. Through interviews, I found that some people—especially collaborators and funders—carry certain expectations from their investment of time and money in the network, and at least one communicated that the network has not been able to achieve what they had hoped in its 17 years. Funders and partners could grow disillusioned and invest elsewhere if they do not see desired progress. KUA will have to walk the line between maintaining its effective participant-driven process and producing results. E Alu Pū agreed that a goal of the network was to manage their sites more effectively, but they did not establish what they meant by "more effective" management. Clarifying this could advance the

voice of E Alu Pū as resource management experts while enabling the network and member groups to show progress in implementing effective practices.

Solidarity was the outcome that E Alu Pū member groups talked about the most in interviews, annual surveys, gathering surveys, touch base calls, and closing circles. Participants repeatedly used two terms to discuss their sense of solidarity with other groups: *"ohana"* (family) and "magic." As one person said, "I definitely felt like E Alu Pū was a second family." The magic they felt involved finding people in the world with whom they shared experiences. As one interviewee explained:

> That's what I mean by the "magic." It's like this chain reaction of, like, "Oh, what? You also have those challenges?" Or "Oh, that's how you solve them? Oh, wow! That's interesting! Maybe we should try something similar but adapted for our situation." And next thing you know, they're volunteering in each other's community workdays and helping each other, trading tips, exchanging leads for funding.

However, even groups that have experienced that magic talked about unmagical aspects of E Alu Pū. A concern woven through conversations was that KUA should be aware of and involved in the experiences of groups that were having challenges or who felt stuck. These groups may not have felt that E Alu Pū was a safe space to divulge their problems. Participants believed that the emphasis among E Alu Pū groups was about moving forward, making progress, and getting things done. If a group was stuck, they felt that something was wrong with their group or even their community. One person asked, "Is it just our island? Is there something about the way

our communities interact?" when wondering whether other islands experienced similar conflicts and challenges. The word groups used to describe their feeling was "shame." All groups face challenges and barriers, so KUA may want to create an increased sense of safety for groups to discuss challenges alongside positive momentum.

Sharing about challenges may result in additional trust-building as well as opportunities to connect groups that have successfully navigated similar challenges. Even though SNA results indicated strong connectivity, opportunities still abound for groups to work together and call on each other more. As one interviewee said, "The network is there for communities to be there for each other." Another person said, "We all know that one person asking for something is not as strong as hundreds of people from all over, you know, from different communities, supporting you."

The network demonstrated that groups showed up for each other when a group sent out a *kāhea,* or call for help. E Alu Pū was cited by member groups, collaborators, funders, and even agencies as a key reason for several advocacy successes. For example, E Alu Pū groups played an important role in the passage of the Hā‘ena Community-Based Subsistence Fishing Area rules. Even though the effort helped only one group, 31 member groups supported Hā‘ena through advocacy actions. This phenomenon of seemingly selfless assistance is consistent with collective action theory and systems theory (Hummelbrunner, 2011; Ostrom, 2009). Groups showed up for Hā‘ena because doing so advanced Native Hawaiian self-determination, they wanted to support people with whom they had relationship, and they believed that helping Hā‘ena would benefit everyone. As one person explained, "Hā‘ena paid the dues,

right?...Because of what they went through, when it's someone else's turn—like Kīpahulu right now—they're jamming because of all those lessons learned from Hā'ena, Mo'omomi, right?" As a result of the network showing up for each other, interviewees said they witnessed a change in perception of and support for community engagement in resources management among agencies. "We went from communities screaming to be heard," an interviewee said, "And now, institutions don't want to make a move without first consulting with them."

The increased voice and power of E Alu Pū contributed to policy wins for community-based resources management in Hawaii. Those advocacy experiences also generated lessons learned—especially increased caution to ensure that voice was authentically centered in community. First, conflict arose over who really represented a community. If someone does not live in a community or does not have ancestral ties to the community, can they claim to represent the community? Can one person or one family claim to represent the entire community? E Alu Pū has not resolved this issue. Second, there were negative repercussions from the involvement of E Alu Pū in a community's policy-setting controversy. E Alu Pū threw its weight behind a member group's policy, but the policy was controversial within the community. This situation was very much on the minds of almost everyone I talked with. According to these conversations and archival documents, in addition to published literature, this kind of conflict is a barrier to the success of community-based resource management efforts (Gruber, 2010). The key lesson learned, according to interviewees, was that the role of KUA and other intermediaries is to help community groups do the work within their

communities to garner authentic support so that a policy change is a real community-driven effort. Then, only once the community largely supports the effort, the role of E Alu Pū should be to provide backup and stronger voice. In other words, E Alu Pū's voice cannot replace the local community's voice.

The challenges E Alu Pū and its member groups experienced indicated the importance of group leadership, which was raised by interviewees as a key element that can contribute to or diminish achievement of outcomes. This finding was consistent with other literature about community-based resources management (Berkes & Ross, 2013; Garcia-Amado et al., 2012; Gruber, 2010). Lack of effective leadership, along with lack of funding, staff, and community volunteer support, severely hampered E Alu Pū groups. People I interviewed said that E Alu Pū member groups were most successful when they had strong, nuanced leaders that were respected cultural practitioners in addition to leaders who understood nonprofit management and community engagement. KUA has not waded into the murky waters of evaluating or assessing member group leadership skills. While leadership was cited clearly as a factor that can affect outcome achievement, leadership skill data were not available for this study.

Not all communities have resident cultural practitioners to address every environmental or cultural need. As a partial solution, member groups can turn to other groups to build their own resource management knowledge and skills. The case study indicated that the groups who participated in E Alu Pū were more effective resource managers because they learned from one another. For example, extensive knowledge

about *limu* (marine algae, or seaweed) and its biocultural importance was brought to the network by Uncle Henry Chang Wo and disseminated throughout the network by his successor, Uncle Wally Ito. In surveys and conversations over the years, E Alu Pū member groups listed dozens of things they learned from other E Alu Pū participants.

When some member groups were not able to glean the knowledge and skills they needed from other groups, they utilized technical assistance offered by several organizations in Hawaii, including KUA. KUA's theory of change indicated that technical assistance, along with networking and training, would help groups achieve the desired outcomes. While several interviewees mentioned the importance of technical assistance to their work, two unintended issues arose in conversations about technical assistance that KUA can consider. First, KUA has not clearly and transparently conveyed to member groups the type of technical assistance available, who could access it, and how. If groups understood what assistance was available, they might feel more comfortable asking for the help that could advance their goals. Second, technical assistance cannot take the place of authentic community engagement. A fine line existed between a project being community-driven and being community-based. Technical assistance should be provided to support projects and activities born and bred by community members. When technical assistance providers inserted their own goals, took over a project, or spoke with a louder voice than the community, then the project no longer belonged to the community.

The qualitative data I gathered during the case study provided context, detail, and new information that SNA and survey data did not uncover. I learned about

nuanced conditions that helped groups achieve greater success or that hampered groups' pursuit of goals. While survey and SNA illuminated current conditions, qualitative data explored why those conditions occurred and how they intersected. Survey and SNA data indicated that E Alu Pū groups were achieving outcomes to a degree, but did not provide information that linked those outcomes to networking. Qualitative data explored that potential link more effectively, providing a pattern of evidence from multiple sources including member groups, collaborators, supporters, and KUA staff about how networking contributed to outcomes. The case study data revealed a large degree of variety from group to group, and the challenge was in teasing out how important networking was when compared to other plausible explanations for groups' outcome achievement. I had trouble finding patterns that could indicate whether member groups' participation in the network consistently led to better outcomes at their sites. I turned to QCA to further explore potential patterns through integrating the quantitative and qualitative data.

Qualitative Comparative Analysis

The purpose of QCA is to surface the patterns of conditions that were necessary and sufficient for identified outcomes among comparative cases (Ragin, 1987). QCA is based on theories of causality that are different from those upon which inferential statistics is based, and I urge readers not to interpret QCA using a probability theory lens. It is a different game with different rules. See Mello (2021) for a thorough discussion of key differences and similarities among four major concepts of causality. Set theory, Boolean algebra, and causal complexity form the theoretical

foundations for QCA, leading to the relatively simple idea that social scientists can uncover what configurations of conditions were present for cases that experienced or did not experience an outcome (Mello, 2021). When "cause" is discussed in QCA, it should be discussed "to make sense of cross-case patterns and thereby aid the causal interpretation of cases, using theory and accumulated substantive knowledge as guides" (Ragin, 2005, pp. 33-34). Mello (2021) cautioned that "a set-theoretic relationship of necessity and/or sufficiency does not warrant a causal claim" (p. 71).

For this research, I asked what conditions were necessary and sufficient for E Alu Pū outcomes related to advocacy, resources management, and solidarity. I employed KUA's theory of change alongside literature about community-based resources management to determine what conditions theoretically should lead to the three outcomes. No condition was found necessary, but the *absence* of a condition was found to be necessary for the *absence* of an outcome. Plus, several combinations of conditions were found sufficient for the desired outcomes. I discuss the meaning of these results below.

First, I considered the outcome of advocacy. According to KUA's theory of change, by participating more in E Alu Pū, being better connected within E Alu Pū, and attending more E Alu Pū trainings and other events focused on advocacy skill-building, groups would participate in more types of advocacy actions. The QCA results indicated that groups that achieved greater participation in advocacy had greater participation in the network. This result was consistent both with the case study and with collective action theory (Ostrom, 2009). It is also a key rationale for the existence

of E Alu Pū, so perhaps groups that get involved in E Alu Pū do so because they already recognize the value of advocacy. It is worth noting, however, that six groups (17.1%) had not participated in advocacy actions, and four groups (11.4%) had participated in only one. So not all groups shared the same view of the importance of advocacy. Clearly, some groups became members of E Alu Pū for reasons other than advocacy.

Second, I considered the outcome of resources management. According to KUA's theory of change and published literature, by participating more in E Alu Pū, being better connected within E Alu Pū, receiving more technical assistance, and having more organizational resources such as staffing, member groups would utilize effective resource management practices to a greater degree. Interestingly, the only necessary condition of the study appeared here. *Fewer organizational resources* were found necessary for *less adoption* of effective community-based resources management practices. In other words, in every case where there was less implementation of effective resources management practices, there were also fewer organizational resources. This result was consistent with what I learned from the interviews, and the phenomenon has been discussed in community-based resources management literature (Gruber, 2010).

The result of the test for sufficiency indicated two possible sufficient conditions for more thorough adoption of effective community-based resource management practices. Either (1) groups were more well-resourced or (2) groups were better-connected within E Alu Pū *and* had a higher rate of participation in the network.

A sufficient condition is one that alone can produce an outcome (Mello, 2021). So having more organizational resources alone—without any other condition—could produce the outcome of greater adoption of effective practices. So again, organizational resources were identified as important to resources management. But also, the combination of being better connected within E Alu Pū and greater participation in E Alu Pū activities could produce the outcome of greater adoption of effective practices.

It also is worth noting here the surprising result that technical assistance, which was indicated in interviews and the literature as being important to successful community-based resources management, was not found to be necessary or sufficient. Looking closely at the groups who had received more technical assistance, they were smaller groups, newer groups, and groups that had fewer resources such as staff. Essentially, the groups that really needed technical assistance were getting it, so it was not surprising after all that the groups had not yet adopted many effective resources management practices. It could be interesting to continue to track those groups to see whether the provision of technical assistance helped them progress toward their resource management goals.

Finally, I considered the outcome of solidarity. According to KUA's theory of change and published literature, by participating more in E Alu Pū, being better connected within E Alu Pū, and having a greater affinity for E Alu Pū, member groups would show up more for other member groups. The result of the test for sufficiency indicated two possible sufficient conditions for greater solidarity. Either (1) groups had

a greater affinity for and connectivity with E Alu Pū, or (2) groups had greater participation and connectivity. Again, a sufficient condition is one that alone can produce an outcome (Mello, 2021). So having a greater affinity for and connectivity with E Alu Pū could produce the outcome of greater solidarity. Likewise, greater participation and connectivity with E Alu Pū could produce the outcome of greater solidarity. Collective action theory and case study interviews provided meaningful context for this result: If a group was a "true believer" and connected with others, the group showed up for others because the group was fulfilling the purpose it signed up for. On the other hand, a group that participated and connected showed up for other groups because it was enculturated to do so. This result seems to bridge the two network research schools of thought. The connectionists would be more comfortable with the first result but would reject the idea of an outcome produced by enculturation. Structuralists, on the other hand, would be very comfortable discussing an outcome as a result of enculturation (Borgatti & Foster, 2003; Borgatti & Halgin, 2011). As I hypothesized in Chapter 2, this finding indicated that both the connectionist view and the structuralist view could be true.

Overall, Study 2 was extensive and incorporated archival survey data including SNA data, 93 archival documents, 17 interviews with 15 people, a case study, and mixed methods integration using QCA. This study required extensive case knowledge and took a considerable amount of time. The result of the study was satisfying, as I was able to link networking to outcomes. SNA indicated that the network was well-connected, and the survey data indicated that the network was achieving outcomes.

The qualitative case study data surfaced patterns of evidence that indicated that outcomes were achieved to at least some degree because of participation in E Alu Pū, and they also provided contextual information about other factors that supported and limited success. Integration using QCA indicated that groups achieving the three outcomes had in common certain conditions, including high connectivity and network participation for some outcomes. Next, I will review the results related to the overarching question of whether evaluators should add QCA to their network evaluation toolkit.

Discussion of Study 3: Combining Social Network Analysis and Qualitative Comparative Analysis for Network Evaluation

For Study 3, the research question was as follows:

1. How can SNA and QCA be combined effectively to explore the connection between collective action networking and social change outcomes?

Combining SNA and QCA yielded more in-depth, nuanced, and relevant contextual information than using either method alone. Without SNA, I would have lacked data about relationship structures and characteristics that I was able to use as conditions during mixed methods integration with QCA. I would not have been able to explore as rigorously KUA's theory of change that networking contributes to outcomes. Without QCA, on the other hand, I would not have been able to isolate the patterns present in the data that revealed the link between networking and the desired outcomes. The study demonstrated that when one is trying address outcomes in

network evaluation, supporting evidence beyond network characteristics is necessary. Network characteristics were one part of the broader story.

SNA helped me to understand relationship structures and characteristics across the network as a whole, which then became more meaningful as I looked at the network statistics for individual member groups. Conversely, QCA helped me understand the contribution of certain conditions to outcomes by comparing individual member groups with one another, which then became more meaningful when consolidated for the network as a whole.

In addition to illuminating both levels of the E Alu Pū network, combining methods enabled me to bring light to KUA's program theory, systems and complexity theory, and collective action theory. I was able to speak to each component of those theories only with the combination of methods rather than one alone. My experience simply supports the wisdom of choosing methods that are appropriate to the evaluation purpose, questions, context, and guiding theories (Kara, 2017; Mertens & Wilson, 2019; Patton, 2015).

However, it is worth noting that SNA and QCA are analysis methods that I could not have completed without first using survey and case study methods. These were critical components of the study, as each provided information that informed analysis using SNA and QCA. Without the case study, I would not have been able to make sound decisions during QCA, nor would I have been able to recognize a mistake that I made during the initial analysis using QCA. This was an important discovery, as I initially utilized the same conditions for each outcome rather than crafting the

combination of conditions based on program and social science theory. The initial results were problematic, and my deep knowledge of the cases illuminated my rookie mistake. Without the case knowledge, I would have had a difficult time interpreting the error. I also would have had difficulty interpreting the QCA results.

QCA often has been used in policy research using public country-level, state-level, and county-level data (Mello, 2021). Using QCA for evaluation of programs with their unique strategies and contexts, will require evaluators to employ a wide range of skills. For example, most evaluators using CA will have to develop and deploy primary data collection tools of their own creation. Further, to build effective tools focused on the appropriate conditions and outcomes, evaluators will need to understand the content area and context first, in addition to program theory, related social science theory, and prior literature. Also, evaluators will have to understand the situation deeply enough to make decisions about calibration for QCA crisp or fuzzy sets. Finally, evaluators will need the skills to work effectively with program personnel and participations so that assumptions and decisions can be verified. To conclude, QCA requires a lot of an evaluator.

The purpose of this study was to explore whether combining SNA and QCA could be an effective method for network evaluation. When I am facing complexity, networks, and small-*n* to medium-*n* situations in the future, I will consider using QCA if both time and budget allow. I will remember how I pored over SNA and survey data for hours looking for patterns associating achievement of desired outcomes to networking. With the addition of qualitative data, patterns of evidence linking

networking to outcomes became clearer. Then finally with QCA, the experiences of these E Alu Pū member groups indicated that participating in the network and connectivity within the network were conditions held in common (with other conditions) by groups that achieved the intended outcomes. The pairing of SNA with QCA provided clarity that, I believe, improved upon other network evaluation approaches.

Study Implications

At the outset of this study, I thought the results could be interesting to five groups: the case network and its stakeholders, evaluators (both practitioners and researchers), network facilitators and funders, network scientists, and mixed methods researchers. What follows are the contributions this study makes to these audiences.

Implications for E Alu Pū

For E Alu Pū and KUA, this study was important because it provided evidence that E Alu Pū was achieving desired outcomes and that tools KUA employed were linked to desired outcomes. When playing such a long game as is required for environmental and systems change, milestones along the path become important indicators toward the far-off desired future. This study produced some of those milestones of evidence for KUA. In addition, KUA and E Alu Pū received suggestions for improvement. We also have decided to revise KUA's theory of change and evaluation plan to incorporate what we learned.

Implications for Network Facilitators and Supporters

For network facilitators and supporters, the overall implication was that greater participation in the E Alu Pū network and greater connectivity within the network was connected to outcomes. The results of the study are specific to E Alu Pū, but the approach could be replicated for other networks. Also, the alignment of the results to many dimensions of collective action theory and community-based resources management literature buoys the legitimacy of the results. Finally, network facilitators could benefit from the suggestions made to KUA and E Alu Pū, especially if their networks operate within similar contexts.

Implications for Evaluators and Researchers

Evaluators—especially network evaluators—may be interested in whether combining SNA and QCA was effective. I appreciated the combination because it drew out a more complete, nuanced picture of the multiple levels of the E Alu Pū network. As I described above, though, combining these methods required considerable time, knowledge of the content area, and familiarity with the theoretical foundations. Case knowledge proved to be critically important starting during the design phase and continuing through the interpretation phase. Narrowing the conditions was difficult, and results would have been different if I had used different conditions. Because networks are inherently complex and operate within systems, many conditions affect networks. Evaluators must rely on theory and prior research to guide the selection of conditions and sub-conditions. QCA was designed to be iterative, so evaluators may need to return to the data and the participants multiple

times as initial results help to identify gaps or indicate other necessary revisions, as I did when I discovered my mistake in mismatching conditions to outcomes. In general, the implication for evaluators is that combining SNA and QCA can be effective if adequate resources are available.

For network researchers and mixed methods researchers, I found that SNA combined with qualitative data yielded much more interesting, rich, contextual information that illuminated the SNA results. I also found that QCA provided an important, additional layer of understanding about the network. The findings even hinted that the perspectives of both connectionist SNA researchers and structuralist SNA researchers may be accurate. For mixed methods researchers, I found QCA to be an effective tool to integrate quantitative and qualitative data for deeper understanding. For case study researchers, I found QCA to be useful for surfacing case-level patterns from complex comparative cases.

Finally, evaluators and researchers should be aware that limited software is available for QCA and SNA, with a more extensive and growing list of options available for SNA. When using these methods, evaluators and researchers will need to build in the time for training, reading how-to books and articles, watching YouTube videos, consulting list-servs when the inevitable problems arise, and learning by trial and error.

Study Limitations

My study was limited by a variety of factors, especially pertaining to the type of data available and the inherent limitations of the methods I used. Those limitations were as follows:

- I drew extensively from archival data for this study. Given the results of the case study and literature review, I would have liked to include trust, leadership, and conflict as conditions in the study. The data available did not include information about those conditions for all E Alu Pū member groups though, so I excluded them from the study.
- KUA's 2020 survey that provided the bulk of descriptive quantitative data comprised 70 questions and was quite complex. The survey incorporated latent variables about network health, satisfaction, at least three outcomes, and multiple conditions. Even respondents who finished the survey occasionally left questions blank. Reducing survey length and complexity may increase survey completion and the quality of responses. Also, many of the questions used rating scales, so the descriptive quantitative results were largely the result of respondents' perceptions.
- Because I used archival survey data and because surveys were custom-designed for the E Alu Pū network of 36 member groups, I was not able to assess the psychometric properties of the survey.
- A limitation inherent in QCA is that the number of possible conditions must be reduced to yield interpretable results. I first developed a list of

more than 20 possible conditions that could affect the desired outcomes of E Alu Pū. Because I was comparing 36 groups, though, the maximum recommended number of conditions was four per outcome (Kahwati & Kane, 2020 Mello, 2021). Narrowing the list to four per outcome was challenging, and I acknowledge that different conditions would yield different results.

- Because I did not have complete information for member groups over time, I had to focus the study on a point in time. Without longitudinal information, my interpretation of results was necessarily limited. I could link the conditions and outcomes, but I could not state with confidence that the necessary and sufficient conditions met the criteria for causality, even given the different causality theories (Mello, 2021).

Suggestions for Future Research

From my experiences with this study, I have several ideas about future directions for research about network evaluation methods. First, because I was not able to include trust, leadership, and conflict as conditions in this study, future network evaluation could incorporate the data needed to include those conditions. Second, repeating this study with another network could produce deeper understanding. For example, SNA and QCA could be combined again for an evaluation of another network KUA facilitates that is comparable in context and size to E Alu Pū. Third, repeating this study with groups engaged in community-based resources management that are and are not part of a network likely would produce results that would inform

the efficacy of combining SNA and QCA. Fourth, a similar study could utilize temporal QCA and longitudinal SNA to add temporal precedence to the question of whether outcomes occurred in response to networking. If time-oriented methods were used, the study would more convincingly contribute to the discussion between network researchers who identify as connectionists and those who identify as structuralists. Utilizing temporal QCA and longitudinal SNA, researchers could isolate pre-network and post-network conditions to settle the question of whether networks affect ties that are formed or whether networks are a product of ties that exist. Fifth, future research could compare combinations of other network-friendly analysis methods with SNA. For example, evaluation of a large network could combine SNA with hierarchical linear modeling or another modeling method. Borgatti et al. (2018) discussed the use of cluster analysis, QAP[23] correlation, and QAP regression with SNA, though these are meant to assess relationships between two networks rather than outcomes. Through additional research that compares methods for network evaluation, evaluators could develop a catalog of methods with their various strengths and weaknesses. Then, when evaluators embarked on network evaluation, they could select from a variety of tools according to the evaluation context.

Chapter Five Summary

This chapter reviewed the meaning and implications from the three studies that were combined to answer a methodological research question about the use of SNA

[23] QAP: Quadratic assignment procedure

and QCA for network evaluation. Here, I will summarize what I learned from Study 1, Study 2, and Study 3, leading to an overall conclusion from the research.

From Study 1, I learned that E Alu Pū member groups were diverse, from large groups to small groups stewarding large areas to very small areas across most of the Main Hawaiian Islands. Groups participated in E Alu Pū for the long term, leading to network growth over time as new groups joined and existing groups stayed. E Au Pū was comprised of many highly active groups that created a well-connected network, indicated by average path length and diameter. E Alu Pū density indicated that there were more connections to be nurtured, which could aid the network's collective action goals (Crossley & Ibrahim, 2012). E Alu Pū included multiple hubs and authorities, bridges, and connectors. One group was particularly central, indicating that the network was vulnerable to disruption in that group's role.

Overall, network groups were engaged in decision-making practices and, slightly less so, effective community-based resource management practices. With the data available, it was impossible to confirm whether network member groups engaged in these practices before they participated in the network. Solidarity measures indicated that member groups could more effectively leverage the strength of the network. Only a few groups had asked the network for help even though groups tended to respond when asked. At the member group level, KUA could peruse the site-based results with each member group to establish strategies for pursuing the desired outcomes.

The case study highlighted unintended outcomes along with plausible rival explanations and barriers to successful achievement of outcomes. The case study also provided further evidence for the achievement of intended outcomes. From Study 2, I discovered patterns indicating that greater participation in E Alu Pū activities and greater connectivity within the network, along with a couple of other conditions, was linked with the desired outcomes related to advocacy, resources management, and solidarity.

From Study 3, I learned that I needed SNA, survey data, case study data, and QCA for the most thorough understanding of the E Alu Pū network, the intended and unintended outcomes, and facilitators and barriers for success. SNA and survey data provided a useful view of relationship characteristics and the overall status of outcomes. Case study data provided context and detail, while also uncovering unintended outcomes, facilitators, and barriers. QCA was a useful tool to integrate quantitative and qualitative data in a way that surfaced meaningful patterns within member groups that then informed network-level outcomes.

This research was complex and complicated. I was challenged to gain expertise in multiple social science theories, literature relevant to the network's context and the methods I used, four methods (SNA, QCA, case study, and survey), and two new software programs. I advise evaluators and researchers considering the combination of SNA and QCA to consider their depth of content area and case knowledge, the time and resources available for the evaluation, and the learning curve required. The research produced useful results for E Alu Pū and KUA. I would combine SNA and

QCA again for appropriate network evaluation contexts, which are those that allow the time and resources for adequate study.

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APPENDIX A

Subunit and Network-Level Moderating and Outcome Variables

Subunit Moderating Variables	Subunit Outcome Variables	Network-Level Moderating Variables	Network-Level Outcome Variables
• Node indegree • Node outdegree • Authority coefficient • Hub coefficient • Clustering coefficient • Eigenvector centrality • Betweenness centrality • Harmonic closeness centrality • Rate of participation in E Alu Pū • Rate of participation in E Alu Pū advocacy events • Enthusiasm for E Alu Pū • Degree to which technical assistance has been utilized • Staff size	• Degree of participation in decision-making processes • Formal agreement for a site • Degree of biological monitoring • Degree of collaboration with agencies • Degree of native species restoration • Degree of outreach/education • Number of people served annually • Degree of response to calls for assistance • Degree of working with other member groups	• Diameter • Average path length • Average degree • Average weighted degree • Density	• Percent of network groups participating in decision-making processes • Percent of network groups who responded to calls for help • Percent of desired policy decisions that have been approved • Transmission of resource management knowledge • Sense of solidarity

APPENDIX B

Semi-Structured Interview Protocol

For Partners

Introduction

Introduce myself (include connection to KUA) and engage in small talk as necessary to set a friendly, comfortable tone. Explain the current project *("I am conducting interviews to inform to better understand how networking affects community-based resources management outcomes.* Explain the interview process and purpose *("I'm going to be asking you some questions about E Alu Pū, your work with the network, and your perceptions the activities and outcomes.")*

- Can you describe the history and length of your relationship with EAP? Can you describe your various roles over time?
- What is the purpose of your current relationship with EAP?
- Why does your organization collaborate with KUA? What does you hope to get out of it? Why is KUA a worthy collaborator?
- Thinking about this work that KUA does, how would Hawaii be different without KUA? If KUA went away, then what?
- Does this work of KUA's advance natural resources management? Why does this matter? What contribution does this make? Do you think there is a link between networking that KUA does/the work KUA does and ecological changes at sites?

- Are there other effects of networking besides ecological changes at sites? What?
- What else is needed for successful CBRM in Hawai'i? What affects outcomes?
- How important are localized networks? TA? Relationships with natural resource agencies and policymakers? Conflict? Community engagement? Research-based CBRM effective practices (management plan, site agreement, enforcement, bio and social monitoring, etc.)
- If biodiversity outcomes are not achieved at sites, is it worth it?
- What do you think is the purpose of networking?
- What do you think have been any effects of networking CBRM sites in Hawaii?
- As a collaborator, what do you want to see KUA and its networks achieve that it hasn't?
- Anything else you want to share about networks?
- Anything else you want to share about your collaboration with KUA?

For E Alu Pū Members

Introduction

Introduce myself (include connection to KUA) and engage in small talk as necessary to set a friendly, comfortable tone. Explain the current project *("I am conducting interviews to inform to better understand how networking does or does not affect what happens at your site. I'm interested in your opinions about E Alu Pū.")* Explain the interview process and purpose *("I'm going to be asking you some*

questions about E Alu Pū, your work with the network, and your perceptions the activities and any results.")

- Can you tell me a little bit about the group you represent in E Alu Pū?
- When did your group start participating in E Alu Pū?
- Why do you participate?
- How consistent has your participation been? Can you say a little about why?
- Have there been activities, projects, or goals that your group has been able to achieve because of your participation in E Alu Pū?
- Is there anything that you have achieved in the past 17 years that you think would not have been possible without your participation in E Alu Pū? If so, what?
- Now thinking beyond your group and about Hawaii in general, has anything been achieved in Hawaii because of E Alu Pū?
- Overall, are there things E Alu Pū does well that others can't do or don't do?
- Overall, do you think a network is needed? Why or why not?
- Is there anything you had hoped E Alu Pū would achieve by now that it has not been able to achieve?
- Does E Alu Pū have what it needs to accomplish those achievements? (Relationships, resources, etc.) If not, what is missing?
- [If they have not mentioned it, ask specifically about the shared goals created by E Alu Pū network groups.]

- Is there anything else you'd like to share about your experiences with E Alu Pū?

Interviewer Reflections

This is a space to jot down quick notes directly after the interview. What was surprising? What responses are swirling? Why do I think that is?

APPENDIX C

E Alu Pū Desired Outcomes and Indicators Being Examined

Desired outcome	Site-level indicators	Network-level indicators	Research-based evidence
E Alu Pū groups are decision-makers in resource management.	• Degree of network groups' participation in decision-making processes at the site level	• % of network groups participating in decision-making processes • % of policy decisions that network groups advocate for at a network level that are approved	• Curtis et al. (2014) • Dressler et al. (2010) • Gruber (2010) • Murphree (2009) • Ostrom (2000, 2009) • Sterling et al. (2017)
E Alu Pū groups effectively manage natural and cultural resources at their sites.	• Formal agreement tying a group to site (e.g., MOU) • Degree to which the group: uses a site management plan collaborates with formal management agency uses traditional knowledge observes natural and cultural resources observes human use of resources restores native species • # of people the group served through its programs • # of acres the group stewards	• Total acreage under active member group stewardship • Degree to which member groups have adopted CBRM effective practices • Degree to which member groups are using new strategies because of E Alu Pū	• Alexander et al. (2018) • Berkes & Ross (2013) • Blythe et al. (2017) • Bodin and Crona (2008) • Dressler et al. (2010) • Ernstson (2011) • Gooch & Warburton (2009) • Gruber (2010) • Murphree (2009)
E Alu Pū groups display support and solidarity for one another.	• Degree of response to calls for help at the site level	• % of network groups who responded to kāhea (call for help) at network level	• Blythe et al. (2017) • Curtis et al. (2014) • Garcia-Amado et al. (2012)

Desired outcome	Site-level indicators	Network-level indicators	Research-based evidence
	• Outdegree of asking E Alu Pū for help • SNA statistics (especially harmonic closeness centrality)	• Network SNA statistics	• Lozano et al. (2016) • Ostrom (2000, 2009) • Schnegg (2018)

APPENDIX D

R Script for QCA

```
#Clearing environment
rm(list = ls())

#Setting working directory
setwd("E:/Dissertation/Ch 4 Results/Analysis/QCA")

#Creating object EAP resources managers outcome from csv file
EAPRM <- read.csv("EAPRM.csv", row.names = 1)
View(EAPRM)
attach(EAPRM)

#Analyzing necessary conditions for the resources manager outcome and non-outcome
QCAfit(EAPRM[, 1:5], RM_OUT, necessity = TRUE)
QCAfit(EAPRM[, 1:5], 1 - RM_OUT, necessity = TRUE)

#Truth table for resources managers outcome
TTEAPRM <- truthTable(EAPRM, "RM_OUT", complete = TRUE, show.cases =
TRUE, incl.cut = 0.75, sort.by = "incl, n")
TTEAPRM
TTEAPRM$tt
write.csv(TTEAPRM$tt, "EAP RM Truth Table.csv")

#Minimizing for conservative solution
sol.EAPRM <- minimize(TTEAPRM, include = "1", details = TRUE, use.tilde =
TRUE)
sol.EAPRM

#Minimizing for parsimonious solution
sol.pars.EAPRM <- minimize(TTEAPRM, include = "1, ?", details = TRUE, use.tilde
= TRUE)
sol.pars.EAPRM

#Plotting
pimplot(EAPRM, outcome = "RM_OUT", all_labels = FALSE, results = sol.EAPRM,
neg.out = FALSE, jitter = TRUE)
```

```
#Creating object EAP decision-making (i.e., advocacy) outcome from csv file
EAPDM <- read.csv("EAPDM.csv", row.names = 1)
View(EAPDM)
attach(EAPDM)

#Analyzing necessary conditions for the advocacy outcome and non-outcome
QCAfit(EAPDM[, 1:4], DM_OUT, necessity = TRUE)
QCAfit(EAPDM[, 1:4], 1 - DM_OUT, necessity = TRUE)

#Truth table for advocacy outcome
TTEAPDM <- truthTable(EAPDM, "DM_OUT", complete = TRUE, show.cases =
TRUE, incl.cut = 0.75, sort.by = "incl, n")
TTEAPDM
TTEAPDM$tt
write.csv(TTEAPDM$tt, "EAP DM Truth Table.csv")

#Minimizing for conservative solution.
sol.EAPDM <- minimize(TTEAPDM, include = "1", details = TRUE, use.tilde =
TRUE)
sol.EAPDM

#Minimizing for parsimonious solution.
sol.pars.EAPDM <- minimize(TTEAPDM, include = "1, ?", details = TRUE, use.tilde
= TRUE)
sol.pars.EAPDM

#Plotting
pimplot(EAPDM, outcome = "DM_OUT", all_labels = FALSE, results = sol.EAPDM,
neg.out = FALSE, jitter = TRUE)

#Creating object EAP solidarity outcome from csv file
EAPSOL <- read.csv("EAPSOL.csv", row.names = 1)
View(EAPSOL)
attach(EAPSOL)

#Analyzing necessary conditions for the solidarity outcome and non-outcome
QCAfit(EAPSOL[, 1:4], SOL_OUT, necessity = TRUE)
QCAfit(EAPSOL[, 1:4], 1 - SOL_OUT, necessity = TRUE)
```

```
#Truth table for solidarity outcome
TTEAPSOL <- truthTable(EAPSOL, "SOL_OUT", complete = TRUE, show.cases =
TRUE, incl.cut = 0.75, sort.by = "incl, n")
TTEAPSOL
TTEAPSOL$tt
write.csv(TTEAPSOL$tt, "EAP SOL Truth Table.csv")

#Minimizing for conservative solution. No parsimonious solution because no unfilled
rows.
sol.EAPSOL <- minimize(TTEAPSOL, include = "1", details = TRUE, use.tilde =
TRUE)
sol.EAPSOL

#Plotting
pimplot(EAPSOL, outcome = "SOL_OUT", all_labels = FALSE, results =
sol.EAPSOL, neg.out = FALSE, jitter = TRUE)
```

APPENDIX E

Data Matrix Resulting from Calibration for Outcome: Decision-Makers

ID	Decision-Makers	Greater Participation in E Alu Pū	Greater Connectivity	Greater Participation in E Alu Pū Advocacy Events
B	1	0.67	1	1
C	1	1	0.67	1
D	1	1	1	1
E	1	0.67	0.33	1
F	1	1	0.67	0.67
G	1	0.67	1	0.67
H	0.33	0.33	0.67	0
I	0.67	0.67	0.67	0.67
J	0	0.33	1	0
K	0	0	0	0
L	1	0.67	0.33	0.33
M	0.67	0.33	0.33	0
N	0.67	0.33	0.33	0
O	0	0	0	0
P	0.33	0.67	0	0.33
Q	.67	0.33	0	0.33
R	1	0.67	0.67	1
S	0.33	0	1	0
T	0.67	0.33	0.67	0.33
U	1	0.67	1	1
V	0.67	0.67	1	0.67
W	1	0	0.67	0
X	0.67	0.33	1	0
Y	0.67	0.67	0.67	1
Z	1	0.33	0.33	0
AA	0.33	0.67	0.67	0
BB	0	0.67	0.33	1
CC	0	0.33	0	0.33
DD	0.67	0.67	0.67	1
EE	0	0	0	0
GG	0	0.33	0	0
HH	1	1	0.33	1
II	1	0.67	0.33	1
JJ	0.33	0	0.67	0
KK	1	0.67	0.67	0.67

APPENDIX F

Data Matrix Resulting from Calibration for Outcome: Resource Manager

ID	Resource Managers	Greater Participation	Greater Connectivity	More Technical Assistance	More Organizational Resources
B	0.67	0.67	1	0	0
C	0.67	1	0.67	1	0.33
D	1	1	1	1	1
E	0.33	0.67	0.33	0	0
F	1	1	0.67	0	1
G	0.33	0.67	1	0.67	0.33
H	0.67	0.33	0.67	0.33	0.33
I	0.67	0.67	0.67	1	0
J	0.33	0.33	1	1	0
K	1	0	0	0	1
L	0.33	0.67	0.33	0.33	0.33
M	1	0.33	0.33	0.33	1
N	0.67	0.33	0.33	0.67	1
O	0.67	0	0	0.33	0.33
P	0.67	0.67	0	0	1
Q	0.67	0.33	0	1	0.67
R	0.67	0.67	0.67	0.67	0.33
S	0	0	1	0	0.33
T	1	0.33	0.67	1	1
U	1	0.67	1	1	0.33
V	0.67	0.67	1	0	0.67
W	1	0	0.67	0.33	1
X	0.67	0.33	1	0	0.67
Y	0.67	0.67	0.67	1	1
Z	0	0.33	0.33	0.33	0
AA	0.33	0.67	0.67	0.33	0
BB	0	0.67	0.33	1	0
CC	0	0.33	0	0	0
DD	0	0.67	0.67	1	0
EE	0.33	0	0	0.33	1
GG	0	0.33	0	0	0
HH	0.33	1	0.33	0	0.33
II	1	0.67	0.33	1	0
JJ	0	0	0.67	0	0
KK	0.67	0.67	0.67	1	0

APPENDIX G

Data Matrix Resulting from Calibration for Outcome: Solidarity

ID	Solidarity	Greater Participation	Greater Connectivity	Greater Affinity
B	0.67	0.67	1	0.67
C	1	1	0.67	1
D	1	1	1	0.67
E	0	0.67	0.33	0.67
F	1	1	0.67	0.67
G	1	0.67	1	0.33
H	1	0.33	0.67	0.67
I	0.67	0.67	0.67	0.67
J	0	0.33	1	0
K	0.33	0	0	0
L	0	0.67	0.33	0.33
M	0.67	0.33	0.33	0.33
N	0.33	0.33	0.33	0
O	0.33	0	0	0
P	0	0.67	0	0
Q	0	0.33	0	0.33
R	1	0.67	0.67	1
S	0	0	1	0
T	1	0.33	0.67	0.67
U	1	0.67	1	0.67
V	1	0.67	1	1
W	0.33	0	0.67	0
X	0.33	0.33	1	0.33
Y	0.67	0.67	0.67	0.67
Z	0.33	0.33	0.33	0.67
AA	0	0.67	0.67	0.33
BB	0.33	0.67	0.33	0.67
CC	0	0.33	0	0
DD	0.33	0.67	0.67	0.33
EE	0	0	0	0
GG	0	0.33	0	0
HH	0.33	1	0.33	0.67
II	0.33	0.67	0.33	0.33
JJ	0.67	0	0.67	0.67
KK	1	0.67	0.67	0.67

APPENDIX H

Results for the Tests of Necessity

These tables report the consistency, coverage, and relevance for each of the three outcomes and their counter-outcomes.

Table 18

Necessity Test for Outcome: Decision-Makers

	Consistency	Coverage	Relevance
DM_OUT	1.00	1.00	1.00
PX_COND	.69	.87	.88
Cx_COND	.69	.80	.82
AdvPx_COND	.65	.88	.91
~DM_OUT	.21	.35	.71
~PX_COND	.49	.60	.71
~Cx_COND	.45	.59	.74
~AdvPx_COND	.43	.49	.62

Table 16

Necessity Test for Non-Outcome: Decision-Makers

	Consistency	Coverage	Relevance
DM_OUT	.35	.21	.44
PX_COND	.47	.36	.62
Cx_COND	.50	.36	.58
AdvPx_COND	.27	.23	.61
~DM_OUT	1.00	1.00	1.00
~PX_COND	.82	.62	.72
~Cx_COND	.72	.59	.74
~AdvPx_COND	.85	.60	.68

Table 20

Necessity Test for Outcome: Resource Managers

	Consistency	Coverage	Relevance
RM_OUT	1.00	1.00	1.00
PX_COND	.61	.75	.80
Cx_COND	.63	.71	.75
TA_COND	.58	.74	.81
OR_COND	.66	.93	.95
~RM_OUT	.25	.39	.72
~PX_COND	.58	.70	.77
~Cx_COND	.47	.61	.75
~TA_COND	.48	.56	.68
~OR_COND	.47	.50	.60

Table 21

Necessity Test for Non-Outcome: Resource Managers

	Consistency	Coverage	Relevance
RM_OUT	.39	.25	.46
PX_COND	.61	.48	.66
Cx_COND	.54	.39	.59
TA_COND	.41	.34	.63
OR_COND	.27	.24	.64
~RM_OUT	1.00	1.00	1.00
~PX_COND	.68	.53	.68
~Cx_COND	.61	.51	.70
~TA_COND	.68	.51	.65
~OR_COND	.93	.63	.67

Table 22

Necessity Test for Outcome: Solidarity

	Consistency	Coverage	Relevance
SOL_OUT	1.00	1.00	1.00
PX_COND	.70	.67	.76
Cx_COND	.82	.73	.77
AFF_COND	.74	.82	.88
~SOL_OUT	.30	.27	.55
~PX_COND	.50	.47	.65
~Cx_COND	.40	.41	.66
~AFF_COND	.48	.40	.56

Table 23

Necessity Test for Non-Outcome: Solidarity

	Consistency	Coverage	Relevance
SOL_OUT	.27	.30	.61
PX_COND	.49	.52	.68
Cx_COND	.47	.46	.62
AFF_COND	.34	.42	.70
~SOL_OUT	1.00	1.00	1.00
~PX_COND	.69	.72	.78
~Cx_COND	.73	.82	.86
~AFF_COND	.85	.78	.86

APPENDIX I

Truth Tables for Outcome Conditions to Test for Sufficiency

Configurations that met the sufficiency threshold criteria for both consistency (.75) and PRI (.70) are highlighted.

Table 24

Truth Table for Outcome: Decision-Makers

Config.	Participation in Advocacy Events	Participation in E Alu Pū	Connect-ivity	Outcome: Decision-Making	# of Cases	Consis-tency	PRI	Cases
8	1[1]	1	1	1	12	0.97	0.96	B,C,D,F,G,I,R,U,V,Y,DD,KK
4	0	1	1	1	1	0.86	0.71	AA
7	1	1	0	1	4	0.85	0.79	E,BB,HH,II
3	0	1	0	1	2	0.81	0.62	L,P
2	0	0	1	0	7	0.75	0.57	H,J,S,T,W,X,JJ
1	0	0	0	0	9	0.57	0.38	K,M,N,O,Q,Z,CC,EE,GG
5	1	0	0	?	0	-[2]	-	
6	1	0	1	?	0	-	-	

[1] Row consistency threshold was .75 per Mello (2021), so configurations received a 1 if they met the threshold and a 0 if they fell below.
[2] A "?" indicates that no cases fit this possible configuration.

Table 25

Truth Table for Outcome: Resource Managers

C	Org. Resources	Tech. Assistance	Partici-pation	Connect-ivity	Outcome: RM	# of Cases	Consis-tency	PRI	Cases
9	1[1]	0	0	0	1	3	1.00	1.00	K,M, EE
10	1	0	0	1	1	2	1.00	1.00	W,X
11	1	0	1	0	1	1	1.00	1.00	P
12	1	0	1	1	1	2	1.00	1.00	F,V
13	1	1	0	0	1	2	1.00	1.00	N,Q
14	1	1	0	1	1	1	1.00	1.00	T
16	1	1	1	1	1	2	1.00	1.00	D,Y
8	0	1	1	1	1	7	0.81	0.75	C,G,I, R,U, DD,K K
4	0	0	1	1	1	2	0.77	0.50	B,AA
2	0	0	0	1	0	3	0.73	0.50	H,7,JJ
7	0	1	1	0	0	2	0.71	0.60	BB,II
6	0	1	0	1	0	1	0.71	0.55	J
1	0	0	0	0	0	4	0.50	0.30	O,Z,CC,GG
3	0	0	1	0	0	3	0.50	0.25	E,L,HH
5	0	1	0	0	?	0	-[2]	-	
15	1	1	1	0	?	0	-	-	

[1] Row consistency threshold was .75 per Mello (2021), so configurations received a 1 if they met the threshold and a 0 if they fell below.

[2] A "?" indicates that no cases fit this possible configuration.

Table 26

Truth Table for Outcome: Solidarity

Config.	Participation	Connectivity	Affinity	Outcome: Sol	# of cases	Consist-ency	PRI	Cases
8	1[1]	1	1	1	10	0.91	0.87	B,C,D,G,I,R,U,V,Y,KK
4	0	1	1	1	3	0.87	0.77	H,T,JJ
7	1	1	0	1	3	0.76	0.57	F,AA,DD
2	0	0	1	0	1	0.70	0.44	Z
6	1	0	1	0	3	0.66	0.46	E,BB,HH
3	0	1	0	0	4	0.63	0.33	J,S,W,X
5	1	0	0	0	3	0.56	0.28	L,P,II
1	0	0	0	0	8	0.47	0.18	K,M,N,O,Q,CC,EE,GG

[1] Row consistency threshold was .75 per Mello (2021), so configurations received a 1 if they met the threshold and a 0 if they fell below.