A QUALITY GOVERNANCE FRAMEWORK FOR SUSTAINABLE AND RESILIENT SOCIO-ECOLOGICAL SYSTEMS

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Community Sustainability – Doctor of Philosophy

2021

ABSTRACT

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Individual, institutional, and policy decision management (i.e., governance) has contributed to a disruption of socio-ecological systems (SES). These disruptions have resulted in unprecedented systemic challenges (e.g., climate change, the SARS-CoV-2 pandemic (COVID-19), and associated consequences such as increased severe weather, poverty, and social unrest; and the decline of ecological health, and well-being). An emerging research question within the literature is *how* to improve individual and institutional governance to mitigate our trajectory and improve complex SES outcomes. Changing our trajectory requires a daunting transformative social change initiative. Using interdisciplinary literature, a compendium of qualitative and quantitative longitudinal data collected from applied action research, this dissertation presents an intervention framework that rapidly achieved significant social change, and environmental and public health risk reduction in a specific case. This research demonstrates the benefits of a collaborative and systemic approach to SES governance.

Through this research, a Quality Governance Framework (QGF), and a Diagnostic Capacity Tool (DCT), were developed and found to be reliable and valid. Using SES conceptual models, factors that contributed to a successful governance transformation are presented. The conceptual model provides a means to visually depict the dynamism of key determinant drivers and disruptors to quality governance when attempting to improve complex SES outcomes. This model has been validated with key actors (i.e., social change participants). These actors shed light on cultural,

institutional, and individual factors and associated processes that supported or thwarted the improvements in SES outcomes.

Since this work focuses on human governance it relies on cultural socio-psychological and evolutionary concepts, values formation, learning, and behavioral science. A considerable portion of this human dimension approach is emergent within the SES governance and system dynamics literature.

Collaborative and systemic governance co-create knowledge and broaden the collective understanding of *how* individual and institutional quality governance can shift trajectories and improve the resilience and sustainability of SES. This study also demonstrates that if the underlying theories and processes are not continually reinforced at the individual, institutional, and wider policy level, and embodied in the governing institutions, much like diets, the temporary expansion of rationality fails and the system begins to revert to its pre-intervention archetypical behavior. This speaks to the need to fortify interventions with shared experience, knowledge, understanding, and robust succession plans. Doing so can aid the durability of the intervention. Those left to lead and continue the legacy will be better fortified to continue the positive trajectory of the social system change – even through subsequent system shock.

This dissertation is dedicated to James H. McKay. Thank you for the values and growth mindset you instilled in me.

# ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

ABI – Ability, Benevolence, and Integrity

CSI - Collaborative Stakeholder Initiative

DCT – Diagnostic Capacity Tool

QGF – Quality Governance Framework

MDEQ – Michigan Department of Environmental Quality

MSUE – Michigan State University Extension

SES - socio-ecological systems

R1 – Research Question 1

R2 – Research Question 2

R3 – Research Question 3

CHAPTER 1. INTRODUCTION

This dissertation is submitted as the culmination of my doctorate research and in support of my dissertation defense. My graduate work has aimed to help close the gap between our socio-ecological system trajectory and one that is more resilient and sustainable. My focus is on the human dimensions of socio-ecological systems (SES) governance (i.e. decision-making and management). My dissertation proposal was approved by my committee on March 9, 2020.

My dissertation research sought to augment our historic reliance on traditional sciences and institutions with our human dimensions – a key element in defining SES trajectories. There is a quote by a popular national advisor on climate change that summarizes the role of humans in SES governance.

*"I used to think that top environmental problems were biodiversity loss, ecosystem collapse, and climate change. I thought that thirty years of good science could address these problems. I was wrong. The top environmental problems are selfishness, greed, and apathy, and to deal with these we need a cultural and spiritual transformation. And, we scientists don't know how to do that."*

-Gus Speth, Author and Top U.S. Advisor on Climate Change (multiple versions dated ~2019)

Evolutionary biology, culture, values, behavior, cognition, and one's mental models (i.e., a representation of thought) shape and justify action and decision-making (i.e., governance) (Kahneman 2011; Manfredo et al. 2017; Stern and Dietz 1994). My research has aimed to incorporate human dimensions into *the growing body of empirical evidence that can illuminate 'how' to improve SES governance quality such that SES governance can be transformed, resulting in resilient and sustainable outcomes.* This work focuses on the human capacities to improve SES outcomes as opposed to our impact on the SES. Building on the plethora of literature it provides applied action research and longitudinal empirical evidence.

This dissertation follows a State of Michigan cleanup and redevelopment program as a case study. This program was undergoing a government re-invention to decrease environmental and human health risks and improve Michigan's quality of life. This case is used to study transformative social change with a focus on SES governance for sustainable outcomes. The program was transitioning from a linear authoritarian hierarchical form of governance to one that is more collaborative and able to address SES complexity. This collaborative form of governance aligns with the QGF (see Chapter 2).

The dissertation work builds on my Master of Science Thesis (McKay 2013). The thesis compiled and tested a comprehensive best practice model for improving SES governance. These practices were derived from a wide array of literature hypothesized to tackle wicked problems for more durable SES outcomes. This model focused on the individual, institutional, and structured decision-making practices for improved SES outcomes. These best practices were used to assess current and preferred perceptions from the internal and external State of Michigan cleanup and redevelopment program practitioners. These best practices were found to be reliable and valid.

Chapter 2 builds on the Thesis. Using literature from social science, ecology, business, governance, systems thinking, learning, behavioral, and decision sciences a *quality governance framework* (QGF) was developed along with a 70 item *diagnostic capacity tool* (DCT) - receiving construct validity through an exploratory factor analysis for current and preferred capacities. Chapter 2 includes a link to the published paper.

Chapter 3 takes a longitudinal view and reassesses the reliability and validity of the QGF and DCT with data obtained 1 year after the original data set. A significant movement toward the QGF was revealed leading to improved environmental and human health risk reduction. These improvements were perceived by the respondents and validated with the program metrics. This chapter also includes a link to the published paper.

Chapter 4 returns to the case almost 10 years after the State of Michigan's cleanup and redevelopment program re-invention effort was initiated. The focus of this chapter was to dive deeper into the government reinvention processes to shed light on its successes and failures using the perspective of those involved in the governance change initiative.

Chapter 5 provides concluding remarks and general recommendations.

CHAPTER 2. DEVELOPMENT OF QGF AND DCT

2.1 Introduction

The capacity to sustainably govern complex SES has been identified as a necessary but daunting task by SES scholars, resource stewards, and stakeholders. We are at a critical juncture in SES governance. We face extreme and unprecedented (SES) governance (i.e., decision making and management) challenges. These challenges include shifting away from governance frameworks, institutions, and individual decision-making that has disrupted our ecosystem function. This research sought to inform the question: What are the determinant capacities and functional linkages that can be incorporated into diagnostic tools for analysts seeking to improve sustainable socio-economic system governance.

2.2 Overview of Findings

This research identified that two historically disparate entities, mired in gridlock (the internal regulators and external regulated practitioners) desired the same program governance. The results of this work resulted in the development of a QGF and a 70 item DCT verified through exploratory factor analysis. The implications of this suggest that participatory network-based governance that relies upon systems thinking with higher levels of resource exchange, in the form of interdependent and reciprocal trust, diplomacy, and polycentricity, aligns with practitioners' perceptions of improved program performance.

2.3 Publication

Following is the actual publication that provides specific research context, detail regarding the supporting literature, research questions, methodology, construct development, testing, results, and conclusions.

Article citation: McKay, P.A., Vogt, C.A. & Olabisi, L.S. Environ Syst Decis (2017) 37: 156. https://doi.org/10.1007/s10669-016-9611-8 License to reprint: 4938470616927, dated October 29, 2020, Springer Nature, Version Sept. 30, 2016

CHAPTER 3. LONGITUDINAL DATA AND MIXED METHODS ANALYSIS

3.1 Introduction

This phase of research continued to study SES governance for improved SES outcomes. The purpose of this effort was to conduct a longitudinal study of the same populations included in the first publication to further assess the efficacy of the re-invention efforts and the QGF and DCT in diagnosing and treating for improved SES outcomes. The program was in its third year of program re-invention - transitioning from a hierarchical form of governance to one that emphasized the QGF. The use of practitioner data amid a governance reinvention effort is rare; having the benefit of longitudinal data is even less documented in SES governance literature. This research further contributes to *how* to improve SES governance quality such that SES governance can be transformed, resulting in resilient and sustainable outcomes.

An additional component of this work was an analysis of the difference in responses between the panel (respondents who participated in both the 2013 and 2014 data sets) and the cohort respondents (those who were part of the 2013 and 2014 sample populations but did not participate in both data collection efforts).

Augmenting the questionnaire data, this effort also used mixed methods which compared the research data (e.g., the 2013 and 2014 questionnaire data) to assess the program practitioner attitudinal shifts in program governance, compared the governance shift to the State of Michigan cleanup and redevelopment program environmental and public health risk reduction metrics. This research also assessed QGF adoption rates using open-ended responses by the respondents.

3.2 Overview of Findings

The results indicated further convergence in ratings reflective of improved quality governance, systems thinking, and perceptions of improved SES outcomes. The differences in the panel versus the cohort respondent perceptions appear to align with the literature when attempting a large shift in governance and capacity building. Participants who embrace a sense of urgency,

motivation, and commitment will provide different responses than those who are not at that same level of engagement. Additionally, the change will not occur at the same rate between these two populations. These findings lend additional contribution and empirical evidence to the growing body of governance literature associated with human dimensions of quality governance and SES research.

Program metrics aligned with the attitudinal data collected through the QGF and DCT revealing significant and escalated risk reduction activities during this period. Respondents' open-ended feedback also correlated with the DCT findings and provide further validation for the QGF and competencies associated with quality governance measured with the DCT.

Some of the barriers to shifting to new forms of governance, as articulated through the open-ended responses, revealed the need for further research regarding the role of power imbalances and practitioner values in governance. QGF capacities associated with self-empowerment and deliberation which were lacking in robust perceived achievement in the first data set also revealed themselves again.

### 3.3 Publication

Following is the publication that provides specific research context, detail regarding the supporting literature, research questions, methodology, construct development, testing, results, and conclusions. This is my second publication.

McKay, P.A., Schmitt Olabisi, L. & Vogt, C.A. Environ Syst Decis (2020). https://doi.org/10.1007/s10669-019-09744-0

Version Sept 18, 2019

CHAPTER 4. SYSTEMS THINKING AND MODELING FOR SUSTAINABLE GOVERNANCE

4.1 Preface

Given the multitude of SES dilemmas, greater capacities are needed to envision and guide us toward a sustainable and resilient future. Focusing on the human dimensions of SES governance and social change, the second two chapters in this dissertation contributed to filling the gaps in SES literature through the development of an SES governance framework (i.e., the QGF) and tools to diagnose and treat SES problems (i.e., the DCT). This framework and tool followed the diagnostic and treatment approach recommended by McGinnis and Ostrom (2014) to improve upon our collective understanding of SES governance.

Longitudinal data collected in 2013 and 2014, revealed that significant progress was made in improving SES outcomes (i.e. human and environmental health risk reduction through aligning with the QGF and its associated DCT. Building on this longitudinal study, this chapter moves from the development and testing of the QGF and DCT to insights into the dynamics of the social change initiative.

According to Randers (2019), less is published about SES implementation methodologies and *how* to achieve the requisite social change within the system dynamics field. Randers (2019) states that for the research to have meaning within the field of system dynamics it must also address the implementation process. Using social science evaluation research, and conceptual comparative causal models, this chapter aims to provide insight into the implementation of governance reinvention - the shift from hierarchical to a collaborative, network-based form of governance, that relies upon polycentric theories of governance and systems thinking (i.e., the QGF). Social research methods refer to this shift as a *social change initiative* (see Babbie 2010). The inclusion of system systems thinking and system dynamics modeling differ from many traditional approaches to scientific research methods. Traditional methods use linear and reductionist thinking instead of aligning inquiry with the complexity of the system (Hirsch, Levine,

and Miller 2007). This stems from human's *bounded rationality* which oversimplifies and obscures real-world system dynamics (Meadows and Wright 2008).

By definition, the study of systems is concerned with the phenomenon of dynamic behavior and how one can manage the system (Levine and Fitzgerald, 1992; Meadows and Wright 2008). Systems management is not focused on optimization or certainty (as is the case with a statistical approach), or the more typical one-way flow associated with dependent/independent variable relationship as seen in the vast majority of conceptual or statistical tools, including regression, logic models, and structural equation models (Hirsch, Levine and Miller 2007). In systems modeling; variables may have positive and negative feedback within the system over time or delayed responses. These variables also have interdependencies that can illuminate how best to approach system change (Hirsch, Levin and Miller 2007).

Sharing one's perspectives and mental model of SES with others can build collective understanding through the co-creation of knowledge about a system's behavior. These mental models provide a platform for visual illustration, such as in the form of causal loop diagrams that depict root drivers and relationships in complex systems. These diagrams can be decision-aiding in an arena where most persons lack the capacity or training to synthesize system dynamics sufficiently to effect positive change. (See Kasser et al 2012, regarding insufficient problem identification and problem-solving capacities; and Meadows and Wright 2008, for archetypical system challenges and bounded rationality discussions).

In this chapter, the perspectives of persons involved in the social change process are used to validate the differences in key structural and behavioral components of a hierarchical versus the QGF system of governance. Given the pandemic and time limitations, a set of dyadic discussions (co-learning sessions) were conducted which abided by social distancing and Michigan State University research requirements (see Approved IRB Study 00004823).

Aligning with CSUS dissertation requirements, a draft manuscript for journal submission was prepared that covers this phase of my research. Since it is the culmination of over a decade of engagement, and the journal and peer reviewers have asked for explanations of the entire compendium of work when I submit manuscripts for subsequent phases of work, this chapter and draft journal article summarizes previous work as well. It also attempts to address other concerns or interests expressed by popular journals. An Ecology and Society editor stated at the 2018 Sustainable Development Goals Conference at the University of Michigan that the journal is interested in the topic of power/power dynamics (2018). System Dynamics Review published an editorial (2019) that states that the process of systems change implementation will be reviewed more favorably than a model that solely extracts insights about a system (Randers 2019). Therefore, I have attempted to address these elements where relevant.

This draft article, and intended 3rd publication co-authored by Dr. Laura Schmitt Olabisi, Dissertation Chairman, and Dr. Rebecca Jordan, Chair, Department of Community Sustainability and dissertation committee member,  is currently under peer review. To comply with Michigan State University dissertation and graduation requirements and deadlines, this version of the dissertation, differs considerably from the current form of the 3rd manuscript. This dissertation chapter provides much of the foundational literature review. The draft publication focuses on the diagnostic and treatment processes, validation of the Comparative Conceptual Causal Loop Model, and lessons learned.

## 4.2. Introduction

Humans' relationship with our ecosystem has evolved culturally and structurally over time (Alex 2019; Amel et al. 2017; Manfredo et al. 2016; Muthukrishna and Henrich, 2016). Through this evolution, westernized governance (e.g., decision making and management) has not systematically addressed the negative externalities of our innovations and niche expansion (i.e., global warming, natural resource degradation, biodiversity loss, global pandemics, and

unsustainable infrastructure systems that are decaying and in disrepair). These are complex SES that present wicked problems. Wicked problems that arise from complex systems have uncertain facts, disparate human and social values, high stakes, and urgency to mitigate or address the system behavior (Matso et al. 2008; Patterson 2006; Pielke 2007; Ravetz et al. 2013 Rittal and Webber 1973; Rousseau et al. 1998; Stern et al. 1992). Many of these governance challenges arise from unbounded cultural evolution, incomplete mental models, and bounded rationality (Meadows and Wright 2008). Incomplete, linear, overly simplistic mental models of SES often result in mismanagement of complex systems and unsustainable system behavior. For instance, western capitalistic societies tend to rely upon hierarchical governance and material or technology-based economies regardless of their influence on SES behavior (Diaz et al, 2019; Manfredo et al. 2016).

Given the multitude of SES dilemmas, transformative change is necessary to redirect our trajectory toward a more resilient and sustainable future. Resilience is the capacity of a system to absorb disturbance and remain within the same regime including its function, structure, and feedback systems (Walker and Salt 2006). Sustainability in this context is broadly defined as the capacity of the earth's natural system that supports life to survive and adapt to changing environmental conditions indefinitely (Miller and Spoolman 2016). It is a holistic view that includes the benefits of biodiversity for evolution and ecosystem services, the reliance on natural capital income, ethics for fair and equitable treatment including the recognition of the full costs of goods and services, and ensuring civilization can support future generations.

An emerging research question within the literature is *how* to improve individual and institutional governance (i.e., decision making) to mitigate our trajectory and improve complex SES outcomes. Changing our SES trajectory requires a shift in thinking and a daunting social change initiative. (Applied systems work is really about social change see Babbie 2010; Gooyert and Grobler 2018;

Hirsch, Levin, and Miller 2007). It requires an understanding of behavioral evolution and science; and integrating SES governance theory with human, organizational, and institutional change literature. The majority of literature on SES governance is theoretical or assesses humans' impact on the environment (Binder et al. 2013; McGinnis and Ostrom 2014). The majority of transformative change literature tends to be associated with organizations and not individuals or institutions (see Ehde et al. 2013 regarding the status of transformative health/rehabilitation research) or uses erroneous assumptions without addressing the chasm between assumptions and reality (Ostrom 2005; Poleete, Janssen and Ostrom 2010). In the business world, most of these organizational transformation efforts fail (Kotter 1995). We have yet to develop sufficient examples of how obstacles to wicked complex SES governance can be overcome through improved understanding and successful social change implementation (Randers 2019). This research is a step toward contributing to our collective understanding of implementing social change initiatives to improve SES governance.

To improve upon the success rate of social change, one needs to understand the underlying causes associated with the SES governance failure. Understanding, in this case, requires a process of learning about existing SES governance behavior, how to modify SES governance, and eventually how to convey that knowledge to others (adapted from Ostrom 2005).

SES governance failure is a failure of the combined social and ecological system of the planet to which humans have expanded their niche.  Humans and our mental models are critical SES variables. As Amel et al. (2017) state: we are not facing an environmental problem; we are facing a human behavior problem.

The contemporary theory posits that governance challenges are rooted within the individual, institutional, and evolutionary cultural system with each having an influence on and being influenced by the other components (Alex, 2019; Amel et al. 2017; Manfredo et al. 2016; Ostrom

2005; Schwartz 2008). Culture, according to the literature reflects social and biological evolution, including mental models, values, and normative behavior (Gintis 2011; Manfredo et al 2006; Muthukrishna and Henrich, 2016; Ostrom 2005). Institutions are the prescriptions and structures that humans use to organize all forms of repetitive behavior (Ostrom 2005). Individuals can have wide-ranging behaviors from *short-self-interest* to ones that are *better than rational* (Ostom 2005).

These governance challenges present numerous systemic variables that are not determinate nor distinct and within an SES influence the behavior of one another. Further within the complex system, there are nested components. For example, and as used in this research, there is a governance framework, which is supported by factors, subfactors, and measurement items. There is also theory as well as real-world application. For instance, the social change initiative process has a bearing on the overall SES governance performance and its durability in maintaining the desired SES system behavior. Studying these variables within a real-life SES change initiative can inform our understanding of the hurdles to resilient and sustainable change. From this experience, we can fortify our understanding of social change initiatives to address the root causes of SES failure. Given the complexity of SES, and the plethora of items that could be studied in a social change initiative, we focus on shifting from a hierarchical form of governance to one that is aligned with the QGF (McKay et al. 2017 and 2020). Focal elements include culture, institutions, individuals, and the process (see Figure 1). Within these elements are factors, sub-factors, and measurement items. Given the complexity of the overall SES and change initiative process not all of these are listed or included in this research Chapter. They can be found in the publications incorporated into Chapters 2 and 3.
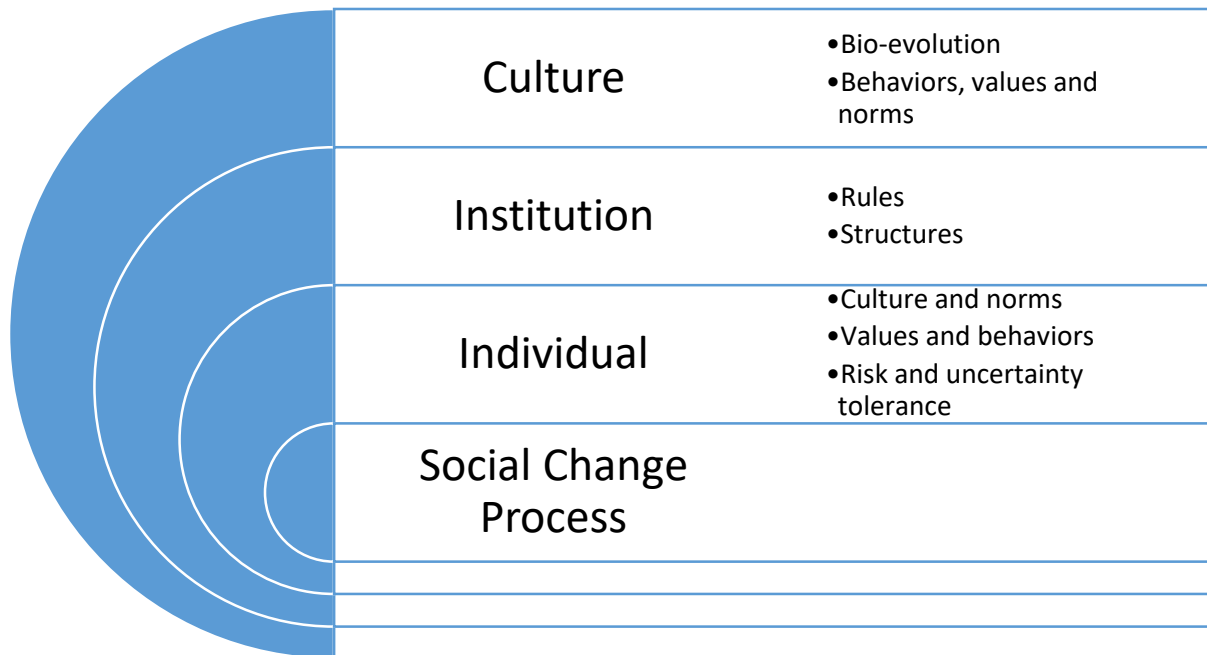
Figure 1. Focal Elements

### 4.2.1 History of Studied Case

The studied case was a complex SES program within the State of Michigan. Program practitioners investigate the nature and extent of uncontrolled hazardous substances in the environment; establish risk-based exposure limits and assess the adequacy of site-specific control measures, design; implement cleanup and redevelopment activities; and support legislative action, rule promulgation, and compliance and enforcement activities.

By definition, complex SES are full of uncertainty and, disparate social values, high stakes, and urgency to mitigate the impacts (Matso et al. 2008; Patterson 2006: Pielke 2007; Ravetz et al 2013 Rittal and Webber 1993; Rousseau et al. 1998; Stern et al 1992). The State of Michigan's cleanup and redevelopment program embodies these attributes. Within complex SES, there is no clear scientific solution. Scientific solutions may not be reliable based on bounded understanding, may not be desirable based on values and tradeoffs, or may not be practicable. For instance, cleaning up a contaminated site to background levels of contaminants may be desirable, but is

often infeasible from a cost or logistical standpoint (e.g. given site geology or hydrology). These situations present wicked problems.

The Comprehensive Environmental Response and Cleanup Act (i.e. CERCLA, the Superfund Program) uses a risk-based management approach as does the State of Michigan when addressing sites of environmental contamination. However, SES risk assessment is fraught with uncertainty. Given the complexity, uncertainty, and value incongruence, risk management is desirable but often unattainable, especially in a politicized regulatory culture. Incongruently, individual, and institutional governance still approach these as tame problems – heuristically assuming that one can effectively manage the uncertain risk with certainty (e.g. with a set of prescriptive rules).

The governance reinvention study period associated with this program spans approximately ten years. This hazardous substance cleanup and redevelopment program underwent a collaborative intervention process to improve environmental and public health risk reduction from uncontrolled hazardous substance disposal. The following discussion includes highlights associated with this case and its re-invention effort.

Given the public concern over the efficacy of the State of Michigan's cleanup and redevelopment program, newly appointed Governor Snyder began re-inventing the State government. Beginning in early 2011, and through a very intentional goal-setting process, the cleanup and redevelopment program began a reinvention process to shift from traditional linear and hierarchical governance to one that was more collaborative, polycentric, network-based, with increased reliance on systems thinking, and a structured decision-making process, aligning with the QGF and its DCT (McKay et al. 2017 and 2020). This framework and its associated tool were developed to guide and assess the SES governance transformation process and achievement of the program reinvention goals.

Key variables associated with this governance shift included a clear mission with positive leadership support, collaboration through diverse representation, and state staff empowerment facilitated through a culture of growth (i.e. a growth mindset), trust-building, and social learning. This shift resulted in the delegation (i.e., polycentric governance) of top-down decision-making, increased productivity, and improved environmental and public health risk reduction (McKay et al. 2020).

The previous study populations were comprised of the regulators and the regulated professional practitioners who implement the State of Michigan's cleanup and redevelopment program. The research reported in this manuscript augmented the previous populations through the inclusion of persons involved in the reinvention of state government (e.g., professional facilitators, and policy advisors internal and external to the legislative branch of government.

Using collaborative applied social science evaluation, mixed methods action research, and system dynamics (e.g. mental models and causal loop diagrams), this paper illustrates root drivers and relationships within complex systems for a variety of audiences – providing insight into *how* beneficial social change can occur and *why* it began to falter. This is followed by recommendations stemming from lessons learned.

This body of research has the potential to further support our understanding and implementation of quality governance and the use of tools for assessing system thinking capacities, processes, and decisions. This work informs and contributes to the potential to shift trajectories and improve upon the resilience and sustainability of SES.

### 4.2.2 Theoretical Underpinnings
*Governance at the individual, institutional, and cultural levels*

Shifting SES governance trajectories requires holistic systems thinking to avoid indirect effects and delayed, non-linear, or long-term unintended consequences that occur through multiple feedback loops and functional linkages (Forrester 2016; Ostrom 2007; Senge and Sterman 1992;

Sterman 1989). Holistic systems thinking includes concepts of resilience and sustainability and the often-overlooked human dimensions. While the human role may be considered "soft or intangible" humans are the drivers of governance and SES outcomes at the individual, organizational, institutional, and policy levels (Manfredo et al.2017; Schwartz 2008). Humans have also driven SES disruption. A few salient quotes capture the reality of dealing with the human dimensions of social change. These quotes have been adapted to the context of this research.

*The idea that if the emotion is not dealt with during systems change – it comes back and in a dysfunctional form. It is a principle of all clinical/applied work.* – Kegan and Lahey (2009)

*If we want a deeper understanding of the prospect of change, we must pay closer attention to our powerful inclinations to not change…if we can unlock this system, we will release new energies for new ways of seeing and being.* – Kegan and Lahey *(2003)*

Kegan and Lahey's (2003, 2009) work focuses on humans' strong characteristics of living with a sense of cognitive dissonance. We have many behaviors that affect our risk perception and capacities to change for the betterment of the whole (Gifford 2011, Hastie and Dawes 2010; Plous 1991).

There has been considerable improvement in socio-psychological and behavioral science testing and understanding in recent decades (Chugh, Kityama, and Muthukrishna 2020; Seligman 2012, 2013). This dissertation relies upon this new research and weds it to an emergent dimension of SES governance research.

*Individual Scale, Including Bio-Cultural Elements*

The human drivers and barriers are key artifacts when seeking to understand and implement resilient and sustainable SES approaches. A simple visual caricature of this concept can be witnessed by the United States' systemic social dilemmas associated with managing the pandemic

(i.e., COVID-19); climate change; and hate, gender, or racial bias throughout our history. The body of research on the human dimensions can shed light on many social change initiatives.

If we are proponents of improved SES outcomes we must analyze one's proclivities to limit innovation and prevent improvement for the greater good. *We need to counter the whimsical thinking of others with knowledge and truth. What we do echoes through generations* (Obama, 2020).

At the individual level, evolutionary biology, culture, values, behavior, cognition/mindset, and one's mental models shape and justify action and decision-making (Kahneman 2011, Manfredo et al. 2017; Stern and Dietz 1994). The mental models which shape our worldview are created from observations, emotions, and assumptions to name a few. Since they are incomplete and biased, they are rarely accurate. Kegan and Lahey's (2001) research indicates that adults must grow into and out of several qualitatively different views of the world before they master the challenges of life. As life proceeds, one's subsequent decisions are influenced by these mental models and reciprocal feedback processes linked to deeply embedded physiology, culture, and cognition that are part of a complex system that is not readily understood nor easily changed (Amel et al. 2017; Delizzona 2017; Fredrickson 2000; Manfredo et al. 2017; Muthukrishna and Henrich 2016).

Our evolutionary thought processes often align with *tame* (simple) problems while the world and its interdisciplinary and complex problems are *wicked* (Kahneman 2011; Rittel and Webber 1973). Many human capacities and our institutions align with limited cognition, a fixed mindset, and oversimplified *linear* thought while we attempt to tackle complex *systems* (Chugh and Bock 2018, Meadows and Wright 2008). Those with a fixed mindset and oversimplified thought are less likely to embrace change.

In attempting to maintain a positive image of oneself, we deny our fallibility – using defensive behaviors rather than viewing it as an opportunity to grow (Chugh and Brock 2018). Instead, we want to maintain the fiction of how we are perceived, stunting cognitive growth. Many of these humanly constructed or influenced systems produce problematic or perverse behavior (Chugh and Brock 2018; Meadows and Wright 2008).

Further, humans have evolved to not overload cognitive capacities for simple and routine occurrences (Kahneman 2011). In these instances, persons rely on heuristics and mental models in their decision-making (Kahneman 2011; Ostrom 2005). This epistemological set of human characteristics tends to equate familiarity with truth and safety (Kahneman 2011). Often this misguides judgment in a complex and wicked world.

Thaler and Sunstein (2009), refer to this simplistic approach as human mindlessness or passive decision making.  Meadows and Wright (2008) refer to this mental processing as bounded rationality – meaning people may make perfectly fine decisions based on the information they have, but they don't have sufficient information about the system (ibid). Crucial system components or an understanding of how the systems behave may be overlooked.  The tendency to oversimplify (i.e. thinking fast) can be distinguished from deeper cognition (i.e., thinking slowly and more deeply). This evolutionary approach to thinking fast has served us well (Chugh 2018; Kahneman 2011). However, not aligning our shallow or deeper thoughts with the situations we face has resulted in a chasm between our capacity to sufficiently interact with complex systems in ways that support resilient and sustainable adaptation.

According to Plous (1993) and Tversky and Kahneman (1981 and 1992), humans are not good at assessing probability or risk.  Likewise, we hold numerous perceptual biases and behaviors that limit deeper assessment and understanding. For example, Giffords (2011) explains 29 reasons for human inaction or barriers to remediating the social dilemmas associated with climate change.

Real-world examples include the tendency of some groups to flatly deny climate change or that the pandemic of 2020 is a hoax.

Another example of ancient adaptations that helped us to survive but can be problematic in present-day situations is associated with being wired for safety and success in uncertain and interdependent environments. When concern for our safety and success is triggered our higher brain which contains reasoning capacities can be overridden by the reptilian (e.g. amygdala) component (Delizonna 2017; Fredrickson 2000; Schwartz 2018). In essence, when faced with fear and risk, and we need higher-order thinking, our higher-order thinking capacity eludes us – and our flight or fight center takes over. Under threat, we become rigid and primal in our thoughts and actions. This is referred to as threat rigidity (Staw et al. 1981). Institutional threat responses to crises reveal a reduction in complexity in communication, resources use, and the centralization of power (e.g., an approach consistent with hierarchical governance) (Manfredo et al. 2016, Staw et al. 1981).

Another example of the evolutionary culture that influences human cognition, action, and decision management relates to one's internal appraisal system. Western individualistic cultures tend to use more individualistic emotion in decision-making than people from collective cultures when making life-satisfying decisions (Suh, Diener, Oishi, and Triandis 1998). Further, the emotion of fear has been shown to increase risk aversion, while anger decreases risk aversion (Lerner and Keltner 2001). The rationale is that anger has causal attribution to individuals, whereas fear or sadness is attributed to situations (Learner and Keltner 2001). Similarly, the more generalizable fundamental attribution error reveals that persons over-rate their behavior, abilities, traits, and motives (e.g., unrealistic optimism) and underrate situational facts (Plous 1993, Weintsein 1982). Attribution studies also reveal that actors explain their behavior based on situational factors where observers ascribe the same behavior to behavior (ibid). These human attributes may have

beneficial evolutionary etiology but are likely unhelpful when attempting to counteract the negative externalities of our material and technological drive and niche expansion.

A less obscure study of western individualistic behavior can be observed in behaviors that have evolved in white males in the United States. Finucane et al. (2000) found that risk perception is different based on gender and color. This same study coined the phenomenon referred to as the "white male effect". This effect was present in thirty percent of the studied sample. This population subset prospered in education and household income. Further, they held very different attitudes in risk perception, and trust in institutions and authorities. They were also anti-egalitarian, including a disinclination toward giving decision-making power to outgroup citizens in areas of risk management. This study states that risk perceptions relate to an individuals' level of decision power, with those with power having a greater ability to influence decisions regarding environmental risk management. This cultural and evolutionary phenomenon does not necessarily correlate to better risk management or complex decision-making. Similar behavior has also been documented by Malmenlier and her peers (2020). Their research reveals again that we are not homo economicus, but malleable based on our individual life experience.  This is consistent with what is being observed through contemporary public behavior and debates as we approach the 2020 presidential election. Topics associated with democracy, ethics, racial inequities, white supremacy, the financial market, and the pandemic are ripe examples.

Tedlow (2011) and Chamooro-Premuzic (2013) weigh in from a business perspective and reveal the fallibility of our leadership and our collective judgment – that often the reality is denied. We can see this playing out in the pandemic of 2020. Dogma is prevalent with 1) less democratic decision-making at the national level of government, and 2) it often is not based on scientific-based risk assessment. As the 2020 presidential election nears one can observe that there are still a significant number of supporters of this decision power approach to governance;

unfortunately, it is based on emotion rather than thoughtful logic and long-term resilient and sustainable governance.

Further, humans have tendencies towards feeling we are exceptional and our ideas are better than other's (Plous 1991; Yong 2020). We have learned to accept position and hubris as leadership when in fact we may be responding to the superficial charisma or charm (Keltner 2017). This tendency can be seen with the fascination with Hollywood celebrities and their ability to influence public opinion. Even politicians are stating that the right decision is being overruled by party politics (Demming 2020).

Scholars contend that our worldview and cultural values arise for adaptive purposes and evolve through human populations through social (e.g., power relations) and biological evolution (i.e., environmental factors and natural selection) (Delizonna 2017; Manfredo 2017). This can be viewed as the coevolution of genes and culture (Richerson and Boyd 2008). This co-evolution phenomenon evolves over considerable time. These human characteristics reveal why rationality and logic don't prevail and why tackling wicked problems has been so difficult.

Again, many of the aforementioned examples relate to human bounded rationality. Shifting from the familiar to something new (e.g., a new mental model) requires a growth mindset and a willingness to be vulnerable. Contemporary research reveals that a willingness to embrace risk, uncertainty, and be vulnerable can transform the way we live and learn (Brown 2012; Collins, Brown and Holum 1991; Dweck 2016; Wong 2006). Brown (2012) defines vulnerability as uncertainty, risk, and emotional exposure. In her more recent book (Dare to Lead, 2018) Brown defines vulnerability as having the courage to show up when you can't control the outcome. Brown goes on to say *we need to trust to be vulnerable to [further] build trust* (pg. 29). *Trust is the stacking of moments and reciprocal vulnerability over time. Trust and vulnerability grow together, and to betray one is to destroy both* (pg. 34). Similarly, the willingness to be vulnerable,

based on *positive expectations* of the intentions or behavior of another, is trust (Rousseau, Sitkin, Burt, Camerer 1998). According to learning science, trust and a willingness to be vulnerable is an antecedent of mental model shifts and adoption of new cognition (Collins, Brown and Holum 1991; Dweck 2016; Wong 2006). Trust, also referred to as psychological safety, is a requisite antecedent for all productive relationships (Fredrickson 2000; Guo, Lumineau and Lewicki 2017). Schwartz (2018) states that trust and positive feelings are just as important as how much one knows when building relationships. Psychological safety affects how people feel and their abilities to have positive interactions with others.

This sense of safety is also influenced by our language. Kelly and Kelly (2015) state that language is the crystallization of thought. Our choice of words reflects and shapes thought patterns. Consistent with Obama's previous quote, Kelly and Kelly (2015) state that our vernacular needs to be changed to change attitudes and behaviors. Our language needs to label and give meaning to governance trends and concepts that could benefit from being brought from darkness into the light of decision making. An example of this would be turning the public's perception of vulnerability into one that evokes a positive perception given that it is an antecedent to growth and a growth mindset. This would also uncover truths that are currently hidden.

Psychological safety that supports continuous mental growth occurs at the individual and organizational levels. A growth mindset can be nurtured through psychological safety. Instead of interactions being defensive or ideas and discourse being denied, responses and interactions become positive and interactive growth opportunities. In a growth culture, persons are willing to be vulnerable and take risks. They also build the capacity to see through blind spots both within themselves and the world around them. When situated in a growth mode people spend less energy defending themselves and their beliefs. This frees energy (negentropic energy) available to create value (Delizonna 2017; Fredrickson 2000; Kegan and Lahey (2003, 2009).

This research on human behavior indicates that antecedents to a governance shift require a growth mindset. Human cognition must develop the capacity to confront risk and fear with higher-order thinking, and positive emotions with social empathy. Positive emotions broaden one's ability to tap their full suite of positive and creative resources. This includes fostering cooperative relationships, trust, curiosity, confidence, and inspiration - building physiological, psychological, cognitive, social, and physical resources (Fredrickson 2000). These individual capacities can support the movement from a more simplistic egocentric (e.g. power-based or rational egoists) form of governance to one that recognizes and sees the connections among the collective human race and complex systems. This transition can help align us with the challenges we face.

More recently, work by Muthukrishna and Henrich (2016) argues that innovations are emergent properties stemming from cultural and social networks. The more robust the social connections, the fidelity of transmission, and culture diversity, the more these and other tools will exist in one's toolbox to innovate, disperse that knowledge, feeding more collective brainpower which is an antecedent to new observations and innovations for a collective benefit. In the alternative, isolation, stagnant culture, and low diversity limits social learning.

*Institutional Scale, Including Bio-Cultural Components*
Human behavior is influenced by culture and the structures in place to support the cultural framework. Cultural values within the United States, have been theorized to emanate from historical adaptation and sense-making. For instance, Kitayama et al. (2010) illustrate how the pioneers and early settlers of the United States had to learn to be independent to survive in low-density settlements. Western Christian beliefs, practices, and norms, placed humans in a position to master nature and promote a highly competitive economic system (Dietz, Stern and Guagnano 1998, Hitzhusen and Tucker 2013; Manfredo et al 2017; Minteer and Manning 2005; White 1967). Further, the proliferation of normal science and technology development by the westernized world evolved without an appreciation for the natural evolutionary processes (Kuhn 1996). Designing

our culture and its institutions without regard for the natural worlds (e.g., the ecosystem and its SES) is an example of detrimental bounded rationality.

Reflecting historic bias, often the impacts caused by humans are studied, but not their governance approach which results in the SES degradation (Binder et al 2013; Huitema et al. 2009; McGinnis and Ostrom 2014; Sharma et al. 2007; Wustenhagen 2008). This artifact of normal science is steeped in the western world's culture and values which viewed humans as being separate and able to control their environment (Kuhn 1996). Technological and often market-based or hierarchical governance has been used to address problems and design our future (Kjaer 2010; Kuhn 1996; Rhodes 1999; Senge and Sterman 1992). This bounded approach has been insufficient in managing the complexities associated with complex and dynamic SES behavior.

Instead of mimicking the systems of the natural world, technology and our institutional culture and structures evolved as linear/siloes or hierarchical forms of governance. These hierarchical forms of governance rely upon power and authority, a linear framework of prescriptive rules, and the command and control of subordinates Kjaer 2010; Stoker1999). This culture and structure of governance were likely beneficial at the time given the emergence of assembly lines, formalized education, etc. (Tedlow, 1993). However, their attributes are not aligned with the complex wicked problems we face. Given the global state of SES affairs, this approach has not been effective nor sustainable.

The western hierarchical approach accompanied by white male dominance as referenced earlier, are artifacts of our cultural values. Likewise, valuing power as an individual asset rather than the benefit of catalytic and collaborative connections and community-based empowerment is based on a dated cultural bias (Riger 1993). According to scholars such as Axelrod and Hamilton (1981), Fredrickson (2000), Gintis (2011), and Keltner (2015 and 2017), altruistic or beneficial positive reciprocal social ties are critical to the success of our species and institutions. Those who display

kindness, altruism, and social intelligence rise in social power and evolutionary fitness regardless of one's status (Gintis 2011: Keltner 2017). Axelrod and Hamilton (1981) state that the benefits sought by living entities are disproportionately available to cooperating groups; it is a fundamental basis for all social life. Not only do these benevolent cooperative societies benefit from resource efficiencies – they avoid costly biological signaling against perceived adversaries (Bulbulia and Sosis 2011). These scholars recognize humans as natural beings within a natural SES. Further, governance cultures and structures which integrate and mimic natural phenomenon, natural selection, evolution, and socio-ecological system frameworks are increasingly thought to be more sustainable (Axelrod and Hamilton 1981, Benyus 1997; Manfredo et al. 2017).

*Shifting Governance to Align with the SES Challenges*
Governance literature has theorized that moving from hierarchical governance to network-based ones, that use polycentric, structured deliberative decision processes, and capacities that align with systems thinking (i.e., the QGF) are more likely to improve SES outcomes (Folke et al. 2010; Kjaer 2010; McKay 2013; McKay et al. 2017; McKay et al. 2020; MDNRE 2010; Public Sector Consultants, Inc. 2007; Renn et al. 1993; Rhodes 1999; Senge and Sterman 1992). The QGF approach focuses on new world views and creative problem solving rather than historic conflict or forced compromise. The QGF changes the interpersonal dynamics; the dynamics move from a focus of conflict and adversity to working collaboratively toward a shared goal. This approach aligns with socio-psychology, learning, and behavioral sciences (see Introduction). This governance system is illustrated on the right side of Table 1, providing a visual comparison of the three general approaches to western capitalistic tending governance.

Table 1. Typical Western Capitalistic Governance Compared to a Quality Governance Framework

| Defining Elements | Markets | Hierarchy | Quality Governance | Quality Governance Detail |
|---|---|---|---|---|
| Basis of relationships | Legal - Contracts and property rights | Simple employment relationship based on power, economics, and bounded goals. | Complexity in networks and resource exchange | Diffuse power, altruistic collaboration, balanced and expansive goals |
| Degree of dependence | Independent | Dependent | Interdependent, polycentric, and transparent | A clear and transparent mission is established through democratic and diverse representation. Decision-making authority is delegated to those that hold the knowledge. Promotes beneficial relations, growth mindset, and social learning |
| Medium of exchange | Price/monetary | Authority (Authoritarian) | Trust (Authoritative) | Improved ability, benevolence, and integrity, leading to positive feedback and improved collective outcomes |
| Means of conflict resolution | Haggling and judicial power | Rules and commands | Diplomacy | De-escalation of conflict through discourse and innovative problem management and adaptive risk reduction approach |
| Culture | Competition | Subordination | Reciprocity | Altruistic with positive growth |
| Structure | Bounded System | Linear | Diverse system | Extremely complex |

Table 1. is adapted from Kjaer (2010), McKay (2013), McKay et al. (2017 and 2020), and Rhodes (1999)

Traditional hierarchical structures and cultures rely on prescriptive rules, commands, and control – a power-based construct often described as a task-based menu of compliance items. This governance approach is designed to ensure homogenous alignment within the governance construct, with a focus on *what is wrong*. When management is challenged it tends to respond forcefully, ratcheting inward with an increase in centralized control (Staw et al. 1981). When management focuses on problems, the critique is framed and limited by the reviewer's bounded

worldview, not by future innovation and creative potential. This form of governance doesn't promote creativity and innovation, problem-solving, psychological safety (e.g. positive trusting environment), and a growth mindset (Dweck 2016; McGregor 2019).  Recall, these positive traits are attributes that improve outcomes.

In the alternative, the QGF departs from a prescriptive power construct to one that diplomatically promotes the positive attributes of expansive altruistic collaboration for the common good through social learning and the development of shared values and norms. These shared values and norms become a common mission implemented through diffuse power (i.e., delegated authority and individual empowerment). A well-constructed mission or goal establishes a performance measure, rather than a set of prescriptive tasks. The relationships are built on reciprocal trust that supports improved collective decision management (Rhodes 1999). Trust is built, learned, and reinforced as a reciprocal and endless endeavor (Rhodes 1999). Reciprocity is a way of establishing a positive altruistic enduring scope of trust that would exist in the future without having to re-establish trust with each interaction; in essence, trust is an experience-based expectation that the quality or type of relation guarantees reciprocity in the future (Fredrickson 2012). Schoorman, Mayer, & Davis's (2007) work on trust states that not looking at the reciprocal elements of trust-building is a shortcoming in the research and an area requiring further study.

Trust facilitates efficient interactions and human satisfaction when dealing with organizations, including regulatory organizations (see Hamm 2017; Pirson and Malhorta 2011). Most disciplines conceptualize trust to include the element of vulnerability: a willingness to make themselves vulnerable to the discretionary behavior of another (Rousseau et al 1998). Trust can exist between individuals, or one or more individuals and an organization. When the object of trust (trustee) is an organization the "other" can be an individual, a different stakeholder, or an organization (e.g., intersubjective trust - see Fredricksen 2012) (Pirson and Malhorta 2011).

Trust is distinguished from trustworthiness – the conditions which lead to trust through attributes that influence a willingness to accept vulnerability (Mayer Davis and Schoorman 1995; Mayer and Davis 1999; and see Pirson and Malhotra 2011). While several factors associated with trustworthiness have been identified in the literature, trustworthiness is a complex function of both personal idiosyncrasies and situation/domain/context-specific (Freidrickson 2012; Mayer, Davis, and Shoorman 1995, Mayer and Davis 1999, Pirson and Malhorta 2011). The most common factors of trustworthiness are ability, benevolence, and integrity of the trustee perceived by the trustor (Mayer, Davis, and Shoorman 1995):

Ability – a group of skills, or perceived groups of skills or competencies, and characteristics that enable a party to influence a particular situation or person. This can include interpersonal competence, business or technical competence, and judgment (Mayer, Davis, and Shoorman 1995).

Benevolence – the perception that a trustee will do good to the trustor, rather than an egocentric profit motive, or reliance on lies and falsehoods. Altruism and loyalty are also factors considered in the literature (Mayer Davis and Shoorman 1995). Further, the attribute of benevolence appears to align with procedural fairness (e.g., that the trustee and trustor are involved in a fair process or exchange).

Tyler (1997, 2000), suggests that people are more willing to accept decisions when they perceive that the decisions are made through a trustworthy and fair process. Procedural fairness research suggests that people evaluate fairness primarily through criteria that can be provided to all the parties to a conflict, including opportunities to participate in the decision process; whether the authorities are neutral; the degree to which people trust the motives of the authorities; and whether people are treated with dignity and respect during the process" (Tyler 1997, 2000).

Integrity – the perception that the trustee will adhere to a set of principles that the trustor finds acceptable, consistency in past actions, credible communication, a strong sense of justice, and the extent that the trustee's actions are congruent with the trustor's sense of integrity (Mayer Davis and Shoorman 1995). Sitkin and Roth (1993) take a more constrained definition limiting it to value congruence.

The concept of *distrust* has multiple models that stem from various interpretations of the relationship between trust and distrust. The early interpretations viewed distrust and trust to exists in the same dimension but on opposite ends of a continuum with overlap (Guo et al. 2017). Another model depicts the attributes as opposite values with a neutral range between (ibid). A third views trust and distrust as separate concepts on different dimensions based on value incongruence (ibid). Since culture and values are a key artifact of this research, distrust is considered a violation of fundamental values (Guo et al. 2017).

Slovic's (1993) principle of trust asymmetry posits that trust is easy to lose but hard to generate, where distrust is easy to obtain but hard to reduce. Further distrust, untrustworthiness, or a negative experience where trust is eroded (i.e., mistrust among individuals and institutions) tend to fall into a phenomenon known as threat rigidity and the establishment of relationships that tend to remove vulnerability from the interaction (Staw, et al 1981). In Guo, Lumineau, and Lewicki's (2017), review of the emerging literature distrust is related to unproductive or negative business strategies (i.e., actions that lower investments, increase internal controls, distort information, etc.). These types of rigid and self-protective behaviors align with power constructs and insular hierarchical governance which is counter to that espoused by the QGF to promote improved resilient and sustainable SES outcomes.

This distinction between trust and distrust has important significance when attempting to diagnose and treat capacities to improve SES outcomes. Trust relates to positive interactions;

distrust stems from a difference in basic values that likely have generational and cultural influences.

Trust literature is evolving as new and often finer nuances are being analyzed and tested under different relationships (e.g., interrelationships), objects, and situations/ contexts (see Fredrickson 2012; Hamm 2017; Pirson and Malhorta 2011). Further Searle, Nienabaer, and Sitkin (2018) discuss that trust emergence and dispersion present interesting avenues for future research. Searle et al. (2018) state that trust emergence research requires observations over time, yet few studies have explicated the trust-building and patterns of emergence. This compendium of longitudinal and action research contributes to filling this gap.

Diplomacy is defined as management by negotiation that encompasses "truthfulness, precision, calm, good temper, patience, perseverance, modesty and loyalty" (Rhodes 1999, forward, in Stoker, 1999). Finally, reciprocity represents the establishment of deep obligations and duties, bringing stability to the relationship (ibid).

Systems thinking and modeling are a disciplined way of understanding dynamic relationships, identifying leverage points for effective intervention, trade-offs, and unintended consequences. Systematically addressing complex SES differs from many traditional scientific research methods that oversimplify or obscure real-world system dynamics by being overly concerned with the generation of quantitative data (Hirsch, Levine, and Miller 2007). The study of systems by definition is concerned with the phenomenon of dynamic change and how one can manage the system (Levine and Fitzgerald 1992; Meadows and Wright 2008). Systems management is not focused on optimization or certainty (as is the case with a statistical approach), or the more typical one-way flow associated with dependent/independent variable relationship as seen in the vast majority of conceptual or statistical tools, including regression, logic models, and structural equation models (Hirsch, Levine and Miller 2007). In systems modeling; variables may have

positive and negative feedback within the system over time or delayed responses. They can also have interdependencies that can help illuminate how best to approach system change (Hirsch, Levin and Miller 2007).

Literature posits that the source of the poor performance of systems failure is often the result of limited capacities of individuals or organizations to fully understand and holistically manage dynamic and complex functionally linked systems that produce their patterns of behavior over time (Forrester 1916; Meadows 2008; Senge and Sterman 1992; Simon 1993). *Throughout management science, the emphasis is on techniques rather than principles, on mechanics rather than decisions, on tools rather than on results, and, above all, on the efficiency of the part rather than on the performance of the whole*" [Drucker, 1973: 509 in Kasser et al. 2013]. Further, the work on improving systems understanding in the engineering and computer science fields has focused on improving and developing new systems processes, ignoring the social system, including its people (Kasser et al 2012).

Systemic and historical bias along with bounded rationality has contributed to archetypical failures (Meadows and Wright 2008). If we want to shift humans from more simplistic linear thought processes to more complex and dynamic systems thinking which is a requisite for addressing the complexities of today's SES problems, we must recognize we are attempting to shift our culture, basic human cognition, and our very nature – a daunting task. Overcoming this historic bias and barrier to improved SES outcomes presents numerous challenges and opportunities in the arena of SES research.

*Base SES Governance Models*
This research uses a comparative conceptual causal loop diagram model lens derived from literature and mental models to contrast hierarchical and collaborative governance (i.e, the QGF).

A mental model is a representation of thought. When we study human cognition, it is theorized that thinking is the "creation of mental representations of what is not in the immediate environment…and the skill of filling the gaps with evidence" (Hastie and Dawes, 2010). Figure 2 depicts a simplified conceptual model translated into a causal loop diagram. It depicts the governance systems associated with our case study's governance shift: hierarchical governance and the QGF.

Causal loop diagrams use variables (text) and connectors (arrows) to show system feedback. Systems thinking and this research stresses chains of reciprocal and causal relations among variables that reinforce ("R") or balance ("B") the system behavior. In this instance, each influences the rate of environmental and human health risk reduction. The top portion of this figure shows the positive feedback associated with the hierarchical system when assessing residual risk. (Meaning hierarchical governance tends to increase residual risk.) The bottom loop depicts the balancing feedback associated with a network-based governance system. The balancing loop would reduce residual environmental risk.

Key to the governance transition, in this case, was the ability to move from hierarchical, rigid rule-based analysis to collective generation of more complete knowledge and synthesizing a larger system for improved environmental and human health risk reduction. As a very simplified summary, when moving from hierarchical governance to one that is more collaborative, power and status within the culture moves from coercive tendencies to the collaborative - built on reputation and trust including one's abilities, benevolence and integrity, and an overarching sense of procedural fairness. Power is diffuse and space is created for meaningful discourse, the co-creation of knowledge, and individual growth and empowerment (Keltner, 2017). Governance is collaborative, altruistic, reciprocal, positive, and reinforcing. New mental models can be generated

and the structure moves from singular or linear concepts to one with a holistic systems view. Through this system, improved management approaches to complex SES can be achieved.
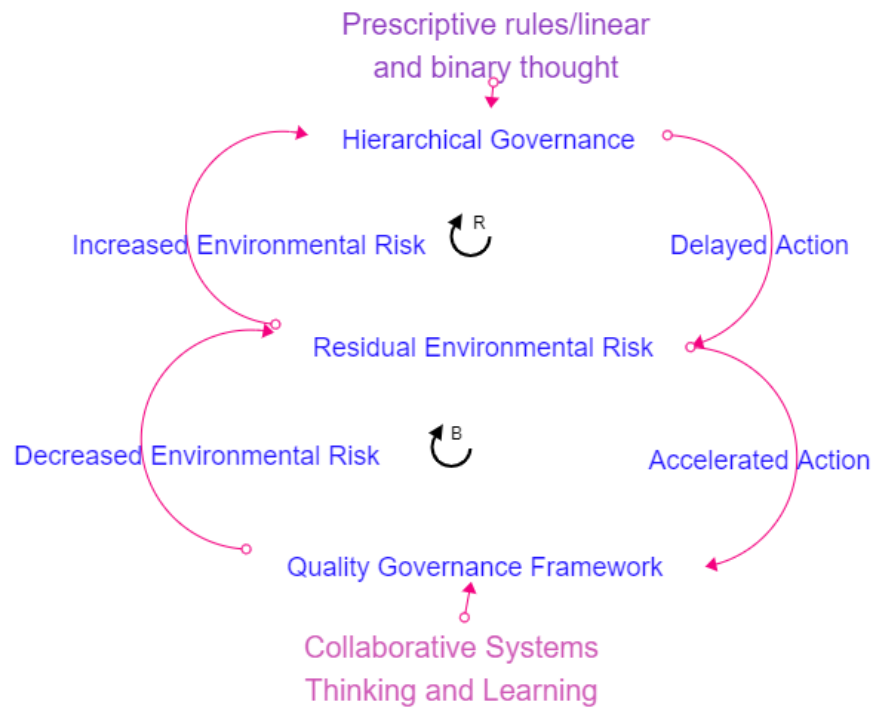


Figure 2. Base Governance Model

### 4.2.3 Social Change Initiatives

Describing the shift in governance via a systems model is only part of what brings about social change. Intentional and durable social change takes considerable effort and time. It must integrate SES governance theory with human, organizational, and institutional change literature. Further, it must overcome instilled culture, norms, biases, and behaviors. It includes the *human socio-psychological dimensions* of SES. As indicated by Kegan and Lahey (2009), and referenced earlier, *The idea that if the emotion is not dealt with during systems change – it comes back and in a dysfunctional form. It is a principle of all clinical/applied work.*

Here we provide a general overview of the *process* (i.e. implementation) of change, utilized in the case study.

From a historic perspective, the State's program had a long-standing disparity between program implementation and the public's expectations for the improved protection of environmental and public health. This disparity was documented through numerous stakeholder processes. In 2011, due to public concern, the newly appointed Governor called for a state government re-invention initiative (i.e., the Collaborative Stakeholder Initiative or CSI). The goals for this initiative were (MDEQ and MSUE 2012):

- Goal 1. Foster an improved climate of trust, cultural understanding, and cooperation among stakeholders and state agency staff.

- Goal 2. Set the stage for swift and durable implementation of seven key issue groupings that affect progress in Michigan's cleanup and redevelopment program.

Further consistent with the Governor's vision the initiative was to be (MDEQ and MSUE 2012):

- Innovative

- Collaborative

- Swift

- Strive for relentless *positive action*

- Expedite the development of durable and actionable recommendations to department management to help move Michigan's cleanup and redevelopment program forward.

This process included critical planning and process design steps that greatly contributed to the initial success of this reinvention effort. For example, care was taken to identify, vet through intentionally selected steering and coordinating committees, and incorporate persons from within and without the regulatory agency who could best carry out and *spark* CSI. Initial sessions were critically designed with a structured and facilitated kickoff session and a follow-up "retreat". The retreat can be considered a *ritual*. Rituals are effective in building cohesive, benevolent, and cooperative teams (Shariff 2018). The purpose of the retreat was to build community and trust

among the participants as the contentious issues were vetted to sufficiently diagnose for treatment various options These options (e.g. rule and statutory changes) were supported by decision aiding records provided early in the process. This was partially done to ensure a swift process – to keep the momentum and be respectful of participants' time (i.e., elements of the QGF and its DCT). This facilitated the rapid development of recommendations to department management. This process did not preclude internal cultural and structural modification to align with the intentions of CSI and the government re-invention initiative. Examples of this are discussed later when describing the shift from a hierarchical form of governance to one embracing the QGF.

*Positive action* was never clearly defined during CSI. Its general meaning was to move forward with positive interactions and outlook in accomplishing the stated mission and goal. Consistent with the literature reviews, the meaning of this term means individual flourishing and resilience of one's wellbeing. This includes a state of excellence characterized by objective flourishing across a lifetime and brought about through the exercise of moral virtue, practical wisdom, and rationality (Seligman 2013). Further, one's life has engagement and meaning…such that when engaged time stops (e.g. termed as *flow*) (Seligman 2013). The opposite of flourishing is poverty, unrest, and degradation of life (Seligman 2012).

The design framework of the CSI initiative mirrored Kotter's (1995) eight steps to transforming organizations. These include:

1. Establishing a legitimate sense of urgency

2. Forming a powerful guiding coalition

3. Creating a vision

4. Communicating the vision

35

5. Empowering others to act on the vision

6. Planning for and creating short term wins

7. Consolidating improvements and producing still more change

8. Institutionalizing new approaches

Additional descriptions and the effects and results of this process are described under the Findings and Discussion section to better integrate the process with the conceptual modeling of the governance shift. Combined they provide a unique and holistic review of the social change initiative.

4.3. Method

4.3.1 Developing and Testing a Comparative Conceptual Model of Hierarchical and Collaborative Governance Frameworks

A conceptual model was developed using the literature, qualitative and quantitative data obtained through this longitudinal research, and perceptions associated with the initial Collaborative Stakeholder Initiative. The model compares the pre-social change governance model (i.e. hierarchical governance) with the transition to a more collaborative form of governance (i.e., the GQF).

The one-on-one discussion sessions with the participants provided differing perspectives and a broader insight into the governance change initiative and its persistence over time. Given the timing of this research, group and face-to-face meetings were limited by public health emergency orders and Michigan State University policy. Given that this work was done during the 2020 pandemic, collaborative discussions and didactic social learning were used. The protocol is provided in Appendix A.

## 4.3.2 Research Questions

The research questions used to guide this phase of research and conceptual model validation were selected from perceived system change drivers when moving from a hierarchical form of governance to the QGF (see Table 1). The model also incorporates measurement items used in the DCT.  The focus areas for this research were on the role of a clear guiding mission statement, staff empowerment, systems thinking, trust, and social learning (e.g., a growth mindset) on improving SES outcomes (see Figure 3). Depending on the mindset of the respondent, perceptions of the governance framework, capacities from the QGF and DCT, and associated concepts provided in the literature were further mined.

The social change process was also included in discussions to bridge theory with the implementation process for a more holistic view of the social change initiative. The implementation process is a critical component of this social change initiative, and the respondents were more focused on this aspect rather than the governance theories behind the initiative shift. The discussion on the initial process change management followed the CSI process, including Kotter's (1995) *Eight Steps to Transform Your Organization.*
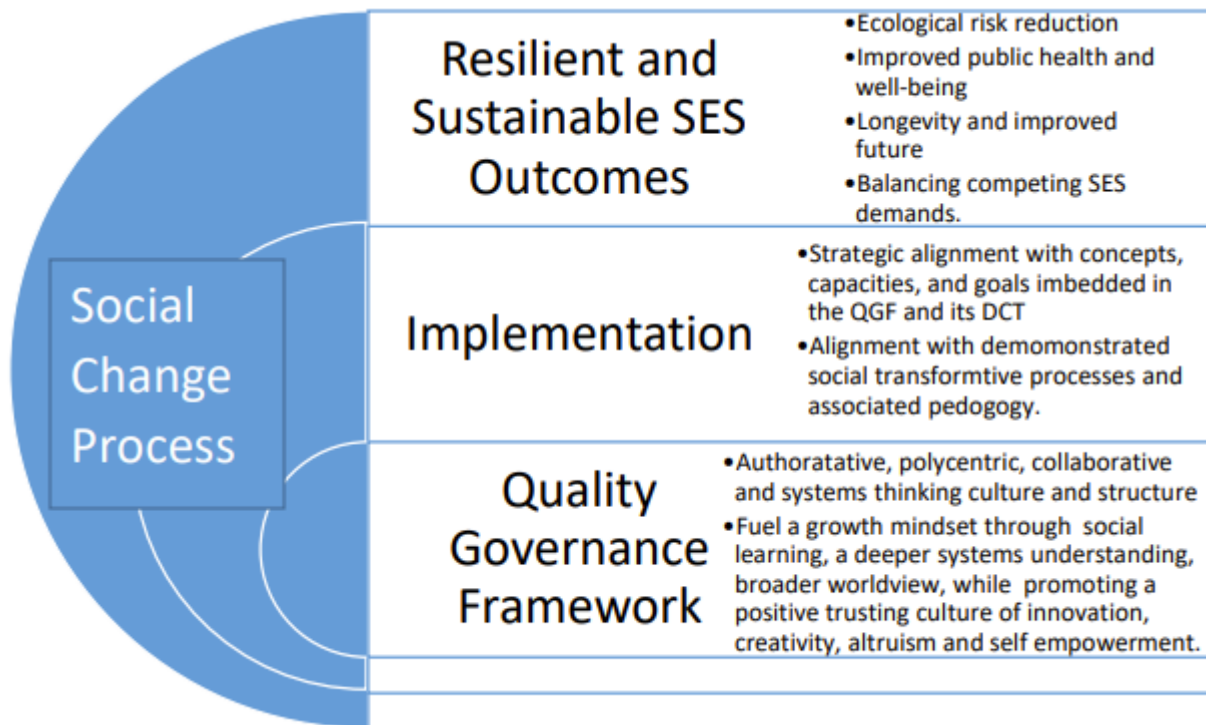
Figure 3. Research Focal Areas

To help bridge the disciplinary language (i.e. vernacular) divide between practitioners and scholars, the research questions were:

*1. What were the key elements of the cleanup and redevelopment program's [governance] reinvention that contributed to improved program outcomes?*

*2. Which improvements persisted? If persistent, what elements were key to their durability?*

*3. Which improvements did not persist? If not persistent, why were these improvements not durable?*

This summary provides a framework and discussants' comments. If an issue was not explicitly mentioned by the discussant, mining their thoughts was not necessarily further explored unless it was related to key elements of the QGF and DCT or associated literature.

### 4.3.3 Participants and protocol

To address the research questions twelve potential discussants were contacted. Ten discussants who participated in the State of Michigan's reinvention initiative participated in open-ended co-learning discussions. The discussants were selected based on the intensity of their role/engagement in the re-initiative process and to provide diversity in worldviews. For instance, the department head and policy specialists, and division chiefs who held active roles during the initiative were interviewed. Initiative conveners, facilitators, and internal and external practitioners within the program were also interviewed. The practitioners' disciplinary focus reflected technical, legal, facilitative, and management expertise.

The discussions took place during 2020. Discussants were given an identifying number and their comments were recorded in a draft of this dissertation in brackets (i.e., [1,2,3,4,5,6,7,8,9,10]). To allow discussants to remain anonymous this published dissertation only provides the number of participants who are referenced by the comment. Note that the positions, experiences, and roles of the discussants were diverse. The diversity of respondent identifiers per discussion point reflects discussant diversity including their perspective, mental models, and time engaged in the initiative. For instance, some, such as a CSI facilitator might have had key, but only fleeting time involvement in the initiative. Others have since retired and others are still practicing within the program.

The protocol allowed participants to present their ideas first. This facilitated unbiased opinions and the sharing of unanticipated worldviews (e.g., not being limited by a set rubric). This concept was consistent with a prevalent theme from the discussants for the cleanup and redevelopment regulators to learn to *listen first* [4].

### 4.4. Discussion of Findings

In general, change is hard. Individual, institutional, and cultural change is even more difficult. Change within interdisciplinary complex systems is daunting: it is wicked. On one hand, the

change revealed through data collection (2013-2014) was remarkable. However, it can't be assumed to be continuous or prevail. Systems change takes a whole systems approach, including the elements, process, and continuous diligence. Leadership needs to be aligned, guiding, and demonstrating the necessary framework and capacities otherwise the change effort is destined to fail.

Recall that this 3rd phase of research was intended to validate the conceptual causal systems model of the shift in governance.  Following the research protocol (see Appendix A), I allowed the discussants to lead with their perceptions of the governance change initiative. The process of change was the most salient and consistent topic among all of the participants. Since this provides a lens into the implementation process, the findings follow in two subsections: 1) the social change process, and 2) the shift in governance conceptual modeling effort. Both reflect social change implementation findings as revealed through the co-learning sessions and supported by relevant documentation and literature. Components of social change are all interrelated as part of a dynamic system and are not necessarily distinct and can have considerable overlap and systematic influence upon each other.

In general, the discussants felt that the shift in governance to one that was more collaborative, including the processes followed to achieve the governance shift, were key factors in achieving improved program outcomes [10].

### 4.4.1 Process Related Findings

This section follows Kotter's (1995) eight steps for transforming an organization (e.g., a requisite element of governance change). Context is added to the co-learning sessions with the discussants through the author's knowledge of the process and documentation of the process provided in Reinventing the State's Cleanup and Redevelopment Program (MDEQ and MSUE 2012). (Note that I was part of the reinvention process.)

Kotters Eight Steps

1. **Establish a sense of urgency**. *In this step, the reality of the crises and opportunities presented the urgency.*

In this case, hierarchical SES governance had failed, resulting in increased environmental and health risks (i.e., a lack of remediation of those risks). The failed efficacy of the program was documented in the numerous stakeholder and regulatory processes before the re-invention initiative. Sites of environmental contamination were growing faster than sites were being cleaned up. Further, there were discussions of funding cuts should the governmental program not become more effective at meeting the needs of the public. Seven technical barriers and agency culture and structure were identified as key barriers to meeting the desired program outcomes [1].

2. **Form a powerful guiding coalition**. *Leadership must be aligned with the social change initiative.*

The governor's and his appointee's leadership spearheaded this government change initiative with a clear mission statement. The governor appointed knowledgeable advisors and department leadership with advantageous skill sets to key positions. Further, since this was an issue that crossed public and government boundaries, the coalition needed to build trust across both domains [10].

Since change is hard, it was critical to have strong collaborative leaders and participants that did not absorb existing toxicity [1] or resort to power plays.

The members selected to participate in the governance shift were to have the following qualities: bring diversity in experience and thought, be well informed and respected leaders, good listeners, and possess the ability to develop comradery across disciplinary boundaries and government/public domains [4].

The establishment of the coalition and initial membership was done collaboratively with great intention. While shadow networks provided *a window of opportunity* to build momentum, the selection of membership was not guided by or limited to the shadow network of the originating coalition [2].

Selection of the initial Collaborative Stakeholder team and the placement of new management stirred up emotions and personal ties within the organization, even though it was recognized that it was a necessary step to achieve the desired initiative outcomes – improved SES [2]. This reflects the emotional component when dealing with social change. Perhaps it could have been handled differently. One common theme was a desire to increase transparency and procedural fairness, including broader public participation in this process [2].

Over time, and into the governor's second term, it appeared to one discussant that the governor who sparked the initiative was not necessarily as accessible as is the current (2020) governor. The current governor was touted as being better at team building during a crisis [1]. The governor and his leadership team who sparked the initiative succumbed to threat rigidity later in the process [9]. This is explained further in Item 8.

*3.* **Create a vision and developing strategies for achieving the vision**. *The strategy for achieving this mission was to convene the Collaborative Stakeholder Initiative (CSI) as a core element of an overall governance transformation by the State, program stewards, and stakeholders (i.e. internal and external practitioners) associated with the cleanup and redevelopment program.*

CSI was intended to be an initiating *spark* for the governance transformation.

- Goal 1. Foster an improved climate of trust, cultural understanding, and cooperation among stakeholders and state agency staff.

- Goal 2. Set the stage for swift and durable implementation of seven key issue groupings that affect progress in Michigan's cleanup and redevelopment program.

Relationships are important [10]. A three-day face-to-face retreat was planned to create an opportunity to build positive relationships where people exist within a safe environment, are on equal footing, and can self-regulate [2]. Bonding truly begins after two nights – as persons let down their guard and allow themselves to become more vulnerable [2]. Face-to-face collaboration is beneficial and improves outcomes (Axelrod and Hamilton 1981; Ostrom 2005). (Since we are in an era of virtual meetings, two discussants indicated that virtual meetings seem to be less formal and more productive than some face-to-face meetings [2]). It is the ability to break bread together, read the faces, and avoid back channeling that truly matters [7]. In reality, the participants wanted the same beneficial outcome (McKay et al. 2017;  [2]). Given inconsistencies among an individual's tolerance for risk, there is likely a chasm in one's ability to trust another when addressing the uncertainty associated with complex SES [3]. This is covered under the model validation discussion.

*4. **Communicate the vision**. The vision was communicated and repeated continuously.*

*To expedite the re-invention, the sparking phase was intentionally condensed.*

All CSI-related deliberations and reporting occurred between February and March of 2012. The visionary message was branded as 2-7-3 (two goals, seven issues, and three sessions). Branding is a marketing tool that assists with communication. Another aspect of this step was to teach new behaviors by example (i.e., exemplified by the guiding coalition). To achieve this step, the following principles were developed and used as initiative guidance:

- Focus on creating a hospitable space

- Explore questions that matter

- Encourage everyone's contribution

- Connect diversity in people and ideas.

- Listen together for insights, patterns, and deeper questions

- Make knowledge visible

This work was collaboratively designed and assigned to a Coordinating Committee responsible for guiding the CSI format and facilitating the engagement strategies for all CSI activities (MDEQ and MSUE 2012).

5. **Empowering others to act on the vision.** *This step of the process was facilitated by the development of facilitated workgroups.*

As stated above, *Face time* and *breaking bread* together (e.g. rituals) matter [10]. During the seven-issue group deliberations, participants were encouraged to be collaborative, creative, and innovative in developing actionable recommendations for the State program managers' consideration that:

- Demonstrated best professional judgment and practices in decision-making recognizing verifiable data and research

- Took into account trade-offs by considering relative risk, focusing on the most significant risks and most beneficial issues (e.g., What Matters)

- Seek adaptable and durable program changes

- Use performance-based outcomes (e.g., as opposed to tasks or pre-set rules) where applicable

The initiating process was strengthened by the diversity of participants and thought [8]. The participants were challenged to take advantage of the opportunity to: *get it right, get it done, and play a significant role in leveraging Michigan's assets for its future*. (Diversity in participants is an element of the QGF and its DCT.)

As the roll-out continued past the initial spark, decisions were delegated and made at the staff and district levels, rather than one or two individuals at the program division's headquarters (i.e. polycentric governance). This helped with staff engagement and learning with fewer politicized program decisions. Staff became more accountable and empowered - learning through experience and diverse relationships and building reciprocal trust [8].

6. **Planning for and creating short-term wins.** *Planning for and creating visible performance improvement was accomplished through the creation of program improvement recommendations during the "2-7-3"sparking phase of the initiative.*

This process was strengthened by the preparation for the retreat and its 7 workgroups [3]. The vision was well articulated and acted upon [1]. Barriers (problems) were well explained so the groups could focus on solutions using real examples [1]. Trust in a diverse body of participants was initiated [9]. After the initial retreat, collaborative workgroups were convened that brought in more practitioners into the change process. The resulting rescission of over 400 rules that were barriers to progress was considered "breaking the dam" and removing the conceptual and historic barriers to change [1]. Other actions such as delegating authority, leading by example, and shifting management from what was wrong to what was right and achievable (positive action and excellence in execution rather than perfection) also created short-term wins [4].

7. **Consolidating improvements and producing still more change.** *This is accomplished by building credibility and momentum.*

As indicated in item number 6 above, over 400 regulatory prescriptive rules were rescinded. Management maintained their leadership in the vision and hired, promoted, and developed employees who could implement the vision [1]. Through this, new projects, themes, and change agents were generated [1].

New division management, who had the opportunity to become familiar with a larger stakeholder group during the CSI retreat, began to interact with internal and external participants and lead the further transformation. New leadership began to shift program focus from what's wrong to one of what can be done [3]. Consistent with polycentric governance decisions were delegated to those staff with the knowledge to make the decisions [2]. Further, by letting staff know division management had their back there was a marked shift from forever living with one's mistakes (a focus on what was wrong)  to one of positive adaptive management [2].

Division processes were also refined to further build trust through productive relationships and teams. This included staff's technical and personal abilities (e.g. improved systems thinking, empathy/understanding of others' world, empowerment, and risk-taking and risk management within a paradigm of uncertainty) [7].

Management hired and promoted diverse staff that held diversity in experiences in both career and life [1]. This was felt to align with Kegan and Lahey's (2001) mental growth model. This model acknowledges that adults must grow into and out of several qualitatively different views of the world before they can master the challenges of life. Sustainable problem solving and being able to acknowledge mistakes is how complex problems get fixed (e.g., Dweck's, 1916, growth mindset, and a willingness to be vulnerable to embrace the unknown) as well as the ability to see the larger picture (e.g., SES). All of the discussants referred to these concepts as benefits of the social change process [10].

8. ***Institutionalizing New Approaches.*** *This is supported by articulating the connections between the new behaviors and successes and the development and implementation of a succession plan.*

Generally, the work identified in the previous steps became institutionalized and normalized where appropriate. Were the implementation fell short is two-fold:

i. Entropy in management and the mission over time [3]. Many managers involved in the initiating processes retired.

ii. Failure to continue to articulate, reinforce, and expand the guiding governance framework to staff, and other state program areas [5].

Further, the initiative needed more tangible metrics to promote skill sets. For instance, the terms *trust* and *system thinking* which help describe key system components are not well understood except at the intuitive level [2].

Since the social change was not instituted throughout the department or into other state program areas, this reinvention initiative was not insulated from external system shocks [6]. There was insufficient resilience to withstand external impacts. On one hand, we have a productive governance re-invention underway within Michigan's cleanup and redevelopment program. However, within the same agency at the same time, the agency's water program remained hierarchical as did other branches of state government. This form of governance contributed to what is now known as the Flint Water Crisis (see Box 1). As anticipated, instead of having the capacity to embrace the challenge with positive innovation, the counterproductive behavior of threat rigidity set in.

The vestiges of this hierarchical governance and power imbalance within state government after the crisis became public resulted in a loss of quality governance traction in Michigan's cleanup and redevelopment program. Contact with existing and previous employees of the Michigan Department of Environmental Quality revealed a reluctance to be able to continue with their depth and breadth of collaboration after the crisis became public until recent history. The agency appeared to revert to power-based hierarchical governance department-wide.

The threat and risk aversion robbed the agency of the capacities necessary to address this threat head-on with effective efficiency, a clear mission, logic-based approaches, creativity, and innovation [10]. (As indicated in the literature review, benevolent cooperative societies benefit from resource efficiencies – avoiding costly biological signaling against perceived adversaries (Bulbulia and Sosis 2011).

The residual impact of the Flint Water Crisis had a significant impact on the staff's ability to continue the initiative or willingness to take risks; many quit or retired [6]. Management became weaker, decisions became politicized, and staff lost leadership strength and the agency was no longer aligned with reinvention tasks at hand [6].

One of the discussants revealed that when the Flint Water Crisis occurred (2014), it was the staff of the cleanup and redevelopment program (e.g., the studied and socially changed population) who were the ones that had sufficient empowerment skills to volunteer to work within the Flint community. They held the capacities and positive collaborative supportive growth mindset [1]. They supported their program management [1]. This was not the case in the other State divisions which had not gone through governance reinvention that aligned with the QGF [3].

In summary, the lack of leadership and reinforcement thwarted the longevity of this social change shift. The Flint Water Crisis as well as the state's historic problems associated with PFAS (discussed in the next section) highlight the difficulties in shifting to the GQF, especially when dealing with vestigial power imbalances and lack of open interdependent resource exchange, trust, diplomacy, and the continuance of reciprocity within a governance system (e.g. the antithesis of the QGF governance).

4.4.2 Modeling and Systems Thinking
The conceptual systems model included in Figure 4 began as a simplified model of the key conceptual and theoretical components of the historic and preferred governance framework

(hierarchical to the QGF). As discussed earlier, this is a complex and nested system. To provide a more workable and parsimonious conceptual diagram, many of the details are not included in the documentation or the diagrams. The Comparative Conceptual Governance Model provided in Figure 4 reflects input from the co-learning sessions. The original model was revised to include the concept of a fixed and growth mindset which is part of the positive and negative feedback process within the system and aligned with the literature. While part of the literature, this concept was felt by the discussant to be a strong element of the success of the transition (which aligns with the QGF and its DCT). The model was validated through the one-on-one co-learning sessions with the discussants.

In discussing the concepts of the model, it was apparent we each speak and operate under different world views and there is no absolute agreement on terms and concepts. For instance, while many people use the term *trust* they cannot describe it in much analytical or empirical depth – it is more a feeling or emotion. Similarly, *systems thinking* is not part of their vernacular unless they have spent considerable time within the practice using *systems thinking*. Terms such as *seeing the bigger picture*, or *seeing the field or forest* were used by the discussants. Operating at a more emotional or general level makes it difficult to develop meaningful vernacular and train others in the elements of trust, trust-building, and systems thinking (see Kegan and Lahey 2003; Kelly and Kelly 2015). Given this chasm in disciplinary parlance or vernacular, the discussions reflect the general theory and application of the GQF.
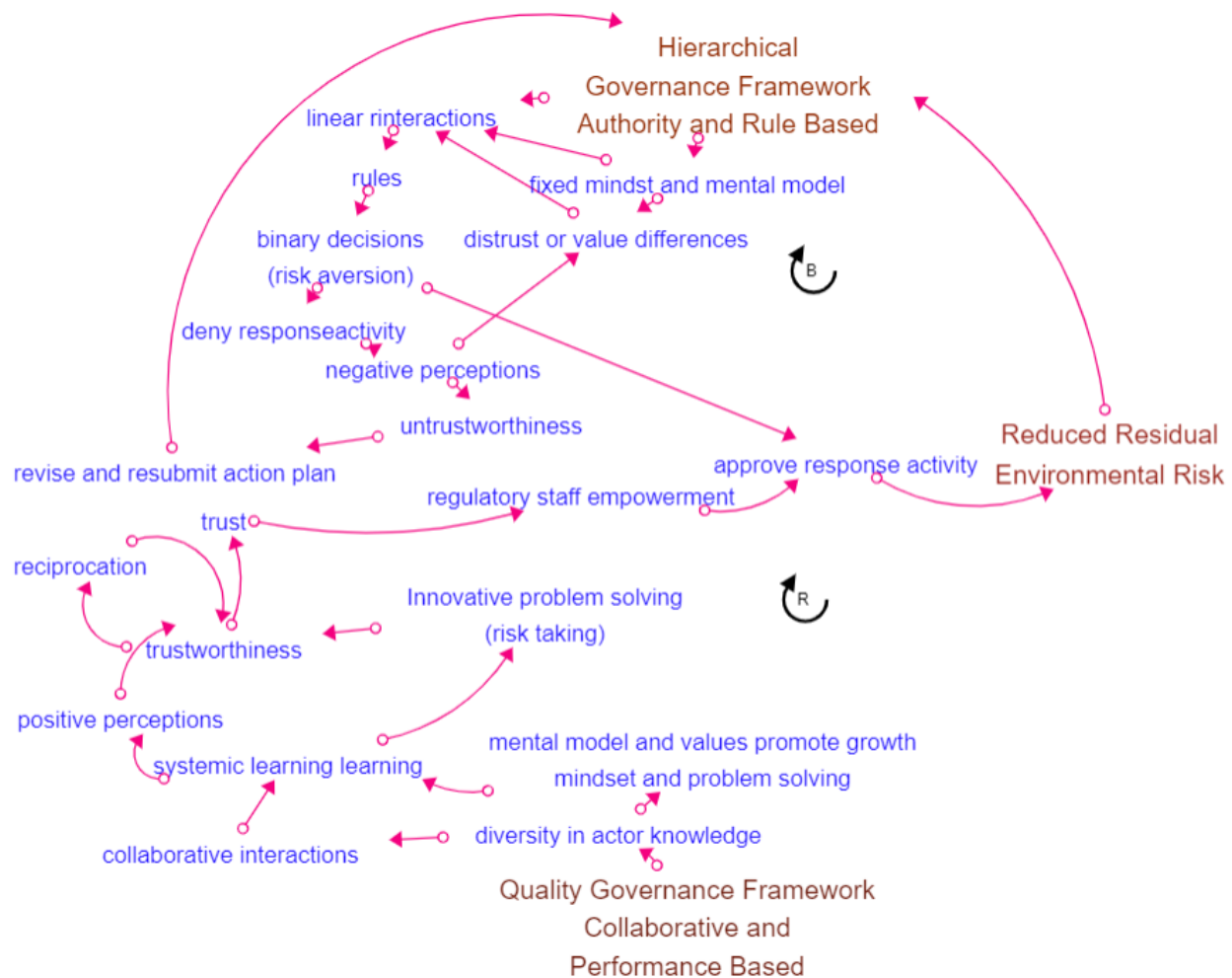
Figure 4. Comparative Conceptual Governance Model

The top half of Figure 4 depicts hierarchical governance. The operational relationships are internal and external to the institution as a superior and a subordinate (i.e., employee-employer or regulated-regulator relationships). These relationships are based on power and authoritarian rules and commands implemented through a linear structure. Decision-making is not delegated. The medium of the exchange is through the enforcement of statutes and regulatory rules and commands e.g., such as guidance documents or work rules). This form of governance is prescriptive – imposing or enforcing a rule or method. In the studied case the subordinate's work product was assessed against a set "menu" or "checklist". The reviews and responses are written

– the proposal met the statute and rules or it didn't (i.e. compliance is binary – with little room for risk assessment, problem-solving, or risk management).

Approvals went up the chain of command with an internal review process. Generalizing, if the work product did not meet the set of prescriptive rules and guidance documents, it was denied or sent back for revisions. Few if any cleanup (i.e. environmental and human health risk reduction plans) were approved under the hierarchical form of governance. A hierarchical governance framework may work for tame problems but not for are complex socio-ecological systems (SES) that present wicked problems. As stated in the introduction of the manuscript, incomplete, linear, overly simplistic mental models of SES often result in mismanagement of complex systems and unsustainable system behavior. Wicked problems have uncertain facts, disparate human and social values, high stakes, and urgency to mitigate or address the system behavior (Matso et al. 2008; Patterson 2006; Pielke 2007; Ravetz et al. 2013 Rittal and Webber 1973; Rousseau et al. 1998; Stern et al. 1992). This state program is a complex SES that aligns with a wicked problem. Under the hierarchical form of governance, the complexity of the system being regulated was not taken into account. It became an archetypical problem or trap (see Meadows and Wright et al. 2008). Instead of thinking deeper and adjusting the SES governance structure, we hang on to our existing values, norms, and cultures; blame, tinker, and work harder driving the existing system levers – not realizing it is the system structure itself that is the problem.

More specifically, there was a mismatch between the environmental and public health governance framework and the complexity of the SES being addressed. These wicked problems cannot be tamed through prescriptive rules. The uncertainty must be embraced and managed through deliberative processes that assess and *manage risks* through adaptive management, feasibility studies, and trade-offs – not by further seeking to control uncertain risks.

This governance system had no clear mechanism to build *ability* (knowledge of different values and perspectives); *benevolence,* or *integrity* (including procedural fairness) in implementation. The regulated community often felt that regulatory staff had no interest or faith in the regulated communities' interest in doing the right thing. The regulatory staff felt that the regulated community was disingenuous. However, this compendium of research has indicated that both the regulator and the regulated community generally wanted to achieve the same goal (McKay et al, 2017) [5]. There is another view of this as highlighted by the discussants.

A number of the discussants' alluded to the difficulty of the program staff to manage the uncertainty associated with the complex SES. The underlying motivational factor could stem from a basic lack of trust, bounded rationality, risk aversion, technical capacities, and associated disparities in values [5]. For example, several respondents referred to the propensity of regulators to use problematic approaches such as reductionist thinking nor a more holistic systematic view. Additionally, the co-learning revealed that program staff needed the training to improve their abilities to manage uncertainty [5]. Relying on empirical data from the 2013 and 2014 questionnaires and their analysis, the regulated community was perceived to have higher system thinking capacities (McKay, et al. 2017 and 2020).

Further, reviews and approvals tend to flow from the staff to management for ultimate decisions – with each step creating its own set of barriers or system reinforcement. Finally, there is little focus on building positive experiences and trust within the organization and between the regulator and the regulated community. Persons doing this work are likely not positively engaged - building meaning, and engagement. The upper portion of this mental model operates linearly yet the regulated system (e.g., uncontrolled hazardous substances in the environment) is very much a wicked complex system full of uncertainty and value disparities. One of the value disparities has been an attempt by some to minimize risk and uncertainty (or stive for no risk and uncertainty)

within a system fraught with uncertainty. In the alternative, a risk management or an adaptive management approach might be more effective in reducing environmental and public health risks [5]. For instance, there is a prevalent saying in the program that more data was sought instead of stepping back and truly assessing the risk and using risk management approaches. *One can never have too much data* and *perfection is the enemy of the good* are common program glitches [5].

These wicked problem phenomena were not being addressed. The causal loop model reveals bounded and fixed mindsets, laden with risk aversion. Risk aversion was manifested as excessive scrutiny and comprehensive reviews of the regulated entities' cleanup proposals – based on rules - not over-arching performance goals or guiding positive purpose and logic [2]. This process tends to rob staff of agency, social learning through peers, their beneficial risk-taking, and the development of independent judgment. Their mindset tends to become fixed.

Since there is little personal attachment developed through this process between the regulator and the regulated entity application, denial had low stakes for the regulator, but high stakes for the regulated community [1]. Denials were frequent [1]. This reinforced the balancing feedback loop and the disconnect between the regulated and the regulated entities world. Little environmental and public health risk reduction was occurring. Further, little trust is engendered. It is likely, based on discussant comments and the literature, that distrust was being established through value differences, negative perceptions, and the systems' positive feedback loop. Tied to ones' culture and values, distrust runs deep and is hard to reverse. Sadly, the system was self-reinforcing and maintaining residual environmental risk.

The hierarchical portion of the conceptual model can be contrasted with the bottom half of Figure 4 which is based on collaborative (i.e., QGF) governance. It contains more variables and potential action steps, each providing considerable reinforcement of improved environmental risk

reduction. This form of governance provides a continual potential for positive and collaborative interactions with the regulated community, maintaining an innovative growth mindset – adding to problem-solving experiences [10]. The staff builds skills and connectivity with others. This results in a reinforcement loop of a reciprocating growth mindset, diplomatic engagement, social learning, trust-building, and individual agency and empowerment. Overall interactions with the regulated community become positive – further reinforcing environmental risk reduction with shared goals and understanding. Under this governance system, decision-making becomes polycentric and disbursed to those with knowledge and the capacity to make the decisions [8]. This is discussed under the process subsection. Leaderships' role is to mentor and support staff. Risk aversion and threat rigidity are diminished and a positive work climate is developed.

*Research Question 1*
*1. What were the key elements of the cleanup and redevelopment program's governance reinvention initiative that contributed to improved program outcomes?*

The respondents provided context to the social change initiative. According to a few of the respondents, the State's cleanup and redevelopment program had stagnated under previous regimes and governance models. The previous governor abolished the Natural Resource Commission, the body which selected the agency's leadership and set policy direction. Without the independent commission, State environmental program leadership had become weak and politicized [4]. Weak leadership tends toward hierarchical governance, relying upon autocratic rules, power, and control rather than empowering staff through vision and leadership [1]. Politicized decisions are not based on system structures and related behaviors. According to Meadows and Wright (2008), these decisions reinforce the same behavior or worse and result in perverse policy fixes which drive further failure. Several external (e.g., representatives of the regulated community felt that politics harm progress. It undermines systematic, scientific, and logic-based progress [2]. The removal of a commission between the politicians and the program

has exacerbated this dynamic. While not explicitly a variable in the model, politics influences the governance system whether it is hierarchical or it aligns with the QGF. Politics drove the re-invention initiative. It may have also eventually undermined its progress. The latter matter of the re-invention having been undermined is discussed later in the findings.

Unless combined with a benevolent style, hierarchical governance tends to have a fixed mindset. Often the position is what gives authority, not knowledge or skill. If challenged, the actor can be easily threatened and resort to evolutionary-type responses such as aggression or avoidance (e.g., fight or flight, and denial). Or, in the alternative, succumb to our tendency toward heuristics or viewing our abilities as exceptional (e.g., attributional biases) and cloud cognition. The primal brain is tapped rather than logic [1]. As one discussant commented – typical government institutions tap you down; instead, they should empower and reward staff [1]. This is reflected in the comparative model. In this model hierarchical governance is based on authority, rules, and commands. The QGF is based on trust, social learning, and a collective growth mindset.

Every discussant [10] indicated that the shift from a hierarchical to a collaborative form of governance was desirable. It resulted in significant risk reduction as documented in McKay et al 2020. From the discussants' standpoint, the key elements were: the process that facilitated the shift (summarized in Section 4.1), collaboration and social learning that could support trust-building and an understanding of alternate and broader systemic views, staff empowerment, and delegated decision making. This is reflected in the difference in the comparative conceptual system model's structure and behavior.

Through this governance shift, staff felt they were no longer being silenced [2]. CSI provided a significant positive impact on the cleanup program and empowered its staff [2].

*Employees are great performers when there is reciprocal trust between an employee and their bosses* [1].

Empowered staff can tap cultural and social capital for innovation and creative good. They are risk-taking and seek better solutions to complex system problems [9]. This is part of a positive feedback system that builds knowledge and trust depicted in the QGF potion of the comparative model.

A discussant stated that one of the benefits of the re-invention was shifting the system dynamics and the vernacular from negative words and exchanges to those that planted positive seeds through words [1]. Discussions moved toward what one wants and what is possible. After all, both the regulated and the regulators wanted the same thing. The barrier to achievement has been our own culture and behavior. This barrier to progress is reflected in holding on to the familiar hierarchical governance framework when addressing complex and wicked problems that are fraught with uncertainty (i.e. the mismatch of governance frameworks to the problem at hand). The QGF allowed the regulators and the regulated to begin to collaborate to achieve a common goal.

The cleanup and redevelopment program migrated from one infused with linear thought and a negative culture to one with more positive interactions, holistic understanding, and a problem-solving mentality [1]. This more positive and holistic approach is consistent with systems thinking. The internal staff's role was no longer that of checking off a menu of requirements in proposals and viewed as an impediment to progress but to that of engaged participants and problem solvers. It is now an expectation that the regulators and the regulated will collaborate early on – a true cultural shift [1]. However, the complexity and uncertainty associated with the program's cleanup standards, have been a historic problem. The shift in governance did improve the rate of cleanup, but some staff continues to struggle with perfection and certainty in an uncertain domain where reliance on *excellence* is likely a better approach than perfection [4].

Collaboration brings unique and diverse sources of knowledge into the deliberations creating the potential for greater understanding and base knowledge for problem-solving. This improves transparency, trust, and problem-solving skills [2].

Further, authority was dispersed and regulatory staff started acting as a cohesive team. Cohesive teams support one another [3]. The majority of respondents felt trust emerged between the regulators and the regulated. Trust between the regulators and the politicians (and politically appointed staff) was not as strong [1].

As an indicator of the progress in cleanup activities, there were 158 cleanup actions approved in 2010, with no prior year reporting over 200 cleanup actions. By the end of 2013, 423 cleanup actions were approved (McKay et al. 2020).

In essence, under the QGF portion of the model, there was a substantial change in the regulatory staff's authority to interact. This resulted in practitioners internal and external to the agency feeling better about their regulatory interactions [2].

As for resolving all of the 7 technical program barriers, there were mixed results [3]. The majority of the discussants who still work within the program or related programs feel the initiative has lost momentum and needs to be reinforced within the cleanup and redevelopment program, and across other state divisions and departments [6]. This is discussed as we look at difficulties in continuing the trajectory sparked by the initial initiative.

In summary, consistent with the concept of collaborative governance and questionnaire data obtained in 2013 and 2014, the process and collaborative governance system was significantly successful and improved risk reduction in a very short time. As shown in the model, it is a positive, empowering, mental growth framework that building trust and provides productive ways to manage uncertain risks within complex SES.  However, additional training and reinforcement are recommended.

*Research Question 2*
*2. Which improvements persisted? If they persisted, what elements were key to their durability?*

Capacities that have remained are those associated with attempts at positive collaboration when addressing systemic environmental matters. This includes listening, brainstorming, orientation toward problem-solving, and implementable solutions [7]. This is a reflection of social learning and some ability to see the bigger picture and focus on a goal as articulated through an overall mission statement. This is reflected in the initial elements of the QGF which begins the positive feedback systems, that lead to trusting relationships and further progress in achieving environmental and public health risk reduction. For example, many discussants stated that interaction resulted in meaningful conversations with others, trust, and better program outcomes [7].

While still present, the depth and extent of collaboration seem diminished. Some of this was attributed to sheer workload and some based on a change in culture (discussed below) and a lack of strong leadership. Re-enforcement of the re-invention mission, its framework, and necessary steps previous to truly transform the culture of the program has waned [4].

The persistence of the collaboration component stems from an overall trend reflected in newly schooled students enter the workforce with these skill sets, and as an outcome of the Flint Water Crisis [1]. Along with the Flint Water Crisis, another environmental and public health issue dealing with the ubiquitous contamination associated with PFAS (e.g., Per- and polyfluoroalkyl substances) has challenged State resources. These chemicals are very persistent in the environment and bio-accumulate in the human body. There is evidence that exposure to PFAS can lead to adverse human health effects. (See Appendix B. Box 2).

Within the current governance, the staff is called upon to participate in numerous collaborative and social learning sessions. These sessions contribute to one's understanding of the larger issues at hand (i.e, the SES). However, workloads are overwhelming and not sufficiently prioritized.

Moving from discussion to action is a daunting process with the achievement of a risk reduction becoming a looming and distant goal [2].

*Research Question 3*
*Which improvements were not sustained? If not sustained, why were these improvements not sustained?*

In general, collaborative efforts are one of the remaining components of the QGF. Problem-solving capacities have reverted in a large part back to a form of hierarchical governance with considerable risk aversion – looking for certainty in an uncertain SES [6]. Risk aversion is even stronger in other departments such as the Michigan Department of Health and Human Services [3]. Risk aversion undermines a sense of positive collective progress, staff empowerment, and increases threat rigidity. This is problematic in a program that is charged with the management of wicked problems; the risk must be managed as well as the uncertainty inherent in the SES [3]. In this instance, the trend toward delegated authority (e.g. polycentricity) was reversed and returned to the pre-social change days with limited power dispersion. Further, much of the trust in people and the institution which was beginning to be built has been lost [6]. Once again the public is not benefiting from environmental and public health risk reduction. This is represented in a return to the hierarchical portion of the conceptual model and its negative feedback system relative to achieving improved risk reduction.

Consistent with this negative feedback within the hierarchical system, leadership, including transparency, and management strength has diminished [4]. Further, focus on the overall mission has been lost with competing messages and priorities being given to staff. The resultant workload does not align with resources nor is it maintaining a culture of risk reduction [4]. Politics and short-term directives and efforts are again driving day-to-day priorities [3].

This research also reveals humans bounded rationality and that not all people are able or have tapped the ability to think more slowly in systems [2].  This limits future growth.

To overcome this social dilemma better and deeper training in human behavior, systems learning, and beneficial governance approaches are necessary to make the unknown visible (one of the process goals). Only then can human decisions become more resilient and sustainable through effective governance. Table 2 provides a comparative summary table of key governance variables as highlighted in this longitudinal study and depicted in the comparative governance model (Figure 4), Research Questions 1-3 (i.e., R1, R2, and R3), and emphasized during the 2020 co-learning sessions. The relative timeline is also provided. One can observe the loss of QGF capacities over time.

Table 2. Comparative Summary of Key Governance Variables

| | Pre-intervention baseline | R1 (positive response pre-Flint) | R2 (positive response post-Flint) | R3 (negative adjusted to a positive response post-Flint) |
|---|---|---|---|---|
| Timeline | 2011 | 2012 | 2014 | 2020 |
| Governance accompanied by a clear mission or goal supported by leadership (key to process) | | ✓ | | |
| Polycentricity | | ✓ | | |
| Diverse collaboration | | ✓ | ✓ | ✓ |
| Staff empowerment | | ✓ | | |
| Trust (ABI) | | ✓ | | |
| Social learning | | ✓ | ✓ | |
| Systems thinking | | ✓ | ✓ | |
| Improved outcomes | | ✓ | | To be determined* |

* What can be said is that there are more sites needing risk reduction action than being addressed [1]. The number of risk reduction cases continues to increase. The addition of PFAs sites is just one example. This trend continues.

4.5. Conclusion

The literature has few examples of case studies that address transformative complex SES governance social change for resilient and sustainable outcomes. Improving the trajectory of complex SES outcomes is largely a human cognitive and social change effort (Babbie 2010; Gooyert and Grobler 2018; Hirsch, Levin, and Miller 2007; Meadows and Wright, 2008). It requires an intentional shift in culture, institutions, individuals, their thinking, and their governance (i.e. decision management). Often it requires moving from tame problem solving to wicked problem management. In the studied case there was incongruence between the environmental and public health SES risks and the governance approach necessary to manage the risk. A social change initiative was undertaken to improve upon risk reduction in a State of Michigan cleanup and redevelopment program.

To improve upon the success rate of social change, one needs to understand the underlying causes associated with the SES failure. Understanding, in this case, requires a process of learning

what SES does, how and why they work, how to create or modify them, and eventually how to convey that knowledge to others (Ostrom 2005). Aligning with McGinnis and Ostrom's (2014) recommended approach to improve upon our understanding of the complex dynamics of SES, this case study research took a social science and evaluative approach to an intervention initiative to shift from a hierarchical form of governance to the QGF. We relied upon literature, including longitudinal empirical data from mixed methods and applied action research, the associated case study and its actors, change management processes, and conceptual systems modeling. Combined, this work can inform the diagnosis of systems failure and *how* to design governance or treat to achieve requisite SES change for environmental and public health risk reduction through governance. Specifically, action research and actors' mental models are mined and summarized to demonstrate what efforts worked and the reasoning behind those successes, and how and why a successful transition effort was eventually thwarted. Documenting the social change effort, the process followed, and depicting the major elements of the hierarchical and QGF (pre and post-treatment governance) in a conceptual causal loop diagram shed light on the shift to governance that aligns with more durable SES outcomes. This work contributes to *how* requisite real-world social change within SES and the system dynamics field can be achieved.

Using conceptual models and practitioner perceptions through learning sessions, this phase of research reveals the shift in governance was embraced by the majority of the queried practitioners.

Key overarching responses revealed the following regarding the governance reinvention initiative:

- A clear mission statement and the process were key components in sparking the shift in governance and improving SES outcomes

- The shift in governance moved from a culture associated with what is wrong or a negative and fixed mindset to one focused on possibilities, and a positive growth mindset

- Trust among the practitioners began to emerge

- Systems thinking emerged through collaborative social interactions and learning

There was a breakdown in the positive trajectory over time. It is hypothesized that this was four-fold. As within any system, these are not separate silo issues. Each influences the other. For ease in discussion and delivery, they have been separated.

1) The progress initially made was based on an opportunity with sufficient capacity to achieve remarkable social change (e.g., following Kotter 1995). High performance was achieved from which the future and succession are then compared. For example, innovation, diffusion, and adoption were rapid and risk reduction rates were remarkable (McKay et al. 2019).

2) Insufficient capacity was maintained and the mission lost leadership and focus. Reasons for this appear to be based on the vestiges of governance silos remaining within adjacent divisions and departments (e.g., a larger system). For example, when those programs failed, (e.g. management of the Flint Water Crisis and PFAs) the larger governance system succumbed to threat rigidity. This reversal in governance and loss of trust and positive expansive systems thinking had wide-reaching and detrimental effects on SES environmental and risk reduction metrics. Unfortunately, primal unproductive human instincts and regression took hold. As revealed in this manuscript, threat rigidity is counter-productive to taking productive steps to address the failure. Instead, progress is undermined and extensive collateral damage tends to occur. As revealed in the literature, a culture of altruism wins over cultures lead by rational egoist or egotistical behavior. But yet we have not sufficiently learned how to embrace this higher-order

thinking. We succumb to the basic primal functions of our brains (Kahneman 2011, O'Donoghue and Rabin, 2003).

3) The failure to continually rely upon and enforce the 8 steps in transformation and embody it in a clear and longer-term succession plan resulted in gaps in understanding and the further dispersion of capacities to move the social change effort forward. For example, *the theories and processes* (the *how and why*) of the transformative change process were insufficiently normalized within individuals and the institutional leadership to achieve the mission. Potential and actual threats to the initiative arose through:

i) Early abandonment of the comprehensive guiding coalition. This led to a loss of beneficial collaboration (e.g. diversity in expertise and base knowledge about governance initiatives and boundary representatives - such as those able to connect the program with the theory, and those who can guide the agency and practitioners through trusting relationships and adequate systems thinking). Further, the lack of a clear and intentional succession plan resulted in organic entropy, attrition, and regression undermining the sustainability of the reinvention progress.

ii) Not developing depth in ranks and of the concepts and theories behind quality governance (e.g., developing a deeper understanding of the QGF and its DCT within the staff and the next leaders). For instance, many of the base concepts and underlying frameworks behind the shift were not visible or understood by the succeeding leadership after the Coordinating Committee was disbanded.  This is evident through the lack of a comprehensive understanding of the GQF, and the meaning of concepts such as trust and systems thinking in recent discussions with participants. Without this deeper understanding actors revert to a heuristic level and are not primed to be to build on the legacy with deeper sense-making, normalization, and accompanied

mental models. More resilient and durable social change can prevail once these concepts become more thoroughly understood and normalized by practitioners.

Given its roots in genetic-cultural evolution, social change is extremely hard to achieve, often taking generations (Gintis 2011, Manfredo et al. 2016). Within the institutional context, leadership comes and goes, and unless sufficiently fortified, complex SES governance is at the whims of the new leadership. Given the myriad of conflicting values and challenges to our founding democracy for the benefit of the whole, our value and governance systems need fortification to tackle our wicked problems. This research can help inform *how* to transform individual and institutional governance to mitigate our trajectory and improve complex SES outcomes.

CHAPTER 5. DISSERTATION CONCLUSION AND RECOMMENDATIONS

## 5.1 Conclusion

Our SES trajectory presents numerous challenges given the complexities of the problems we face.

Wicked problems have uncertain facts, disparate human and social values, high stakes, and urgency to mitigate or address the system behavior (Matso et al. 2008; Patterson 2006; Pielke 2007; Ravetz et al. 2013 Rittal and Webber 1973; Rousseau et al. 1998; Stern et al. 1992).

These problems require improved human and organizational capacities that depart from our prevailing culture, values, behaviors, norms, and institutions. One such example is the continuance of relying upon hierarchical governance for the management of wicked problems. Hierarchical governance is typically a linear structure that relies upon authoritarian power, command, control, and prescriptive rules. Wicked problems are fraught with complexity and uncertainty. No one person can practicably hold or represent all knowledge of the uncertain and complex system, nor can SES be managed with a predetermined set of rules and commands.

*How* to tackle human decision management (i.e. governance) when tackling wicked SES problems for improved outcomes is not well addressed in the literature or practice. This research provides insight into the underlying problems and barriers to achieving requisite social change when tackling wicked SES problems. It also provides a framework and process by which improved SES governance can occur.

Through this effort, a Quality Governance Framework (QGF) and a Diagnostic Capacity Tool (DCT) were developed and tested to assist in diagnosing and treating SES for durable outcomes (See McKay et al. 2017, and 2020). Durable outcomes, in this case, were framed as environmental risk reduction associated with uncontrolled releases of hazardous substances into the environment, and improved quality of life. The QGF and DCT rely upon collaboration, polycentric and network-based governance, and structured deliberative decision processes fortified through a governance structure and culture of diversity in thought, trust, reciprocity, and systems thinking.

The State of Michigan cleanup and redevelopment program's attempt to reinvent itself for improved SES outcomes provided the case and its internal and external practitioners provided the study populations. The reinvention initiative made strides in replacing linear rules and command and control hierarchical governance, with a QGF style of governance. QGF governance was theorized and in this case, demonstrated a significant reduction in SES environmental and human health risks. A key component of the QGF is acknowledging the complexity and uncertainties associated with SES. The QGF relies on collective approaches that allow for the co-creation of knowledge through the inclusion of diverse and engaged actors collectively achieving a better understanding of the complex system, trusting and reciprocal social networks, and system thinking capacities designed to achieve a performance goal through a structured decision-making process. This form of governance can build human capacity (i.e., empower staff through increased knowledge and trust for sustainable action). This research's longitudinal data revealed:

1) despite numerous stakeholder processes to resolve the disparity between the regulated and the regulators and poor environmental risk reduction outcomes, both practitioner groups preferred program governance framework was similar – meaning the regulators and the regulated practitioners wanted the same program outcomes (McKay et al. 2017).

2) the preferred governance approach departed from linear, hierarchical governance (e.g., unilateral decision making) to one that is more collaborative (e.g., network and trust-based), and used concepts associated with systems thinking (McKay et al. 2017, 2019).

3) the state's cleanup and redevelopment program's migration to a more collaborative governance framework resulted in improved SES outcomes as revealed through risk reduction metrics and respondent perceptions (McKay et al. 2019).

4) governance innovation, diffusion, and adoption (e.g. social change or transformation) were rapid and risk reduction rates were remarkable (McKay et al. 2019).

5) revisiting the initiative approximately 10 years after its initiation revealed positive outcomes with significant durability challenges and regression stemming from a lack of trained and fortified succession planning leadership. As the guiding coalition and leadership waned, insufficient knowledge and momentum remained to avoid regression to heuristic norms and cultures.

Through this case study, we are beginning to understand *how* we need to tackle human transformative governance associated with wicked SES problems. This transformation can be sparked by intentional social change management efforts at the requisite individual and institutional levels. To support its durability, the transformative processes must become transportable and begin to feed a paradigm shift. One such step is widening the breadth of knowledge through outreach, taking advantage of opportunities to broaden individual and institutional understanding of productive and unproductive approaches to shifting our culture, values, behaviors, and norms. We must strive to normalize new governance theories; our future SES depends on it.

This dissertation illuminates the misalignment between the challenges we face and the way we operate on an individual, institutional, and policy level. As the literature reveals, given our cultural evolution, many humans use simplified linear thinking, short-term self-interest, and a fixed mindset when dealing with complex SES dilemmas (e.g., bounded rationality, see Chapter 4, Section 1.2.; Ostrom 1998). Those with a fixed mindset and oversimplified thought are less likely to reveal the true ramifications of one's thoughts and decisions. This mindset tends to not embrace change for the betterment of one's self or the betterment of the collective whole, leaving them and others worse off. (See the discussion of threat rigidity in Chapter 4 section 1.2; Ostrom 1998).

These bounded rationality and governance tendencies affect our SES governance. Additionally, given our cultural evolution, we have not seen ourselves as part of the complex systems in which

we live, nor do we have a true understanding of how SES function or the system's purpose. According to Meadows and Wright (2008), one must study the system to know its purpose. A system's purpose is *deduced from its behavior, not from rhetoric or stated goals*. Systems often operate contrary to one's intended purpose. For instance, many hold on to the view that technological advances or the pursuit of economic development make lives simpler without understanding how the larger interconnected system and subsystems function. Potential unintended consequences of preceding this way can be illuminated through a system's subsystems such as the economic and environmental costs of living increase which may, in turn, contribute to an ecological deficit and an economic divide.

Focusing on complex SES, wrought with uncertainty, we often approach these complexities in simple linear ways, repeating our past with short-sighted and incomplete steps that often push the SES in the wrong direction – defeating what truly matters (e.g. improved and holistic SES outcomes). Incongruently, individual, and institutional governance still tend to approach these as tame problems – heuristically assuming that one can effectively manage the uncertain risk with certainty. This type of thinking and SES management results in an archetypical trap. Instead of recognizing that system hierarchies evolve from the lowest level up – from the pieces (e.g. individual or cells) to the whole (e.g., institution), our governance structures have reversed the role of hierarchical governance to one that is top-down, controlling its parts and resulting in a malfunctioning system (Meadows and wright 2008; and see Chapter 4). To be a functional system, the governance system must balance the welfare of a system's sub-systems with the total system – controlling only for achieving the larger system goal – while keeping the subsystems flourishing and self-organizing (Meadows and Wright 2008). Ensuring that both the system and its subsystems thrive is consistent with resilience theory. This management approach

is complicated with no simple magic bullet. Further, there are no cheap tickets to mastery of a system (Meadows and Wright 2008).

## 5.2 Recommendations

As it relates to our misalignment between the challenges we face and the way we operate on an individual, institutional, and policy level functional improvements can be achieved by deliberately moving from linear command and control rule-based hierarchical governance to a QGF that aligns with the complexities of our SES dilemmas. The social dilemma is *how to shift* the paradigm from our rote governance that relies on our bounded rationality to one that would be aligned with sustainable SES governance. In this case, the QGF, its DCT, and the transformative process of this dissertation are informative. The following conceptual recommendations, or design principles, are provided as lessons gained from this dissertation that may assist in future transformational SES governance change or paradigm shifts.

Thomas Kuhn (1996), the author of the seminal book about the great paradigm shifts in science states that we must keep pointing out the anomalies and failures in the old paradigm. Act visibly with assurance (Kuhn 1996). Kuhn (1996), Meadows, and Wright (2008) state that change agents and leaders be publicly visible and hold sufficient agency to work with other active change agents and with the vast number of open-minded [and system thinking] people.

This attempt at a shift should also recognize that humans are fallible and that there is no certainty in any worldview. Keep the goal on a universal purpose, (e.g., the 6 principles of sustainability which recognize the laws of nature and civil/ethical society, Miller and Spoolman, 2016). Allow for self-organization within that goal or purpose, and learn to be open and dance with the system rather than holding on to an existing [linear or malfunctioning] paradigm (Meadows and Wright 2008). Avoid archetypical system traps (See Meadows and Wright 2008).

As individuals within these larger systems, we need to shed our need to maintain the fiction of how we are perceived (i.e., a popular and positive image of ourselves). Rid ourselves of denying

our fallibility and using defensive behaviors rather than viewing it as an opportunity to grow (Chugh and Brock 2018; Dweck 2016). These human behaviors stunt cognitive growth as well as the health of our SES through humanly constructed or influenced institutions and related systems - producing problematic or perverse behavior (Chugh and Brock 2018; Meadows and Wright 2008).

In the alternative to self-promotion, we must embrace the science that altruistic or beneficial positive reciprocal social ties are critical to the success of our species and institutions. Those who display kindness, altruism, and social intelligence rise in social power and evolutionary fitness regardless of one's status (Gintis 2011: Keltner 2017). Axelrod and Hamilton (1981) state that the benefits sought by living entities are disproportionately available to cooperating groups; it is a fundamental basis for all social life. Not only do these benevolent cooperative societies benefit from resource efficiencies – they avoid costly biological signaling against perceived adversaries (Bulbulia and Sosis 2011).

Shifting from the archetypical trap of hierarchical governance and aligning with the QGF would result in improved and sustainable SES outcomes. This updated form of governance recognizes and encourages the normalization of:

- the need to move toward a higher SES purpose, goal, or mission that recognizes the concepts of sustainability, resilience, our social and ecosystem interconnectivity, and the complexities of our natural world and niche expansion
- recognition of all the subsystems necessary for SES health and goal achievement
- the need to collaborate and provide positive reciprocal and trusting bonds for the benefit of society as a whole
- incorporate tools and processes that conceptualize complex issues and improve decision making and implementation

- embrace a culture of positivity, vulnerability, and a growth mindset and use every opportunity in formal and informal learning to point out the anomalies and failures of existing governance systems

- accelerate SES learning in a way that promotes problems identification and sustainable problem=solving in the real world for the benefit of the collective whole

- delegate decision-making to those closest to understanding the components of the system along with building a diverse knowledge base and co-learning opportunities for successful succession.

- incorporate diverse participation in deliberate discourse and co-learning regarding science, uncertainty, values, and trade-offs

- account for the interconnectedness, stochasticity, and long-term side effects of the holistic and complex system for improved, sustainable and resilient SES outcomes

The theory and overall goals, culture, and structure of the QGF can be augmented with Kotter's (1995) 8 steps for leading transformative change which follow. These steps provide more specificity of organizational and social transformation learned through this dissertation. These discussions are not exhaustive and are provided as examples of addressing the steps. These lessons learned are augmented with my experience as a practitioner, a program manager in the SES field, and as a researcher, college professor, and university instructor. In carrying out this process, the QGF and its DCT should not be forgotten, but integrated.

- **Develop a realistic sense of urgency.** This step of the process is a call for action. Examine the realities of our current crisis and trajectories along with opportunities. Building on this dissertation's research, we must focus on the individual, institutional, policy, and environmental components as a connected system. We must be able to

articulate the interconnectivity of the SES. *Urgency achievement* must be incorporated into our discourse. For instance, in the studied case, the misalignment of using tame problem cognition and problem-solving approach when addressing a complex system must be made clear. This can be fortified with theory and data as opposed to platitudes and simple linear thinking and sound bites. Engage and carry out meaningful discourse and co-learning that dives into one's over-simplistic thinking or emotional response. Course work and collaborative discussions need to guide improved systems synthesis using higher-order slower systems thinking versus heuristic thinking (e.g. thinking slow versus thinking fast, Kahnemen 2011).

Know your blind spots and manage them daily (Tedlow 2011). Ones' own perceptual biases should be challenged using a positive demeanor, engendering trust, and by working through a deeper analysis of its basis and its reflection of reality. Intercepting biased thinking by deliberate slower thought is used in some implicit bias training modules. While this discussion is at the individual level, it can and should be done at the institutional and policy level. Challenging ideas should be embraced as a means of improving conceptual strength.

- **Form a powerful guiding coalition.** Strategically establish quality governance framework coalitions to tackle complex systems problems. These coalitions must be diverse with sufficient quality governance knowledge, leadership, and systems thinking aptitude to guide transformative change. This should begin with an understanding of the larger issues and the systems that are ripe for transformation. Both society and academia need to partner in this social change effort to improve collective understanding for the benefit of the whole.

Focused change at both the individual and institutional levels can begin through both formal and informal education. For example, participation, collaboration, and group work were brought into the academic curricula. The vestiges of this pedagogical approach held in this research's case study, with respondents indicating new employees were used to this approach. However, there are still individuals who operate in a non-collaborative and authoritarian manner.  This can be addressed by understanding that some behaviors and norms that helped us survive, are no longer the ones that will help us tackle the complexities and uncertainties of our current world. Examples are related to authoritarian behavior rather than authoritative and collective altruistic behavior, and that collective polycentric decision-making is aligned with addressing complex SES versus a set of prescriptive rules. These vestigial mindsets need to be exposed for what they are while encouraging positivity, trust, robust systems thinking, and a willingness to be vulnerable to achieve cognitive growth.

Coalition leadership must be trustworthy and respected leaders, with the ability to mentor and empower others to be future change agents. They need to have the confidence to let go of their worldviews if better ideas are presented. They should be straight talkers and be able to speak truth to power, and leadership needs to be able to listen  (Tedlow 2011). Leadership must adopt a long-term perspective (Tedlow 2011). Leadership should be selected with objective criteria and not be disruptive to the collective process and its goals. Too often teams are selected by those who think alike or with those who are familiar. This type of thinking has resulted in our environmental and human health SES governance challenges.

- **Creating a vision.** Create the vision and strategies to achieve a more resilient and sustainable SES. Following the previous bullet, the development of systems thinking can

be used as an example for implementing this step. While systems thinking and systems dynamic has been around for quite some time, it is not part of our common social understanding. Neither is student lead innovative problem solving as a pedagogical method that translates into real-world work and problem identification and problem-solving skills.

A strategy to achieve improved systems thinking is to challenge people's understanding of the topic including its systemic components. Educational institutions can do a much better job of practicing critical and systemic thought. Too much of the educational system is based on learning content without understanding its real-world implications within a system. Knowledge learning in one domain does not necessarily or readily translate into another domain. Without working through pre-conceived notions, existing biases are heuristically relied upon. How this can be carried out is discussed under communicating the vision.

- **Communicating the Vision** Use every vehicle possible to communicate and teach new vocabulary and behaviors by example and through intentional pedagogical approaches. A simplified example can be drawn from teaching SES in environmental science. Many people falsely believe that the world's population growth rate is still exponential. A unit teaches about ecological footprints and the impact of consumption on the planet, especially from affluent societies. Affluent societies' population growth rates are lower than the replacement value. However, when querying the students to determine whether population or consumption is a bigger environmental problem, students often fall back to their initial bias and say population growth is exponential and a bigger problem than consumption. This can be overcome in many instances by teaching these concepts as an interconnected system. But this isn't how it is delivered in many situations – it is often

taught as individual content without practicing integration and systems application. Often instructors don't even think in systems themselves. More activities that rely upon the integration of subsystems within an overall SES, including the human and institutional behavioral need to become more visible and incorporated into practice.

- **Empower Others to Act on the Vision** Get rid of obstacles to change. Use every opportunity to use the concepts embodied in the QGF including insights into human and institutional behaviors, systems thinking' and systemic approaches where it truly matters. Empower change agents. Don't promote mediocrity. The more robust the social connections, the fidelity of transmission, and culture diversity, the more these and other tools will exist in individual, institutional, and policy developers' toolbox to innovate, disperse that knowledge, feeding more collective brainpower which is an antecedent to social change. In the alternative, isolation, stagnant culture, and low diversity limits social learning.

- **Planning for and Creating Short-Term Wins** Planning and creating actual improvements. Recognize and reward those involved. Embrace, amplify, and celebrate those that meet the challenge and who are true change agents. Make attempts to normalize this improved way of thinking and governance. Again, intercept and challenge one's own biases and that of others through positive inquiry that builds trusting relationships. Begin to normalize this new vocabulary and improved thinking and behavior.

- **Consolidating improvements and Producing More Change** Use increased credibility to change systems, structures, culture policies that don't meet the goal or mission. Hire and, promote and develop employees who can implement the vision. Reinvigorate the process with new projects and change agents. Learn to dance with the SES and embrace

new change. Use these successes as an example and share successes in ways that others can learn from them.

- **Institutionalize new approaches** Articulate the connections between new behaviors and success to make them visible and available for other change initiatives. Develop the means to ensure the durability of leadership development and success. Make this step an element of all implementation plans. This dissertation showed the effects of not continuing with this transformative process and its underlying theories well beyond the initial spark. All transformations and paradigm shifts take reassessment, adaption, and maintenance. Take critical and intentional action to ensure the continuance of social transformation.

What often happens in an institution is the effect of threat rigidity or new leadership with new ideas. While perhaps too ideal, we need to continue to push for the implementation of ideas that align with the QGF, learning how to articulate with positive conviction the resilient and sustainable benefits of the QGF. Promote this way of governance through improved cognition, systems thinking supported by theory and data. We need to counter the whimsical thinking of others and learn how to dance confidently and successfully within complex systems - moving from recipes to cognitive enlightenment and creative intuition. Transcend the tame life and learn to embrace our wicked SES problems.

APPENDICES

APPENDIX A

Co-learning Session Protocol
IRB Study 00004823

AIM

This research aims to help validate a causal loop diagram or systems dynamic model. This research component contributes to understanding *how* socio-ecological (SES) outcomes can be improved and social change can occur given complex social dilemmas. Contemporary examples of complex SES decision-making relate to climate change, genetic engineering, the COVID 19 pandemic, and the State of Michigan's Cleanup and Redevelopment Program. Each of these topics is mired in social, economic, natural resource, cultural, and ethical issues.

The foundation of this dissertation chapter work builds on the previous chapters that established the Quality Governance Framework and its Diagnostic Capacity Tool. Earlier work was conducted through IRB#13-019e, Category Exempt 2. Since this IRB approval is not in the new CLICK system, we were requested to submit a new IRB.

To complete this chapter, we will invite seventeen participants of the Collaborative Stakeholder Initiative to share insights into their mental models of the governance shift that was initiated/occurred during the previous study. The focus will be on components of the governance change process that contributed to (or thwarted) improvements in the cleanup and redevelopment program.

BACKGROUND

The capacity to sustainably govern complex SES has been identified as a necessary but daunting task by SES scholars, resource stewards, and stakeholders. There is a great need to improve our capacities to think and communicate in ways that reflect the realities of our interconnectedness within complex SES and to contribute to the resolution of real-world problems through social change initiatives. The complexities associated with SES tax our cognition and historic ways of governance. These matters cross disciplines, with no person possessing the knowledge to singly

address the issue. Using contemporary governance theory, the Cleanup and Redevelopment Program's Collaborative Stakeholder Initiative was designed to spark a governance change initiative for improved and durable SES risk reduction outcomes. This initiative built on the theories of systems thinking capacities, network-based governance, and structured decision-making processes to shift from a hierarchical form of governance that relied on authoritarian rules and commands. The program's improved outcome goals included the use of adaptive management practices, the balancing of socio-economic issues with human health and environmental risk reduction, and overall improved quality of life for Michigan. The desired governance approach tackled the socio-ecological "system" complexities and departed from linear or siloed governance.

Concurrent with the Collaborative Stakeholder Initiative, empirical research was conducted and two peer-reviewed academic papers were subsequently published. The findings of the research revealed:

1) despite numerous stakeholder processes to resolve the disparity between the regulated and the regulators, and poor environmental risk reduction outcomes, both of these practitioner groups *preferred* program governance framework was similar – *meaning the regulators and the regulated practitioners wanted the same program outcomes* (McKay et al. 2017).

2) the preferred governance approach departed from linear, hierarchical governance to one that is more collaborative (e.g., network and trust-based), and used concepts associated with systems thinking (McKay et al. 2017, 2020).

3) the state's cleanup and redevelopment program migrated to a more collaborative governance framework which in turn resulted in *improved SES outcomes as revealed through risk reduction metrics and respondent perceptions* (McKay et al. 2020).

4) governance innovation, diffusion, and adoption (e.g. shift) were rapid and the number of Increase risk reduction rates was remarkable (McKay et al. 2020).

*Given these findings will seek practitioner perspectives on this shift in governance and improved program outcomes and compare their perspectives to the mental model that contributed to the QGF and DCT. This model focuses on aspects of social learning and trust development in achieving improved risk reduction using theories associated with Network-based Collaborative Governance.*

PROTOCOL

In this research, we will be going back to a select few of the initiative participants, based on their intensity of involvement in the Collaborative Stakeholder Initiative (the initiative used as a case study under IRB# x13-019e), and key Initiative Conveners. The purpose is to conduct personal interviews with approximately 10-17 persons to obtain their perceptions regarding the sustainability of the shift in program governance. These interviews will be used as one means of validating or refuting the researchers' systems change model.

The 17 persons identified were selected from the previous participants and were vetted with the Initiative Conveners, to ensure active participation in the case before and through the entire social change initiative.

These persons will be contacted to see if they are interested in an informal discussion to articulate their perspectives of the social change initiative in general, tied to the Quality Governance Framework and associated Diagnostic Capacities. Contact will be made via social media (e.g. LinkedIn, email, and telephone. Interviews will be conducted through social distancing and mostly via the telephone. The researcher will discuss the confidentiality agreement, and follow up with signatures (or receive their concurrence), and take notes.

Research Questions for the Participants:

From your perspective

1) What were the key elements of the Cleanup and Redevelopment program's Collaborative Stakeholder Initiative that contributed to improved collaboration?

2) What were the key elements that contributed to the perceptions of improved response activities and validated by the increased number of interim response activities?

3) a. Which program improvements were sustained?  If so, what elements were key to their sustainability?

3) b. Which improvements were not sustained?  If so, why were these elements not sustained?

4) Systems thinking is a disciplined way of understanding dynamic relationships and avoiding unintended consequences.  Did the collaborative stakeholder process improve practitioner understanding of various interdependent components, alternative approaches, and leverage points for tackling improved intervention?

Depending on the participants' mental model or area of focus additional questions will be asked that dive deeper into the Quality Governance Framework and associated capacities with a focus on trust-building and social learning. For instance, trustworthiness is comprised of skills and abilities, compassion or benevolence, and integrity (e.g., doing what was promised or the right thing for the right reason). Social learning is related to one's willingness to be vulnerable and have trust in another.  Other capacities include a willingness to learn from others and recognize that others, even those who are different or unique may hold and contribute relevant information. Handwritten notes are typed up for the record. Interviewees will also be asked if they wish to remain anonymous. The official record will have names redacted for those wishing to remain anonymous.

The responses will be summarized as a validation test of the trust and social learning model proposed for the last research chapter of my dissertation.

If the person does not exhibit comfort in discussing mental models, I moved on and used the following prompts. These prompts will follow the participants' lead in the discussion to support an informal dialog and allow for the emergence of their issues and their mental model.

From your perspective.

1) What is your overall perception of the Collaborative Stakeholder Initiative?

2) Was it successful, and if so in what ways?

3) If it wasn't successful, what were the reasons, or which aspects thwarted success?

4) What were the key elements of the Cleanup and Redevelopment program's Collaborative Stakeholder Initiative that contributed to improved collaboration?

5) What was the role of trust (and its sub-elements of ability, benevolence, and integrity)? [i.e., trustworthiness is comprised of skills and abilities, compassion or benevolence, and integrity (e.g., doing what was promised or the right thing for the right reason).

6) Did learning take place among diverse persons? Can you elaborate and give examples? [i.e., Social learning is related to one's willingness to be vulnerable and have trust in another. Other capacities include a willingness to listen and learn from others and recognize that others, even those who are different or unique, may hold critical and relevant information.

Depending on the conversation, I will take a deeper dive and ensure the elements of the model are covered as may be appropriate to the discussion and comfort level of the participant. For example:

What capacities contributed to trust and social learning? If a prompt is needed I will run through the main capacities from the Diagnostic Capacity Tool. These include the following:

Empowerment

Networking and team-building

Leadership

Trust

Looking at alternative approaches

Diversity in thought and experience

Were regulators and the regulated able to problem solve

Did the program participants move toward improved systems thinking?

Did environmental and human health risk reduction occur?

Did program progress continue after the Flint Water Crisis? (Elaborate regarding its impact

– if they know or feel comfortable discussing.

I will also dive deeper and discuss their perceptions of hierarchical governance versus collaborative (Network-based) governance. (i.e. one is linear and relies on rules and authority; the other relies on trust and reciprocity). I will probe their concepts and thought on this and its tie to systems versus menu-driven (i.e. prescriptive rule) assessments.

APPENDIX B

Flint Water Crisis and PFAS Summaries

Box 1.

*There seems to have been a system governance failure, where lead contamination in municipal drinking water impacted human health and deepened distrust between the community and government authorities, and shocked the nation. Checks and balances and necessary accountability in the governance system were lost or were not present when the state-appointed emergency manager made key decisions that contributed to the water crisis and human exposure to lead. The water crisis was precipitated by a decision to switch the source of public water supply for the city of Flint, Michigan from treated water from Lake Huron and the Detroit River to a less costly—but chemically different—source of water from the Flint River. Due to insufficient water treatment and corrosivity of the Flint River water lead leached from water pipes into the drinking water and exposed more than 100,000 residents to elevated lead levels. Other problems followed that related to governance and communication of the ensuing consequences. The hierarchical governance approach present in the Flint water crisis differed significantly from the participatory, polycentric, network-based approach that the State had engaged previously to meet its environmental issues. Governor Snyder himself is quoted in the U.S. House Joint Committee Report (2016) as saying "Let me be blunt…[Flint] was a failure of government at all levels—we failed the families of Flint." What did work was the courageous role and agency of Flint's engaged citizens, other bold individuals who challenged governmental leadership, and investigative reporting by members of the press (Flint-Advisory-Task-Force 2016). These persistent efforts helped uncover and illuminate the environmental and public health issues so that corrective measures could begin. (from Cockrell et al. 2020)*

Box 2

*Per- and polyfluoroalkyl substances (PFAS) are a large group of man-made chemicals that include perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). These chemicals have been used globally during the past century in manufacturing, firefighting, and thousands of common household and other consumer products. These chemicals are persistent in the environment and the human body – meaning they don't break down and can accumulate over time. In recent years, experts have become increasingly concerned by the potential effects of high concentrations of PFAS on human health. One major route of exposure is its presence in drinking water.* Michigan Department of Environment, Great Lakes, and Energy (EGLE) listed just under 140 individual PFAS source areas (August 8, 2020).

*On February 4, 2019, Governor Gretchen Whitmer signed Executive Order 2019-3, establishing MPART as an established, enduring body to address the threat of PFAS contamination in Michigan, protect public health, and ensure the safety of Michigan's land, air, and water, while facilitating inter-agency coordination, increasing transparency, and requiring clear standards to ensure accountability.*

*The Order creates MPART as an advisory body within the Department of Environmental Quality, with the director or director's designee from within that department from the following seven agencies:*

*Department of Environment, Great Lakes, and Energy (previously the Department of Environmental Quality)*

*Department of Health and Human Services*

*Department of Natural Resources*

*Department of Agriculture and Rural Development*

*Department of Transportation*

*Department of Military and Veteran Affairs*

*Department of Licensing and Regulatory Affairs*

*The director of the Michigan Department of Environment, Great Lakes, and Energy (EGLE), or the director's designee from within the department, will serve as the chairperson of MPART. MPART will be charged with providing recommendations to the director of EGLE, and the directors of the other involved agencies, and coordinate efforts between them. MPART will also research, identify, recommend, and implement PFAS response actions relative to the discovery, communication, and mitigation of PFAS, and report regularly to the governor on its activities.*

(EGLE 2020 [minor grammatical edits])

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