

A Case Study in Water Sustainability: The Craft Brewing Industry in Alberta and California

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Abstract

Access to high quality, reliable freshwater resources has been recognized as a global issue for decades and as the demand for water continues to grow, water management and sustainability issues have been pushed into the limelight. Despite this mounting pressure, variation in water use practices continues to persist, which contributes to both local and global water security challenges. Drawing on the environmental management literature, I noticed that the majority of the existing research focuses on the role of managerial demographics rather than on the process of how managers think, interpret, and act in strategic situations. Thus, in an effort to address this gap I adopted a qualitative research approach, conducting semi-structured interviews with managers at craft breweries in Alberta and California. My findings indicate that managerial sensemaking acts as a mediating process in a manager's choice of water management strategy, ultimately influencing their brewery's water use performance. And, that these relationships are affected by managerial characteristics as well as contextual factors. As the world's demand for fresh water, and the number of people living in water stressed conditions continues to rise, these findings have important implications. By both extending and contributing to existing sensemaking and cognitive frame theory, my findings shed light on alternative cognitive determinants driving water use variation and thus support the development of more sustainable water management practices.

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Chapter 1: Introduction

1.1 The Problem: Water Sustainability

Access to high quality, reliable freshwater resources has been recognized as a global issue for decades (Devlaeminck et al., 2017) and the “demand for water continues to grow in tandem with rapidly increasing human populations and accompanying economic and social development” (Sandford, 2017, p. 2). This demand is rising so rapidly that the Organization for Economic Co-operation and Development’s (OECD) environmental outlook study predicts that approximately 4 billion people will live in river basins experiencing severe water stress by 2050 (UN Environment, 2019).

In response to these mounting environmental pressures, concern regarding the uncertainty of and competition for water resources has escalated, pushing the sustainability of companies’ water use and management practices into the limelight (Christ & Burritt, 2017; Hepworth & Orr, 2013). Evidence of this can be found in the actions of multi-national corporations such as Nestlé, Coca-Cola, Anheuser-Busch, and Unilever, all of whom have launched water stewardship strategies over the last decade (Christ & Burritt, 2017). While water stewardship at many organizations, such as those listed above, has improved, substantial variation in water consumption persists within and across industries. Unfortunately, research advancing my understanding of this variation is almost entirely absent. Organizations continue to operate with immense variation in their water use and yet, relatively little is known about how management practices contribute to greater water security issues.

These challenges are highlighted in the craft brewery sector, where breweries range from world leaders in water use practices to laggards who fail to comply with basic regulations. For example, Bear Republic Brewery in California has poured millions of dollars into developing new local wells, installed a wastewater treatment plant to reduce the concentration of their effluent as well as recycle water, and installed software to track all water use which is used to inform standard operating procedures (“Bear Republic Brewing Company and Cambrian Innovation Unveil Pioneering Wastewater Reuse System,” 2014). As a result of these efforts, their water to beer ratio is approximately three liters of water to one liter of beer. On the other end of the spectrum, many breweries have done absolutely nothing to reduce their water consumption, using up to 20 liters of water to produce one liter of beer. This wasteful water use

contributes to water insecurity, a condition that is harmful to the natural environment and one that leaves organizations vulnerable to water-related business risks.

1.11 Water Insecurity

Water security is defined as “sustainable access, on a watershed basis, to adequate quantities of water of acceptable quality, to ensure human and ecosystem health” (Norman et al., 2010, pp. 4). By looking broadly at all demands a watershed faces, the overarching goal of water security is to balance competing land and water-use practices. When these practices are out of balance, water insecurity, the lack of reliable water, of appropriate quality and quantity, results. Examples of river basins that have, and continue to experience water insecurity, are the Colorado in the Western United States and the Murray-Darling in Southeastern Australia (Garrick, 2015). Being in this state is harmful to the environment because it threatens aquatic species as well as the reliability and quality of drinking water. Evidence suggests that when streamflow in rivers or the volume of water in lakes is too low, water bodies lose their dilution capacity which concentrates pollutants and decreases water quality. Further, when water bodies lose volume, they lose their ability to buffer against temperature changes and sustained, increased water temperature decreases dissolved oxygen (DO) content, degrading aquatic habitat.

1.12 Water-Related Business Risks

For breweries, water can present numerous significant challenges because it is the primary ingredient in beer, comprising approximately 98% of the beverage, and it is used in almost every step of the production process. For example, in the brewhouse, water is needed to brew beer, to heat and cool liquids, to dilute waste water, and to wash equipment. On average, it takes seven litres of water to produce one litre of beer (Fillaudeau et al., 2006) and thus, breweries require water security for their everyday operations as well as production of their end product. A brewery that cannot access sufficient volumes of high quality water, is vulnerable to water-related business risks which include: physical, regulatory, reputational and financial risks(Levinson et al., 2008).

1. *Physical Risks*: Physical risks refer to regional water stress, the inability to meet human and ecological demand for fresh water. Water stress poses significant challenges to craft breweries because it can lead to water use restrictions which results in a decrease or

complete cessation in production. For example, the 2015 drought in California, which left most of the state in water stressed conditions for many years, resulted in Fallbrook County imposing a 10% water use restriction on Fallbrook Brewing. This restriction ultimately contributed to financial pressures that resulted in the closure of the brewery (“California Craft Beer Brewers Balance Drafts and Drought,” 2015).

2. *Regulatory Risks*: Regulatory risks include pricing, permitting and licensing. Scholars predict that the cost to obtain and treat water will rise due to supply and demand imbalances, new water policies, and public pressure (Levinson et al., 2008). Similarly, permitting and licensing is predicted to become more challenging, limiting a company’s ability to expand or even get started.
3. *Reputational Risk*: Reputational risks arise from community perceptions and concerns about a company’s practices and their impact on the environment. A new study from Dutch Bank ING found that 61% of respondents would be less likely to buy a product if the company had poor environmental practices (*A Circular Economy Survey*, 2020). This finding demonstrates the risk that breweries could face should they operate with little regard for the environment.
4. *Financial Risk*: The outcome of the aforementioned risks is financial loss resulting from foregone revenue, higher production costs, or delayed/supressed growth (Levinson et al., 2008). For example, Bear Republic Brewing lost 4,500 USD/day for nine months, due to water shortages that halted their expansion and limited their production during the 2015 California drought (Bear Republic Brewing, 2014).

Based on the above information, it is evident that water insecurity poses major challenges to both the natural environment as well as the craft brewery industry. Thus, further study of water sustainability practices is warranted to limit both environmental damage and business-related risk in this business sector.

1.2 The Purpose of this Study

Scholars still know relatively little about why individual companies behave the way they do with regards to environmental management (Gunningham, Kagan, & Thornton, 2003; Millar, Hind, & Magala, 2012; Russell & McIntosh, 2011). Even less is known with regards to water

management in particular. Thus, the purpose of this study was to improve our understanding of variation in water use management and performance throughout craft breweries in Alberta and California. To do this, I used semi-structured interviews to explore the role of managerial sensemaking in water management decision making processes. By breaking down brewery manager's perceptual processes into noticing, interpreting, and responding, my findings shed light on factors that drive differential approaches water management and outcomes in water use performance.

1.3 Research Questions

In order to pursue the objective stated above this study specially addressed three questions, which include the following:

RQ1: How, if at all, does managerial sensemaking influence managers' choice of water management strategy?

RQ2: How, if at all, do managerial characteristics play a role in this sensemaking process?

RQ3: How, if at all, do contextual factors (the external environment, the organizational environment) contribute to managers' water-related sensemaking decisions?

1.4 Significance of this Study

This research is important because it will provide insights on factors that drive variation in water management and therefore has the potential to reveal new ways to improve water management practices. By improving our understanding of water management the following groups will benefit:

1. *Craft Breweries:* This research will benefit craft breweries by identifying factors that drive variation in water management and therefore reveal new ways for breweries to improve their water management practices. By making their processes more water efficient, breweries can save money, time, improve their environmental reputation, and contribute to greater water security, or sustainability.
2. *The Natural Environment:* This research will help craft breweries to improve their water use and management practices, making them more efficient and therefore

leaving more water in water bodies. By increasing instream flows and water levels, water bodies will have an improved dilution and temperature buffering capacity thus, contributing to greater overall health of the water body and the surrounding ecosystem.

3. *Society*: Society will benefit from this research because improved water use and management practices at local organizations could help to reduce the number of people living in water stressed conditions, thus limiting economic loss, human hardship, and environmental degradation.
4. *Governments*: Governments, including municipal authorities, who are interested in promoting sustainable water use practices will benefit from this research because findings will provide insights on various contextual as well as regulatory variables that influence water management and water use performance.

1.5 Organization of this Study

In this chapter, I introduced the problem of persistent variation in water management and in doing so, revealed the risks to the natural environmental as well as industry, such as craft brewing. Following this, I identified the purpose of my study being to improve our understanding of the factors driving variation in water use performance, raised my research questions, and described why they are important. The remainder of this thesis follows the ensuing structure. In Chapter 2 I provide a review of the related literature, covering topics such as environmental and water management as well as environmental and water performance, in order to reveal gaps that my research will address. In Chapter 3, I cover the methodologies I used for this research project. The following chapter, Chapter 4, describes my findings with regards to the research questions I posed. I finish with a discussion in Chapter 5, which includes how my findings contribute to and extend existing literature, suggestions for future research recommendations, and my concluding thoughts.

Chapter 2: Literature Review

The purpose of this literature review is to better understand the determinants driving differential approaches to water management and thus to shed light onto why variation in water use performance (WUP) persists. Since there is minimal literature that specifically examines the relationship between WUP and water management strategies (WMS), I situate the present inquiry in a broader context by primarily reviewing the scholarship on corporate environmental performance (CEP) and environmental management strategies (EMS).

Our review is structured as follows. It begins by defining CEP and explains how this concept is commonly measured. I then elaborate specifically on WUP, the various methods for measurement, and the method I will use moving forward. This is followed by a brief review of environmental management strategies (EMS), in the absence of specific water management strategies (WMS), that have been shown to contribute to variation in CEP. Next, I will review common external, organizational, and managerial factors that have been shown to influence an organization's choice of EMS and the relationship between those strategies and CEP. The final section reveals the gaps in the literature and introduces the concepts of managerial sensemaking and cognitive framing to develop theory as to why (and how) managers might vary in their preference for one type of management strategy over another (or none at all).

2.1 Corporate Environmental Performance

Corporate environmental performance has numerous definitions and conceptualizations throughout the literature. Despite this variation, most definitions “focus on the outcomes of management activities with regard to the natural environment as well as on these activities itself” (Trumpp et al., 2015, p. 188). This finding corresponds with the definition put forward by the International Organization for Standardization (2013), which defines CEP as “the measurable results of an organization's management of its environmental aspects” (Dragomir, 2018, p. 1125) and therefore will be my definition moving forward.

Like many other phenomena studied in organizational research, CEP is regarded as a construct because it cannot be observed directly (Trumpp et al., 2015). A construct is defined as a “theoretical creation that can be defined in conceptual terms but cannot be observed and therefore is anchored to observable reality by means of indicators” (Bisbe et al., 2007, p. 790).

Indicators, also referred to as measures, are “observable manifestations or facets of a construct” (Bisbe et al., 2007). Environmental performance indicators (EPI) help to measure, quantify, and evaluate the organization’s impact on the environment (Jamous & Müller, 2013). However, there is no consistency with regards to their use across studies (Hourneaux et al., 2014; Trumpp et al., 2015) and therefore there is no unanimously agreed upon method for measuring CEP in organizations (Anton et al., 2004; Dahlmann & Brammer, 2011; Darnall et al., 2010).

That being said, a common approach is to use varying forms of aggregation to summarize selected CEP indicators (Escrig-Olmedo et al., 2017; Jung et al., 2001). The end result is often a concise indicator that provides an overall measure of an organization’s CEP (Escrig-Olmedo et al., 2017). For example, Dahlmann and Brammer (2011) used an annual cumulative measurement to quantify a firm’s environmental strategy in order to reflect its CEP. The method involved summing the firm’s strengths and subtracting their weaknesses, resulting in a net annual environmental strategy value that could range from negative two to positive six. Similarly, Anton et al. (2004) quantified firms’ proactive environmental strategies by using a count model for nine selected proactive environmental practices. When a firm employed an environmental practice on the list, it received one point and if it did not, the firm received no points resulting in a concise indicator that ranges from zero to nine.

One element of CEP, such as a proactive environmental practice described by Anton et al. (2004), is a company’s water use and management practices. Since water is the focus of my study the next section elaborates on water consumption, how it is measured, and how it is used.

2.11 Water Use Performance

Over the last two decades, there has been a rapid increase in the amount of attention companies within the private sector have given to water use and management practices (Christ & Burritt, 2017; Hepworth & Orr, 2013), as evidenced by the actions of large multinational corporations such as Nestlé, Coca-Cola, Kellogg’s, Unilever, and Anheuser-Busch. All have launched water stewardship strategies in the last decade and publicly report water use/savings. For example, Anheuser-Busch reported an 18% reduction in water use from 2009 to 2012 (Jones et al., 2015) and set a new target to reduce water use by an additional 9% by 2025 (Anheuser-Busch, 2020). Similarly, Unilever reported a 29% reduction per ton of production between 2008 to 2013, prioritizing regions in water-scarce locations (Jones et al., 2015).

Several approaches exist for assessing companies' impacts on water resources, some of which include (but are not limited to): the Water Stewardship Framework by the Alliance for Water Stewardship, the Corporate Water Gauge from the Center of Sustainable Organizations, the Local Water Tool from the Global Environmental Management Initiative, the Water Footprint from the Water Footprint Network, and the Water Risk Filter from the World Wildlife Fund. All of these techniques include "templates for environmental reporting and transparency purposes, online calculation tools, standardized scientific methods, and impact mitigation oriented frameworks" but the methodology embedded within these approaches differs significantly, including variation in their primary objectives, value chains addressed, as well as if and how environmental impacts are measured (Forin et al., 2018, p. 2). Thus, similar to CEP, there is no universally agreed upon method nor best approach for measuring the effect of companies' water use and management practices (Forin et al., 2018; Hepworth & Orr, 2013).

That being said, the Water Footprint (WF) method has been described as "an important element underpinning and informing water stewardship strategy" (Jones et al., 2015, p. 273). A "consumption based indicator of water use" (Hoekstra & Chapagain, 2006, p. 2), WF is determined by accounting for "the total volume of freshwater used to produce a company's goods and services" (Jones et al., 2015, p. 273). This method has proven to be particularly "formidable" in its ability to "directly motivate business leaders to address water risk" (Chapagain & Tickner, 2012; Hepworth & Orr, 2013, p. 225). This motivation has been attributed to water footprinting's ability to improve understanding and facilitate visualization of water use by both companies and consumers, which in turn drives hydrologically sustainable practices of consumption (Hoekstra & Chapagain, 2006). An example of this process can be found in research performed by SABMiller and the World Wildlife Fund (WWF) in 2009. Using the WF method, their research revealed that 98.3% of the company's WF was related to crop production in South Africa. Overlaying this information on maps that depict regional water stress, SABMiller was prompted to pursue new stakeholder partnerships in order to address water scarcity in those locations (Chapagain & Tickner, 2012).

Therefore, due to the popularity and effectiveness of WF, I will use this method as my primary measure of water use performance (WUP) throughout this study. In doing so, I acknowledge that it is not perfect. Critics of the WF method have voiced concerns about the availability and reliability of data required for this approach and how it "decouples volumetric

water use and water quality issues from local contexts that determine sustainability and equity” (Hepworth & Orr, 2013, p. 224). To summarize, the CEP focus of this study is on Water Use Performance (WUP), and my metric for WUP is the Water Footprint Approach (WF).

2.2 Environmental Management Strategies that Influence CEP

CEP is the output of an organization’s environmental management strategy (EMS) (López-Gamero et al., 2009). The environmental management strategy, which is just one part of an organization’s overall corporate social responsibility (CSR) plan, is a set of “initiatives aimed at mitigating a firm’s impact on the natural environment” and can incorporate “changes to the firm’s products, processes and policies” (Bansal & Roth, 2000, p. 717). Therefore, a water management strategy (WMS) is a set of managerial initiatives aimed at mitigating a firm’s impact on water resources, such as reducing water consumption or decreasing effluent concentration. Managerial initiatives such as these comprise the organization’s WMS, and become the basis for its classification.

A WMS may be classified along the lines of the approach used for CSR plans. Many different models for CSR classification exist (Azzone & Bertelè, 1994; Buysse & Verbeke, 2003; Carroll, 1979; Hunt & Auster, 1990; Roome, 1992; Russell & McIntosh, 2011; Wartick & Cochran, 1985) and while most can be categorized on a scale “according to the extent to which they proactively respond to social (and environmental) issues” (Russell & McIntosh, 2011, p. 3) these models exhibit both similarities and differences (Maon et al., 2010). CSR models differ in four primary ways; (1) the models are based on dissimilar theoretical assumptions, (2) have varying starting points, (3) have a varying number of stages, and (4) focus on different content in each progressive stage (Maon et al., 2010). Figure 1 depicts a handful of CSR models on the continuum of proactivity, visually demonstrating some of the differences described above, but also their similarities.

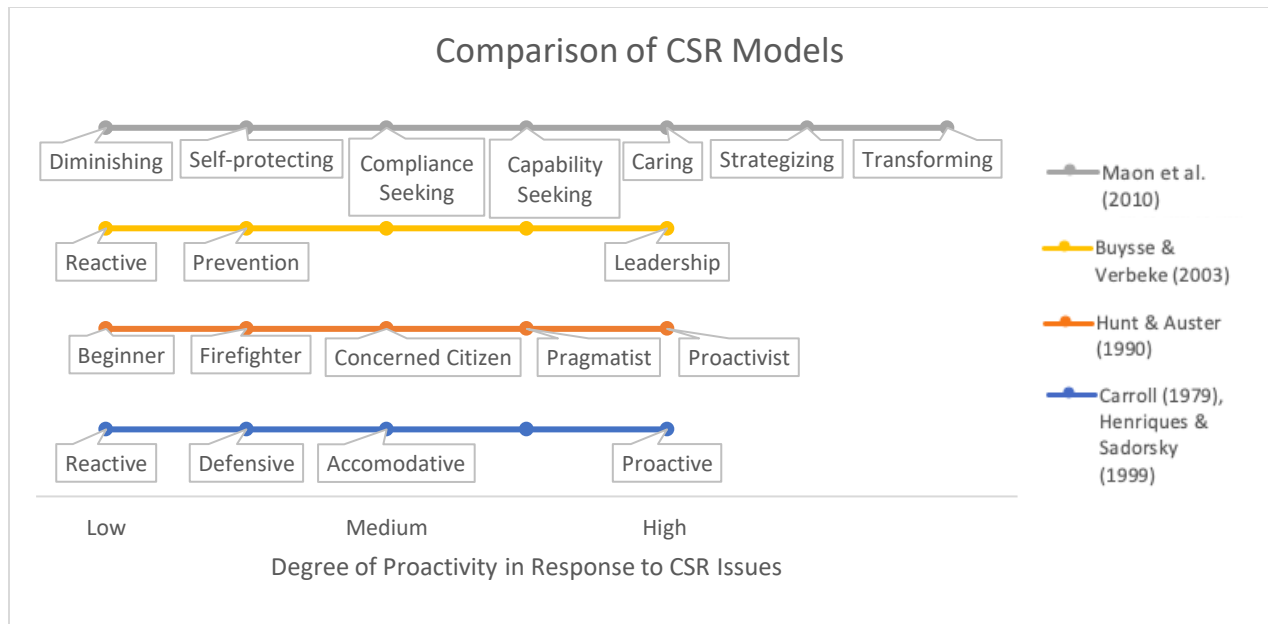


Figure 1. Four models of corporate social responsibility.

These similarities can be found in the model’s description of CSR-related development, “which consists of a progressive integration of social (and environmental) concerns into organizations’ decision-making processes” (Maon et al., 2010, p. 15). Each progressive stage, of which key characteristics across models overlap, (Maon et al., 2010), “reflects an increasingly important focus on societal issues, both in terms of strategy formulation and implementation” (Buisse & Verbeke, 2003, p. 454). Due to this similarity across CSR models I elaborate on just one, Carroll (1979), due to its popularity and relative lack of criticism. Thus, the following is a brief summary of each phase in this model and will be used in my research.

- i) *Reactive:* A reactive environmental strategy is characterized by little or no action in response to social or environmental issues. This strategy allots minimal funding to addressing environmental issues and its core value reflects profit maximization.
- ii) *Defensive:* The defensive environmental strategy involves some action on sustainability, but this action is typically only in response to legislation. The core values of the strategy revolve around compliance.
- iii) *Accommodative:* The accommodative environmental strategy partially integrates social and environmental issues into the business strategy, going beyond what is required by law.

- iv) *Proactive*: The proactive environmental strategy is characterized by a long-term focus on and active engagement with the management of sustainability issues. Sustainability is a core value of this strategy.

2.3 Multi-Level Factors Prompting Pursuit of an EMS for CEP

There is minimal research describing the relationship between multi-level factors that influence WMS selection and ultimately WUP. But, a significant body of research exists identifying contextual, firm, and managerial-level factors that influence EMS selection and CEP. Therefore, for this literature review I have provided a brief description of these relationships.

Contextual factors describe operating conditions that drive organizations to adopt environmental management strategies in order to improve CEP. Two of the most cited contextual drivers in the literature are:

- 1) *Legislation and Policy*: Research suggests that most managers believe that government policy or legislation is needed to encourage responsible behavior (Azapagic, 2003; Dummett, 2006; Emtairah et al., 2002) and that most firms report government legislation is what drove to them to pursue greater CEP (Dummett, 2006; Faruk, 2003).
- 2) *Stakeholder pressures*: Stakeholders put pressure on companies to improve their CEP (Dummett, 2006; Naidoo & Gasparatos, 2018; Ramanathan et al., 2014; Saha & Darnton, 2005) and consumers have been identified as the group with the greatest influence on companies (Dummett, 2006; Smith & Perks, 2010).

Firm-level factors, characteristics specific to a firm, often dictate the capacity of a firm to select a specific EMS and thus largely influence the firm's CEP (Chariri et al., 2017; Hojat et al., 2010; Moura-Leite et al., 2012). Size appears to be the most influential firm level factor in the literature (Stubblefield Loucks et al., 2010; Wang et al., 2018; Younis & Sundarakani, 2019).

- 1) *Size*: Small to medium enterprises (SME) typically have fewer resources and therefore focus on economic development as opposed to CEP (Wang et al., 2018) whereas large enterprises are more likely to pursue practices that would improve their CEP (Stubblefield Loucks et al., 2010).

Managerial factors: Upper echelons theory is a management model which states that organizational outcomes are, in part, predicted by the characteristics and experiences of the top level management team (Hambrick, 2007). Managerial characteristics identified in the literature as influential in EMS selection and CEP include:

- 1) *Gender:* Women are more positively associated with CSR (Huang, 2013; Simga-Mugan et al., 2005) and environmental CSR (ECSR) (Bear et al., 2010; Post et al., 2011) than men.
- 2) *Tenure:* There is an inverse relationship between the amount of time spent in the office and the amount of organizational change that occurs (Finkelstein et al., 2009; Lewis et al., 2014), with most major CSR and ECSR-related actions taken by CEOs in their first 2.5 years (Lewis et al., 2014).
- 3) *Education:* A manager's educational background affects an organization's environmental practices (E. S. W. Ng & Burke, 2005), specifically the type of program studied influences a firm's voluntary disclosure practices (Lewis et al., 2014).
- 4) *Functional background:* A manager's "educational background, training and skills, experiences, and affiliations shape how they classify and categorize problems" (Gunningham, Kagan & Thornton 2003), thus influencing how they choose to respond to environmental challenges (Kagan et al., 2003; Walls & Hoffman, 2013).
- 5) *Values:* Values influence managerial behavior directly (when they base their decisions on their values) and indirectly (when decisions are filtered through their values) (E. S. W. Ng & Burke, 2005). Personal (Boiral et al., 2015; Daily et al., 2009; Egri & Herman, 2000), social and moral (E. Ng & Burke, 2010), cultural (Hofstede, 1983; E. Ng & Burke, 2010), individualism-collectivism (Hofstede, 1983; House et al., 2004; McCarty & Shrum, 2001; E. Ng & Burke, 2010; Owen & Videras, 2006; Parboteeah et al., 2012), and human/future orientation (House et al., 2004; Parboteeah et al., 2012) are values proven to influence CSR and CEP.
- 6) *Attitudes & Beliefs:* Leaders charged with environmental management who have positive attitudes (who identify with specific environmental issues & have higher levels of environmental commitment) have organizations with greater environmental sustainability practices (Cantor et al. 2013; Cordano et al., 2010; Flannery & May, 2000; Roxas & Coetzer, 2012).

- 7) *Self-transcendence/openness to change*: A manager who is able to implement a successful environmental program is characterized by higher levels of self-transcendence and is more open to change (Egri & Herman, 2000; Fernández et al., 2006; Sharma, 2000).
- 8) *Leadership style*: There is a positive relationship between transformational leadership and a firm's CSR activities, whereas transactional leadership is negatively related to CSR activities (Burns, 1978; Du et al., 2013; E. Ng & Burke, 2010).

2.4 Gaps in the Literature: *Managerial Sensemaking and WMS Selection*

One of the limitations of Hambrick & Manson's (1984) upper echelons theory, discussed in the previous section, is that its contribution rests primarily in its emphasis on managerial demographics rather than on illuminating how managers think, interpret, and act in strategic situations (Boal & Hooijberg, 2000; Priem et al., 1999). This is an important omission because, although there is extensive research on the impact of demographics in EMS selection and CEP (see preceding section), the nature of the decision-making process related to environmental management requires a non-conventional approach, and the speed (van der Heijden et al., 2012) in which sustainable adaptations are required (and improved CEPs are to be sought) can be unexpected. The adoption of sustainable strategies and policies "confronts managers, employees, and stakeholders with a new reality" and this reality "influences processes and departments so that people can no longer rely on old routines and patterns to make sense of new ideas" (van der Heijden et al., 2012, p. 538).

Scholars have argued that sensemaking could be used to fill this gap in the literature (Luscher & Lewis, 2008; van der Heijden et al., 2012), but studies specifically examining managerial sensemaking and WUP are non-existent. Therefore, the purpose of this research is to investigate whether (and how) sensemaking might act as a mediating process in a manager's selection of WMS and influences WUP.

2.41 The Process of Sensemaking

Sensemaking is defined as a process "that involves attending to and bracketing cues in the environment, creating intersubjective meaning through cycles of interpretation and action, and thereby enacting a more ordered environment from which further cues can be drawn"

(Maitlis & Christianson, 2014, p. 67). ‘Managerial sensemaking’ is the term used when this process is performed by a manager. This process is triggered when an individual confronts events, issues, or actions that violate their expectations (Maitlis & Christianson, 2014), such as tackling corporate sustainability (CS) or selecting a WMS. These tasks trigger sensemaking because they are complex, requiring managers to “address a widely diverging but interconnected series of concerns for the natural environment, social welfare, and economic prosperity” (Hahn et al., 2014, p. 463). Thus, in addressing complex events or issues through sensemaking managers answer two questions: (1) what is going on here? And (2) what do I do next? The following section describes how the three stages of sensemaking address these two questions.

1. *Scanning*: Scanning occurs when a manager notices something out of their range of normal (Weick et al., 2005), such as when an event, issue, or action violates their expectations (Maitlis & Christianson, 2014). In these circumstances, the manager will begin to cognitively organize external cues and stimuli in an effort to reduce the amount and complexity of information presented to them (Hahn et al., 2014; Zietsma, C & Vertinsky, 1999).
2. *Interpreting*: The second stage, interpretation, involves “carving out meaning from ambiguous cues” (Thomas & Porac, 2002, p. 178) previously identified and organized in the scanning process. This involves bracketing or categorizing the identified anomalies and labelling them (Weick et al., 2005). Labelling is a very important part of interpretation because it ‘regularizes and routinizes the unexpected’ thereby creating a form ‘more amenable to functional deployment’ (Weick et al., 2005).
3. *Responding*: While the preceding stages focus on answering the question ‘what is going on here?’, the third stage, responding, addresses the question of ‘what do I do next?’. Action is integral to this stage, as people understand the world through acting and waiting to see what the consequences of their actions are (Maitlis & Christianson, 2014; Weick et al., 2005). This process generates more stimuli and therefore, action itself “serves as fodder for new sensemaking, while simultaneously providing feedback about the sense that has already been made” (Maitlis & Christianson, 2014, p. 84).

The ultimate result of sensemaking is the simplification of chaos as well as the creation of new meaning so that managers are better able to cope with the novel reality they currently face (van der Heijden et al., 2012). Despite participating in the same processes, managers continue to attach different interpretations to the same information and this has been explained with cognitive framing theory (Cornelissen & Werner, 2014; Hahn et al., 2014; Maitlis & Christianson, 2014; Weick, 1995). The last section of this review will provide a summary on the current literature regarding cognitive frames and managerial sensemaking in relation to environmental management.

2.42 Cognitive Frames and Sensemaking

A cognitive frame is “the mental template that individuals impose on an information environment to give it form and meaning” (Walsh, 1995). Frames reduce ambiguity and complexity by selectively interpreting cues from the situation based on past learning and experiences (Hahn et al., 2014; Zietsma, C & Vertinsky, 1999). Karl Weick, the grandfather of sensemaking, describes frames as “*past* moments of socialization” and sensemaking cues as “*present* moments of experience” (Weick, 1995). He states that meaning is then generated when a relationship is developed between a frame and a cue (Weick, 1995). The content of sensemaking is therefore composed of frames developed through past experiences, cues from the present experience, and the way in which both are connected (Weick, 1995). Thus, a manager’s cognitive frame is highly influential in the sensemaking process (Cornelissen & Werner, 2014; Hahn et al., 2014; Maitlis & Christianson, 2014; Weick, 1995).

Work by Hahn et al. (2014), specifically identified how different cognitive frames can influence each stage of the sensemaking process. These scholars found that during the act of scanning managers filter information using their cognitive frame (Hahn et al., 2014; Zietsma, C & Vertinsky, 1999), directing their attention towards cues that fit their existing frames and away from cues that are inconsistent with these frames (Hahn et al., 2014). In the interpretation phase, managers interpreted issues by assessing aspects of the issue against their frame and therefore attached different labels to the same information (Hahn et al., 2014). And again, in the response stage of sensemaking, Hahn et al. (2014) identified that a manager’s cognitive frame led them to

adopt differing decision-making approaches, a “rationalized mental attitude toward an issue” and “predisposed the individual to act in certain ways” (Hahn et al., 2014, p. 476).

Based on these findings, it is evident that the cognitive frame a manager uses while participating in sensemaking has the potential to drive significant variation in WMS selection and WUP. Several authors (Andersson & Bateman, 2000; Maon et al., 2010; Sharma, 2000) have “applied a cognitive lens to the analysis of corporate sustainability and related concepts” (Hahn et al., 2014, p. 464), but a “detailed analysis of the effects that cognitive frames with different content and structure have on manager’s sensemaking of the ambiguities around sustainability is still lacking” (Hahn et al., 2014, p. 464). Thus, my research will address this gap by exploring whether there is a relationship between the cognitive frames managers use while sensemaking and WMS selection.

2.5 Summary

To summarize, I have provided an overview of the scholarship on corporate environmental performance and specifically water use performance, environmental management strategies, and the relationship between these concepts. In doing so, I demonstrated how little is still known about the factors driving persistent variation in both constructs and thus introduced sensemaking as well as cognitive frame theory as a potential theoretical lens to better understand this variation.

Chapter 3: Study Design and Methodology

The purpose of this chapter is to describe the methods used in my research as well as the rationale behind them and thus, is structured as follows. I begin with my research questions, before describing my study design, research setting, recruitment and sampling techniques, data collection methods, and my procedures for data analysis.

3.1 Research Questions

The objective of my research project was to address the following three research questions:

RQ1: How, if at all, does managerial sensemaking influence managers' choice of water management strategy?

RQ2: How, if at all, do managerial characteristics play a role in this sensemaking process?

RQ3: How, if at all, do contextual factors (the external environment, the organizational environment) contribute to managers' water-related sensemaking decisions?

3.2 Study Design

My study primarily used a qualitative research approach as previous scholars (Eisenhardt, 1989; Gioia et al., 2013) have demonstrated that qualitative techniques can provide a more complete understanding of a contemporary phenomenon, when compared to quantitative research strategies. This is because qualitative research is well suited to addressing questions regarding 'how' and 'why' a particular phenomenon occurs (Eisenhardt, 1989; Woodside & Wilson, 2003; Yin, 2003) especially in situations "where the researcher has little or no control over the phenomenon of interest" (Yin, 2003).

Using this approach, my main investigative tool was the semi-structured interview, as dynamic and curiosity focused conversations are particularly good at uncovering unconscious cognitive processes that would otherwise be impossible to capture (Woodside & Wilson, 2003). Thus, I began by crafting an interview protocol that would allow for changes and adaptations to be made as interviews progressed, reflecting the iterative nature of qualitative research (Howard-Grenville et al., 2017). Interview questions centered on how managers make sense of water-related cues and stimuli, breaking this process down into the steps of scanning, interpreting, and

responding. For each question, a series of probes was included to reveal facilitators and barriers throughout the sensemaking process and for a few, managers were asked to rate a specific attitude, opinion, or perception on a scale of one to five. In addition, each manager was asked if they knew their water to beer ratio and if so, what it was. The purpose of this quantitatively-based question was to incorporate a subjective measure of water use performance.

3.3 Case Research Settings

My research focuses on craft breweries in two settings, Alberta and California. The reasons for this are: (1) access to water and the impacts of climate change are matters of concern in these jurisdictions, (2) water management practices have come under scrutiny, and (3) both Alberta and California have experienced a boom in the craft beer industry.

1. Access to water and the impacts of climate change

The waterscape of Alberta and California leave both regions vulnerable to water stress. This is because 80% of Alberta's water is located in the northern part of the province whereas 80% of the population lives in the south. Similarly, more than 70% of the streamflow feeding California's water supply is generated in the north (north of Sacramento), while approximately 80% of the state's water requirements reside in the south. Complicating matters further, the majority of both region's water resides in rivers fed predominantly by snowmelt and precipitation (Faramarzi et al., 2017; Medellín-Azuara et al., 2008). This can introduce a temporal restriction on water supply because flows are typically highest in the spring during runoff and gradually decrease all year as the snowpack shrinks. This reliance on snowmelt can also create what some refer to as a 'feast or famine' water cycle. The feast describes the high volumes of water in rivers after a big snow year, while the famine refers to the low flow associated with low snow years, thus demonstrating the vital link between water supply and weather in these areas.

Amplifying the vulnerability of water supply in both regions is climate change. Research has demonstrated that climate change is contributing to a reduction in water quantity and quality throughout Alberta (Faramarzi et al., 2017; Tanzeeba & Gan, 2012) and California (Knowles et al., 2006; Null et al., 2010; VanRheenen et al., 2004). Both regions are predicted to see an increase in average temperature, most significantly resulting in more winter precipitation falling

as rain, a decreased alpine snowpack, as well as more melting and an earlier melt season (K. A. Forbes et al., 2011; Knowles et al., 2006; Null et al., 2010; Tanzeeba & Gan, 2012). The potential consequences of these changes are increased winter runoff, but also an earlier and decreased summer run off (K. A. Forbes et al., 2011; Lettenmaier & Gan, 1990; Medellín-Azuara et al., 2008; Tanzeeba & Gan, 2012). Research has shown that these impacts have the potential to increase the frequency and intensity of droughts in California (Medellín-Azuara et al., 2008) and in Alberta, where these changes are predicted to increase aridity throughout the province, leading to an increase in drought frequency (Sauchyn et al., 2004).

2. Water management

The management and “over-allocation of water licenses for extractive purposes have endangered river systems across the world”, including Alberta and California (Zuo et al., 2015). Critiques have described the water allocation systems in both regions as ‘out-dated’ and believe that these systems reflect water management needs during a time of abundance (He et al., 2012; Zilberman et al., 1994). Unfortunately, this time of abundance is now in the rear view mirror, as the Colorado River runs dry and the South Saskatchewan River shuts down applications for new allocations.

Alberta’s water is primarily managed through the Water Act which delineates the First in Time-First in Right (FIT FIR) allocation system. This approach entitles the most senior water licenses to their full allocation before junior licenses can take any water. Critiques have stated that the FIT-FIR system is one of the least efficient and least conservation oriented systems because it encourages water users to take their full allocation as opposed to the volume of water that they actually need (He et al., 2012).

As a result of this system, the provincial government stopped accepting applications for new water allocations for the South Saskatchewan River Basin in August 2006 due to mounting concerns over the health of the river (K. A. Forbes et al., 2011; Pernitsky & Guy, 2010; Tanzeeba & Gan, 2012). And, more recently, the City of Calgary announced that it will likely reach its daily water licence limit in the Bow and Elbow Rivers by 2036 (Potkins, 2019). The moratorium on water allocations for the South Saskatchewan River Basin and the more recent news regarding the Bow and Elbows River’s daily water limit clearly demonstrates the extent to which the provinces water resources are stressed.

In California, the water allocation system continues to reflect water rights that were established in a time when water was abundant and does not encourage conservation (Zilberman et al., 1994). While the government has been working to improve the allocation system through the introduction of transferable rights, the state continues to experience significant water stress. The water stress is evident through the most recent drought, which resulted in significant water restrictions and two new pieces of water-oriented legislation. The restrictions first came into place in 2015, during the 2011-2016 drought, and mandated a 25% water use reduction on 400 local water supply agencies which served 90% of California's residents (Nagourney, 2015). These restrictions remained until 2017.

After the drought, in 2018, bill AB 1668 and SB 606 were signed and they set water efficiency standards that mandate indoor water use be reduced by 55 gallons per person, per day by 2023 and outdoor water use be reduced as well (target is still being worked on) (Sabalow et al., 2020). The goal of these measures is to reduce the impact of future drought moving forward and avoid the restrictions implemented during the 2011-2017 drought. These examples demonstrate the degree to which California has and could be affected by water scarcity.

While the degree to which California has been affected by water stress and water scarcity is more significant than Alberta, it provides a good comparison for what Alberta could be facing in the future.

3. Boom in the Craft Brewing Industry

The Alberta craft beer industry is growing rapidly. In December of 2013, the Alberta Liquor and Gaming Commission (ALGC) removed a restriction on Alberta breweries that set a minimum production requirement and the industry has dramatically expanded since. Prior to this removal, in 2013, Alberta had 20 craft breweries ("Alberta | Beer Canada," 2018) and the number has steadily risen to 125 existing and pending licenses as of January of 2019 (Riebe, 2019).

The California craft beer industry has also undergone an incredible boom, rising from approximately 70 to 200 breweries throughout the 1990's and to over 900 craft breweries in the state today (Thompson, 2018). Differing from Alberta, the craft-beer movement in California has been "driven by consumer demand", evident in the rise of "three main markers in craft beer— fuller flavor, greater variety, and more intense support for local businesses" (Thompson, 2018).

Also differing from Alberta, California's boom primarily happened in the 1990's and 2000's whereas Alberta's did not start until 2013. Thus, California's craft beery industry is much more established and now, world renowned, therefore potentially offering a valuable industrial learning opportunity.

3.4 Recruitment and Sampling

Personal as well as professional networks were initially used to recruit craft breweries to participate in this study. Once these networks were exhausted, snowball sampling, a technique where participants recruit future participants, was employed. These approaches are a form of convenience sampling, which is a technique where participants are recruited based on their accessibility (Bornstein et al., 2013). Convenience sampling was chosen because of its ease of use and cost effectiveness, but, it is often critiqued because it does not yield a representative sample and therefore findings cannot be extended to the entire population. In an effort to increase the generalizability of the findings, theoretical sampling was employed and additional breweries were chosen based on their ability to "illuminate and extend relationships and logic", thus contributing to the development of theory (Eisenhardt & Graebner, 2007, p. 27). An emphasis was made to ensure polar types were included as this can "lead to very clear pattern recognition of the central constructs, relationships, and logic of the focal phenomenon" (Eisenhardt & Graebner, 2007, p. 27). For example, breweries on the forefront of water efficiency technology and implementation were invited to participate in this study in addition to breweries that had not taken any action to address water efficiency.

Each case study represented one brewery and within each brewery the unit of study was an individual. Each individual worked in a managerial role related to the brewing process and had titles such as Brew Master, Director of Brewing Operations, and General Manager. The interviews continued until data saturation was reached. Data saturation was achieved when the collection of new data reached the point of diminishing returns and no new contributions were provided by additional interviews (Bowen, 2008; Miles & Huberman, 1994). At this point, 17 managers throughout Alberta and 11 throughout California had been interviewed (Figure 2). This sample size of 28 cases is in line with recommendations from scholars performing similar qualitative research (Creswell et al., 2007 n=20-30; Morse, 2000 n=20-30).

3.5 Data Collection Method

The interviews were conducted between the fall of 2019 and winter of 2020, lasted on average 45 minutes, and took place in person or over the phone. To maintain consistency, all interviews were performed by the principal investigator, Kate Hanly. All interviews were digitally recorded, with approval, transcribed (resulting in a total of 296 pages of data), and imported in Nvivo for data analysis.

The interview protocol, available in Appendix A, was composed of questions that focused on how managers made sense of water-related cues and stimuli. These questions were constantly adjusted as interviews progressed, an iterative process common in qualitative research (J. Howard-Grenville et al., 2017). These changes were made in response to reflections on new findings and in an effort to better capture what is actually happening. For example, the interview protocol originally started by directly asking:

“What are the current environmental issues or challenges, of relevance to your business, that exist in Alberta/California? Please list the major issues that are affecting you.”

Starting with this question, managers often stumbled to come up with environmental challenges and so in response to this a more general question was asked first to determine if any manager would list environmental challenges without being prompted to do so. After this new question, the question prompting for environmental challenges was asked:

1. *“What are the current issues or challenges, of relevance to your business, that exist in Alberta/California? Please list the major issues that are affecting you.”*
2. *“What are the current environmental issues or challenges, of relevance to your business, that exist in Alberta/California? Please list the major issues that are affecting you.”*

Similarly, towards the end of interviews managers would bring up slightly off topic, but important and relevant information. In response to this, a question was included that allowed the manager to add whatever information that they believed to be important and was missed.

“I have asked you some specific questions, now is there anything I have missed that you would like to add? Ex. Recommendations to gov’t – to help you do what best aligns with your business and the environment?”

3.6 Data Analysis

The data analysis included both qualitative and quantitative components. The vast majority of my analysis employed qualitative techniques and therefore I will start by describing this approach and finish by describing how I analysed my quantitative data.

3.61 Qualitative Data Analysis

The goal of my qualitative data analysis was to support the development of a conceptual model and this was done through an inductive approach (Fayard et al., 2017). Using the constant comparative method, all interview data was analyzed by simultaneously coding data fragments and comparing these sections of coded data to each other (Glaser & Strauss, 1967). Coding is the process of naming a fragment of data, such as a phrase or thought, that can provide insight into the posed research questions (C. Hahn, 2008). Comparison is then used to highlight characteristics such as similarities, differences, frequency, sequencing, and causation in the processes of scanning, interpreting, and responding (Glaser & Strauss, 1967; Goulding, 2002; Locke & Latham, 2002). This iterative process resulted in the “generation of aggregate dimensions and the saturation of their properties” (Glaser, 2001, p.185), ultimately yielding theory development. The following is a description of the specific steps taken throughout the analysis process.

Three rounds of coding were performed as per Gioia, Corely, and Hamilton (2013). The first round was very detailed, using the interviewee’s own words to describe researcher identified constructs in order to maintain the reliability and integrity of the analysis process (Gioia et al., 2013). This stage resulted in 125 codes, a high number, but one that is in line with the work of Gioia, Corely, and Hamilton (2013) due to the fact that constructs were not further distilled into categories to further maintain the interviewee’s voice (Gioia et al., 2013).

Moving to a more theoretical level, the second-order analysis uses the raw data and first-order codes to reveal ‘explanatory dimensions’ (Gioia & Chittipeddi, 1991) in order to determine if “the emerging themes suggest concepts that might help us describe and explain the phenomena

I are observing” (Gioia et al., 2013, p. 20). Thus, in this stage of analysis first-order codes were re-organized and condensed by focusing on salient features of the data set (Saldana, 2009). Specifically, using a process similar to axial coding, similarities and differences amongst first order codes were sought out and used to reduce the number of codes to 30 (Gioia et al., 2013; Strauss & Corbin, 1990). These new 2nd order codes were then given labels and descriptors in order to facilitate the identification of patterns, processes, and the ‘larger narrative at play’ (Gioia et al., 2013) in order to start answering the question of ‘what is going on here?’ via gestalt analysis (Gioia & Chittipeddi, 1991).

The final step is to connect the 2nd order codes to the extant literature in order to develop aggregate dimensions that delineate higher order concepts (Paroutis & Heracleous, 2013; Strauss & Corbin, 1990), ultimately resulting in “theoretical saturation” (Glaser & Strauss, 1967). The establishment of 1st, 2nd order codes, and aggregate dimensions revealed a data structure that was then used as the basis for building a process model to demonstrate the role of managerial sensemaking in CEP. The data structure was developed using Gioia, Corely, and Hamilton’s (2013) model (Figure 2) because it “provides a graphic representation of how I progressed from raw data to terms and themes” which is “a key component of demonstrating rigor in qualitative research” (Gioia et al., 2013, p. 20; Pratt, 2008).

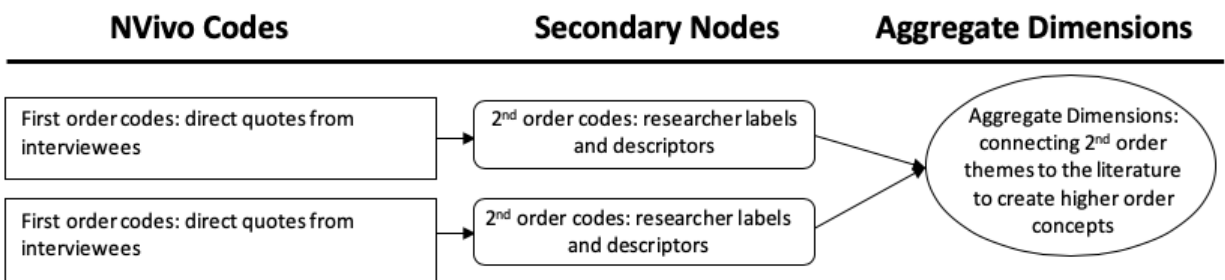


Figure 2. Example model of my data structure, adapted from Gioia et. al (2013).

3.62 Quantitative Data Analysis

The goal of the quantitative data analysis was to identify if a craft brewery’s water use performance is related to how managers make sense of water-related challenges. To do this, I adopted the cross-tabulation technique, a statistical tool used for categorical data that employs a basic tabular form to draw inferences between data sets. The two data sets I used here include the

aggregate dimensions identified in the qualitative analysis and the brewery’s water use performance. The brewery’s water use performance was calculated using the water footprinting technique described in my literature review. As a reminder, WF is “the total volume of freshwater used to produce a company’s goods and services” (Jones et al., 2015, p. 273). Due to time, cost, and complexity, I did not perform a WF analysis on each brewery but instead asked each brewery if they knew or tracked their water WF. At a brewery, the WF is their water to beer ratio, a measure that represents the volume of water a brewery uses to produce one litre of beer.

I then compiled the aggregate dimensions and the craft brewery’s water to beer ratio in order to identify if a relationship exists between these data sets. The framework for my tabular form can be found below in Table 1.

Table 1. Framework of tabular form adopted for quantitative data analysis.

Brewery Code Name	Does the brewery know their Water to Beer Ratio?	Water Use Performance (Water to Beer Ratio)	Aggregate Dimension 1	Aggregate Dimension 2 etc.
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3.7 Summary

Chapter 3 presented my study design, research context, and methodology of how I collected and analysed my data, using both qualitative and quantitative techniques, for this research project. In the following chapter, I will present my research findings.

Chapter 4: Findings

4.1 Descriptive Findings

4.11 The External Environment

A total of 28 breweries participated in this study, 17 came from Alberta, Canada and 11 from California, United States. Located in the central and southern regions of the province, participating Alberta breweries were found in regions primarily classified as a Continental Subarctic (Dfc) climate according to the koppen climate classification. The Dfc classification is characterized by long, cold winters, short warm summers, and low levels of precipitation. The California breweries were almost equally split between Northern California, with a Warm Summer Mediterranean (Csb) climate, and Southern California, with a Hot Summer Mediterranean (Csa) climate. While Csb climates experience mild summers and Csa climates enjoy hot summers, both classifications are characterized again by their distinctively low levels of precipitation. Thus, despite California breweries experiencing more intense heat and those in Alberta, more intense cold, both regions are relatively arid and vulnerable to water stress.

The population of cities or towns that each brewery was located in varied significantly, ranging from 403 residents in the smallest town to 1.426 million in the largest city. Despite this wide range, I found that approximately half participating towns and cities had populations in the smallest size category (below 500,000 residents) and both areas had comparable average population sizes (664,009 residents in Albertan and 602,555 residents in Californian towns and cities).

With regard to market pressures, 94% of breweries in Alberta and 100% of breweries in California reported experiencing high levels of competition. Breweries in both locations described an increase in the sheer number of craft breweries, resulting in greater competition for shelf and taproom space. Consumer pressure for ‘greener’ products was also examined and I found that only 12% of Albertan and 27% of Californian breweries reported feeling pressure from consumers in this regard.

The regulatory pressures I examined included water pricing mechanisms and water use restrictions. Throughout most of Alberta, water for commercial uses, such as brewing, is priced using a decreasing volumetric scheme. This means that as a customer uses more water, the price which they pay per unit decreases. In contrast, California uses an increasing volumetric pricing

scheme which means that as customers increase their water use, the price they pay per unit also increases. In addition, many cities throughout the state have a different water pricing regime according to the water supply conditions, resulting in an increasingly higher cost per unit of water under increasingly stressed water supply conditions.

The second element of the regulatory environment I examined was legislation governing water-use restrictions. my findings indicate that most cities and towns throughout Alberta and California have some form of legislation in place that gives them the ability to implement water use restrictions when water supply is low. But, only two managers reported experience with operating a brewery under water use restrictions.

Table 2. Summary of external contextual factors

		Alberta	California
Number of participating breweries		17	11
Location in province/state		Central/Southern Alberta Alberta Rocky Mountains	Split between Northern and Southern California
Koppen Climate Classification		Predominantly Dfc	Predominantly Csb and Csa
Population size in cities where breweries were located	Average	664,009 people	602,555 people
	Range	403 to 1.3 million	8,000 to 1.4 million
Market Pressures	Competition	94% breweries reported feeling competition 65% listed it as a top three challenge	100% breweries reported competition 72% listed it as a top three challenge
	Environmental Pressure from Consumers	12% of breweries reported 0% listed in top three challenges	27% of breweries reported 0% listed in top three challenges
Regulatory Pressures	Water Pricing Mechanism	Decreasing volumetric	Increasing Volumetric
	Water Use Restrictions	No breweries had experience with water use restrictions	2 breweries had experience with water use restrictions

4.12 The Internal Environment (firm level)

The breweries that participated in this study varied in age from 2 to 40 years old and were small organizations ranging in size from 9 to 225 employees and producing between 304 and

540,600 HL of beer annually (Table 3). The majority of breweries, 24 out of 28, employed less than 100 employees and 25 out of 28 produced less than 50,000 HL of beer annually.

Table 3. Summary of firm level factors

Location	Brewery	Founding Date	Number of Employees	Annual Beer Production (HL)
AB	B1	2011	27	12000
AB	B2	1996	75	24000
AB	B4	2015	14	2200
AB	B5	1993	30	9000
AB	B7	2005	60	5000
AB	B8	2014	25	2000
AB	B11	2012	40	3000
AB	B12	2017	15	352
AB	B13	2015	25	5000
AB	B14	2013	27	5500
AB	B16	2017	22	3000
AB	B17	2016	38	4000
AB	B18	2018	14	700
AB	B19	2018	25	700
AB	B20	2012	14	400
AB	B21	2016	25	2000
AB	B24	2015	12	500
Cali	B3	1995	175	77506
Cali	B6	1980	150	540600
Cali	B9	2015	50	7040
Cali	B10	1996	130	287502
Cali	B15	2008	100	23470
Cali	B22	2014	9	1000
Cali	B23	2008	24	304
Cali	B25	1995	75	31450
Cali	B26	2012	35	17850
Cali	B27	1987	225	46800
Cali	B28	2016	18	562

4.13 Managerial Characteristics

The vast majority of brewery managers interviewed were male, with 4 out of 28 being female (Table 4). These individuals' functional backgrounds varied significantly, involving educations that ranged from high school to the PhD level in the field of science, arts, law, and business. Most managers had more than three years' experience in the brewing industry, in addition to wide ranging backgrounds in industries such as engineering and academia (Table 4).

With regard to personal values, I found that about 50% of the managers interviewed had concern for or identified with an environmental challenge (Table 4). Examples of concerns include water scarcity, climate change, and pollution.

Table 4. Managerial factors of potential relevance to the sensemaking processes with regards to water use management and decision making (issue salience and framing).

Manager	Gender	Level of Education	Field of Education	Work Experience	Personal Values
M1	Male	Bachelor	Science (enviro)	10 years in breweries	No concern
M2	Male	Post-grad	Law & Brewing	7 years in breweries	No concern
M3	Male	Bachelor	Arts	27 year in breweries	Concern
M4	Male	Bachelor	Business	9 years sales 4 years breweries	Concern
M5	Male	Bachelor	Science & Brewing	Exclusively breweries	no concern
M6	Female	Bachelor	Science (enviro)	12 years brewery (sustainability dept)	Concern
M7	Male	Bachelor	Science	10 years in breweries 4 years in enviro consulting	Concern
M8	Male	Bachelor	Science & Brewing	Brewing	No concern
M9	Male	Bachelor	Science	7 years in breweries	Concern
M 10	Male	Bachelor	Science	1 year with American Red Cross for biomedical health, 12 years at engineering firm	Concern
M 11	Male	HS	N/A	Entrepreneur/Start Up - mostly in tech	No concern
M 12	Male	Bachelor	Business & Brewing	Construction (labourer), managed a calf/cattle herd, most of last 10 years he was in school	No concern

M 13	Male	Bachelor	Business	5 years in brewing, accounting, real estate	No concern
M 14	Male	Diploma	Brewing		No concern
M 15	Male	Bachelor	Science & Brewing	12 years brewery	No concern
M 16	Male	HS	N/A	Sales	Concern
M 17	Male	HS	N/A	Oil field	No concern
M 18	Female	Diploma	Brewing	Beverage industry	No concern
M 19	Female	Post-grad (MSc)	Science	1st brewing job, energy storage and pharm	Concern
M 20	Male	HS	N/A	Brewing	No concern
M 21	Male	Post-grad (MSc)	Science	In brewing since 2015, environmental consulting	Concern
M 22	Male	Bachelor	Business		Concern
M 23	Male	Diploma	Brewing	Brewing for the last 15 years	No concern
M 24	Male	Bachelor	Science		No concern
M 25	Male	Post-grad (MSc)	Science & Brewing	6 years in brewing, previously in academia	Concern
M 26	Male	Post-grad (MBA)	Business	4 years in brewing, before that consulting and research	Concern
M 27	Female	Post-grad (PhD)	Science	Academic	Concern
M 28	Male	Bachelor	Science (enviro)	Enviro conservation	Concern

4.2 Analytical Findings

Our first research question asked, “how, if at all, does managerial sensemaking influence managers’ choice of water management strategy?”. To begin to address this, my first round of coding focused on the issue salience and framing aspect of the sensemaking process. I found that the majority of managers interviewed (20 out of 28) perceived water use and management to be

unimportant. This lack of perceived importance led us to focus my second round of coding on the question of ‘why’ water management was deemed to be of such little significance in a notoriously water-intensive industry and in water-stressed regions. Careful attention to managers’ descriptions of water and their water-related decision making processes suggested that managers were using different sensemaking frames, a “mental template that individuals impose on an information environment, to give [external cues] form and meaning” (Walsh, 1995, p. 281). Thus, during my second round of coding I labelled the language managers used to describe their interpretations as one of three different sensemaking frames, a community-focused, economic case, and locus of responsibility frame. Since one’s frame can lead to variation in their decision making processes and subsequent action, my third round of coding focused on the relationships between a manager’s frame and the type of water management strategy each brewery adopted (Cowan & Harding, 1986; Nutt, 1984).

Figure 3, adapted from Gioia et al. (2013), is a graphic depicting the data structure that emerged from my analysis and demonstrates “how I progressed from raw data to terms and themes” (Gioia et al., 2013). The ‘raw data’, also called in vivo or first order codes, is composed of direct quotes from interviewees to provide a representative sample of the participants’ thoughts, beliefs, and behaviors. These quotes were then re-organized, condensed, and labelled into secondary nodes and again into aggregate dimensions in order to facilitate the identification of patterns, processes, and the ‘larger narrative at play’ (Gioia et al., 2013; Saldana, 2009; Strauss & Corbin, 1990). The following section is a description of my findings and relationships that emerged, with regards to the aggregate dimensions I identified. Specifically, it offers insights into the first research question by clarifying how managerial framing shaped the managerial sensemaking process, and, by extension, managers’ choice of water management strategy.

NVivo Codes

Secondary Nodes

Aggregate Dimensions

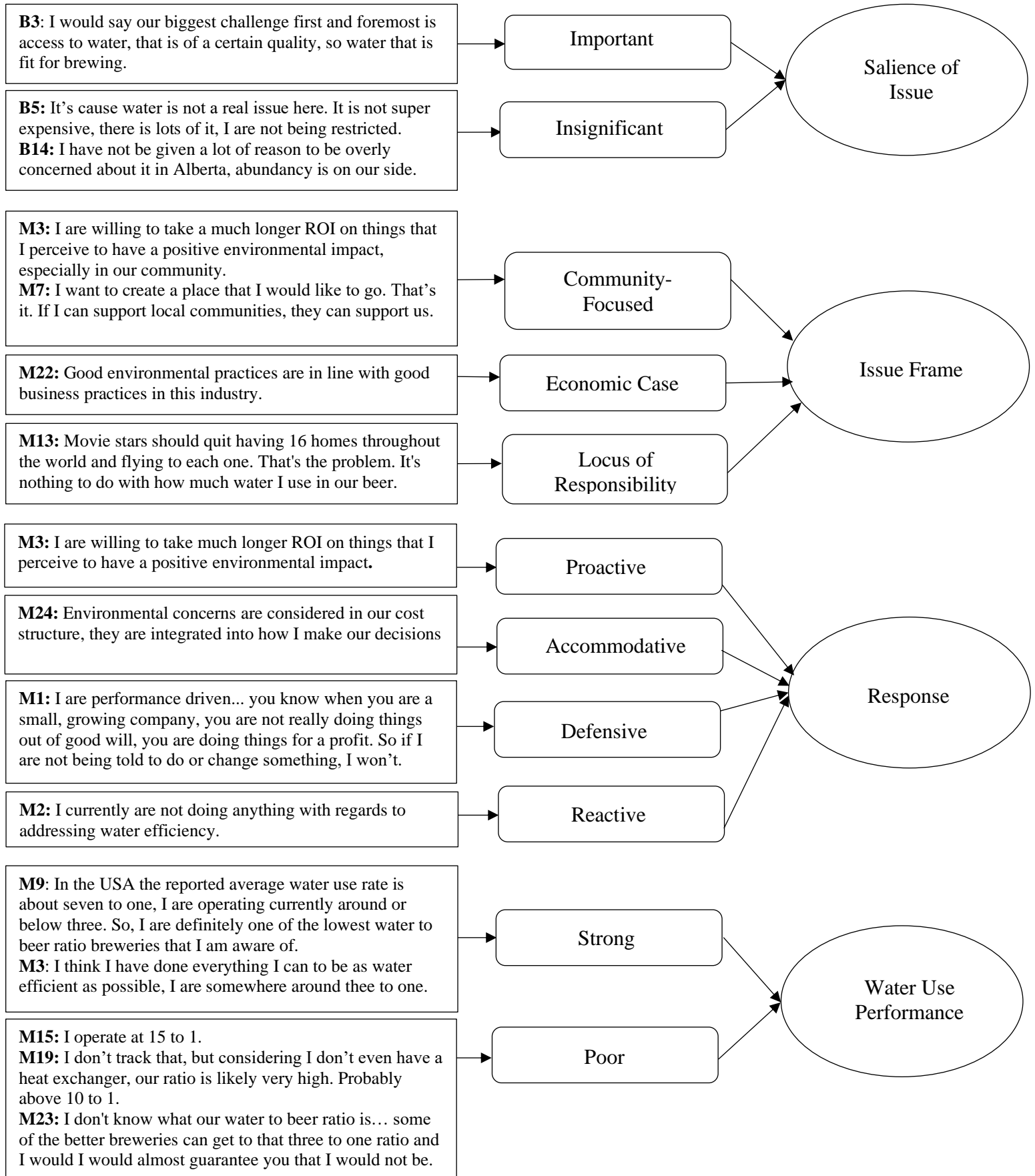


Figure 3. Data coding structure, adapted from Gioia et al. (2013).

4.21 The Influence of Salience in Sensemaking Frames

Our findings revealed that managers take a binary approach to perceiving the salience of their water use and management practices, identifying them as either important or unimportant. The majority of managers, 71%, perceived the salience of these issues to be unimportant and the minority, 29%, to be important.

The managers who perceived water use and management to be unimportant described how water *“has not been a big issue”* [M4] and that *“it’s not a huge priority”* [M23]. This lack of importance stemmed from the fact that these managers did not believe that water challenges will impact their business. For example, one manager said that *“water is not a real issue here. It is not super expensive, there is lots of it, and I are not being restricted”* [M5] and another manager shared that *“I haven’t been affected by restrictions and I don’t think it will happen soon, so I aren’t worried”* [M15]. In contrast, managers who perceived the salience of these issues to be *“incredibly important”* [M6] described their relationship with water as *“the most, most important thing for me”* [M10]. Managers in this group perceived water to be important because of challenges with access to or impacts of their operations on local water resources. For example, one described how locally, *“the availability of, or access to low cost, high quality drinking water is going to be an ever increasing issue”* and so *“I are being the best stewards of the local environment, local community and economy that I can be”* [M9].

Since salience guides managers to “focus on issues that are perceived as having a potential impact on the organization” (Bergman et al., 2016, p. 163), the perceived salience of an issue can be considered an antecedent to issue framing. My results support this, as I found that the frame managers used to interpret their water use and management was coupled with their perceived salience of water issues. In the following section, I first describe the sensemaking frames found in my results and then their relationship with issue salience.

Sensemaking Frames

Sensemaking frames, or “cognitive structures, are mechanisms that filter strategic issues and claim them in a certain context and purpose” (Bergman et al., 2016, p. 163; D. P. Forbes & Milliken, 1999). Frames allow managers to “develop subjective representations of the environment that, in turn, drive their strategic decisions and subsequent firm action” (Nadkarni

& Barr, 2008, p. 1395). As indicated above, in my research I identified three frames; a community-focused (25%), economic case (65%), and locus of responsibility (10%) frame.

i) Community-Focused Frame

Managers who employed a community-focused frame used language that situates water and water management decisions within their local communities. This frame allowed managers to connect global issues with local challenges in order to form an interpretation of how their actions would support or weaken their local communities. For example, one manager described how his/her community *“was one of 17 communities during the 2012-17 drought that was due to run out of water within 100 days”* and so they decided to *“advance over half a million dollars that allowed the city to refurbish existing wells and to put in two additional wells”* [M3]. By doing this, Brewery 3 was able to increase water access for themselves and the town, therefore strengthening the resiliency of both the town and their brewery. Expressing similar sentiments, another manager described how *“I have grown our breweries to support the communities that I are in”* and so in their decision making processes, their local community is considered because *“I wouldn’t be supporting our communities if I weren’t taking care of the local environment as well as our local people”* [M7]. These quotes clearly demonstrate that the goal of managers who employ a community-focused frame is to strengthen their local communities and therefore, they interpret their water use and water management practices as either positive or negative for their community.

ii) Economic Case Frame

The economic case frame, similar to the frame described by Hahn et al. (2014) and Carroll & Shabana (2010), was characterized by the use of economic language in environmental and specifically, water-related, decision making processes. Evident in one manager’s comments that *“good environmental practices are in line with good business practices”*[M22], the goal of individuals using this frame was to *“improve economic performance at the organizational level”* (Hahn et al., 2014, p. 467). Thus, these managers interpret water-related challenges as either positive or negative for their business and use this interpretation as the basis for their decision making process.

iii) Locus of Responsibility Frame

The third frame identified, the locus of responsibility frame, was characterized by managers who did not believe that addressing water use and management practices was their responsibility. When probed about their decision making processes on these issues, individuals would deflect responsibility onto others, saying that *“it is not my problem to deal with”* [M20]. And so, the goal of managers using this frame was to unload the burden of improving their environmental practices on to others through rationalizations such as *“I have a very small impact compared to other industries”* [M13] and *“it is not our expertise, so even if I wanted to reduce our water use I wouldn’t know how”* [M14]. Thus, managers using this frame interpret their water use and management practices to either be or not be their problem.

Relationship Between Issue Salience and Framing

Our findings indicate that the frame managers used to interpret their water use and management was coupled with the manager’s perceived salience of water issues. For example, the majority of managers who perceived water use and management to be important, 7 out of 8, adopted a community-focused frame. The remaining 20 managers, those who perceived issue salience to be unimportant, used either an economic case or a locus of responsibility frame. The majority, 87%, adopted an economic case and 13% adopted a locus of responsibility case frame. Figure 4 graphically depicts these relationships, demonstrating that managers who perceive issue salience to be important are most likely to adopt a community-focused frame whereas those who believe it is unimportant are most likely to adopt an economic case frame.

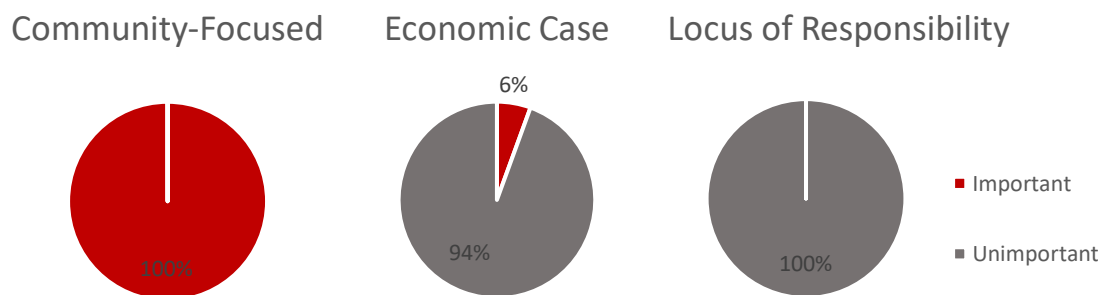


Figure 4. The relationship between managerial perception of issue salience and issue framing.

4.21 Managerial Factors Relevant to Saliency and Sensemaking Frames

Our second research question asked, “how, if at all, do managerial characteristics play a role in the sensemaking process?”. With regards to managerial factors, my results suggest that issue saliency and framing are influenced by the level of education a manager achieves, their field of study, as well as their personal values (in relation to the environment).

Managerial Characteristics and Saliency

Education and Field: My findings suggest that managers with a higher level of education, specifically in the field of science, will perceive the saliency of their water use and management practices to be more important than those with a lower level of education. 100% of managers who fell into the group who considered water to be important had a post-secondary degree and of the 100%, 70% studied science. In contrast 65% of those who considered water to be unimportant had obtained a post-secondary degree and of that 65% the majority, 41%, exclusively studied brewing with the next most common field being science (Figure 5).

Personal Values: My results also suggest that managers who hold personal values of concern for the environment are more likely to perceive the saliency of water use and management to be important. 57% of managers who perceived the saliency of this issue to be important had a concern for or identified with an environmental challenge and 43% did not (Figure 5). In contrast, 100% of managers who perceived their water use and management practices to be unimportant did not have a concern for or identify with an environmental challenge (Figure 5).

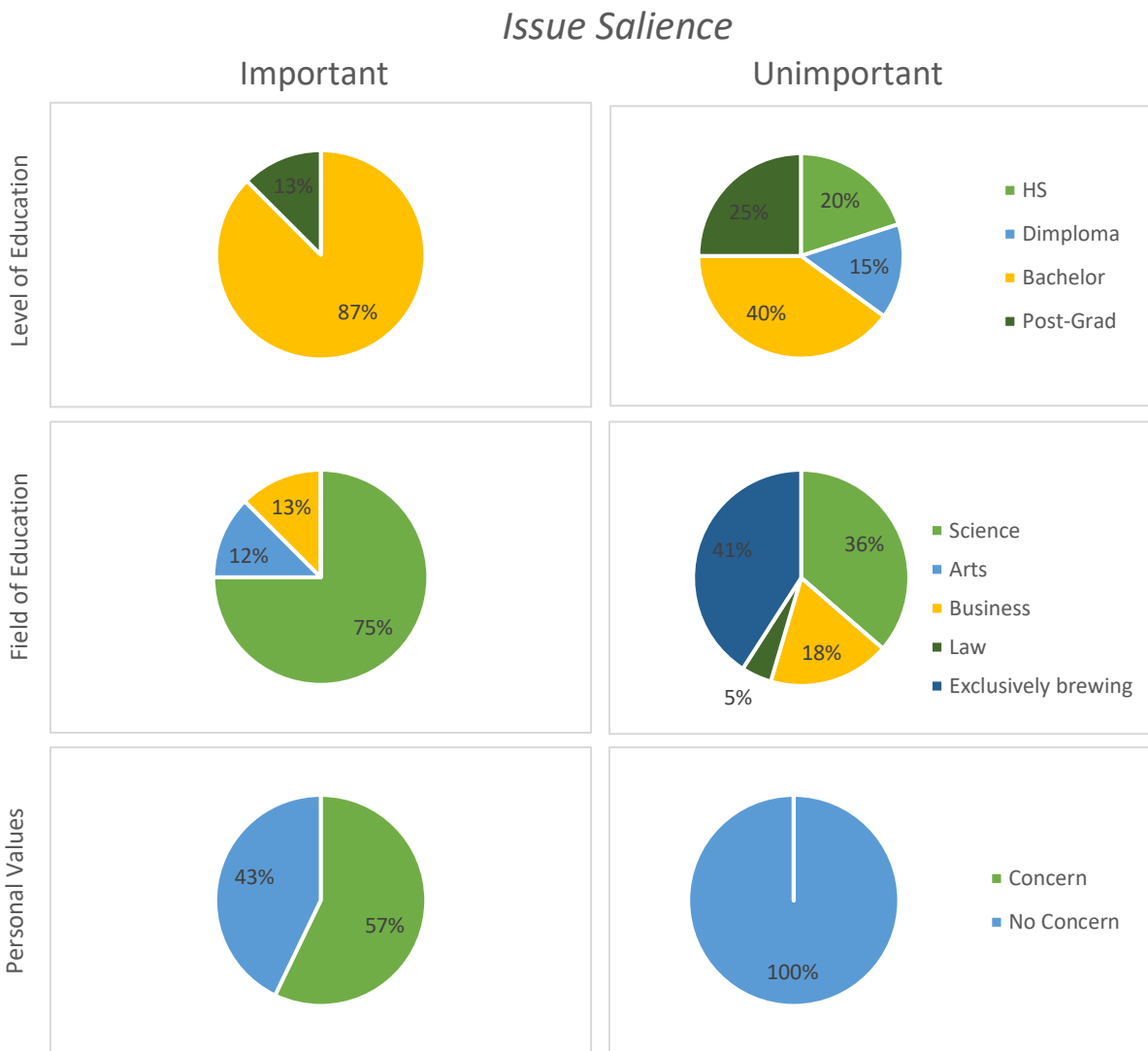


Figure 5. Manager’s perception of issue salience in relation to managerial characteristics.

Managerial Characteristics and Framing

Education and Field: My results indicate that managers with a post-secondary education in the field of science are most likely to adopt a community-focused or economic case frame. I found the community frame to be composed 100% of managers with a post-secondary degree, 86% of whom studied in the field of science. Similarly, 72% of the economic case frame had a post-secondary degree, of which 40% studied science. In comparison, those with lower levels of education in the field of arts or brewing, were found to most often adopt a locus of responsibility frame.

Personal Values: With regards to personal values, I found that managers who have concern for or identify with an environmental challenge are more likely to adopt a community-

focused frame than those who do not. The latter are more likely to adopt a locus of responsibility frame. The community-focused frame was 100% composed of individuals whereas on the opposite end of spectrum, the locus of responsibility frame was 100% composed of managers who did not have these concerns (Figure 6).

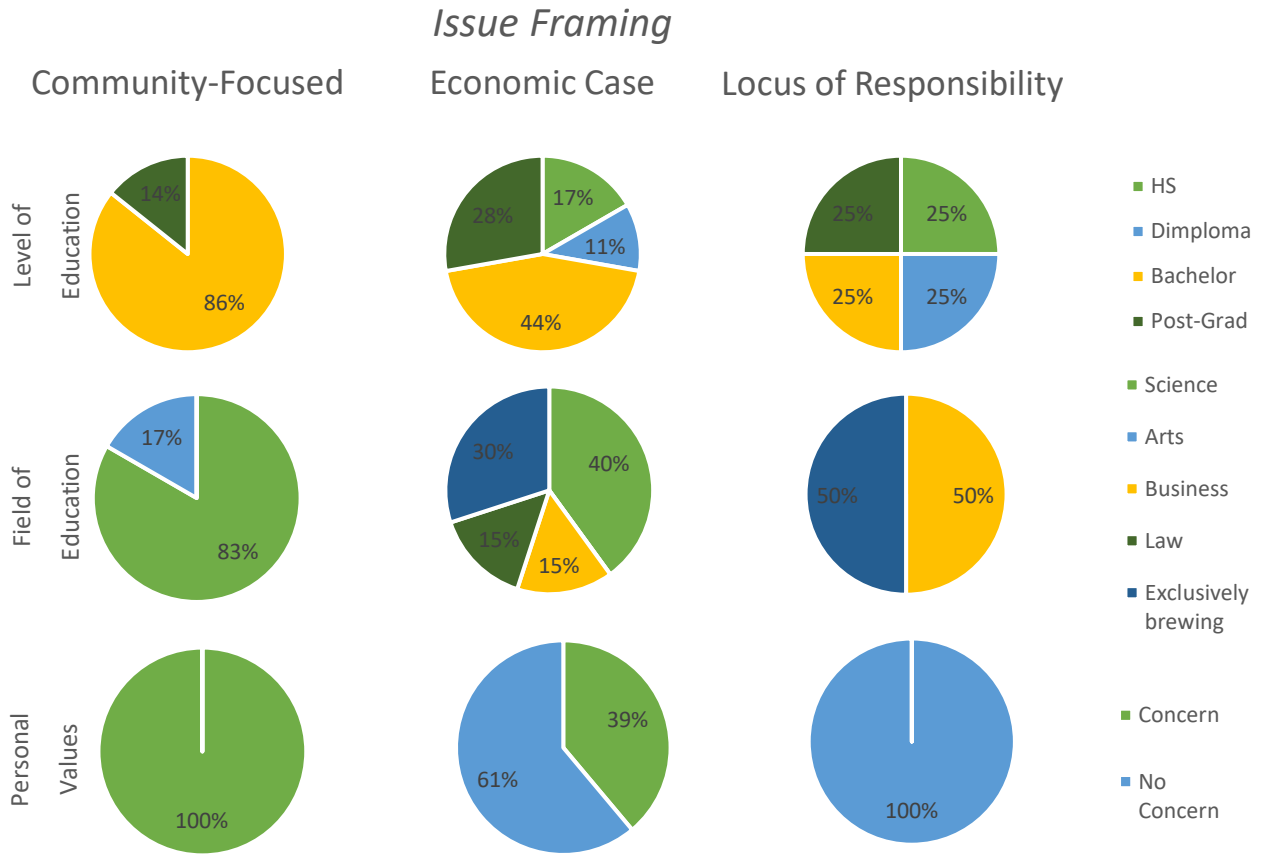


Figure 6. Manager’s sensemaking frame in relation to managerial characteristics.

4.22 Contextual Factors Relevant to Salience and Sensemaking Frames

Our third research question was “how, if at all, do contextual factors (external/internal to the organization) contribute to managers’ sensemaking decisions?”. Here I will review the external factors first, followed by the internal factors.

External Factors and Issue Salience

Population Size: I found population size and the regulatory environment to be influential in issue salience. With regards to population size, my findings suggest that breweries located in

towns and cities with smaller populations are more likely to perceive water use and management to be important than those with larger populations (greater than 500,000) (Figure 7). This is because, 62% of managers who perceived issue salience to be important worked at breweries located in towns and cities in the smallest size category of my research (500,000 or less residents). In contrast, only 45% of managers who perceived issue salience to be unimportant worked at breweries located in the same size category.

Water Pricing System: In the regulatory environment, I found that water pricing systems and experience with water use restrictions influence issue salience (Figure 7). 29% of the entire sample, or 8 of 28 managers, perceived water use and management to be important and of these eight managers, the majority, 75%, operate within an increasing volumetric pricing system. In contrast, 20 of the 28 managers who considered water to be unimportant, 75%, operate within a decreasing volumetric pricing system (Figure 7). This suggests that those individuals who are charged more for water perceive their water use and management to be more important.

Water Use Restrictions: In addition, 25% of those who perceived the salience of water use and management to be important had the experience of operating under water use restrictions, whereas 100% of those who perceived this issue to be unimportant did not have this experience. While 25%, or two managers, may seem small, it represents 100% of those who experienced water use restrictions and therefore suggests that breweries who have firsthand experience operating within restrictions are more likely to perceive water use and management to be important¹.

¹ The 100% of breweries who experienced water use restrictions only represents two breweries in my sample. Manager 3 reported that during a major drought, their local municipality could not provide the volume of water they needed to continue operations at their current level, resulting in a loss of production capacity and millions of dollars. Manager 28 reported an indirect experience with water restrictions. He/she could not open their brewery in their desired town because they could not get access to the volume of water they needed to operate and therefore opened in an alternative location.



Figure 7. Managerial perception of issue salience in relation to external contextual factors.

Population Size: I did not find a relationship between population size and issue framing, with all three groups primarily composed of towns and cities in the smallest population classification. Nevertheless, my results did suggest that the more money managers and breweries pay for water, the more likely they are to adopt a community focused approach to issue framing. 71% of managers who operated within an increasing volumetric pricing scheme adopted a community focused frame, whereas 67% of the managers who adopted an economic and 100% of managers who adopted a locus of responsibility frame operated within a decreasing volumetric pricing scheme (Figure 8).

Water Pricing System: Somewhat contradictory to these findings, managers who operated in both pricing schemes maintained that the price of water was “*so ridiculously cheap... it has no bearing on [breweries decision making] at all*” [M6]. For example, one manager who

worked within the increasing volumetric pricing system said that “*water cost is not a huge driving factor because it is still relatively inexpensive*”[M9]. Similarly, a manager who worked within the decreasing volumetric pricing system commented that water “*is surprisingly cheap... they seem to be giving it away*”[M4] and that “*it is not super expensive, there is lots of it, and I are not being restricted*” [M5].

Water Use Restrictions: My results also indicate that 100% of breweries who experienced water use restrictions had managers who adopted a community-focused frame (Figure 8). I did not identify a relationship between those who did not have experience with water use restrictions and issue framing, as these managers appeared to adopt all frames in no recognizable pattern.

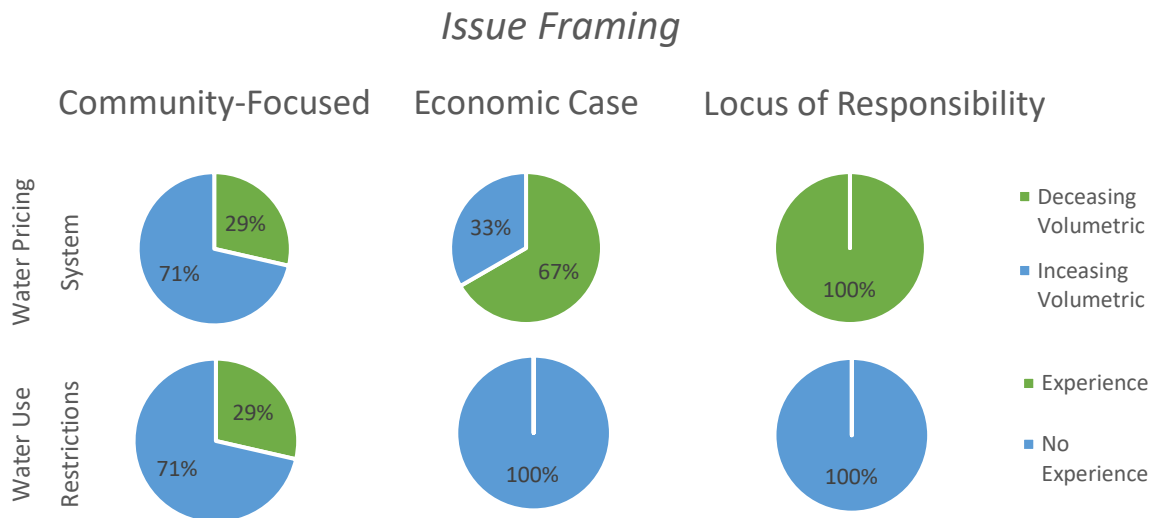


Figure 8. Managerial issue framing differentiated by contextual factors.

Internal Factors (firm level)

Brewery Age: My results suggest that the older and the larger the brewery, the more likely they will be to perceive issue salience as important. While the majority of all breweries were founded in the youngest age category, between 2007 and 2020, and classified in the smallest size category, on average breweries in the group that considered water to be important were both older and larger. Of the breweries in this group, 50% were founded between 2007 and 2020 whereas 80% of the breweries who considered water to be unimportant were founded during this time (Figure 9). The additional 30% found in the group that considered water to be

unimportant translated into an average brewery age of 10 years old, 5 years younger than breweries who perceived water to be important.

Brewery Size: With regards to size, a smaller proportion of those who considered water to be important were classified as small and had a more significant presence of medium and large size breweries (Figure 9). On average, this group was composed of larger breweries, employing 77 employees and producing about 115,000HL of beer annually. In contrast, those breweries who considered water to be unimportant were composed of, on average, 45 employees and produced 10,000 HL of beer annually.

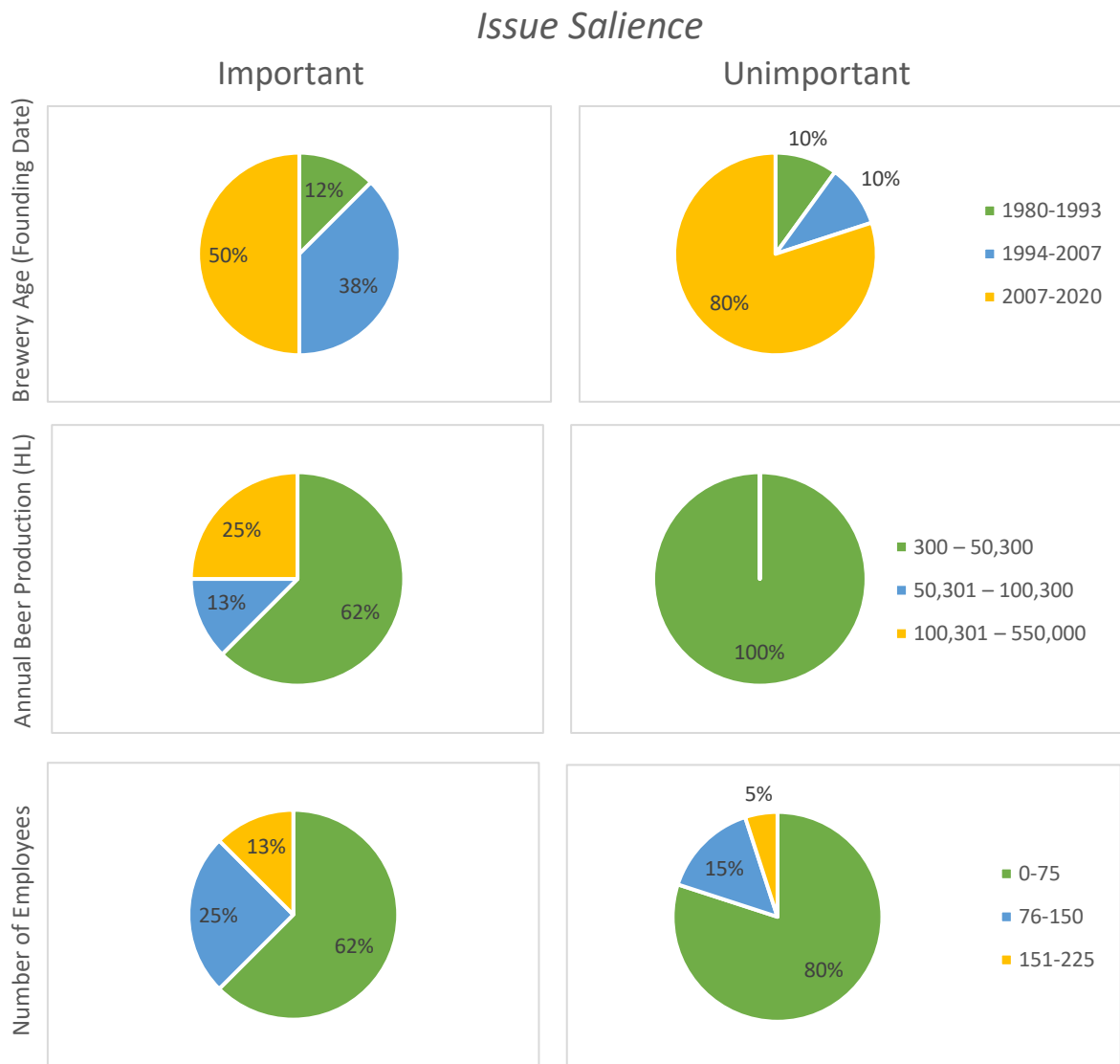


Figure 9. Managerial perception of issue salience differentiated by firm-level factors.

I identified patterns that suggest the older and larger the brewery is, the more likely they are to adopt a community-focused frame, whereas the younger and smaller the brewery is the more likely they are to adopt an economic or locus of responsibility frame. This is because the community frame had the largest percentage of middle-aged (43%) and old breweries (14%) in addition to the largest percentage of medium (29%) and large sized (14%) breweries (Figure 10). In comparison, almost all managers who adopted the locus of responsibility and economic case frame, 100% and 78% respectively, fell into the youngest age group. Similarly, 100% of those who employed a locus of responsibility and 89% of those who adopted an economic frame are located in the smallest size category (Figure 10).

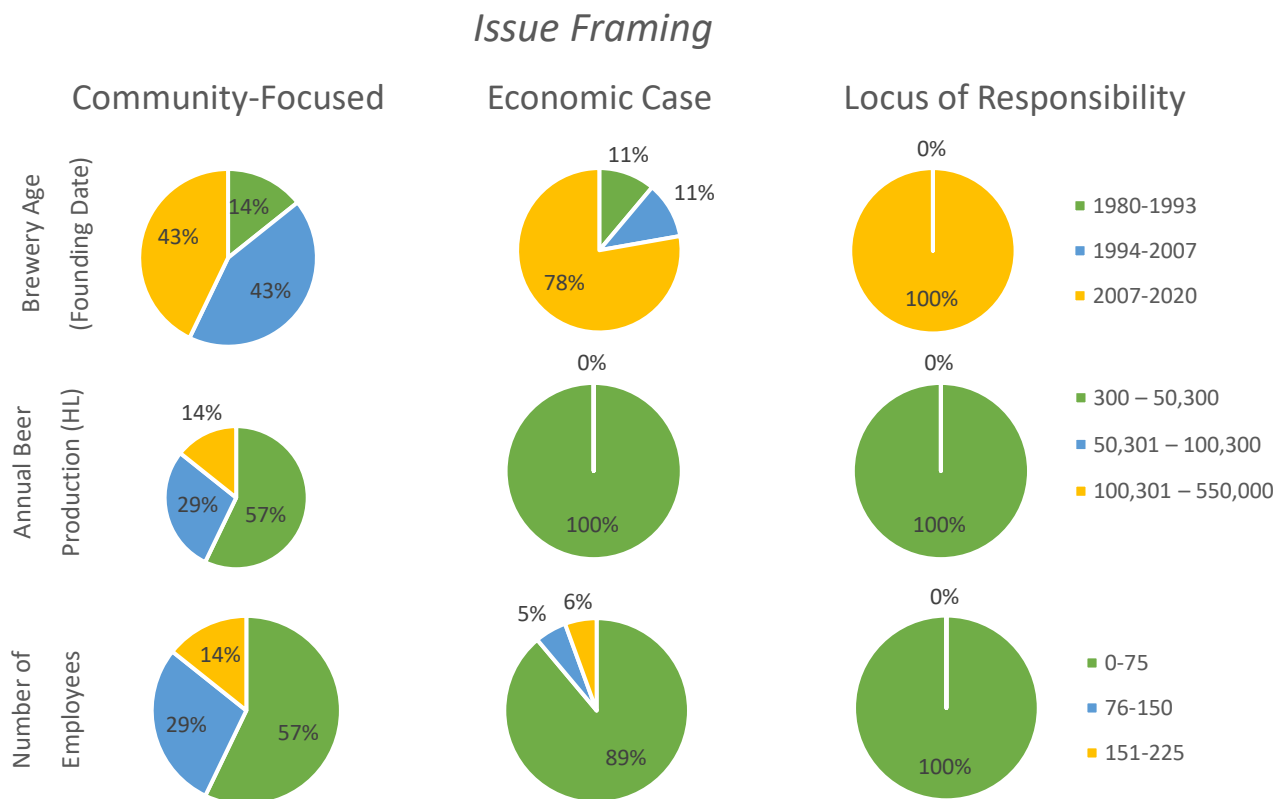


Figure 10. Manager’s adoption of sensemaking frame in relation to firm-level factors.

4.23 The Relationship Between Sensemaking Frames and Water Management Strategy Selection

Our findings thus far have indicated that the salience of the water issue influences how managers frame, and ultimately make sense of the water management challenge. My findings

have also indicated that contextual differences can influence both the salience and the framing aspects of this sensemaking process. I now turn to the question of whether the resultant sensemaking frames employed by the managers is related to the water management strategy (WMS) each manager adopted. In the following sections, I will first provide a brief explanation of each WMS identified in my results, and then describe how sensemaking frames were related to them.

i) *Description of Water Management Strategies*

Many different models for environmental management strategies exist in the literature most of which can be categorized on a scale “according to the extent to which they proactively respond to environmental issues” (Russell & McIntosh, 2011). As previously mentioned and elaborate upon, I used the RDAP (reactive, defensive, accommodative, proactive) management strategy scale, originally developed by Carroll (1979), to classify each brewery’s approach to water management. Each progressive strategy ‘reflects an increasingly important focus on water-related issues, both in terms of strategy formulation and implementation’ (Buysse & Verbeke, 2003).

Reactive Water Management Strategy

A reactive strategy is characterized by little or no action in response to water issues, reflecting core values of profit maximization and a complete absence of water-related challenges being integrated into the decision making framework (Russell & McIntosh, 2011). Breweries that adopted reactive WMSs had “very little long-term vision” (Russell & McIntosh, 2011, p. 9), as indicated by one manager’s comments *“I haven’t been given a lot of reason to be overly concerned about water in Alberta, right now abundancy is on our side and so I do not have any water strategy”*[M14]. This inability to anticipate future challenges acts as a barrier for these breweries to adopt more sustainable or water efficient practices.

Further, in line with Clarkson (1995) and Zadek (2004) findings, these breweries seemed to “deny any responsibility for environmental issues” (Russell & McIntosh, 2011) evident through Manager 13’s comments that water stress or scarcity has *“nothing to do with how much water I use in our beer... the problem is global warming, which is a totally different issue. Movie stars should quit having 16 homes throughout the world and flying to each one, that’s the*

problem not me”[M13]. This complete denial of responsibility halts the development of any water related policy, eliminates funding to support the adoption of water efficiency measures, and results in zero involvement or support from top management on these issues.

Defensive Water Management Strategy

A defensive water management approach is characterized by breweries that take some action to address water use and management, but this action is typically only taken in response to legislation (Roome, 1992). For example, during recent renovations Brewery 8 and 24 had to replace their current toilets and sinks with low flow utilities because of the “*new Calgary building permit*” which legally “*requires owners to put in low flow toilets and automatic sinks*” [M8]. This example reflects compliance as the core value of breweries who take a defensive WMS and demonstrates how these breweries do not anticipate changes in the water efficiency agenda (Roome, 1992). Consequently, this style results in a piecemeal approach to water management where breweries adopt ‘add-on’ practices instead of creating meaningful change in the way the brewery operates (Russell & McIntosh, 2011).

Accommodative Water Management Strategy

Breweries who adopt an accommodative water management strategy ‘are beginning to be proactive in response to water-related concerns’, evident by the partial integration of water use and management into the brewery’s business strategy (Russell & McIntosh, 2011). This integration indicates that some forethought regarding water use and management has occurred, reflecting a critical shift from a purely reactive to a proactive approach. The shift to a proactive response is demonstrated in a manager’s description of their brewery’s corporate goals for 2020, one of which is to “*reduce our waste, and that includes water waste*” [M19]. The fact that this manager’s brewery has water-related corporate goals demonstrates some degree of proactivity in addressing water and integration of water into their business strategy.

According to the literature (Roome, 1992), another key component to the accommodative WMS is that the actions breweries take to address water use and management, go beyond what was required by law. For instance, “*basically putting into place everything that I can, in terms of water recovery and heat recovery, at the scale that I am at*”[M7]. Beyond proactive action, the jump from defensive to accommodative is coupled with “the implementation of new man-

agement thinking and a change in organizational culture” (Russell & McIntosh, 2011) such as what is found at Brewery 26. The manager at this brewery described how in Berkeley and Oakland, where the brewery’s employees live and work, *“the environment is at the top of everyone’s mind”* and so they have *“created that culture at our brewery too, by using hiring practices and hiring people that value the environment”*[M26].

Proactive Water Management Strategy

The proactive management strategy involves “doing a great deal to address issues, including anticipating and actively addressing specific concerns or leading an industry effort to do so” (Jawahar & McLaughlin, 2001). The key characteristic in this definition, and the differentiating factor between proactive and accommodative strategies, is the ability to *anticipate* future challenges and *address* them (Clarkson, 1995). Breweries that adopted proactive WMSs recognized that *“the availability of, or access to low cost, high quality drinking water is going to be an ever increasing issue”*[M9] and that *“water is a finite resource that is essential”* [M3]. This capacity to look beyond the present and anticipate future challenges is the distinguishing characteristic that results in branching between proactive and accommodative WMSs.

Stemming from this capacity, breweries that have adopted a proactive WMS ‘demonstrate consistency in the adoption of voluntary environmental practices over time’ (Russell & McIntosh, 2011, p. 12) and engaged in “a range of activities that were not required by regulation” (Russell & McIntosh, 2011, p. 12). For example, the majority of proactive breweries installed *“full scale pre-treatment systems that have the potential to re-use waste water for various purposes throughout the brewery”* [M3] and in a few cases *“generate energy”*[M3]. With this technology in place, breweries can *“treat all of [their] own waste, discharge almost nothing to the sewer”* [M9] and for Brewery 9 achieve an *“overall reclamation rate of about 70%”* which means that, *“that water gets brought right back into the brewery and is used again for various purposes”* [M9]. These breweries even described how they have the ability to re-use even more water by using it in actual beer production, but that legislation *“is not clear”* and despite *“a lot of research on whether I were able to use it in beer or not... no one knew who’s oversight it was to tell us no”* [M9].

Proactive breweries went beyond technical additions and modifications to their operations and included behavioral change of employees. For example, breweries installed flow

meters to monitor water use in order to inform and evaluate the success of current employee’s water use and management practices in the brewing process. This information was then used to show employees in “fairly real time, what impact their actions have on our resources”[M3].

Beyond this internal water efficiency work, proactive breweries participate in community engagement and outreach, focusing on the education of water resources and responsible use. For example, Brewery 10 collaborated with the city of San Diego on the *Pure Water* project to raise awareness about water scarcity, responsible use, and ultimately to reduce the stigma around drinking reclaimed water. This brewery and its manager worked with the city to promote the project by brewing a beer with ‘toilet’ water from the city’s demonstration facility. The beer produced from the project was then available for sampling “as a tool to teach the public about water re-use”[M10].

ii) *Summary of Relationship Between Sensemaking Frames and Water Management Strategy*

I found that the sensemaking frame managers use to interpret the issue of water use and management practices influenced the WMS their brewery adopts. As Figure 11 demonstrates, I found that the majority of managers (71%) who employed a community-focused frame adopted a proactive WMS, most managers (78%) who interpreted water issues with an economic case frame adopted a defensive WMS, and 100% of managers who used a locus of responsibility frame adopted a reactive WMS.

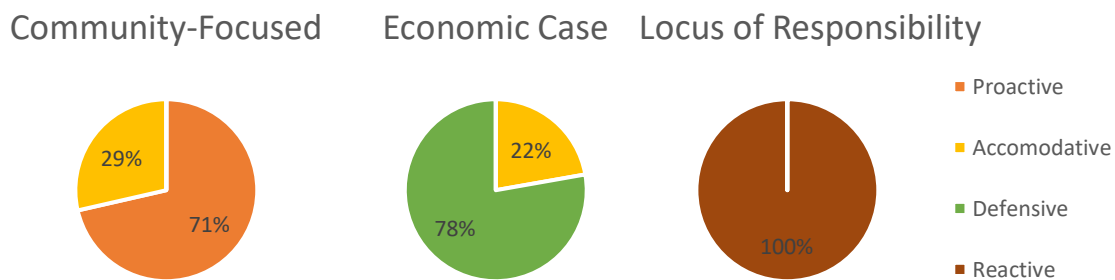


Figure 11. The relationship between each manager’s cognitive frame and the adoption of water management strategy.

Table 5. The relationship between the sensemaking frame managers adopted and their water management strategy.

Cognitive Frame	Water Management Strategy	Manager’s Quotes
Community-Focused	Proactive	M3: “I are willing to take much longer ROI on things that I perceive to have a positive environmental impact, especially in our community”.
		M9: “I treat all of our own waste, I discharge almost nothing to the sewer and our overall reclamation rate is about 70%, so that water gets brought right back into the brewery and is used again for various purposes” because “the availability of, or access to low cost, high quality drinking water is going to be an ever increasing issue”.
33.3% Community-Focused 66.6% Economic Case	Accommodative	M26: “Good environmental practices are in line with good business practices in this industry, and so I have integrated some of these practices into our business strategy”.
		M7: “I know I use a lot of water, so I have basically put into place everything that I can, in terms of water recovery and heat recovery for the scale that I are at”.
Economic Case	Defensive	M1: “I probably should reduce our water use, but it doesn’t save us money or time so I won’t right now”.
		M8: “I could put a plan together and propose some things to do that are not prohibitively expensive, but right now our priority is the cashflow and compliance side”.
Locus of Responsibility	Reactive	M2: “I currently are not doing anything with regards to addressing our water efficiency.”
		M13: “It is not my responsibility... I haven’t done much on water consumption.”

4.24 The Relationship Between WMS and Water Use Performance

I found that the WMS a brewery adopted was related to their brewery’s water use performance, simply measured here by their water to beer ratio. Breweries with proactive or accommodative WMSs had the lowest water to beer ratio, at 4.2L water/1L beer and 3.9L water/1L beer respectively (Table 6). Surprisingly, breweries who adopted an accommodative WMS had on average a slightly lower water to beer ratio than those who adopted a proactive WMS. This discrepancy could be explained by my findings that 100% of breweries who implemented a proactive WMS knew their water to beer ratios, while only 66% of those who employed an accommodative WMS did. Therefore, the missing water to beer ratios could skew the

accommodative group’s average WUP. Breweries who implemented a defensive WMS had on average the highest water to beer ratio at 7.9L water/ 1L beer, but only 25% of the breweries in this group knew their water to beer ratio. Further, no breweries who adopted a reactive WMS knew their water to beer ratio and thus I have no average value for this group of breweries.

Table 6. Summary of the relationship between the water management strategy a brewery selects and that brewery’s water to beer ratio.

Water Management Strategy	Average Water to Beer Ratio (L water/1 L Beer)	Percentage of Breweries who know their Water to Beer Ratio
Proactive	4.2	100%
Accommodative	3.9	66%
Defensive	7.9	25%
Reactive	Unknown	0%

4.3 Summary

To summarize, in this chapter I presented my qualitative and quantitative research findings addressing my three research questions. In my next chapter, I will present my discussion by situating my findings within the literature, the limitations of my study, my recommendations for future research directions, and my concluding thoughts.

Chapter 5: Discussion

5.1 Summary of Key Findings

Access to high quality and reliable freshwater resources is a global concern and demand continues to grow (Devlaeminck et al., 2017). In the face of these mounting pressures the need for sustainable water use practices is paramount, yet organizations continue operate with immense variation in their WUP. Thus, my research was driven by the desire to better understand why variation in WUP – and accordingly variation in water sustainability - continues to persist within the craft brewing industry. In an effort to better understand this variation, my study addressed three questions:

1. How, if at all, does managerial sensemaking influence managers' choice of water management strategy?
2. How, if at all, do managerial characteristics play a role in this sensemaking process?
3. How, if at all, do contextual factors (the external environment, the organizational environment) contribute to managers' water-related sensemaking decisions?

In order to answer these questions, my methodology went beyond the traditional approach of analyzing managerial characteristics and applied a sensemaking framework to semi-structured interviews. In doing this, I discovered the following findings:

First, I found that managerial sensemaking at craft breweries and specifically, the processes of issue salience and issue framing, are related to water management strategy selection. The more salient managers perceive water use and management practices to be, the more likely they are to adopt a community focused frame. On the opposite end of the spectrum, those who deem water to be non-salient are more likely to adopt an economic or locus of responsibility frame. Further, the frame brewery managers adopt appears to be related to the water management strategy they select. Managers who adopt a community focused frame are most likely to implement proactive water management strategies (WMS) whereas those who adopt an economic case or locus of responsibility frame are more likely to pursue defensive and reactive WMSs. Crucially, I found that such water management strategies are highly related to the water use performance of the brewery. In short, the type of cognitive frame a manager adopts is, indeed, environmentally relevant.

Second, I found that the relationships described above are influenced by contextual, firm, and managerial characteristics. Breweries whose managers were most likely to perceive water to be salient and adopt community focused frames, operated within an increasing volumetric water pricing system and had direct experience with water use restrictions. These breweries were typically larger as well as older, were managed by individuals who achieved higher levels of education, specifically in the field of science, and by individuals who personally valued the environment. The opposite was found to be true for brewery managers who perceived water to be non-salient and adopted defensive or reactive WMSs. These breweries operated within a decreasing volumetric water pricing system and had no experience with water use restrictions. On average, these breweries were smaller as well as younger, were managed by individuals who had lower levels of education, such as a high school diploma or certificate, and by individuals who did not value the environment.

These findings have implications that contribute to the extension of both existing theory and to the improvement of water use practices at craft breweries. In the following sections, I will elaborate on these implications, describe the limitations of my study, and provide directions for future research.

5.2 Theoretical Implications

Our literature review led us to recognise that there is a lack of knowledge and understanding explaining why water use varies so significantly within the craft brewery industry. Thus, I expanded my review to include corporate environmental performance (CEP) at organizations more generally. I found that the majority of literature on this topic focused on the role of managerial characteristics, such as Hambrick & Mason's (1984) Upper Echelon Theory, in environmental management and did not shed light on how managers actually perceive, interpret, and act in strategic situations (Boal & Hooijberg, 2000; Priem et al., 1999). While the literature demonstrates that managerial characteristics can play an important role in environmental management and CEP, this unidimensional approach failed to capture the actual processes at play and hinders an organization's ability to improve environmental and water use performance. Thus, the purpose of this research was to improve my understanding of the multi-level factors that contribute to variation in water use and more generally, CEP.

5.21 Extension of Sensemaking Theory

The purpose of this study was to go beyond traditional approaches used to explain variation in corporate environmental performance, in order to address the lack of literature on how people actually notice, interpret, and respond to environmental challenges. While conventional approaches focus on managerial characteristics, I chose to conduct semi-structured interviews in a sensemaking framework in order to identify alternative cognitive determinants that could contribute to variation in water use performance. In doing this, I extended existing theory in two ways: first, by applying sensemaking to a new context and secondly, by generating novel insights into what drives discrepancies in water use performance. In the following sections, I elaborate on these findings and their contributions to the literature.

Sensemaking in a New Context

Since studies specifically examining managerial sensemaking and water use management/performance are completely absent, my research expands upon the existing sensemaking literature by applying a sensemaking framework to a novel context. My application of sensemaking to understanding how craft brewery managers notice, interpret, and respond to water-related stimuli bridges two bodies of literature: sensemaking and water management. In doing this, I developed a model to depict how the way in which brewery managers make sense of water-related stimuli can influence their water use performance (Figure 12).

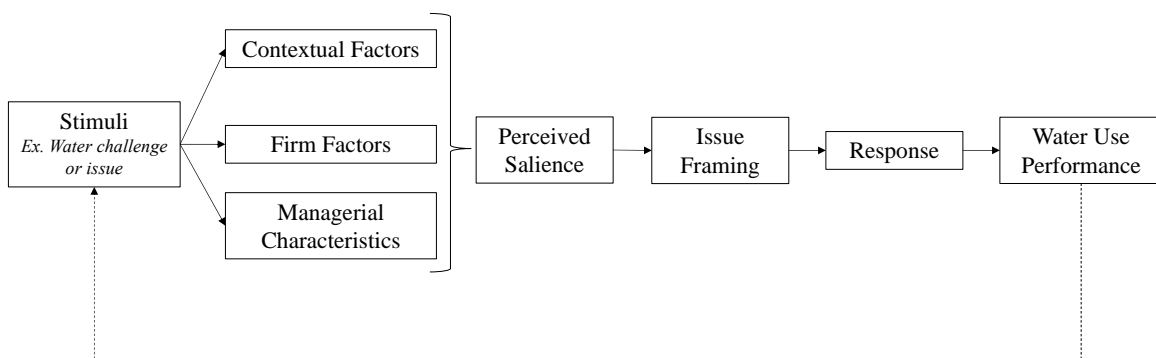


Figure 12. Model depicting manager's decision making process based on my findings.

As shown in Figure 12, my findings suggest that perceived salience of water use and management practices is related to how a brewery chooses to address water-related challenges

and ultimately, their brewery's water use performance. Those managers who perceive water issues to be highly salient appear more likely to interpret the issue using a community focused frame, putting greater energy and resources into integrating sustainable water management practices at their brewery. I found this perception and water management approach yielded the most informed brewery managers, with regards to their water consumption, and a water to beer ratio below the industry standard. On the opposite end of the spectrum, I found that managers who deemed water-related challenges to be non-salient adopted an economic case or locus of responsibility frame. This resulted in the implementation of less proactive approaches to water management, such as defensive or reactive WMSs, allotting significantly less energy and resources to water issues. Consequently, the water use performance of these breweries was weak, evidenced by the large percentage of breweries that did not know or track their water to beer ratio and for those that did, their ratios were above industry average.

These findings are important because they shed light on alternative cognitive determinants driving variation in water use performance and demonstrates that the sensemaking process can act as an influential mediating process in water management and water use performance.

The Effect of Cognitive Frames on Managerial Sensemaking

Several authors have used a cognitive frame lens to examine and analyze environmental sustainability-related topics (Andersson & Bateman, 2000; Maon et al., 2010; Sharma, 2000), but a “detailed analysis of the effects that cognitive frames with different content and structure have on manager's sensemaking of the ambiguities around sustainability is still lacking” (Hahn et al., 2014, p. 464). Providing insights into this gap, my results indicate that cognitive frames with distinct content and structure are associated with different perceptions of issue salience, different water management strategy selections, and different water use performance outcomes (Figure 13). For example, 100% of managers who adopted a community focused frame perceived water issues to be salient and, of those managers, all employed either a proactive (71%) or accommodative (29%) WMS. Further, the breweries that these individuals managed had the best WUP evidenced by the fact that on average, they had the lowest water to beer ratio.

Following a similar pattern, 100% of managers who adopted a locus of responsibility frame perceived water issues to be non-salient. All of these managers employed a reactive WMS

and none of them knew or tracked their water to beer ratio, producing on average the worst WUP. Thus, my findings indicate that dissimilarities in cognitive frames that a manager adopts can lead these individuals to interpret water-related stimuli differently. These differing interpretations can then lead managers to pursue different water management strategies which ultimately influences their brewery's water use performance.

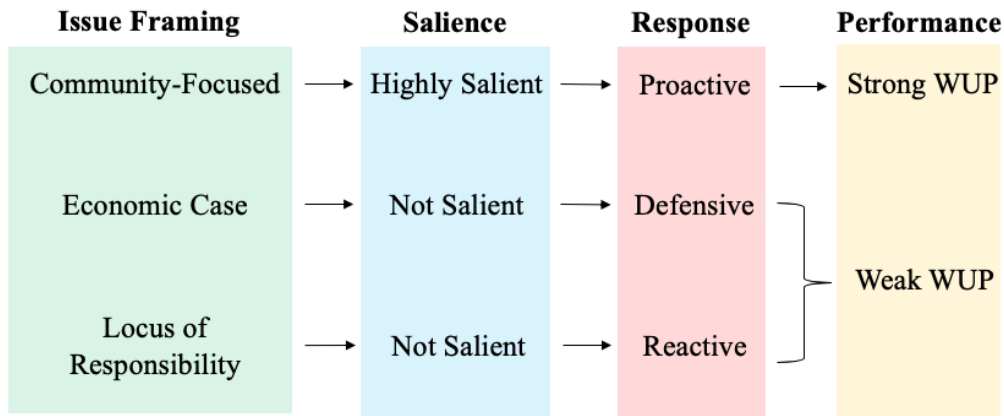


Figure 13. Summarization of sensemaking frames and their relationships with issue salience, response, and water use performance.

The Introduction of New Cognitive Frames

Our findings further expand upon cognitive frame theory by introducing alternative cognitive frames that managers appear to use. Presently, the literature surrounding cognitive frames is dominated by business-case thinking (Carroll & Shabana, 2010; Hahn et al., 2014) and this has resulted “in a situation where managerial responses to sustainability issues are conceptualized along an opportunity/ threat dichotomy dominated by economic objectives of the firm” (Andersson & Bateman, 2000; Hahn et al., 2014, p. 464; Sharma, 2000). While I found that a large proportion of managers interpreted and responded to water challenges in an economic sense, the language of opportunity and threat did not emerge. Instead, alternative cognitive frames that surfaced in my study included a community focused and locus of responsibility frame. Those managers who adopted a community focused cognitive frame appeared to conceptualize water-related issues in relation to how their decisions would strengthen or weaken their local community. Managers spoke about their decisions in relation to their community's local environment, economy, and social cohesion. In contrast, the alternative frame that emerged was the locus of responsibility frame, which filtered and situated water-

related decisions in the context of who's responsibility it was to address these issues. Thus, my findings expand the traditional dichotomy of opportunity/threat which dominates the literature and suggests that while the business case of for water issues is important, it is not the only way in which managers make sense of water related decisions. The alternative frames I identified in my study provide greater understanding of the underlying cognitive determinants that generate different responses to water and more generally, environmental issues.

5.22 Deeper Understanding on the Influences of Individual Differences

My research contributes to and enriches existing theory regarding managerial characteristics and environmental performance in two ways. First, my findings support the hypothesis that some managerial characteristics can and do influence environmental performance (Finkelstein et al., 2009; Hambrick, 1982, 2007; Kagan et al., 2003; E. S. W. Ng & Burke, 2005; Post et al., 2011). For instance, I found that breweries with the best WUP scores employed managers who had higher levels of education, studied in the field of science, and who personally valued the environment. Secondly, my research goes beyond our traditional understanding of this relationship by establishing links between managerial characteristics and the intermediate steps of the sensemaking process. The establishment of these links sheds light on how and why managerial characteristics influence the environmental performance of organizations.

With regards to how, I found that certain managerial characteristics can influence all stages in the sensemaking process including the perceived salience of a water related issue, how this issue is interpreted, and ultimately how the manager chooses to respond. For instance, I found that managers with the following characteristics: (1) obtained a bachelor or post-graduate degree, (2) studied in the field of science, and (3) personally valued the environment were more likely to perceive water related issues to be salient. Managers with these characteristics also tended to interpret water issues with a community focused frame and subsequently adopt a more proactive WMS, yielding the best WUP scores in my sample. The establishment of these links helps to explain why a managerial characteristic, such as education, might influence a brewery's WUP score. Therefore this finding provides insights not only into the decision making processes at these and similar organizations but also into training programs for brewery managers and ways in which a brewery can improve their WUP score.

5.23 Deeper Understanding of the Influence of Contextual Differences

In the environmental management literature, many different contextual factors are cited as reasons for why organizations are driven to improve their CEP. In no particular order, three of the most cited include, (1) legislation and policy, (2) profitability, and (3) external pressures (Dummett, 2006; Naidoo & Gasparatos, 2018). The results of my research support existing theory for both legislation and policy as well as profitability. I found that breweries who operate under an increasing volumetric water pricing system are more likely to perceive water use issues to be important, pursue more proactive WMSs, and have better WUP. An increasing volumetric system legislates that the price of water increases as the user consumes more water and thus due to a combination of both legislation and profitability, managers are driven to decrease their water consumption. This finding contributes to the discussion regarding contextual factors that influence CEP and also provides insights for municipal authorities who are interested in promoting sustainable water use and management practices.

5.3 Limitations

While I believe this study enriches and adds to existing theory, it is not without its limitations. Specifically, my cross-sectional approach contributed to the development of a linear model, the nature of which limits my research in two significant ways. First, it inhibits my ability to determine which step in the sensemaking process occurs first. To elaborate, my study demonstrates that relationships between perceived salience and the type of cognitive frame adopted exists but, I cannot determine which stage drives the entire the process. For instance, I cannot state if issue salience drives issue framing, or if the perceived salience of water use and management practices is the result of how the manager chooses to frame the issue.

Secondly, my cross-sectional approach and linear model excludes important feedback cycles that likely exist within the decision making process. In previous work, linkages between the sensemaking stages were identified and the impact of each stage on preceding or subsequent stages was described. For example, Thomas et al. (1993) demonstrated how the act of scanning can influence interpretation and interpretation simultaneously influences scanning, creating a positive feedback cycle.

Acknowledging my limitations are important to consider, I believe that my research contributes to and extends the literature on environmental management/performance. Further, I

believe that due to these limitations, my research provides opportunities for further research in and contributions to this area of study.

5.4 Directions for Future Research

Despite the above limitations, the findings of my research reveal multiple opportunities for further research in the area of managerial sensemaking and water use performance. Specifically, my introduction of two new cognitive frames (community-focused as well as the locus of responsibility) expands my understanding of the underlying cognitive determinants and demonstrates the effect that cognitive frames can have on water use performance. These findings raise new questions about how communities can attract and retain companies that possess a community focused frame and what has made these companies so community focused? Similarly, what drives companies to adopt a locus of responsibility frame? Does this cognitive frame appear in other industries or in alternative environmental contexts?

5.5 Practical Implications for Water Sustainability

Notwithstanding the limitations listed above, this study has several practical implications for craft breweries immediate economic well-being as well as their water use efficiency. Further, these implications could be informative for similarly sized organizations that share comparable water use concerns. First, the fact that each sensemaking frame identified in my study was associated with the adoption of different water management strategies is important. Since each strategy allots varying amounts of time, energy, and resources to addressing water-related issues, each sensemaking frame is associated with different water use performance outcomes. The implication of this finding is that depending on the level of water use performance sought, the optimal sensemaking frame for a brewery, or a similar organization, will vary. For example, community-focused frames may be highly desirable for breweries who seek to improve their water use practices whereas an economic case frame may be better suited for those who do not see it as salient and prefer to prioritize profit generation.

Second, I identified characteristics of managers that are related to the adoption of sensemaking frames. For example, I found that most managers who achieved higher levels of education, specifically in the field of science, were more likely to adopt community focused frames. Since, each frame is associated with a strategy, and each strategy is related to water use

performance outcomes (as described above) these characteristics are therefore also related to water use performance outcomes. Similar to my first implication, these findings suggest that the characteristics of an optimal manager for a craft brewery will vary depending on their goals and aspirations. This finding suggests that breweries that aspire to improve their water use practices should consider a manager's education and personal values when hiring.

Our third implication is for governments, including municipal authorities, who are interested in promoting sustainable water use and management practices. My findings suggest that a manager's perceived salience of water and water-related issues or challenges is related to the water pricing system they operate within. I found that those who operate within an increasing volumetric pricing system, a system under which the cost of water increases as the amount of water used increases, believe water is more salient. Since my findings suggest that higher salience is related to the adoption of more proactive water management strategies, I therefore predict that when it costs more to use greater amounts of water, breweries are more likely to pursue proactive water management strategies. This finding has practical implications for municipalities who are interested in promoting sustainable water use and management practices.

5.6 Conclusions

In conclusion, my research aimed to address three questions: (1) how, if at all, does managerial sensemaking influence managers' choice of water management strategy? (2) how, if at all, do managerial characteristics play a role in this sensemaking process? And (3) how, if at all, do contextual factors (the external environment, the organizational environment) contribute to managers' water-related sensemaking decisions? To address these questions, I explored how managers at craft breweries make sense of water-related stimuli using semi-structured interviews. I found that managerial sensemaking acts as a mediating process in a manager's choice of water management strategy and ultimately influences their brewery's water use performance. In addition, I found that these relationships are affected by managerial characteristics and contextual factors.

My findings are both relevant and important, as the world's demand for fresh water and the number of people living in water stressed conditions continues to rise. The findings I have made both extend and contribute to existing sensemaking and cognitive frame theory, therefore shedding light on alternative cognitive determinants driving water use variation. In addition,

these findings have practical implications for breweries, and similarly sized organizations with like water consumption goals, as they provide ways in which breweries can improve their water use performance and thereby contribute to water sustainability.

While I believe my findings have great value, I acknowledge that my study does have limitations. These limitations have raised new questions and inspired ideas for new research directions. For instance, how can communities foster, attract, or retain organizations that employ community focused frames? Or, what factors contribute to the adoption of locus of responsibility frames? And, can my findings be extrapolated to other organizations? Answers to these questions would contribute to my understanding of why variation in water consumption practices persists within and across industries, thus contributing to greater water security and sustainability.

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Appendix

Appendix A. The semi-structured interview protocol used to collect data for this study.

Interview Protocol: *The Role of Managerial Sensemaking in CEP*

Brewery Name:

Interviewee Name & Position:

A) DEMOGRAPHICS

1. Please provide the following information –
 - Gender:

 - Length of time in current position:

 - Education (level and program):

 - Past work experience (in last 15 years):

B) ORGANIZATIONAL INFORMATION

1. How many people are employed at your brewery?

2. How much beer do you produce annually?

3. Are you connected to an association or industry group? *Speaks to their sectoral knowledge.*

C) SCANNING

1. What are the top three challenges facing your brewery?

2. What are the top three environmental challenges facing your brewery? (If you have any)
 - i. **IF WATER DOES NOT COME UP:** Are you aware of any water-specific challenges? Please tell me what you know.

 - ii. How did you become aware?
 - Probes:
 - Legislative / Policy issues considered (& how/why?)
 - Stakeholders considered (& how/why?)
 - Profit issues considered (& how/why?)
 - Managerial factors (e.g., personal values, beliefs, attitudes)

3. To what extent do you perceive the environment (water) to be important in your company's ability to achieve its goals?

Circle one answer:

- 1 – no importance whatsoever
- 2 – very little importance
- 3 – semi-important
- 4 – important
- 5 – very important

- i. What has influenced this perception?

Value component:

- Is it of value for your brewery to operate in a more environmentally friendly way?
 - Why or why not?
 - If it **is** – how do you reconcile this value with how you operate your business?

Short term vs. long term perspective: not a concern now, but do you think it could become a concern in the future? Have you thought about this? How long do you think it would take to respond should you find yourself in a situation where water restrictions are implemented?

4. To what extent do you feel that you have the time and resources to research and understand the environmental issues relevant to your business?

Circle one answer:

- 1 – no time
- 2 – very little time
- 3 – some time
- 4 – enough time
- 5 – more than enough time

- i. What do you see as the major facilitator or hinderance to your time and resources?

5. How often do you receive **useful** information from each of the following sources regarding environmental (water) challenges in Alberta? *Useful is defined as information that helps the manager to understand the issue and plan/make decisions regarding action.*

Please rank from 1 to 5: 5 = daily, 4 = weekly, 3 = monthly, 2 = few times a year, 1 = less than 1 a year

		Source	Answer (1-5)
Internal	Personal	Conversation with employees	
		Staff meetings	
		Other	
	Impersonal	Studies/Reports/Data	
		Memos	
		Other	
External	Personal	Conversation with peers from different organizations	
		Personal tours/ trips	
		Other	
	Impersonal	News sources (paper, magazines)	
		Academic research journals	
		Other	

- i. Is there a reason why you opt for the sources you do over others?

D) INTERPRETATION

1. To what extent would you label Alberta's environmental challenges (specifically water) as a positive/negative situation for your brewery operations? Please rank and explain why you gave it that ranking.

Circle one answer:

- 1 = very negative
- 2 = negative
- 3 = neutral
- 4 = positive
- 5 = very positive

Explanation probes:

- Legislative / Policy issues considered (& how/why?)
- Stakeholders considered (& how/why?)
- Profit issues considered (& how/why?)
- Managerial factors (e.g., personal values, beliefs, attitudes)

2. To what extent do you feel that you have something to gain or lose from the situation described above? Please rank and explain why you gave it that ranking.

Circle one answer:

- 1 = a lot to lose
- 2 = something to lose
- 3 = no impact
- 4 = something to gain
- 5 = a lot to gain

Explanation probes:

- Legislative / Policy issues considered (& how/why?)
- Stakeholders considered (& how/why?)
- Profit issues considered (& how/why?)
- Managerial factors (e.g., personal values, beliefs, attitudes)

3. To what extent do you feel that you have control over the situation described above? Please rank and explain why you gave it that ranking.

Circle one answer:

- 1 = no control
- 2 = very little control
- 3 = some control
- 4 = moderate control
- 5 = full control

Explanation probes:

- Legislative / Policy issues considered (& how/why?)
- Stakeholders considered (& how/why?)
- Profit issues considered (& how/why?)
- Managerial factors (e.g., personal values, beliefs, attitudes)

ACTION

2. Have you responded to your perception of the water situation in Alberta? Yes/No, please explain.

1. How have you responded?

- i. Have you adopted any **new technology or equipment** to address the water situation in Alberta? Please list and explain.
- ii. Have you adopted any **new strategies or operations** to address the water situation in Alberta? Please list and explain.
 - *Formal policy/strategy, formal reporting, financial support, employee training, integration into daily processes, monitoring (measurements or indicators that would indicate the effectiveness of said strategy)*

2. What do you see as major facilitators or hinderances to adopting a response?

Explanation probes:

- Scanning process?
- Interpretation process?
- Legislative / Policy issues considered (& how/why?)
- Stakeholders considered (& how/why?)
- Profit issues considered (& how/why?)
- Managerial factors (e.g., personal values, beliefs, attitudes)

3. What prompted you to respond? Please explain.

Explanation probes:

- Scanning process?
- Interpretation process?
- Legislative / Policy issues considered (& how/why?)
- Stakeholders considered (& how/why?)
- Profit issues considered (& how/why?)
- Managerial factors (e.g., personal values, beliefs, attitudes)

3. How much water do you use per litre of beer produced?
4. Do you have any other environmental practices or initiatives? Ex. Diverting spent grain, CO2 recovery, stewardship initiatives?
5. I have asked you some specific questions, now is there anything I have missed that you would like to add? Ex. Recommendations to gov't – to help you do what best aligns with your business and the environment?