



Integrating Sustainability: Exploring Management Control Systems in the Land-Based Aquaculture Industry

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Abstract

This thesis explores the integration of sustainability within Management Control Systems (MCS) in the land-based aquaculture industry, focusing on how these systems support companies in developing sustainable practices. As environmental concerns and regulatory demands intensify, the role of effective Management Control Systems (MCS) in integrating sustainability into core business operations has become essential. This study adopts a qualitative research design, conducting semi-structured interviews with industry stakeholders to investigate this integration.

The findings indicate that while many organizations in the land-based aquaculture industry adopt innovative approaches to align their economic, environmental, and social goals, significant challenges persist in fully integrating sustainability at all operational levels. Specifically, the effectiveness of MCS varies greatly depending on each company's strategic vision plan, cultural dynamics, and operational priorities. This variation influences how broadly sustainability is integrated into strategic planning and daily operations. The study reveals that despite the recognized importance of comprehensive MCS, their effective deployment in enhancing sustainability practices is often hindered by a lack of clarity in sustainability goals and insufficient alignment with broader strategic objectives. Technological advancements and stakeholder involvement emerge as key drivers that could enhance sustainability integration.

The study contributes to a deeper understanding of MCS's strategic and operational implications in integrating sustainability within a rapidly evolving industry. It highlights the need to develop systems that support current sustainability goals and are adaptable to future environmental and regulatory changes. The findings aim to inform and inspire aquaculture practitioners and policymakers in enhancing sustainable industry practices.

Key Words: Management Control Systems, Sustainability, Land-based aquaculture, Environmental Management, Stakeholder Engagement, Dynamic Capabilities

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Sumário

Esta tese investiga a integração da sustentabilidade nos Sistemas de Controle de Gestão (SCG) na indústria de aquicultura terrestre, enfocando como esses sistemas ajudam as empresas a desenvolver práticas sustentáveis. Com o aumento das preocupações ambientais e das exigências regulatórias, torna-se essencial que os SCG incorporem sustentabilidade nas operações de negócios principais. Este estudo utiliza um design de pesquisa qualitativa, realizando entrevistas semiestruturadas com stakeholders da indústria para explorar essa integração.

Os achados mostram que, embora muitas organizações adotem abordagens inovadoras para harmonizar seus objetivos econômicos, ambientais e sociais, ainda existem desafios significativos para integrar completamente a sustentabilidade em todos os níveis operacionais. A eficácia dos SCG varia consideravelmente conforme o plano de visão estratégica, as dinâmicas culturais e as prioridades operacionais de cada empresa, afetando a extensão da integração da sustentabilidade no planejamento estratégico e nas operações diárias. Apesar da importância dos SCG, a clareza dos objetivos de sustentabilidade e o alinhamento com os objetivos estratégicos mais amplos frequentemente limitam sua implementação eficaz.

Os avanços tecnológicos e o envolvimento dos stakeholders são identificados como fatores que podem melhorar a integração da sustentabilidade. O estudo contribui para um entendimento mais profundo do papel estratégico e operacional dos SCG na promoção da sustentabilidade em uma indústria em rápida evolução, ressaltando a necessidade de sistemas que suportem objetivos de sustentabilidade atuais e futuros. Os resultados destinam-se a orientar praticantes e formuladores de políticas da aquicultura na promoção de práticas sustentáveis no setor.

Palavras-chave: Sistemas de Controle de Gestão, Sustentabilidade, Aquicultura Terrestre, Gestão Ambiental, Envolvimento dos Stakeholders, Capacidades Dinâmicas

Título: Integrando a Sustentabilidade: Explorando os Sistemas de Controle de Gestão na Indústria de Aquicultura Terrestre

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List of Abbreviations

BSC	Balanced ScoreBoard
ESG	Environmental, Social and Governance
GRI	Global Reporting Initiative
KPI	Key Performance Indicators
LoC	Levers of Control
MCS	Management Control Systems
PMS	Performance Measurement Systems
SDG	Sustainable Development Goals
SPMS	Sustainability Performance Measurement systems
TBL	Triple Bottom Line

1. Introduction

1.1 Background

The concept of sustainability has significantly risen in importance over the last decades. The Brundtland Commission's report in 1987 and subsequent discussions have heavily influenced the development of public and corporate policies towards more short- and long-term sustainable goals. This is due to increased awareness of social and environmental concerns like water scarcity, pollution, inequality, and poverty, prompting the development of global and local regulations to mitigate these issues (Howes et al., 2017; United Nations, 2015).

Despite the increasing consciousness about sustainability, progress toward sustainable development has been less than satisfactory. In response, the United Nations reinforced its commitment with the 2030 Agenda for Sustainable Development in 2015, calling for multi-stakeholder collaborations to enhance knowledge sharing, expertise, technology, and financial resources to meet these ambitious goals (United Nations, 2015).

The private sector has responded by enhancing its role in sustainable development through corporate sustainability programs, public-private partnerships, and impact investments aligned with the Sustainable Development Goals (SDGs). However, the effectiveness of these initiatives is often questioned, with concerns about "SDG-washing," where actions may appear aligned but lack substantial impact (United Nations, 2023).

As businesses face increasing pressure from stakeholders, the frequency of sustainability reporting has surged, reflecting a broader trend where companies recognize the competitive advantage of sustainable business practices (Kolk, 2004; Pucker, 2021). However, integrating these practices into core business strategies and activities remains challenging, with many companies still struggling to embed sustainability meaningfully (Beusch et al., 2022).

Amidst these challenges, the aquaculture industry, particularly land-based aquaculture, has emerged as a pivotal area for applying sustainable practices. Historically, the rise of aquaculture has been driven by diminishing wild fish stocks, overfishing, pollution, and climate change-related impacts on marine habitats. As the global demand for fish continues to grow, fueled by its nutritional value and increasing population, sustainable aquaculture has emerged as a viable solution to meet this demand without exacerbating the existing pressures on marine biodiversity (World Bank, 2013).

Land-based aquaculture has gained traction as a more sustainable alternative, mainly due to its ability to control environmental conditions and reduce several of the negative impacts associated with traditional ocean-based fish farming, such as sea lice, diseases, and effluent problems (Bergheim et al., 2009). However, this shift to land-based systems brings new challenges, including higher energy use, significant resource requirements, and potential impacts on local ecosystems and communities. Management Control Systems (MCS) play a crucial role within this context.

This industry segment presents unique opportunities to mitigate some traditional aquaculture challenges while simultaneously facing issues such as energy consumption and resource management. Integrating sustainability into Management Control Systems in land-based aquaculture firms can provide strategic advantages and operational efficiencies, aligning economic and environmental goals. MCSs are not just tools but pivotal for embedding sustainable practices at all levels of organizational operations, from strategic planning to day-to-day management. They ensure that sustainability is not just a peripheral concern but a core operational focus, underscoring the crucial role that each of you plays in this process (Crutzen & Herzig, 2013).

1.2 Purpose and Research Question

As globalization advances, the significance of information technology in enhancing transparency, openness, and accountability has grown, prompting a reevaluation of business practices with a focus on capitalism, ethics, sustainability, and social responsibility (R. E. Freeman et al., 2010). Organizations adapt their structures to align with sustainable goals, integrating organizational values, metrics, incentives, and structures (Jørgensen & Pedersen, 2018).

Despite recent growth in research, there is still a significant gap in understanding how companies design and implement management control systems for environmental and sustainability strategies, indicating a need for further study (Crutzen & Herzig, 2013). This thesis explores how sustainability is integrated within organizations' management control systems (MCS) in the land-based aquaculture industry. Specifically, it seeks to investigate how land-based aquaculture firms measure and monitor sustainability and identify any problems or challenges associated with the current practices of integrating sustainability into MCS to improve business operations and environmental impact.

Hence, the research question is:

How do land-based aquaculture companies approach the integration of sustainability into their management control systems?

Given the emergent nature of land-based aquaculture as a sustainable alternative, this research will delve into how the industry is working to integrate sustainability into management control systems and its operational and strategic implications.

2. Literature Review

This section will address the literature for the thesis and justify the topic. The first section will present relevant literature on sustainability and its importance and implications. The second section will present a selection of management control systems and how sustainability can be integrated into decision-making and control systems.

2.1 Sustainability

This section presents the relevant literature on sustainability. The section comprises three parts. It starts by introducing the concepts of sustainability and sustainable development. Then, it will introduce Corporate Sustainability, followed by a presentation of Sustainability indicators and their use.

2.1.1 Sustainability and Sustainable Development

Sustainable development, a concept that has significantly evolved since its early inception, seeks to address the complex interplay between environmental protection, economic growth, and social equity. The seminal report by the World Commission on Environment and Development (1987), commonly known as the Brundtland Report, provided the most widely adopted definition of sustainable development: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987)

2.1.2 Corporate Sustainability

Corporate sustainability is defined as "*meeting the needs of a firm's direct and indirect stakeholders, without compromising its ability to meet the needs of future stakeholders as well.*" (Dyllick & Hockerts, 2002). Corporate sustainability involves extending the broad principles of sustainable development to the business realm. This means that a sustainable company adopts

a multi-dimensional approach, systematically incorporating economic, ecological, and social components into its core operations (de Oliveira et al., 2023)

Economic, ecological, and social factors are considered the fundamental components of corporate sustainability (Dyllick & Hockerts, 2002). To achieve corporate sustainability, a company must preserve and enhance the capital of these three dimensions. An organization must implement strategies that ensure profitability while maintaining sustainability, which includes establishing appropriate goals for each dimension, measuring and monitoring key metrics, and effectively communicating these details to stakeholders. Focusing exclusively on economic factors might lead to perceived short-term successes in sustainability. However, for long-term viability, a firm must concurrently satisfy environmental, social, and economic criteria (Dyllick & Hockerts, 2002). These interconnected dimensions are essential to the "Triple Bottom Line" concept, emphasizing the need for a holistic approach to corporate sustainability.

The Triple Bottom Line (TBL) stands for measuring success on the three parameters: people, planet, and profit, and it has gained recognition as a framework for measuring business performance. Today, it is recognized as the most appreciated and accepted way of doing business. The three pillars of the TBL capture values and criteria for measuring organizational and societal success not only from an economic perspective but also from an ecological and social concern (Goel, 2010). Elkington coined the term in 1994 as a familiar concept for understanding a business's sustainability efforts. The framework advocates that companies evaluate their social and environmental impacts alongside their financial performance. Therefore, it can be segmented into three main areas: profit, People, and Planet. This classification allows businesses to frame their environmental responsibilities and assess potential adverse social effects of their operations (Miller, 2020).

Corporations have historically been identified as major contributors to climate change, which positions them to hold the key to driving a positive change. As awareness of this responsibility grows, many corporate leaders increasingly acknowledge their duty to act sustainably and proactively develop strategies to foster positive environmental changes. The commitment is highlighted by initiatives aiming to integrate sustainability into core business practices (Miller, 2020). However, this shift is not without challenges. Critically, much of the existing research on corporate sustainability has been predicated on a "win-win paradigm," suggesting that it is possible to enhance economic performance and achieve environmental and social sustainability simultaneously. This perspective has been questioned by scholars, who argue that this overly

optimistic view may overlook complex trade-offs (Hahn et al., 2010). Further complicating the landscape are the financial burdens associated with implementing, monitoring, and advancing sustainability initiatives. The literature points to the high costs involved and the difficulties in accurately quantifying the benefits of sustainability measures. These challenges underscore corporations' complexities as they strive to reconcile profitability with environmental responsibility (Durden, 2008; Lisi, 2015).

Baumgartner and Ebner (2010) categorize corporate sustainability into four distinct approaches. *Introverted strategies* are primarily driven by the need for risk management and compliance with regulations, which require companies to adhere to legal and sustainability standards. In contrast, *extroverted strategies* emphasize public communication of a company's commitment to sustainability to enhance its legitimacy and safeguard its operational license. However, this approach may not necessarily integrate sustainability into the company's internal processes, increasing the risk of greenwashing. The *conservative approach* prioritizes internal actions and the economic impact of sustainability, focusing on cost reduction and process efficiency. Here, financial performance takes precedence, with sustainability expected to be integrated into decision-making processes accordingly. On the other hand, *visionary strategies* seek to leverage sustainability for competitive advantage and to establish leadership in the marketplace regarding sustainability issues (Baumgartner & Ebner, 2010).

A company's approach to integrating sustainability varies based on several factors, including compliance with legal standards, the ability to communicate and internalize sustainability practices, and the overall importance placed on sustainability within the organization.

2.1.3 Sustainability Indicators

The emphasis on sustainability challenges prompts organizations to incorporate financial, social, and environmental aspects into their strategic frameworks (Hristov & Chirico, 2019). There is a notable trend towards integrating sustainability within corporate strategies, with extensive research focused on the effectiveness of sustainability Key Performance Indicators (KPIs) for organizations. The use of these indicators is crucial in enhancing organizational sustainability initiatives. However, for these indicators to be effective, they must be contextualized appropriately and comprehensible to the employees utilizing them (Mickwitz & Melanen, 2009). A strategy that effectively integrates sustainability can enhance organizational performance, for example, by improving reputation and reducing costs through more efficient resource use (Hristov & Chirico, 2019)

Indicators serve primary functions such as aiding decision-making, communicating information, setting standards and targets, facilitating discussions, and tracking progress. Over time, indicators can evolve into Key Performance Indicators (KPIs), which are critical metrics often representing a balanced array of aspects like productivity, utilization, or overall performance (Liebetruh, 2017).

2.1.4 Use of Indicators

Numerous companies strive to attain triple-bottom-line performance, focusing on financial, environmental, and societal metrics. However, achieving success in this attempt typically demands cultivating new relationships among various stakeholders across the company's supply chain regarding products and talent. The Balanced Scoreboard (BSC), initially designed for articulating and executing the strategy of a single organization, must be modified to accommodate the complexities of multi-stakeholder strategies aimed at achieving a triple bottom line (Kaplan & McMillan, 2020).

Saulpic et al. (2011) highlighted the constraints of using financial indicators to manage business operations. Specifically, financial indicators are geared towards directing managerial efforts towards short-term goals, centering their focus solely on shareholder outcomes, and offering limited insight into the overall performance (Saulpic et al., 2011).

The implementation of a hybrid measurement system as the balanced scoreboard (BSC) was found to be an effective tool in reinforcing the connection between economic performance and sustainability issues (Länsiluoto & Järvenpää, 2010). By incorporating sustainability into the balanced scorecard, it becomes possible to manage both dimensions within a single framework, emphasizing environmental concerns to all employees and enhancing the relationship between economic outcomes and sustainability (Länsiluoto & Järvenpää, 2010).

2.2 Management Theory

This section will present relevant literature on management theory. It begins with an overview of dynamic capabilities and their relation to sustainability. The discussion then moves to stakeholder theory.

2.2.1 Dynamic Capabilities

Dynamic capabilities are *“the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments.”* (D. J. Teece et al., 1997).

Thus, they represent the organizational and strategic routines that enable firms to adapt and realign resources as markets develop, merge, fragment, change, and disappear. Their capacity for adaptation and transformation is crucial for managing the complexities and rapid expansion within the sustainability sector (D. J. Teece, 2007).

Sustainability activities often require companies to respond to environmental, social, and regulatory changes with innovative solutions. Dynamic capabilities enable organizations to perceive these changes early, seize opportunities, and maintain competitive advantage through strategic adaptation and innovation. Firms with strong dynamic capabilities are proficient at scanning and sensing environmental changes. This includes identifying shifts in sustainability regulations, market demands for sustainable products, and changes in natural resource availability. Sensing capabilities allow firms to anticipate and react proactively to sustainability changes (Helfat & Peteraf, 2009).

Once changes are sensed, dynamic capabilities facilitate the seizing of opportunities by mobilizing resources to support sustainable innovations. This can include the development of new products, such as biodegradable materials, or processes that reduce environmental impact (D. Teece, 2017). Integrating dynamic capabilities into sustainability strategies offers the dual benefit of addressing societal expectations while achieving economic objectives. These capabilities foster a resilient and adaptable organization that can survive and thrive in the face of sustainability-driven market shifts. Firms that effectively use dynamic capabilities can develop a reputation for sustainability leadership, attract eco-conscious consumers, and enhance their brand loyalty (Beske et al., 2014).

In conclusion, dynamic capabilities are essential for firms aiming to excel in sustainability activities. By enhancing their ability to scan, seize, and transform, firms can meet the demands of a changing world and drive the change towards a more sustainable future. This strategic approach supports environmental and social goals and ensures long-term business viability and success.

2.2.2 Stakeholder Theory

Stakeholder theory argues that organizations must account for the interests of all stakeholders, including employees, suppliers, and the community, alongside shareholders, to achieve long-term success (R. Freeman & Mcvea, 2001). This concept is especially relevant in sustainability, where balancing complex, often competing interests is crucial for developing effective strategies. Stakeholders' significance was later defined through power, legitimacy, and urgency,

emphasizing strategic stakeholder engagement to support sustainable outcomes (Mitchell et al., 1997).

Engaging stakeholders in sustainability practices addresses environmental and social concerns effectively and enhances a company's reputation and competitive advantage, leading to increased customer and employee retention (Bhattacharya et al., 2008). Empirical evidence shows that robust stakeholder engagement can foster greater innovation in sustainability. This highlights the need for inclusive strategies that reflect diverse stakeholder insights and pressures. This approach underscores the importance of integrating stakeholder theory into sustainability activities, aligning business operations with broader societal expectations, and contributing to long-term organizational and societal well-being (O'Riordan & Fairbrass, 2008).

2.3 Management Control Systems

Management Control is the process by which organizations are guided through their operational environments to achieve short-term and long-term goals (Otley & Soin, 2014, p. 1). Management control systems (MCS) are pivotal in guiding organizations toward their strategic objectives, facilitating decision-making, and enhancing organizational performance (Merchant & Stede, 2017). These systems encompass a variety of tools, processes, and practices designed to align an organization's activities with its strategic goals (Otley, 1999). As the landscape continuously evolves, the significance of influential MCS has been increasingly emphasized in contemporary management literature (Malmi & Brown, 2008).

Management controls are typically categorized into formal and informal controls. Formal controls are intentionally designed systems with structured routines, procedures, and processes. Managers use these to ensure corporate strategies are executed and adequately adjusted when necessary (Merchant & Stede, 2017; Simons, 1995). Accounting controls (cybernetic controls), a subgroup within formal controls, have been extensively researched for their role in this structured management approach (Markus & Pfeffer, 1983). On the other hand, informal controls operate differently. They do not rely on explicit measures to guide behavior but are based on shared values, beliefs, and traditions that influence employees. These are often communicated indirectly through symbols and the behaviors of supervisors and colleagues, shaping the organizational culture subtly but effectively (Crutzen & Herzig, 2013; Ferreira &

Otley, 2009; Malmi & Brown, 2008). In the following paragraphs, I will present a selection of MCSs in which we will see the presence of formal and informal controls.

Robert Simon's work is central to the discussion on MCS, which introduces the concept of the Four Levers of Control (Simons, 1995). Simons' framework is based on different field studies and argues that these levers are crucial for managers to balance organizational creativity and innovation with strategic alignment and control (Ferreira & Otley, 2009). The LoC framework presents the four levers: *belief systems*, *boundary systems*, *diagnostic control systems*, and *interactive control systems* (Martyn et al., 2016). They can be divided into two contrasting forces. The belief and interactive control systems represent the positive levers by serving as sources of inspiration. In contrast, the boundary and diagnostic control systems represent the negative levers by imposing constraints and regulating compliance. (Simons, 1995)

Belief systems describe an organization's values, direction, and vision, inspiring and directing its efforts toward its strategic objectives and purpose. Boundary systems set formal rules limiting employees' freedom to innovate and make decisions through codes of conduct, ethical guidelines, and strategic boundaries. Diagnostic control systems use traditional management tools like budgets, performance metrics, and financial controls to monitor outcomes and correct deviations. They follow the standard performance management approach of measuring against KPIs. Interactive control systems track new ideas, involve subordinates in decision-making, and foster organizational learning by focusing on strategic uncertainties (Simons, 1995). The Four Levers of Control framework has been widely adopted and studied in various organizational contexts, demonstrating its versatility and effectiveness in achieving strategic congruence and organizational performance (Henri, 2006; Mundy, 2010). Some research highlights the role of interactive control systems in facilitating innovation and strategic renewal (Henri, 2006). Meanwhile, others emphasize the importance of using the levers in a balanced manner to support achieving strategic objectives (Mundy, 2010).

MCS as a package is a framework developed by Malmi and Brown. It was developed to analyze and synthesize nearly four decades of MCS research, including reviews of the Simons LoC framework. The framework aims to facilitate and stimulate discussion and research in management control. The strength of the model lies in the broad scope of the controls in the MCS rather than the depth of its discussion of individual systems. (Malmi & Brown, 2008) The model proposes five types of control: cultural control, planning, cybernetic controls, reward and compensation, and administrative controls.

2.3.1 Integrating Sustainability

Given that traditional management control systems are oriented toward achieving the business and economic goals of the companies, they could be viewed as limited in incorporating the interests of a broad range of stakeholders other than shareholders and in addressing environmental and social issues as well as their interrelationships with financial issues (Gond et al., 2012). Due to the growing societal and environmental challenges worldwide, the imperative for organizations to integrate sustainability into their strategic objectives has never been more pronounced (Tessier & Otley, 2012). Despite an increasing recognition that sustainability issues play a significant role in achieving corporate success, there is still little empirical knowledge concerning intra-organizational dimensions of management control for sustainability (Crutzen et al., 2017, p. 1291).

In their research, (Crutzen & Herzig, 2013) states that *“Even if a growing body of empirical research has emerged over the last decade, our current knowledge about how companies design or use management control to support environmental or sustainability strategy appears to be limited in several ways, providing scope for further research”*

The framework “MCS as a package” developed by Malmi and Brown (2008) is regarded especially appropriate for integrating sustainability (Lueg & Radlach, 2016; Sundin & Brown, 2017). The framework has a broad foundation that diminishes the threat of the model under specification. The model covers both formal and informal controls, allowing for the study of internal and external contingencies that influence the design and implementation of MCS (Lueg & Radlach, 2016). Hence, I have chosen to use the MCS as a package to delve deeper into integrating sustainability within management control systems.

2.3.2 Individual Controls

As seen in Figure 1, Malmi and Brown (2008) present five types of control in their framework: *Cultural control, planning, cybernetic controls, reward and compensation, and administrative controls.*

Cultural Controls						
Clans		Values			Symbols	
Planning		Cybernetic Controls				Reward and Compensation
Long range planning	Action planning	Budgets	Financial Measurement Systems	Non Financial Measurement Systems	Hybrid Measurement Systems	
Administrative Controls						
Governance Structure		Organisation Structure			Policies and Procedures	

Figure 1: Management Control Systems Package by Malmi and Brown (2008)

Cultural control includes the values, beliefs, and social norms that are established and that can influence employees' behavior (Malmi & Brown, 2008). The culture in the company emerges and evolves slowly, building a framework for the other controls and ensuring common beliefs in the company (Simons, 1995). In the MCS as a package, these controls are positioned at the top, indicating they are overarching and complex (Malmi & Brown, 2008). A shared culture, notably strengthened through employee training and awareness efforts, is an effective tool for emphasizing a solid sustainability focus among the company's internal stakeholders (Crutzen et al., 2017).

Planning controls represents a proactive form of control that sets objectives for the organizations' functional areas, thereby guiding effort and behavior. It also provides the standards to be achieved concerning the goal, ensuring that the expectations for effort and behavior are clearly defined (Malmi & Brown, 2008). *The long-term planning* period spans 5-10 years and is based on predictions of future developments and related regulations (Gond et al., 2012). Crutzen et al. (2017) suggest that companies should develop long-term plans for sustainability initiatives and incorporate them into the organizational strategy. In their framework, Malmi and Brown (2008) also explore the *action planning* stage, which encompasses tactical decisions and executing sustainability strategies through definitive actions. This stage may include creating task lists that direct employee actions and assigning clear responsibilities and goals to lower organizational levels for product or process redesign initiatives. This approach not only commits employees but also offers them chances to impact the fulfillment of sustainability objectives (Villiers et al., 2016).

Reward and compensation controls involve compensating employees based on achieving preset performance goals to align the objectives of managers and owners (Malmi & Brown, 2008). This form of control can encourage decisions that support sustainability and align with the overarching sustainability strategy. (Lisi, 2015). Organizational rewards may be tied to the sustainability performance at the individual, departmental, or company level (Sundin & Brown, 2017).

Cybernetic controls involve formally assessing a company's performance, utilizing both financial and non-financial KPIs. These indicators are measured against set budgets or targets to ensure accountability (Malmi & Brown, 2008). Such controls are about conducting a numerical sustainability performance analysis (Simons, 1995), which includes quantifying external factors like energy consumption, greenhouse gas emissions, and water use (Sundin & Brown, 2017). Commonly, organizations use benchmarking to compare their sustainability metrics against those of their industry competitors. Additionally, traditional budgeting systems are employed to manage business activities' environmental and social impacts (Corsi & Arru, 2020).

Administrative controls relate to the organization's structure and management of individuals and groups. It involves overseeing the actions of employees and defining accountability for those actions. (Malmi & Brown, 2008). Determining duties and liabilities ensures organizational efficiency and a smooth exchange of information (Ferreira & Otley, 2009). Companies commonly implement policies such as codes of conduct or best practice guidelines to integrate sustainability and establish specific control and auditing processes (Corsi & Arru, 2020). These processes frequently adhere to recognized certification standards (Crutzen et al., 2017). The creation of dedicated roles or departments for sustainability responsible for overseeing the sustainability strategy and its implementation is deemed especially crucial (Sundin & Brown, 2017).

2.3.3 Sustainability in MCS as a package

The flexible structure of Malmi & Brown's model allows for the selective application and integration of various controls to align with a company's specific needs and strategic objectives. It is possible to infer a company's commitment to sustainability based on the types of controls it implements. For instance, the exclusive use of administrative and cybernetic controls might reflect an introverted strategy focused on compliance and regulatory adherence. On the other hand, relying solely on long-term planning could indicate an extroverted strategy, where the

company announces goals without accompanying them with substantive actions. Focusing on cybernetic controls would suggest a conservative approach to prioritizing quantitative measures. In contrast, a visionary strategy would likely incorporate a comprehensive mix of all available controls and perspectives.

Packages of formal controls	Controls included					
	Structure	Cybernetic controls		Planning		Reward and compensation
		Budget	Perf. Meas. (hybrid)	Long range planning	Action planning	
Reporting and measurement and orientated	●	●	●			
Long Range Planning- oriented control	●	●	●	●		
Action-oriented	●	●	●	●	●	
"Full package"	●	●	●	●	●	●

Figure 2 Four Packages of formal management controls for sustainability (Crutzen et al., 2017)

In their study, Crutzen et al., 2017, examined formal management controls within companies and identified incremental differences among them. Figure 2 outlines the categorization of four groups of formal management controls for sustainability. Focusing on administrative controls, the study established that all companies had established structures related to sustainability and implemented cybernetic controls. Companies lacking additional controls were placed in a “reporting and measurement-oriented” category. Another set of companies engaged in extensive long-term planning was described as “long-range planning oriented.” A third group noted for their commitment to immediate sustainability actions was termed “action-oriented.” The most comprehensive approach was found in “full package” companies, which combined sustainability-linked rewards and compensations with all other controls examined. They adopted each layer of controls from the previous categories, thereby illustrating a cumulative structure in their MCSs. This hierarchical integration of controls showed how each level builds upon and extends the previous ones.

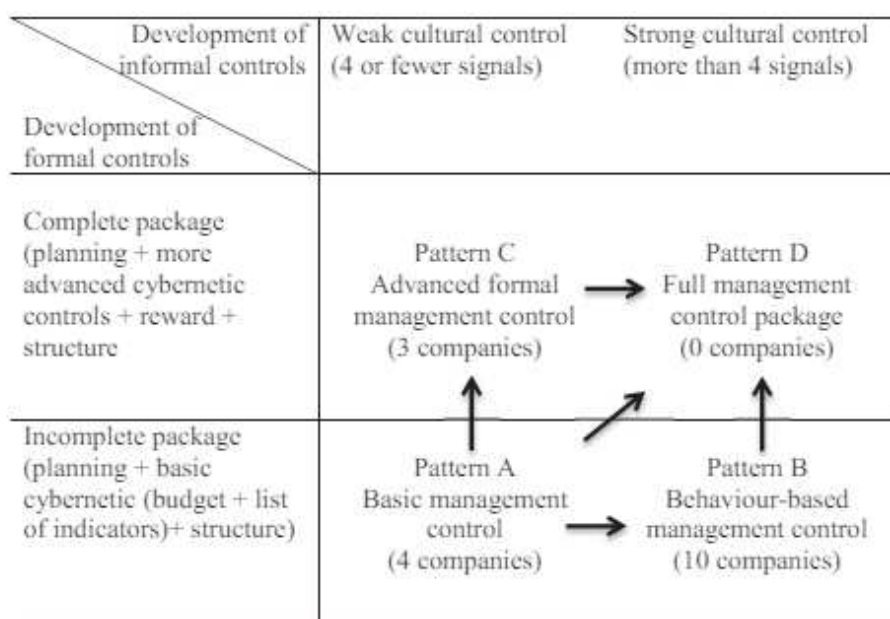


Figure 3 Sustainability Management Control Patterns (Crutzen et al., 2017)

Figure 3 illustrates Crutzen et al. (2017) presented the concept of "Sustainability management control patterns." The concept illustrates different combinations of formal and informal controls, categorized by how intensively they are applied. The research evaluated the use of cultural controls by identifying signals that may affect the shared values within an organization (Crutzen et al., 2017, p. 1297). The analysis included six signals: a sustainability-focused intranet platform, corporate events that acknowledge social and environmental concerns, opportunities for volunteering, the presence of shared values among managers, the inclusion of social and environmental issues in the annual report, and other visual symbols of sustainability. (e.g., green buildings or symbols on letters such as “consider the environment before printing this email”). Companies meeting more than four of these signals were deemed to have solid cultural controls, while those meeting fewer were considered to have weak cultural controls (Crutzen et al., 2017, p. 1295). This assessment and two stages of formal control availability led to patterns indicating that culturally solid controls are not necessarily paired with a comprehensive set of formal controls.

In this study, I will use this framework to investigate these patterns within companies in the land-based aquaculture industry.

3. Methodology

This section includes the methodology and methodological choices that has been made in the research.

3.1 Research Design

There are three main approaches to theory development: deductive, inductive, and abductive (Saunders et al., 2019). The deductive approach involves drawing logical conclusions from theoretical premises, ensuring the conclusion is true given the right conditions. The inductive approach begins by gathering data to explore a phenomenon and then builds a theory or conceptual framework based on that data. The abductive approach blends both, using data collection to explore phenomena, identify themes, and explain patterns, creating or refining theories. It effectively combines deduction and induction, allowing researchers to move between them (Saunders et al., 2019, p. 155).

In this study, I will use an abductive approach to explain the integration of sustainability in management control systems in land-based aquaculture companies. The study incorporates deductive elements by utilizing Malmi and Brown's (2008) MCS as a package and incorporating induction elements as primary data is collected to explore a phenomenon.

The purpose of the research design is determined by how the research question is framed. For this study, the most appropriate purpose would be exploratory (Saunders et al., 2009). The research design presents four primary purposes: exploratory, descriptive, explanatory, and evaluative. Exploratory research seeks to gain insight into a topic by posing open-ended questions, which helps clarify understanding. Its flexibility and adaptability are significant advantages. Descriptive research aims to accurately gather information about people, events, or situations, requiring a clear understanding of the phenomenon before data collection (Saunders et al., 2019, p. 187).

The research method used for this thesis is a qualitative design. It builds its premises on inductive reasoning (Williams, 2007). Qualitative research explores participants' meanings and relationships through various data collection and analysis techniques. It is commonly used in abductive studies and is suitable for this study's exploratory purpose, as it allows for an in-depth exploration of participants' meanings within the companies (Saunders et al., 2019, p. 179).

For research, you can choose between two different time horizons: longitudinal or cross-sectional. Longitudinal studies observe events over an extended period, while cross-sectional

studies focus on a particular phenomenon at a specific time (Saunders et al., 2019, p. 212). A cross-sectional horizon is appropriate since the study investigates the current situation, and interviews were conducted in a short period.

3.2 Data Collection

The study utilized primary and secondary data sources to investigate the research question. Primary data was collected through semi-structured interviews, while secondary data was obtained from online documents, relevant reports, scholarly articles, and websites. Primary data involves information explicitly gathered for this study. In contrast, secondary data includes information that was originally collected for other purposes, such as published works, that can provide further insights (Saunders et al., 2019, p. 338).

For this study, I conducted semi-structured interviews, a non-standardized interview type often employed in qualitative research with an exploratory purpose. For this purpose, they help gather crucial background and contextual information (Saunders et al., 2019, p. 443)

To collect the primary data, I interviewed people working in the industry. I started with an industry expert who has worked in corporate finance, focusing solely on the seafood and aquaculture industry for over two decades. This helped me better understand the industry and its challenges and opportunities. In the second round of interviews, I interviewed high-level officers at different companies in the land-based fish farming industry. I contacted CEOs and CFOs in companies listed on the Oslo Stock Exchange and those not listed.

In the search for interviewees, people working in Norwegian land-based fish-farming companies were contacted by e-mail and LinkedIn. After some follow-up emails and being connected by some participants, 10 people agreed to participate in the study. Due to the vast array of organizational structures and architectures, the participants fulfilled varied roles within their respective organizations. I did not limit my inquiries to one position exclusively, as I recognized that the respective companies themselves could better evaluate a company's internal knowledge structure.

Interview #	Company	Date	Length (min)	Position of Interviewee
Round 1				
A	-	14.03.2024	1 hour	Industry Expert
Round 2				
1	A	18.04.2024	32 min	CSO
2	B	22.04.2024	42 min	CCO
3	C	29.04.2024	1 hour 3 min	Communication Manager
4	D	30.04.2024	35 min	CEO
5	B	30.04.2024	52 min	CEO
6	C	02.05.2024	42 min	CFO
7	D	03.05.2024	45 min	CFO
8	E	03.05.2024	37 min	COO
9	F	06.05.2024	43 min	CSO
10	E	07.05.2024	42 min	Financial Officer

Table 1 Overview of conducted interviews

Secondary data is divided into three broad categories: document secondary data. This category formed the core of my research data (Saunders et al., 2019). Document secondary data often complements primary data collection in research projects. It is commonly utilized when looking at organizations (Saunders et al., 2019, p. 348). In this study, document secondary data proved valuable alongside primary data. I collected this secondary data directly from the companies' websites and supplemented it with reports and other textual documents. The websites provided information about the companies' values and vision. I also used the annual climate and environmental reports, which often come as integrated annual reports, to provide an overview of the sustainability situation at different companies.

3.3 Data Analysis and Research Quality

I analyzed the data using an approach inspired by the Gioia method. This well-established framework employs inductive reasoning to derive insights from the meanings given to an organizational phenomenon (Langley & Abdallah, 2011). Summaries of the interviews and the coding table can be found in the appendices.

3.3.1 Reliability

The evaluation of the research study is essential to validate the quality of the methodological choices made. Certain measurement validity types are better suited for quantitative research than qualitative research. Qualitative research is often not designed to be replicated as it captures participants' unique, socially constructed interpretations within a specific context at

the time of the study (Saunders et al., 2019, p. 216). Reliability refers to the consistency of measurement and the repeatability of the study's results (Bell et al., 2022). Below, I will go through the threats to reliability and what was done in this study to mitigate these.

3.3.2 Threats to Reliability

Participant error refers to the factors that could alter the way in which a participant performs (Saunders et al., 2019, p. 214). It was voluntary for the participants and the company to participate in the study to reduce the risk of participant error. The duration of the interviews varied from 30 minutes and up to 1 hour. The specified period allowed for a thorough examination of the perspectives while ensuring the participants stayed attentive and involved during the talk. To reduce the risk of short and incomplete answers due to the participants feeling pressured on time, the expected timeframe for the interview was disclosed to all the participants.

Participant bias refers to factors that induce a false response. This could include the fear of being overheard or not being anonymous (Saunders et al., 2019, p. 214). To mitigate participant bias in my study, I conducted semi-structured interviews online, ensuring participants felt comfortable in their environment. Emphasizing the confidentiality and anonymity of their answers helped create a secure environment for the participants, reducing the fear of being overheard or identified. By fostering an atmosphere of trust and privacy, I encouraged honest and accurate responses, thereby minimizing the risk of participant bias.

Researcher error involves any factor that alters the researcher's interpretation (Saunders et al., 2019, p. 214). To address potential researcher errors, I ensured thorough preparation before each interview. I also scheduled the interview at times when I was alert and focused, reducing the likelihood of misinterpretation due to fatigue.

Researcher bias occurs when the researcher's subjective views influence the recording and interpreting of participants' responses (Saunders et al., 2019, p. 214). To reduce researcher bias in the interviews, I adhered to a standardized interview guide and maintained a neutral demeanor throughout the conversations. I took notes during and immediately after each interview to ensure my biases did not affect the data collection and analysis process. By implementing these strategies, I aimed to ensure a fair and unbiased representation of participants' views.

3.4 Ethical Considerations

Research ethics refers to any situation where moral considerations regarding a study's appropriateness, fairness, and reasonableness come into play (Bell et al., 2022, p. 112). When conducting a study and gathering information for analysis, such as data about an organization, it is crucial to address ethical considerations (Saunders et al., 2019, p. 252). To address ethical considerations, Bell et al. (2022, p. 113-122) present four ethical principles that must be upheld throughout the research study.

The first principle is about avoiding harm and ensuring that the participants are not harmed in any way due to their participation in the research (Bell et al., 2022, p. 114). It also emphasizes the importance of ensuring that individuals and organizations remain unidentified or unidentifiable unless permission has been granted (Bell et al., 2022, p. 113). Saunders et al. state that data confidentiality and anonymity should be preserved. To ensure compliance, I only saved all the data I collected (notes, transcriptions, and coded data) with the anonymized names and organization names.

The second principle is informed consent, which aims to ensure that research participants receive comprehensive information about the study, allowing them to make an informed decision about whether or not they want to participate (Bell et al., 2022, p. 117). I sent out information about the research project and its purpose to ensure that the participants participated voluntarily and were informed.

Another essential principle relates to protecting the privacy of the research participants. When collecting data, it is essential to ensure confidentiality and respect the anonymity and privacy of the participants (Bell et al., 2022, p. 121). In this study, I assigned participants' names like Participant 1 and anonymized the companies they worked for. The positions were broadly categorized as “director” and “manager.” The participants also received information about anonymity and confidentiality before consenting to participate in the interview.

Lastly, there is the principle of preventing deception. Deception occurs when researchers misrepresent their research, misleading participants about its true nature to elicit specific actions (Bell et al., 2022, p. 122). To uphold this principle, participants were fully informed about the research objectives and methods before they agreed to participate. Each participant was provided clear, comprehensive information about the study's purpose and process, ensuring transparency and trust throughout the research. This approach helped prevent any deception that could compromise the integrity of the research findings.

3.5 Overview of the Methodology

Based on the discussions in this section, Table 2 summarizes the methodological choices made in this study.

Area	Methodological choice
Research approach	Abductive
Research purpose	Exploratory
Research method	Qualitative
Time horizon	Cross-sectional
Data collection:	
<i>Primary data</i>	Semi-structured interviews
<i>Secondary data</i>	Websites, reports, and other documents

Table 2 Overview of the Methodology

4. Background: Aquaculture Industry

Before presenting the findings, I will provide some background about the aquaculture industry to understand better the context of the industry being investigated in the findings and discussion sections.

4.1 The Aquaculture Industry

Aquaculture, or fish farming, has emerged as a vital industry in response to the declining wild fish population driven by overfishing, pollution, and ocean acidification. As wild fish stocks have decreased, global fish consumption has continued to rise, fueled by the nutritional benefits and dietary importance of fish (Gordon et al., 2018). This increased demand, combined with the decreasing wild fish populations, has spurred the growth of aquaculture over the past four decades (World Bank, 2013).

Aquaculture has become a significant industry in Norway and is today the country’s second-largest export industry (after petroleum), with an export value of 9 billion dollars in 2022 (OEC, 2024). As a leader in this field, particularly in salmon farming, it is the world’s largest producer and exporter of farmed salmon. This highlights Norway's role in global sustainable food production. Despite its success, the industry faces high mortality rates due to sea lice, algae,

jellyfish, wounds, and diseases, leading to limited production growth and increased production costs. From 2010 to 2021, the production costs related to salmon farming rose by approximately 44%, adjusted for inflation, primarily because of expenses linked to treating diseases and lice (PricewaterhouseCoopers, 2023).

Diseases in aquaculture and parasites such as sea lice affect farmed fish's welfare and growth rates, leading to significant economic setbacks due to reduced feed efficiency, increased mortality, and lower overall productivity. Contagious diseases can degrade product quality, reduce market value, and disrupt supply, potentially driving up prices. In response to these challenges and the risks posed by sea lice to wild salmon populations, Norwegian authorities have implemented stringent regulations requiring farms to closely monitor and limit the number of sea lice per fish. These health issues could also shift consumer consumption patterns, particularly growing concerns over environmental sustainability, seafood safety, and public health (Liu & Bjelland, 2014).

The regulation of the industry, including the allocation mechanisms for licenses, has also been subject to constant change (Regjeringen, 2021). The aquaculture industry in Norway is regulated by many guidelines designed to protect the environment, maintain fish health and welfare, and bring predictability to businesses in the sector (Eliassen et al., 2022). The PwCs semiannual report, the Seafood Barometer, states that the regulations are introduced to ensure sustainable growth in the industry. However, they argue that fish farmers have been innovative and adaptable historically, but due to new regulations and existing regulations becoming stricter, it is starting to hurt the industry (PricewaterhouseCoopers, 2023).

4.2 Land-Based Aquaculture

As an alternative to marine net pen aquaculture, land-based aquaculture has been recognized for its potential to reduce some sustainability issues inherent in traditional aquaculture methods. Land-based systems, where fish are farmed in tanks on land, are increasingly seen as a viable solution due to advancements in recirculating aquaculture systems (RAS) and other production methods as hybrid flow through, among others. These systems filter and reuse water within the tanks, significantly reducing pollution and the risk of disease transmission compared to open-water farms (Bergheim et al., 2009). By controlling the environment, land-based farms can also prevent interactions between farmed and wild fish populations, thereby protecting biodiversity.

Despite these benefits, land-based aquaculture involves high initial capital expenditures and operating costs, particularly due to the energy needed to maintain water quality and temperature (Participant A). The technology, while effective at reducing environmental impacts, requires substantial investment in infrastructure and technical expertise. Facilities must also adhere to stringent regulations to ensure that they do not contribute to habitat destruction or excessive water use, which can be challenging given the large scale of water and land needed for these operations (Bergheim et al., 2009). Nevertheless, the controlled conditions in land-based systems can lead to higher yields and potentially lower disease rates, making them an attractive investment as market demand for sustainably farmed seafood grows.

4.3 Sustainability in the Aquaculture Industry

Sustainability in aquaculture is a multifaceted issue involving environmental impacts, fish welfare, and economic viability. The industry faces ongoing challenges such as significant fish mortality rates, which are often due to diseases and parasites like sea lice that thrive in densely populated net pens. Such conditions affect fish welfare and health, reduce output quality, and have broader ecological implications, including the potential for disease transmission to wild fish populations (Liu & Bjelland, 2014).

In response to these challenges, the industry has been exploring innovative solutions, including developing new vaccines and genetic improvements to enhance fish health and disease resistance. There is also a growing focus on improving feed efficiency and nutritional quality, which can help reduce the environmental burden and improve the sustainability of fish farming operations. Regulatory bodies have been critical in pushing for more sustainable practices. In Norway, for example, stringent regulations govern the number of fish that can be farmed in each area and the treatment protocols for pests and diseases. These regulations balance industry growth with environmental sustainability, ensuring that fish farming remains a viable and responsible food production method (Eliassen et al., 2022).

As global demand for protein rises, aquaculture's role in food security becomes increasingly important. The industry's future will likely depend on its ability to continue adopting and refining technologies and practices that minimize its environmental footprint while maximizing production efficiency and fish welfare. This ongoing evolution is probably necessary for meeting consumer demands and ensuring the industry's long-term sustainability and ability to contribute positively to global food systems (Participant A).

5 Findings

This section outlines the findings from interviews with land-based aquaculture firm representatives. Initially, it discusses the presence of specific control mechanisms within these companies. The report then compiles these into an overall summary of findings. Additionally, it explores other insights, including dynamic capabilities and the role of stakeholders. All data shared here was gathered directly from interviews; thus, there are no citations from existing literature.

5.1 Individual Controls

5.1.1 Cultural Controls

The interviewed companies demonstrate a significant commitment to sustainability. Executives and key personnel consistently emphasize integrating sustainability into the corporate values and vision, guiding strategic decisions and everyday practice. Participant 5 highlighted: *"Sustainability is part of the business model itself; it is part of the reason we exist."* Indicating a deep-rooted presence within the company's operational culture. Participant 3, from the same company, stated: *«Sustainability has been integrated from the start," showcasing the approach taken to embed these values from the company's inception."*

Participant 4 also emphasizes that sustainability is at the core of the company culture, as the company was started to be able to provide a more sustainable alternative. The participant believes this makes the company attract employees who want to do better and be part of a change. Attracting talent and people with a powerful desire to improve the services and the industry regarding sustainability and fish health further strengthens the idea that sustainability is at the core of the company culture. The participant stated: *"We see this; for example, when hiring new employees, we get applications from people who want to work here because they believe in the company's mission and want to create a difference."*

Some of the companies have started to develop internal awareness and engage employees. Initiatives such as training sustainability ambassadors further exemplify the role of leadership in fostering a sustainability culture. Participant 1 states that *"we train a smaller group of employees, preferably the ones who are curious or have prior knowledge of sustainability practices, but it is not a precondition. This will enable them to spread awareness and motivation to the rest of the employees."* The participant explains that engaging and educating employees aims to foster a deeper understanding of decision-making. This approach is intended to clarify

the rationale behind their choices and encourage the emergence of new ideas, ultimately fostering innovation.

Sustainability is actively communicated at the management level, as noted by Participant 1: *“Sustainability is currently communicated more externally and at the management level, but it is in the plan to integrate the communication through the whole organization.”* This could suggest that despite the strong presence of cultural controls in the beginning, the companies are now facing challenges concerning the depth of integration and the consistency of commitment across all levels of the company. Hence, there is a potential for internal development. Participant 5 emphasizes, *“While sustainability values are highlighted at the strategic and management levels, it is noted that it needs to be ingrained right down to the last link.”* Indicating that the values are not always translated into actionable change at all levels of the organization, reflecting a lag in operationalizing the sustainability values among the more comprehensive staff. None of the companies mentioned that they have a sustainability-oriented intranet platform.

5.1.2 Planning Controls

Integrating sustainability within strategic planning processes is a prominent feature across the companies interviewed. Companies demonstrate a strategic commitment to sustainability by embedding environmental goals in their business models and operational strategies. Participant 9 highlighted the depth of integration, stating, *“We base our strategic planning on sustainability to ensure it permeates all aspects of our operations,”* indicating a comprehensive approach where environmental considerations are central to business operations. The interviews showed the importance of planning controls for integrating sustainability within the companies' strategic frameworks. This integration is necessary for shaping long-term sustainability goals and ensuring sustainable development.

The planning process involves specific sustainability objectives well-defined within the strategic plans. Companies articulate these objectives in compliance with existing regulations and requirements and as initiative-taking steps toward innovation in sustainable practices. Participant 7 notes, *“Certifications and sustainability are always on the agenda in board meetings, and we have defined goals and focus areas we are working with,”* emphasizing the structured approach to sustainability goals.

“Plans for investments in sustainable new opportunities and R&D. are significant parts of our strategic planning,” reflecting a strategic approach for investments in long-term sustainability.

Despite the strategic emphasis on sustainability, fully actualizing these plans remains challenging. Participants noted the difficulty of keeping up with the industry's rapid technological advancements and regulatory changes, which can outstrip planned investments and strategic frameworks. Translating high-level sustainability goals into specific and actionable operational strategies remains a complex challenge, reflecting a gap between strategic intentions and practical implementation.

Planning controls must continually evolve to address the dynamic environmental, technological, and regulatory landscapes, ensuring sustainability remains in business operations and decision-making. This ongoing process requires commitment, flexibility, and adaptiveness in strategic planning.

5.1.3 Cybernetic Controls

Implementing cybernetic controls aligns with the company's strategic commitment to sustainability. The interviews revealed a structured approach to measuring sustainability-related externalities such as greenhouse gas emissions, water usage, and energy consumption. The interviews reveal that companies review these metrics regularly to assess progress and to help make informed business decisions. Participant 4 noted, *"We have begun measurements early to build up a database and to see the development,"* underscoring the proactive implementation of cybernetic controls to track environmental impacts. Participant 1 elaborated on the process: *"We have created a database with defined topics on which we should deliver and measure. Work began early, and topics where we can significantly impact sustainability were analyzed and focused on these"* (Participant 1), indicating a targeted approach to monitoring significant sustainability metrics. This suggests that some companies track sustainability metrics with a structured and data-driven approach and use this data to make informed operational adjustments.

Despite some companies having robust systems and integrated measurement and monitoring of sustainability metrics from the beginning of the company, other companies face challenges related to the precision and comprehensiveness of these metrics. As operations scale, maintaining the accuracy and relevance of sustainability data can become challenging. Participant 3 stated, *"We are still a small company with few employees focused on getting everything right. Measurements are difficult and time-consuming, and there is no point in starting measurements of things we do not know how to use if we cannot trust the data."*

Highlighting concerns over data reliability and measurement difficulties in smaller organizations focusing on growing production and profitability.

5.1.4 Reward and Compensation

Reward and compensation systems within the interviewed companies do not typically recognize sustainability performance, and the mechanisms for recognition vary. Most companies acknowledge the importance of rewarding sustainable practices but have yet to fully develop specific incentive or reward systems directly tied to sustainability outcomes. *“We do not have an incentive system that rewards performance on sustainability at the time, but we should probably have it”* (Participant 9)

The same could be said at the general employee level. Participant 1 states, *“At the employee level, incentive models are to a low degree linked to sustainability performance,”* suggesting that there is room for improvement, and the participant continues: *“The plan is to develop incentive models that are linked with reaching goals and KPIs related to sustainability.”*

Although none of the companies had rewards linked directly with sustainability performance, they recognized that the sustainability initiatives could indirectly affect the company's economic performance, further affecting the reward system. *“The company's commitment to sustainability significantly enhances its reputation and valuation locally and nationally by setting higher industry standards and garnering goodwill. Although no direct incentive systems are tied to reaching sustainability goals, the company's sustainability performance indirectly influences its stock market performance, affecting the rewards for these achievements.”* (Participant 8)

5.1.5 Administrative Controls

A key aspect of administrative controls is the creation of dedicated roles or departments for sustainability, which oversee the implementation and strategic integration of sustainability practices. This organizational structure ensures that sustainability is not only a part of strategic discussions but is also operationalized and embedded throughout the company. There was some disparity between the companies when it came to administrative controls, especially in terms of the appearance of structures of sustainability departments or officers. None of the companies has a dedicated sustainability department; some have dedicated sustainability officers.

“We do not have a dedicated sustainability department responsible for reporting and measurement. Instead, these responsibilities fall to me as the financial officer. My role

primarily involves gathering data and monitoring it consistently, and I am the one who reports this data, which I do annually through the annual report” (Participant 7)

5.1.6 Aggregated Findings

The table summarizes the aggregated findings of the individual controls, indicating whether each company has incorporated sustainability into its operations. Five companies reported having at least four of six cultural control signals, demonstrating strong cultural control. Sustainability aspects are variably integrated into their planning processes, but all companies mentioned some planning controls. Five companies have implemented cybernetic controls, including sustainability indicators and measurement systems. However, none of the companies have integrated rewards or compensation linked to sustainability performance as incentive systems. Only two companies reported having roles directly tied to sustainability practices or a dedicated sustainability department. These findings will be further analyzed and discussed in section 6.

	Company A	Company B	Company C	Company D	Company E	Company F
Cultural Controls	x		x	x	x	x
Planning Controls	x	x	x	x	x	x
Cybernetic Controls	x	x	x		x	x
Reward and Compensation						
Administrative Controls	x					x

Figure 4 Integration of sustainability in controls across companies. Source: own representation

5.2 Other Findings

An important finding from the interviews with participants in the land-based aquaculture industry is the significant role that regulations and reporting requirements play in shaping corporate sustainability practices. The dialogue with industry representatives highlighted a critical intersection between regulatory enforcement, consumer willingness to pay for sustainable products, and competitive market dynamics.

5.2.1 Dynamic Capabilities

Participant 1 underscored the importance of staying ahead and doing more than expected and required, believing that this would give the company a competitive advantage in the future. *“Being ahead in measurements and investment enables us to adjust quickly to market dynamics and regulations changes.”*

5.2.2 Regulatory Influences

Participants underscored the importance of government authorities in regulating the industry, noting that stringent sustainability regulations and comprehensive reporting requirements are pivotal in leveling the playing field among competitors. These regulations mandate minimum sustainability standards and push companies towards adopting more advanced sustainable technologies and practices.

For instance, one participant noted the dilemma when investing in new, more sustainable technology. *“Suppose we spend much money on new, more sustainable technology to improve our sustainability practices. We must charge a higher price for our product, and our competitors will gain a competitive advantage.”*

5.2.3 Consumers

A key challenge highlighted by the participants is the uncertainty regarding consumer willingness to pay extra for sustainability. This uncertainty affects strategic decisions about investments in sustainability. If consumers are unwilling to pay a premium for sustainable products, companies that invest heavily in these practices may find themselves at a competitive disadvantage compared to those that meet only the minimum regulatory standards.

This insight is critical for understanding the broader implications of sustainability initiatives within the industry. It suggests that while regulatory frameworks are essential for establishing baseline sustainability standards, their effectiveness in promoting higher standards depends on their stringency and market response—precisely, on consumers' sustainability valuation. This underscores the significant impact of regulatory frameworks on market dynamics.

6. Discussion

The finding in the previous section provides valuable insights into the control mechanisms the interviewed companies utilize to meet their sustainability objectives. Additionally, this research aims to examine these organizational controls holistically, considering them as a comprehensive package rather than as isolated mechanisms.

6.1 Individual Controls

In this section, I will delve deeper into the findings related to individual controls, highlighting the most significant differences observed between companies and discussing how these findings correlate with existing literature.

Cybernetic controls

This is the type of control where there was the most significant difference between the listed companies and those that were not. This could be due to the extra requirements the companies must comply with when being listed on the stock exchange. There is a lot more demand for reporting and control for the listed companies, which creates differences in how they work with measurement and KPIs.

Applying sustainability indicators is crucial for integrating environmental, social, and financial aspects into corporate strategies. These indicators are key in operational and strategic decision-making within the land-based aquaculture industry. Companies vary in their development stages; newer companies, for instance, may still be in the planning phase and have not yet implemented all the desired measurements for these indicators.

Despite their utility, sustainability indicators face challenges in their application across the aquaculture industry. As indicated by Saulpic et al. (2011), one of the primary concerns is the risk of an overly narrow focus. Companies tend to prioritize short-term financial goals at the expense of long-term environmental and social sustainability. This focus can skew management efforts towards immediate profitability and undermine the broader sustainability agenda. The success of sustainability indicators depends heavily on their context and the user's understanding of that context (Mickwitz & Melanen, 2009). Interview findings suggest that while companies adopt sustainability KPIs, the depth of understanding among employees about what these KPIs represent varies significantly. Without a thorough understanding across the organization, the effectiveness of these indicators in driving real, sustainable change is limited.

Integrating sustainability into corporate strategy using indicators such as the Balanced Scorecard (BSC) is not just a suggestion but a necessity. Kaplan and McMillan (2020) discuss the need to adapt the BSC to handle the intricacies of a multi-stakeholder strategy to achieve a triple bottom line. However, the adaptation process can be challenging, as it requires a fundamental shift in how performance is measured and valued within the organization. The interviews showed that while companies like Company A and Company B have integrated environmental and social metrics into their BSCs, the application and continuous monitoring pose operational challenges. These include aligning these indicators with real-time decision-making processes and ensuring they remain relevant as external conditions change.

While sustainability indicators are invaluable tools for integrating and monitoring sustainability in business practices, their practical application requires careful consideration. Companies must ensure these indicators are well-understood, contextually relevant, and genuinely integrated into strategic decision-making processes. Additionally, companies must be aware of the risk that sustainability indicators might serve as tools for compliance rather than acting as proper drivers of authentic sustainability efforts. Moving forward, the aquaculture industry must continue refining these tools to capture the complexities of sustainable operations, ensuring that the pursuit of indicator targets does not overshadow the broader sustainability objectives.

Reward and compensation

Throughout the interviews, a challenge recognized in implementing reward systems for sustainability is the difficulty in quantifying and attributing specific outcomes to individual or team efforts. Companies often struggle to define precise and measurable sustainability targets that can be directly linked to compensation or rewards, making it challenging to establish clear criteria for rewards based on sustainability achievements (Crutzen et al., 2017).

Despite acknowledging sustainability's importance, many companies need more direct incentive systems that promote sustainability. This gap suggests potential areas for development where companies could enhance their reward systems to better motivate and encourage sustainable behavior among employees.

The interviews indicate the potential for developing more sophisticated incentive systems that link sustainability performance with rewards. Such systems could drive a more substantial alignment between company sustainability goals and employee actions, enhancing overall sustainability goals and employee actions and overall sustainability performance. This aligns with the findings from previous studies (Crutzen et al., 2017).

Administrative Controls

Integrating sustainability into formal organizational frameworks underscores a company's commitment to sustainable development (Morsing & Oswald, 2009; Riccaboni & Leone, 2010). Even with no universal structure, previous studies have shown the advantages of establishing formal sustainability frameworks (Arjaliès & Mundy, 2013; Riccaboni & Leone, 2010). The positioning of a sustainability department within an organization reflects its stance on sustainability (Arjaliès & Mundy, 2013; Crutzen et al., 2017). The interviews with managers in the land-based aquaculture companies also support these findings. The role of a sustainability manager is critical to facilitate and communicate knowledge. As mentioned in the findings, sustainability ambassadors also play a crucial role in disseminating information, facilitating organizational learning, and symbolizing a more decentralized approach to sustainability. Although the ambassadors were initially established for cultural alignment, this mechanism also strengthens administrative oversight. The administrative control dimension serves great potential for the companies in the industry; only half of the companies could say that they had an officer dedicated to sustainability, none of them had a dedicated sustainability department, and only one mentioned initiative like sustainability ambassadors.

6.2 Control Patterns

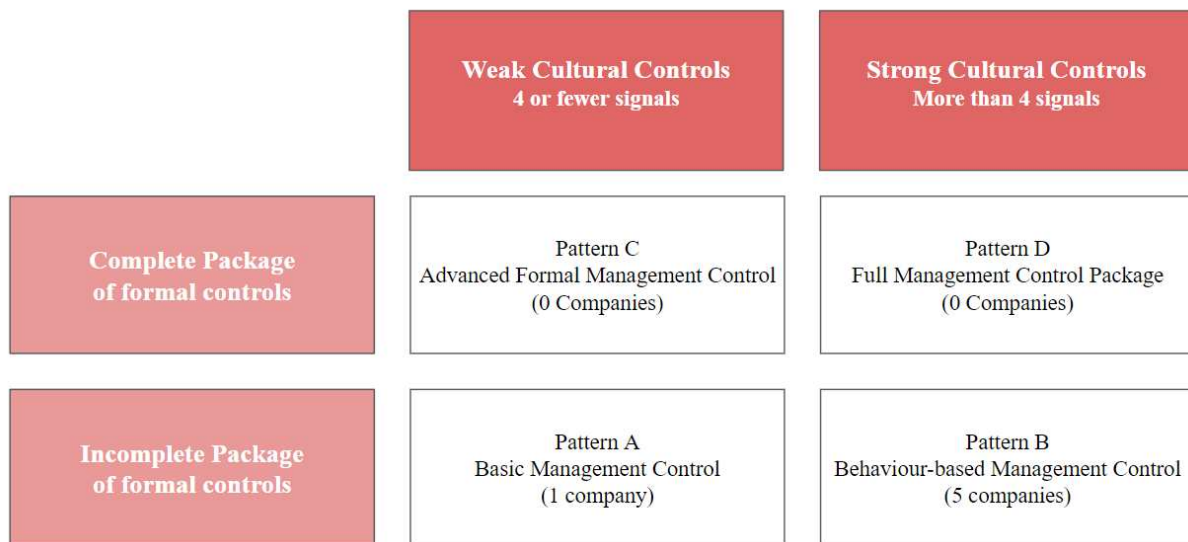


Figure 5 Sustainability Management Control Patterns based on (Crutzen et al., 2017)

One company was categorized under Pattern A, indicative of Basic Management Control. (Crutzen et al., 2017). This organization had put some cybernetic controls in place, focusing

mainly on the measurements and reporting on financial objectives and only required measurements on sustainability. Although they incorporated sustainability into their planning, they needed more comprehensive plans to achieve sustainability goals. Their cultural controls could have been stronger, meeting only two of six identified sustainability signals. This management pattern suggests that the company takes a conservative approach to integrating sustainability, depending predominantly on external pressures from government regulations and consumer expectations rather than on proactive sustainability initiatives (Baumgartner & Ebner, 2010). This approach aligns with Crutzen's study, highlighting how companies often adopt minimal compliance strategies in the early stages of integrating sustainability into their business operations (Crutzen et al., 2017).

The most common pattern in the sample was pattern B, evident in 5 of the 6 companies, which is behavior-based management controls characterized as predominantly informal. The pattern indicates strong cultural controls but an incomplete package of informal controls. (Crutzen et al., 2017). Most companies follow this pattern and are not in the complete package due to the lack of reward and compensation linked to sustainability performance. The main advantage of such an approach is that it creates a prominent level of awareness about sustainability goals in the organization. An interpretation of this pattern is that managers recognize a greater tendency towards sustainability among newer generations of employees or believe that once employees are initially motivated through formal controls to engage with sustainability, they may later influence changes in structures and systems. Pattern B could represent an initial phase in evolving management practices towards sustainability. Here, managers aim to engage all employees in sustainability efforts and later implement more stringent, formalized management control systems once a solid foundation of shared understanding and motivation for sustainability has been established. (Crutzen et al., 2017).

This control pattern could be specific to companies that are at the beginning of working with sustainability issues. As many companies are still young and the focus in the first years has been to establish the company and achieve growth and recognition, sustainability practices might still need to be prioritized. However, participant 1 reflects: *«Educating and informing our employees and stakeholders about sustainability concerns is crucial, aiming to enhance their awareness and understanding of our practices, what we do, why we do it, and how we operate. By doing so, we believe in the importance of engaging everyone to foster innovation and develop innovative, sustainable solutions in our fast-paced environment.»* This could indicate that the companies will likely develop and implement more stringent formal controls.

This pattern, with a lack of formal controls in an environment of informal controls, could also create conflicts for managers in pursuing sustainability goals when these are not reflected in a formal control system, conflicting with traditional economically oriented formal management controls (Crutzen et al., 2017). Other data gathered from the interviews could suggest that one of the reasons for favoring informal over formal management controls is the challenge or impossibility of measuring and formally managing sustainability. Several factors could contribute to the complexity of analyzing and measuring sustainability issues (Korhonen, 2003), such as insufficient knowledge and understanding of what and how to measure and manage. As one of the interviewees mentioned, *“There is no point in spending so many resources on measuring things we do not know how to interpret or use.”* There could also be a perceived mismatch with traditional management practices.

None of the companies were in Pattern D's Full Management Control Package, but two companies were considered in transition toward the pattern. Rewards and compensation are obstacles to developing “the full package,” which combines all the examined formal controls. As previously mentioned, a reason for this could be the underdevelopment of reward and compensation systems, which can be linked to the limited application of financial and hybrid performance measurements and budgets (Arjaliès & Mundy, 2013). This contributes to the ongoing challenge of aligning sustainability with economic performance within many companies (Arjaliès & Mundy, 2013; Crutzen et al., 2017).

This study aligns with previous research in suggesting that achieving sustainability goals requires a blend of both formal and informal controls (Arjaliès & Mundy, 2013; Durden, 2008; Morsing & Oswald, 2009). These control dimensions are designed to complement one another, enhancing the effectiveness of sustainability initiatives (Malmi & Brown, 2008). Relying exclusively on one type of control may not be adequate and could potentially undermine the comprehensive control framework necessary for achieving these goals (Durdén, 2008).

Informal controls serve as a crucial mechanism for influencing employee behavior, embedding sustainability principles into the business's day-to-day operations, and emphasizing the attention employees should dedicate to these initiatives (Malmi & Brown, 2008; Simons, 1995). However, an over-reliance on informal controls alone may introduce uncertainty or ambiguity about the significance of sustainability if it is not also formally institutionalized (Durdén, 2008).

On the other hand, formal controls provide clear signals to management that sustainability is a priority and is taken seriously at all levels of the organization (Arjaliès & Mundy, 2013; Durden,

2008). The controls establish necessary measures and a structured monitoring framework that tracks advances toward sustainable development (Durden, 2008; Malmi & Brown, 2008). Interviews from the current thesis research reinforce this view, with several managers highlighting how formal systems guide strategic planning and ensure accountability and consistent evaluation against sustainability targets.

Integrating formal and informal controls is synergistic, where strategic planning serves as a critical start to effectively measure performance against established sustainability goals (Lueg & Radlach, 2016). Administrative systems strengthen this integration, facilitating the development of cybernetic and internal controls, bolstering them through a robust feedback loop, and ensuring continuous improvement (Hertz et al., 2017; Malmi & Brown, 2008).

6.3 Dynamic Capabilities

The interviews conducted as part of this thesis illustrate how the concept of dynamic capabilities, defined as a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (D. J. Teece, 2007; D. J. Teece et al., 1997) plays a crucial role in the sustainability strategies of land-based aquaculture companies.

Dynamic capabilities are particularly relevant in sustainability, where companies must respond innovatively to environmental, social, and regulatory changes. They enable firms to sense changes early, seize opportunities, and maintain a competitive advantage through strategic adaptation and innovation (Helfat & Peteraf, 2009). The study finds that land-based aquaculture companies employ dynamic capabilities to various degrees, influencing their ability to achieve new resource configurations as market conditions evolve.

A critical resource that strengthens dynamic capabilities in the land-based aquaculture industry is attracting and retaining talented employees who are deeply committed to sustainability. As highlighted in the interviews, companies like Company B and Company E strongly emphasize cultivating a workforce that shares a passion for ecological and environmental welfare. This cultural alignment benefits internal morale and enhances the company's capacity to innovate and respond to sustainability challenges effectively. Participant 2 underscored that the organization's commitment to sustainability is integral to its standards and strongly influences its corporate culture. *“This commitment shapes the company's identity and attracts professionals passionate about sustainability. These employees bring valuable knowledge and innovative ideas for developing new sustainable practices and technologies.”* Employees with a strong background in sustainability contribute significantly to a company's dynamic

capabilities by enhancing its ability to sense and seize opportunities. Their expert insights into sustainability practices enable the firm to more accurately anticipate market trends and regulatory changes and develop responsive strategies aligning with environmental goals and business objectives.

The seizing and transforming aspects of dynamic capabilities are evident in how companies like Participant 3 mention mobilizing resources to support sustainable innovations, such as developing biodegradable materials or processes that reduce environmental impact (D. Teece, 2017). For example, Company C's strategic investments in new opportunities and R&D to advance sustainable practices demonstrate the transformative potential of dynamic capabilities. This strategic approach supports environmental and social goals and ensures long-term business viability and success (D. Teece, 2017).

However, challenges remain in fully harnessing dynamic capabilities, particularly in smaller or newer companies within the industry. Participant 4 notes the difficulty in measuring sustainability metrics accurately due to the company's size and the complexity of the data required. This challenge highlights a gap in the 'transforming' capability, where despite sensing and seizing opportunities, the execution through transformation is hindered by operational limitations.

The interview findings support the dynamic capabilities framework, as they find that those who leverage these capabilities adapt and respond to environmental and regulatory changes more effectively and position themselves as leaders in sustainability within the industry. This strategic alignment between dynamic capabilities and sustainability efforts results in enhanced brand loyalty attracts eco-conscious consumers and fosters long-term resilience and adaptability. Thus, enhancing dynamic capabilities can significantly contribute to firms' sustainability and competitive advantage in rapidly evolving markets. Hence, the dynamic capabilities framework provides a valuable lens through which to view the integration of sustainability in the land-based aquaculture industry.

6.4 Stakeholders Influence

Another aspect evident during the interviews was how the stakeholders significantly influenced organizations' sustainability strategies within the land-based aquaculture industry. Their roles vary, impacting everything from strategic decisions to everyday operations, including investors, customers, regulatory bodies, community groups, and employees.

The interviews conducted for this thesis shed light on how companies in the aquaculture industry engage with and respond to stakeholders to enhance their sustainability efforts. For example, Participant 1 emphasized the critical role that regulatory bodies play in shaping their sustainability policies. The participant noted, *"Regulatory guidelines help us frame our sustainability initiatives, ensuring we meet mandatory standards and strive to exceed them where possible."*

Regulations are a primary driver of sustainability practices. Participant 2 from Company B highlighted the impact of environmental regulations on their operations, stating, *"New regulations push us to innovate and improve our processes to reduce environmental impact."* This reflects the literature's view that regulatory frameworks mandate compliance and encourage companies to adopt advanced sustainability practices (Arjaliès & Mundy, 2013).

Investors increasingly focus on sustainability, affecting how companies report and act on sustainability issues. Participant 3 pointed out, *"Our investors are looking increasingly at how we manage sustainability, which pushes us to be transparent and proactive in our sustainability reporting and initiatives."* This observation aligns with the literature, which suggests that investor interest in sustainability can lead to greater accountability and enhanced sustainability measures within companies (Riccaboni & Leone, 2010).

Community and employee engagement also play vital roles in shaping sustainability practices. Participant 4 discussed community interactions: *"Engaging with the community has helped us understand and mitigate the local environmental impacts of our operations."* Similarly, they noted the importance of involving employees: *"Our employees are at the frontline of implementing sustainability practices, and their commitment is crucial for our success."*

The influence of stakeholders is profound and pervasive, guiding the sustainability pathways for companies in the aquaculture industry. Effective stakeholder management supports compliance with regulatory demands, meets consumer and investor expectations, and fosters community and employee engagement. As illustrated by the interview excerpts and supporting literature, understanding and managing these influences are crucial for developing robust and practical sustainability strategies in aquaculture. This approach helps companies balance business objectives with their social and environmental responsibilities.

7. Conclusion

In this final section, I will answer the research question, acknowledge the study's limitations, and recommend further research.

7.1 Conclusion

A qualitative method was used to answer the research question about how companies in the land-based aquaculture industry approach patterns of integration of sustainability in Management Control Systems. The study reveals the complex interplay between financial imperatives and sustainability commitments within the land-based aquaculture industry. Despite the industry's position at the forefront of sustainable innovation, companies within this sector navigate challenges in integrating sustainability practices. This research demonstrates that while all companies recognize the importance of sustainability, their approaches and the extent of integration vary considerably.

The findings underscore the importance of Management Control Systems (MCS) as a pivotal mechanism for embedding sustainability into daily operations and strategic planning and to provide a consistent perspective on sustainability efforts across the organization. However, the effectiveness of these systems varies based on the company's strategic vision, organizational culture, operational priorities, and maturity. The cases of companies with a comprehensive management control package illustrate that integrating advanced MCS can significantly enhance the organization's ability to implement sustainable practices effectively. On the other hand, companies with less developed MCSs may struggle to align their sustainability ambitions with operational realities, highlighting the need for tailored systems that reflect each company's specific context and sustainability goals.

Furthermore, the study highlights the critical role of stakeholders in shaping sustainability practices. Companies are increasingly accountable to diverse stakeholders, including investors, regulators, customers, and local communities, whose interests must be balanced against operational capabilities and strategic objectives. Engaging stakeholders helps align business practices with societal expectations and enhances the legitimacy and social capital of the firms within the industry.

Dynamic capabilities also emerge as a critical factor in the sustainability integration process. Firms that can rapidly adapt to changing environmental regulations, market conditions, and technological advancements are better positioned to implement sustainability effectively. These capabilities enable companies to anticipate changes, seize opportunities for innovation, and

maintain competitive advantages, thereby supporting sustainable development goals and driving business success.

This thesis contributes to the scholarly understanding of sustainability in emerging industries and provides practical insights for companies aiming to enhance their sustainability integration. It also suggests areas for further research, particularly in the development of MCS that can dynamically support sustainability integration as companies grow and evolve. Incorporating stakeholder perspectives and fostering dynamic capabilities are vital for companies aiming to overcome the inherent challenges of balancing economic and environmental goals. As the land-based aquaculture industry continues to expand, the insights derived from this study can inform practitioners and policymakers aiming to foster a balance between environmental responsibility and economic viability.

7.2 Limitations

Despite conducting ten interviews with people working in the industry and encompassing substantial secondary data, the smaller sample size constrains the generalizability of the findings across the broader Norwegian fish farming industry. Including more interviewees could have enhanced the validity of the research. While qualitative methods are valuable for gaining insights, they lack the reliability of quantitative validation and can introduce subjectivity from both the researcher and the participants.

Another limitation of the study stems from the varied capabilities of respondents to adequately answer the questions posed. Given the diverse levels of knowledge and varying degrees of involvement in sustainability-related processes among respondents, the comprehensiveness and accuracy of the responses were variable. Sustainability officers stress the importance of sustainability in decision-making and its being a foundation for everything the company does. CEOs have a bigger picture and imply that financial activities are equally or even more important than sustainability. The study's findings underscore that sustainability extends beyond just the Sustainability Department, permeating various organizational levels and being integrated across all departments within the company.

Lastly, I only consider sustainability integration as of today and can only determine a snapshot of the overall relationship. As there is no existing literature on the integration of sustainability in these companies, comparing the development of sustainability internalization over time was impossible.

7.3 Further Research

For future research, employing a mixed methods approach, integrating both qualitative and quantitative techniques would be advisable. This combination would allow for more nuanced insights and robust, generalizable conclusions about industry-wide integration patterns. Additionally, longitudinal studies would provide a clearer view of how sustainability practices evolve within corporations, helping to identify long-term trends and the effectiveness of various strategies. Given the dynamic nature of corporate growth, revisiting previous studies in later phases can offer valuable insights into how changes within a company, such as organizational maturation, affect its sustainability efforts. Expanding research to include comparative international studies can also show how different regulatory, economic, and cultural environments impact sustainability practices, enhancing understanding global trends and national differences. Collectively, these recommendations aim to support the development of effective sustainability strategies and deepen our understanding of corporate environmental responsibility.

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and-aquaculture

The AI tool Chat GPT has been used to check for grammar and spelling errors and improve certain sentences in this thesis. <https://chat.openai.com/>

Appendices

Appendix 1: Interview Guide

Part 1 – Introduction (5 minutes)

1. Introduction of myself and the project
 - a. Name, school, and profile
 - b. Introduction of the thesis topic
2. Introduction of the interviewee
 - a. Position and responsibility within the company
 - b. How long have you been working in the company? (Industry)

Part 2 – Interview Questions (min 50 minutes)

Topic 1: Planning

Long-range planning

1. How is sustainability embedded within the company's strategic planning processes?
 - a. Can you provide examples of sustainability objectives in the current strategic plan?
2. What are the plans for investment in sustainability, particularly in new opportunities and R&D?
3. How do you work with KPIs and strategic goals?

Action- planning

1. How does the company approach action planning for sustainability?
 - a. Could you walk me through a recent project or initiative that required collaborative sustainability-related problem-solving?
2. To what extent have your previous sustainability efforts involved developing:
 - a. *New or improved goods and products?*
 - b. *New or improved operational/internal process?*

Topic 2: Cybernetic Control

1. Can you describe how the organization monitors and controls sustainability?
 - a. How often are sustainability metrics reviewed, and by whom?
 - b. What are the differences between other metrics?
 - c. Are there targets for all metrics?
2. In what ways does the company measure the Return on Investment (ROI) for sustainability efforts?
3. In your experience, how are sustainability indicators used in corporate strategic management?
 - a. Can you provide any examples?

Topic 3: Reward and Compensation

1. How are sustainability achievements recognized and rewarded within the organization?
 - a. Could you tell me when the incentive system motivated sustainable action?
2. Do you have incentive systems linked to performance and KPIs?

Topic 4: Culture

1. How does the executive management's commitment to sustainability shape the company culture?
 - a. Can you share how this commitment is communicated and embodied within the company?
2. What efforts are made to engage stakeholders in sustainability?
 - a. How are these efforts received

Topic 5: Administrative Controls

1. Can you describe if you have any policies, such as codes of conduct or best practices guidelines, that are implemented to promote sustainability?
2. What specific control and auditing processes are established to monitor compliance with sustainability standards?

How frequently are these processes reviewed and updated?
3. How does the company ensure the organization and governance of sustainability roles and responsibilities? (Do you have dedicated roles or departments for sustainability?)

Part 3 – Conclusion and final remarks (5 minutes)

1. Is there anything else you would like to share/add on the topic?
2. Thank the participants for their time and insights.
 - a. Ask if they have any questions or comments before the interview ends.

The AI tool Chat GPT was utilized to help summarize the interview transcripts.

<https://chat.openai.com/>

Appendix 2: Interview 1

Participant 1 – Chief Sustainability Officer – Company A

Cultural Controls

The commitment to sustainability is a fundamental aspect of the company culture, driven by the executive leadership's focus on sustainable practices. Sustainability is communicated primarily at the leadership and external levels, with plans to integrate these values fully throughout the organization. Initiatives such as training sustainability ambassadors aim to enhance understanding and competence among all employees, foster a culture where sustainability is a common goal, and encourage employees to contribute ideas and participate actively in sustainability practices.

Planning Controls

Sustainability is integrated into the core business model and company strategic planning processes. The company was founded to use sustainable resources and provide a sustainable alternative, differentiating itself from companies that must adjust their existing models to incorporate sustainability. Strategic goals include minimizing energy consumption through the use of energy-efficient technologies and the production of renewable energy via solar panels. Sustainability goals are regularly reviewed in board meetings and are crucial to the company's strategic direction.

Cybernetic Controls

Although the company is relatively young and not yet in total production, it has established a system for monitoring and controlling sustainability efforts. This includes creating a database for tracking defined sustainability metrics and early implementing measures to monitor progress. The company uses KPIs to monitor various sustainability aspects, which will become increasingly relevant as production scales up.

Reward and Compensation

Currently, the company does not link sustainability achievements to incentive models at the employee level. However, plans are underway to develop incentive systems aligned with sustainability KPIs to motivate employees to achieve sustainability goals through compensation packages.

Administrative Controls

The company follows the Global Reporting Initiative (GRI) framework for sustainability, which guides its action planning and reporting processes. This adherence to recognized standards ensures that sustainability efforts are measurable and comparable across the industry. The company plans to continue integrating and improving its sustainability practices by aligning them closely with the GRI standards and other relevant frameworks.

Appendix 3: Interview 2

Participant 2 – Chief Communication Officer – Company B

Cultural Control

The commitment to sustainability is integral to the company's standards, strongly influencing its corporate culture. The organization was founded with the vision of advancing sustainable practices in aquaculture, which attracts talent passionate about ecological and environmental welfare. This commitment permeates through external communications, shaping the company's identity and operations in ways that resonate with employees and external stakeholders. But the company does lack some internal communication.

Planning Controls

Sustainability is deeply embedded in the strategic planning processes. The business model focuses on enhancing operational efficiencies and reducing environmental impacts, with particular attention to water management and minimizing waste. Strategic initiatives include significant investments in renewable energy sources and sustainable feed solutions, aligning operational decisions with long-term ecological sustainability goals.

Cybernetic Controls

The company employs comprehensive life cycle analyses to manage its carbon footprint effectively from the outset. Sustainability metrics such as water usage, feed efficiency, and energy consumption are closely monitored, with regular reviews to ensure compliance with environmental standards and identify improvement areas. These efforts are part of a broader strategy to optimize resource use and minimize environmental impact.

Reward and Compensation

While direct incentives specifically for sustainability achievements are not yet fully developed, the company recognizes and occasionally rewards efforts that significantly contribute to its sustainability goals. These rewards are generally integrated into broader performance evaluations, considering economic and ecological impacts and aligning employee incentives with business and environmental objectives.

Administrative Controls

The company is proactive in adjusting to regulatory changes, setting clear sustainability goals ahead of compliance deadlines. These goals are integrated into the company's strategic framework, which includes preparing for upcoming environmental regulations and enhancing the sustainability reporting process. Efforts are made to ensure that all areas of operation adhere to the highest sustainability practice standards. The company does not have a dedicated sustainability department or officer.

Appendix 4: Interview 3

Participant 3 - Communication Manager – Company C

Cultural Controls

The company's executive leadership demonstrates a solid commitment to sustainability, significantly influencing the organizational culture. Leadership actions and internal meetings communicate and embody this commitment within the company. Efforts to engage stakeholders in sustainability are highlighted, with initiatives aiming to make sustainability a shared goal across the company.

Planning Controls

Sustainability is deeply integrated into the company's strategic planning processes. The organization has established clear sustainability goals within its strategic plan, including investments in new opportunities and research and development (R&D) to advance sustainable practices. These plans leverage scalable systems and resource-efficient practices, enhancing the company's capacity to manage environmental impacts effectively. The company approaches action planning for sustainability by adhering to specific frameworks and methodologies, such as the Global Reporting Initiative (GRI). These frameworks guide the company in implementing and managing sustainability initiatives, ensuring that all projects and operational improvements are aligned with established sustainability standards.

Cybernetic Controls

The organization's sustainability monitoring and control are conducted through integrated systems that track various metrics, such as CO2 emissions and overall environmental impact. The company utilizes digital systems to enhance the efficiency of these processes. Sustainability measurements are reviewed regularly, with clear targets set for all metrics, ensuring that all aspects of the company's operations contribute to its sustainability goals.

Reward and Compensation

Sustainability achievements within the company are recognized and rewarded through various mechanisms. While the direct link between these achievements and compensation models is not fully established, the company employs an incentive system that encourages sustainable actions among employees. This includes options programs for employees to invest in the company and development opportunities that align personal growth with the company's sustainability objectives.

Administrative Controls

The company has no department or employee with sustainability as its primary responsibility. However, the communication manager is responsible for ensuring they try to do the best for the nature and environment around the company's production facility. He stresses the importance of keeping the local environment as good as possible, both from an ecological point of view and regarding the organization's social aspect.

Appendix 5: Interview 4

Participant 4 – Chief Executive Officer - Company D

Cultural Controls

The company's commitment to sustainability is embedded in its operational culture, focusing on emission controls and fish welfare. This commitment is communicated mainly through regulatory compliance and is a core component of their operational strategy. However, internal communication channels for sustainability are still under development, with plans focusing on fish health and broader sustainability issues.

Planning Controls

Sustainability is integral to the strategic planning processes. The company aims to produce food close to consumer markets, reducing the need for air freight and minimizing ocean pollution.

Challenges include managing energy consumption effectively. Investments in sustainability, particularly in new opportunities and research and development, are aligned with stringent regulatory requirements, which dictate permissible emission levels and influence investment decisions.

Cybernetic Controls

The company does not have specific sustainability KPIs; instead, it focuses on maintaining energy consumption as low as possible and adhering to stringent emission regulations. Sustainability measurements are integrated into regular operational reports (weekly and monthly). Still, the company faces challenges in measuring some sustainability metrics due to its small size and the complexity of obtaining reliable data. Despite these challenges, it strives to stay ahead of regulatory requirements by cooperating with authorities.

Reward and Compensation

Currently, no specific rewards or compensation are linked directly to sustainability achievements within the organization. The incentive systems are more aligned with sales and production targets. There has been no mention of specific instances where the incentive system successfully motivated sustainable actions, indicating an area for potential development in aligning rewards more closely with sustainability goals.

Administrative Controls

The approach to sustainability action planning involves adherence to standard frameworks, though the interview did not detail specifics. The company is AC certified, indicating a commitment to sustainability that extends to demanding high standards from suppliers. This certification is becoming increasingly important in new markets like China, although customers' willingness to pay for certified sustainable products remains uncertain.

Appendix 6: Interview 5

Participant 5 – Chief Executive Officer – Company B

Cultural Control

The company's dedication to sustainability is a core part of its identity, deeply ingrained in its culture and operational philosophy. Founded with a mission to improve the ecological standards of aquaculture, the company attracts skilled professionals who are deeply committed to environmental stewardship. This commitment is communicated through various channels

within and outside the company, significantly influencing how stakeholders perceive the organization.

Planning Controls

Sustainability is a cornerstone of the company's strategic decision-making. The organization's business model is designed to minimize environmental footprints through innovative operational practices. This includes the adoption of systems that enhance water recycling and waste reduction. Strategic planning consistently emphasizes long-term investments in technologies contributing to sustainable aquaculture, such as advanced water treatment technologies and eco-friendly feed options.

Cybernetic Controls

The organization implements detailed environmental impact assessments and uses rigorous sustainability metrics to guide operational decisions. Key performance indicators like water quality, energy efficiency, and waste output are closely monitored to ensure ongoing improvements and compliance with strict environmental regulations. These metrics are integral to the company's strategy to reduce its ecological impact and enhance resource efficiency.

Reward and Compensation

While the company has not fully established direct financial incentives specifically tied to sustainability outcomes, it acknowledges and rewards significant contributions towards sustainability goals within its performance review process. Recognition often comes in forms that foster professional development and highlight employees' contributions to achieving sustainability targets, aligning personal success with the company's environmental objectives.

Administrative Controls

The company maintains a proactive approach to its administrative controls, focusing on governance and compliance. It sets ambitious sustainability targets well before regulatory deadlines. The company does not have a dedicated sustainability department or officer.

Appendix 7: Interview 6

Participant 6 – Chief Financial Officer - Company C

Cultural Controls

The company's commitment to sustainability significantly influences its organizational culture, as emphasized by the CFO. The leadership's commitment is firm, fostering a company-wide culture centered on fish health and environmental responsibility. This intense focus on sustainability is evident in the motivation of new employees who join the company, who are attracted by its innovative approach to aquaculture that prioritizes environmental and animal welfare.

Planning Controls

Sustainability is embedded in the company's business model and strategic planning processes. The company builds its operations on sustainable practices, emphasizing fish welfare as a top priority. Strategic investments are made carefully considering their environmental impact, including choosing construction materials and designs that minimize the ecological footprint, such as using concrete for building fish tanks and employing local stone to reduce transportation impacts. The company follows a robust framework for action planning in sustainability, which includes complying with local regulations and engaging in practices that exceed those requirements to benefit the local community and environment.

Cybernetic Controls

The company employs rigorous measures to monitor and control its environmental impact. Regular checks on fish health, water quality, and other ecological parameters ensure minimal impact on the surrounding ecosystem. The company also engages in meticulous documentation and compliance with stringent regulations, emphasizing transparency and accountability in its operations.

Reward and Compensation

No specific incentive system is directly tied to sustainability performance, as the company is still in the early stages of full-scale operations. However, there is an intention to link rewards to sustainability KPIs as the company reaches total operational capacity. Presently, incentives are primarily related to overall business performance, including stock price appreciation.

Administrative Controls

The company's approach to sustainability is methodical and integrated into every aspect of its operations, from the design and construction of facilities to the day-to-day operational procedures. Sustainability considerations dictate how facilities are built and operated, focusing on ensuring that activities do not disturb local marine life or the broader ecosystem.

Appendix 8: Interview 7

Participant 7 – Chief Financial Officer – Company D

Cultural Controls

The company's culture is significantly influenced by a commitment to sustainability, which is both exciting and future-oriented. This underlies the company's operations and is perceived as a newer, better approach than traditional methods, especially regarding animal welfare. The culture is also shaped by many employees having a background in the aquaculture industry, which contributes to a deeper understanding and commitment to improving practices in sustainable ways.

Planning Controls

Sustainability is a fundamental aspect of the company's strategic planning. The business model revolves around sustainable practices such as producing food near where people live to eliminate the need for air freight, thereby reducing carbon emissions. The company continuously invests in energy efficiency to reduce high energy consumption, a known issue in sustainable production. Strategic investments aim to enhance operational efficiency and sustainability by maintaining financial rationale to support sustainability investments.

Cybernetic Controls

The organization has a limited set of KPIs related to sustainability, primarily focusing on energy consumption and operational efficiencies. Monitoring of sustainability metrics is not as standardized, reflecting the company's stage of growth and current scale. However, efforts are being made to standardize and enhance the measurement of these metrics to manage better and report on sustainability efforts.

Reward and Compensation

Currently, no specific incentive systems directly reward sustainability achievements. The company's compensation strategies traditionally align with overall business performance, including sales and production metrics, rather than particular sustainability outcomes.

Administrative Controls

Administrative approaches to sustainability involve compliance with environmental regulations and leveraging certifications like ASC to enhance the company's market positioning. While some efforts might be somewhat unstructured due to the company's size and resource limitations, there is a clear commitment to meet and exceed regulatory requirements and effectively engage stakeholders in sustainability efforts.

Appendix 9: Interview 8

Participant 8 – Chief Operational Officer - Company E

Cultural Controls

The company's commitment to sustainability is foundational to its culture, profoundly shaping its operations and attracting employees keen on making a positive environmental impact. The company was established to revolutionize aquaculture by addressing critical sustainability challenges and attracting talent passionate about nature and ecological preservation. This foundational commitment is communicated and embedded throughout the organization, influencing how employees and stakeholders perceive and engage with the company.

Planning Controls

Sustainability is an attribute and the core of the company's strategic planning. The business model is built around sustainable practices, including improving fish health and welfare, optimizing environmental controls within aquaculture systems, and reducing externalities such as sea lice and waste. Strategic plans focus on employing energy-efficient technologies and making choices that align with long-term sustainability goals, such as selecting components that maximize energy efficiency in facility setups.

Cybernetic Controls

The organization conducts detailed life cycle analyses to understand and minimize its carbon footprint from the early stages of production. This involves analyzing primary emission sources and optimizing operational choices to reduce impacts, such as producing closer to consumer

markets to minimize transportation needs. The company tracks energy consumption and has begun implementing taxonomy to better standardize and report on sustainability metrics.

Reward and Compensation

While no specific incentive systems are directly linked to sustainability achievements, the company's performance in sustainability does influence its stock market performance, indirectly affecting how achievements are rewarded. The organization gains significant local and national goodwill for improving industry practices, contributing to its reputation and valuation.

Administrative Controls

Action planning for sustainability within the company follows established frameworks, though specific details were not mentioned. The company's approach includes collaborative problem-solving for sustainable innovations, focusing on product development and service enhancements to ensure sustainable operations. This includes improving waste management systems and making strategic decisions that align with stringent environmental standards.

Appendix 10: Interview 9

Participant 9 – Chief Sustainability Officer – Company F

Cultural Control

The company's culture is profoundly shaped by its commitment to sustainability, which is integral to its mission and values. This commitment is actively promoted through internal communications and educational programs emphasizing the importance of sustainable practices in everyday operations. The company attracts and retains employees passionate about sustainability, creating a work environment where ecological considerations are at the forefront of decision-making.

Planning Controls

Sustainability is woven into the fabric of the company's strategic planning. From the onset, the company's business model has prioritized minimizing environmental impact through innovative aquaculture practices. Strategic planning involves continuous investments in sustainable

technologies and methodologies that comply with and exceed environmental regulations. The company regularly assesses environmental strategies and operations and develops strategic plans to mitigate risks and enhance ecological benefits.

Cybernetic Controls

The company employs rigorous cybernetic controls to monitor and manage its sustainability impacts. This includes comprehensive water quality, energy consumption, and waste management tracking. Data from these metrics is used to refine operational processes and improve sustainability outcomes. Management reviews regular reports based on these metrics to ensure ongoing compliance with environmental standards and foster continual improvement.

Reward and Compensation

Although no specific incentive systems are directly linked to sustainability achievements, the company recognizes the value of sustainable practices through non-monetary recognition and career advancement opportunities for employees who champion sustainability initiatives. This approach reinforces the importance of sustainability within the company culture and encourages employees to contribute to sustainability goals.

Administrative Controls

The company has robust administrative controls focusing on the organization and governance of sustainability efforts. Codes of conduct and best practice guidelines are implemented to ensure all employees adhere to the highest standards of environmental responsibility. The company has established specific roles dedicated to overseeing the sustainability strategy, ensuring that responsibilities and duties related to sustainability are clearly defined and aligned with organizational goals. Regular audits and adherence to recognized certification standards help maintain compliance and uphold the company's reputation as a leader in sustainable aquaculture.

Appendix 11: Interview 10

Participant 10 – Financial Officer – Company E

Cultural Controls

The company culture is deeply influenced by sustainability, which is considered integral and not just an add-on to the business strategy. This culture is grounded in the belief that the

company's operations inherently address key sustainability challenges like fish mortality, health, and reducing CO2 emissions. This commitment to sustainability shapes the organizational culture, attracting employees and stakeholders who are conscious of environmental impacts and committed to sustainable practices.

Planning Controls

Sustainability forms the foundation of the company's strategic planning processes. The strategic initiatives focus on reducing environmental impact through optimized operations that enhance fish health and welfare and reduce waste. The company makes strategic decisions to ensure operations are energy-efficient and minimally invasive to the environment, such as using local resources to decrease transportation impacts and choosing sustainable building materials.

Cybernetic Controls

The company conducts life cycle analyses to measure and minimize its carbon footprint, focusing on significant emission sources and optimizing operational choices. While specific sustainability KPIs are not extensively detailed, the company monitors crucial parameters like mortality rates, feed conversion ratios, and energy consumption to guide operational improvements and sustainability reporting.

Reward and Compensation

Currently, there are no specific incentive systems directly tied to sustainability performance. The company's approach to compensation and rewards is more aligned with overall business performance metrics, such as stock market performance, rather than directly linking to sustainability achievements.

Administrative Controls

The company is enhancing its sustainability framework to meet upcoming regulatory requirements. This involves setting clear and measurable sustainability goals and integrating these into the broader company strategy. The focus is improving reporting and compliance with new directives, which will require a more structured approach to monitoring, reporting, and achieving sustainability targets.

Appendix 12: Interview Coding Table

1 st Order Concepts	2 nd Order Themes	Aggregated dimensions
Executive leadership drives a sustainability-focused culture. Active internal and external communication of sustainability values	Commitment to sustainability Communication of sustainability	Cultural Controls
Direct inclusion of sustainability in business strategy and operational planning Setting clear sustainability goals Decision-making focused on energy efficiency and reducing environmental impact	Integration of sustainability Sustainability in Business Strategy	Planning Controls
Established procedures for monitoring and control Control systems in place for sustainability tracking KPIs focused on mortality, energy use, and environmental impact	Monitoring and reporting Compliance and optimization	Cybernetic Controls
Development of reward systems that reflect sustainability Incentive systems more aligned with overall business performance No specific rewards directly tied to sustainability achievements	Alignment with business performance Lack of direct sustainability incentives	Reward and Compensation
Preparing for integration of new regulatory requirements into company strategy Enhancing frameworks for better compliance and reporting	Regulatory compliance Strategic sustainability framework No Sustainability department	Administrative Controls