Mental Models of the Drivers of Corporate Sustainability and the Role of Cross-Functional Communication on their Content and Structure

Mariana Butrich Cisneros

Faculty of Geosciences, Utrecht University

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Dr. Karlijn van den Broek

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Abstract

Since corporate sustainability is a cross-functional challenge that has become an essential part of business, it is necessary to examine the drivers of its implementation. Cognitive structures in the form of mental models are relevant in the field of corporate sustainability as the way individuals in organizations make sense of these drivers will guide their decision-making and actions. It has been found that similarities in mental models impact performance as it facilitates cooperation and coordination. Therefore, this research aims to shine a light on those drivers and the role of cross-functional communication on the mental models of the drivers of corporate sustainability in a cross-functional environment. This research applies a quantitative single case study methodology and uses a standardized mental model elicitation procedure. Empirical data was collected from managers from five different functional areas. The findings show that the mental models of the drivers per functional area are aligned with their tasks and responsibilities and that people within functional areas have more similar mental models than across functional areas. This research could not find a relationship between the frequency of cross-functional communication and mental models' similarities. However, a relationship was found between the number of areas an individual communicates with and the density of their mental models, limited to the perceived drivers. This offers valuable insight on how companies can better approach functions through the content of their mental models and enhance more desirable mental models' structures.

Keywords: corporate sustainability; drivers; mental models; cross-functionality; cross-functional communication

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In the last decades, corporations have become key actors in the sustainability debate (Dunphy, Griffiths, & Benn, 2003; Elkington, 2002; Lozano, 2008, 2015; Moon, 2007; Porter & Kramer, 2006). Their responsibility for many negative impacts on the environment and society has become a central focus of attention (Dunphy et al., 2003; Porter & Kramer, 2006). Therefore, they are being pressured by multiple stakeholders such as consumers, suppliers, NGOs, and government to adapt their traditional way of doing business (Lozano, 2013; Porter & Kramer, 2006; Wolf, 2014). Within this context, corporate sustainability (CS), understood as the corporate environmental and social concerns of business operations and the interaction with stakeholders (Marrewijk & Werre, 2003), has become an essential part of business, meaning it is often seen as a precondition for undertaking business (Holliday, 2001).

A large body of literature states that CS is a cross-functional challenge that requires all functional areas within a company to be involved (e.g., marketing, operations, procurement, human resources, etc.; Baumgartner, 2014; Epstein & Roy, 1998; Epstein, Buhovac, Elkington, & Leonard, 2008; Hoffman, 2001; Lozano, 2012; Shrivastava & Hart, 1995). Functional areas are a common structure within organisations to obtain efficiencies due to the specialised division of labour (Robbins & Judge, 2009). All functions´ involvement is necessary to create comprehensive sustainability solutions as there is a need to align with the complex and dynamic changing environment (Schaltegger, Harms, Windolph, & Hörisch, 2014).

As CS implementation requires the participation of various functional areas, attention is placed on communication to foster alignment and, thus, cooperation and collaboration between

functions (Lozano, 2007; Schneider, Wallenburg, & Fabel, 2014). Communication across functional areas is the ongoing process in which different functions maintain a reciprocal flow of information to support decision-making (Pellathy, Mollenkopf, Stank, & Autry, 2019). Through communication, individuals can express their motivations, ideas, and beliefs regarding various topics (Denzau & North, 1992). One of these topics is corporate sustainability.

Cognitive structures in the form of mental models are a relevant topic in the field of corporate sustainability. Mental models are defined as the internal representations of the external environment that support complex systems' interpretation and guide individuals´ decision-making (Denzau & North, 1992). Mental models are important because they help explain the formulation, adoption and execution of CS practices and policies (Hemingway & Maclagan, 2004). Understanding the mental models of strategic decision-makers is essential if an organisation aims to become more sustainable (Bonn & Fisher, 2011).

Mental model studies in the field of CS are still limited. Existing studies have focused on business responsibility towards society; identifying narrow perceptions on the subject matter (Pedersen, 2010), the business case of CS; providing insights on the perceptions of competitive advantages as the main motivation for CS and identifying a relationship between sustainability performance with mental model complexity (Hockerts, 2015), managers understanding of CS; finding that mental models of sustainability constructively integrate sustainability issues into innovation and risk function within the core of the business (Hielscher & Will, 2014) and, the variation of this understanding across different countries; where the cultural background has an influence on the perception of corporate sustainability (Fassin et al., 2015).

It is important to highlight that there is a call for quantitative research that can provide further insights regarding CS drivers (Lozano, 2015). Even though there is research focusing on managers' understanding of CS (Fassin et al., 2015; Hielscher & Will, 2014; Pedersen, 2010), there is still a need to understand how corporate dynamics can have an influence in the alignment of mental models of CS. This is highly relevant as alignment between across functions facilitates coordination and collaboration (Lozano, 2015; Schneider et al., 2014). Beyond this alignment, there is also a gap in how different factions perceive the drivers of corporate sustainability. This is relevant as it provides an understanding of the perception of which are the main drivers that, according to some authors, act as change leverages towards CS (Lozano, 2015; Sroufe, 2017) 2017). Additionally, the methodological approaches in previous research on mental models in the field of CS lack standardised procedures. Therefore, there is a methodological gap that can be addressed through the use of standardised procedures to facilitate mental model analysis and comparisons.

Communication between people can influence mental models as people can express their motivation, ideas, beliefs, learnings and experiences (Denzau & North, 1992). This, in turn, facilitates the alignment and convergence of mental models (Denzau & North, 1992). The convergence of mental models helps members of a team with similar mental models' better tailor their behaviour to meet the team's expectations (Mathieu et al., 2000). It improves performance as it facilitates the coordination of tasks (Denzau & North, 1992). Additionally, research has found that similarities in mental models impact the team's performance as it facilitates different dynamics such as coordination and cooperation (Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). Understanding the dynamics of communication within a company will provide

more significant insights into people's alignment towards CS and identify potential obstacles for cooperation and collaboration.

Research focusing on the relationship between mental models and communication has found that mental model alignment is carried out more effectively when there is more frequent communication between individuals (Waller, Gupta, & Giambatista, 2004). Additionally, it has also been found that the impact of mental model convergence on a teams' performance is mediated by communication (Mathieu et al., 2000; Waller et al., 2004); showing that higher performance teams engage in more frequent communication which is highly important for problem-solving and strategizing. According to Mathieu et al. (2000), this convergence in mental models suggests adaptable teams that can understand and predict how team members interact. It is relevant to study this relationship in the context of corporate sustainability as previous studies have focused on the relationship of these two variables in highly controlled and structured settings such as command-control crews (Waller et al., 2004) and military (Mathieu et al., 2005). Different to command-control crews and military contexts, corporate sustainability requires subjective evaluation judgement to deal with complex and multi-dimensional issues (Islam, Tseng, & Karia, 2019)

Additionally, there is limited research on the cross-functionality of corporate sustainability. According to some authors, the functional task divisions and lack of communication between them can hinder collaboration to integrate sustainability within a company (Epstein et al., 2008; Hoffman, 2001). Research on cross-functional communication has found that it is positively linked to performance (Hauptman & Hirji, 1996) and collaboration (Souder, 1981). However, cross-functional communication research has concentrated on limited

functional areas and focuses on new product development (Dawes & Massey, 2005; Fisher, Maltz, & Jaworski, 1997; Hoegl & Gemuenden, 2001; Hutt, 1995; Souder, 1981). Therefore, there is a gap that needs to be filled regarding cross-functional communication addressing corporate sustainability.

Studying the mental models of CS across functional areas will provide new insights into understanding the functional areas within a company and the concept of cross-functionality (Dunphy et al., 2003). Furthermore, by understanding the role that communication plays in the differentiation of mental models, developing strategies to align perceptions to foster collaboration and coordination in CS implementation processes is possible. Besides, creating awareness of the mental models regarding the drivers of CS can assist organisations in finding the appropriate path to manage, balance and foster CS (Lozano, 2012, 2015; Marrewijk & Werre, 2003).

Considering the research gaps and the relevance of the topic, this study aims to answer the following research question: (1) *What do the mental models of drivers of corporate sustainability look like?* (2) *Are mental models within a functional area more similar than across functions?* (3) *Can mental models' similarities across functions be explained with the frequency of cross-functional communication?* (4) *How does cross-functional communication affect the structure of the mental model of the drivers of corporate sustainability?*

Quantitative research using an exploratory single case study methodology will be applied. Using a standardised Mental Model Mapping Tool (M-Tool) as an elicitation method will allow a quantitative comparison of the managers´ mental models across functional areas, the identification of similarities in their mental models and understand the role of communication to

explain such similarities as well as to explain the structures of the mental models. The selected case study is a large multinational corporation in the food & beverage sector engaged in integrating sustainability into their business operations. Consumer goods are characterised by their considerable societal and environmental impacts (Bocken & Allwood, 2012). Therefore, there is increased pressure on these fast-moving consumer goods companies to become more sustainable (Bashir, Jørgensen, Pedersen, & Skard, 2020).

This thesis will proceed with the theory focusing on the drivers of CS, mental model theory, and the role of communication in mental models and in cross-functionality to develop hypotheses. Subsequently, the methodology will be described, followed by the presentation of results, the discussion, and conclusions.

Theory

Drivers for Corporate Sustainability

Corporate sustainability definitions are varied in literature. This is not only because of its status as a contested concept but also as a reflection of the various orientations companies put in practice regarding their responsibilities (Moon, 2007). The concept is multidimensional and complex (Aguinis & Glavas, 2019; Baumgartner, 2014; Lozano, 2015; Marrewijk, 2003) and refers to the corporate activities that proactively considers the environmental, social, and economic effects of business activities today and throughout time while addressing their responsibility concerning stakeholders (Lozano, 2015).

According to Lozano (2015), integrating sustainability into a company's system is a highly challenging because of high complexity and multidimensionality of the concept (social, environmental, and economic dimensions) and the issues it addresses. This complexity implies

that CS can be driven and motivated by different factors (Lozano, 2015; Marrewijk & Werre, 2003; Moon, 2007). Drivers are the reasons and motivations that explain why it is essential to integrate CS (Engert, Rauter, & Baumgartner, 2016). These drivers act as change leverage towards CS (Lozano, 2015; Sroufe, 2017).

Research on CS and organisational change management has studied the various drivers of why corporations engage in CS (Babiak & Trendafilova, 2011; Dummett, 2006; Dunphy et al., 2003; Lozano, 2015; Marrewijk & Werre, 2003; Moon, 2007; Sroufe, 2017; Zhang, Oo, & Lim, 2019). These drivers have been identified and stated by various authors in the field of CS. **Table 1** presents a recompilation of the drivers for CS identified in literature with their corresponding general definitions.

Table 1

Drivers of CS Identified in Academic Literature

Driver	Definition	Reference
Risk management	Operations and decision making apply environmental and social criteria as an opportunity to reduce costs associated with the related risks. This may reduce the occurrence and cost of emergency responses.	Dummett, 2006; Hockerts, 2015; Hoffman, 2001; Lozano, 2015; Schaltegger & Wagner, 2006; Sroufe, 2017
Profits and growth	Integration of social, environmental, and ethical aspects into business operations and decision-making because of its contribution to the financial bottom line.	Marrewijk & Werre, 2003; Porter & Van Der Linde, 1995; Schaltegger, Lüdeke-Freund, & Hansen, 2012; Sroufe, 2017
Resources and cost savings	Increase in operational efficiencies through eco-efficiency. Efficiency gains are the result of waste management costs and reduce use of resources such as energy, water, and materials.	Dummett, 2006; Epstein & Roy, 1998; Epstein et al., 2008; Hockerts, 2015; Hoffman, 2001; Schaltegger et al., 2012; Shrivastava & Hart, 1995
Leadership	Proactive senior leadership that pushes forward the integration and implementation of sustainability.	DeSimone & Popoff, 2000; Dummett, 2006; Gill, 2009; Lozano, 2015; Porter & Van Der Linde, 1995; Sroufe, 2017
Employee recruitment and retention	Attract higher quality applicants and retain workers.	Ehnert, 2013; Hoffman, 2001; Marrewijk & Werre, 2003; Quazi, 2001; Revell, 2010
Ethical and moral responsibility	CS as a moral duty: to do the "right thing"	Ditlev-Simonsen & Midttun, 2011; Lozano, 2015; Marrewijk & Werre, 2003
Innovation and technology	Development of new products and business concepts.	Ditlev-Simonsen & Midttun, 2011; Engert et al., 2016; Pujari, 2006; Schaltegger & Wagner, 2011
Legal compliance	Working within the limits of regulation from the legal authorities.	Babiak & Trendafilova, 2011; Dummett, 2006; Dunphy et al., 2003; Engert et al., 2016; Epstein et al., 2008; Hoffman, 2001; Lozano, 2015; Marrewijk & Werre, 2003; Moon, 2007; Schaltegger, 2011
Corporate and brand reputation	Enhance a positive corporate public image and ensure the marketability of its brand name.	Axelsson et al., 2012; Babiak & Trendafilova, 2011; Dummett, 2006; Hockerts, 2015; Hopkins, 2002; Lozano, 2015; Marrewijk & Werre, 2003; Moon, 2007; Sroufe, 2017
Stakeholders' expectations	Meet sustainability related expectations from suppliers, investors, employees, customers, NGOs	Babiak & Trendafilova, 2011; Engert et al., 2016; Lozano, 2015; Marrewijk & Werre, 2003; Sroufe, 2017
Alliances and partnerships	Sectoral or intersectoral alliances and partnerships to effectively foster sustainable goals.	Babiak & Trendafilova, 2011; Dunphy et al., 2003; Lozano, 2015; Moon, 2007
Market demands	Answer to changing market needs and interest with products and services.	Babiak & Trendafilova, 2011; Dunphy et al., 2003; Hoffman, 2001; Marrewijk & Werre, 2003; Moon, 2007
Competitor's benchmarking	Keeping up with the new sustainability trends followed by competitors.	Babiak & Trendafilova, 2011; Epstein & Roy, 2001; Quazi, 2001
Access to markets and customers	The opportunity to enter new markets and access more or different customers.	Babiak & Trendafilova, 2011; Dummett, 2006; Hockerts, 2015; Moon, 2007; Quazi, 2001

Lozano (2015) states that drivers can be internally and externally motivated. On the one hand, external drivers appear to result in reactive measures that contribute less to the progress of integrating sustainability into the company. On the other hand, internal drives tend to be more proactive towards sustainability (DeSimone & Popoff, 2000; Lozano, 2015). The results of Lozano's (2015) qualitative research interviewing top-level corporate managers showed that the most important external drivers were reputation, customer demands and regulations. In contrast, the most important internal drivers were leadership and the business case of corporate sustainability.

Research has also focused on the task, responsibilities, and contributions from each functional area regarding the implementation of CS (Baumgartner, 2014; Epstein & Roy, 2001; Lozano, 2012). For example, the marketing functional area being involved in identifying sustainability-related consumer demands, promoting more environmentally friendly products, ensuring a positive corporate image (Baumgartner, 2014; Epstein et al., 2008; Maignan & Ferrell, 2004). Procurement functional is involved in purchasing harmful materials or choosing more socially responsible suppliers as a response to the market and social demands (Epstein et al., 2008; Lozano, 2012; Schneider et al., 2014). In the Research and Development (& R&D) function, they integrate sustainability expectations and demands into the products and process through technical innovation (Epstein & Roy, 2001; McWilliams & Siegel, 2001). Operation departments tasks have been aligned with the need for internal improvements in processes, resource use and efficiencies (Baumgartner, 2014; Epstein & Roy, 2001).

Even though the previous research provides insights on the involvement of each functional area, no research has uncovered how different functional areas perceive the drivers of corporate sustainability.

Mental Models and Cognitive Mapping

Various authors have developed institutional or organisational approaches to investigate why companies engage in CS (Brammer, Jackson, & Matten, 2012; Campbell, 2006; Yang & Rivers, 2009). Yet, researchers call to provide an understanding of how individuals think of CS within a company (Aguinis & Glavas, 2019; Hockerts, 2015). To do so, the field of cognitive research in CS uses mental models to understand corporate sustainability's cognitive processes and structures (Basu & Palazzo, 2008).

Mental models are internal conceptual representations of the external environment that individuals use to make sense and interact with their surrounding (Denzau & North, 1992; Jones et al., 2011; Senge, 1994). Individuals build their mental models based on a series of diverse experiences, perceptions, knowledge, beliefs, values, and expectations, explaining how they think, make judgements, process, and perceive new information selectively (Easterby-Smith, 1980; Maitland & Sammartino, 2015; Naude, 2009). Mental models are cognitive structures that store information that supports the cogitation process by facilitating knowledge interpretation and understanding (Doyle & Ford, 1998), influencing decision-making and, therefore, individual behaviour (Denzau & North, 1992; Jones et al., 2011; Senge, 1994). Therefore, the way individuals in organisations perceive sustainability issues influences the type of response to new opportunities and challenges they will adopt (Aguinis & Glavas, 2012; Hahn & Aragón-Correa, 2015).

Mental models exist in the minds of individuals, and therefore, they are not available to be directly analysed or measured as such (Eden, Ackermann, & Cropper, 1992; Jones et al., 2011). Eliciting mental models allows to uncover implicit assumptions people make and understand how these assumptions influences their interpretation of a complex system (Jetter & Kok, 2014; Moon, Blackman, Adams, & Kool, 2017). To do so, cognitive mapping is used as an elicitation technique to collect and represent knowledge systematically (Gray & Zanre, 2013).

Cognitive maps used to visually represent an individual's mental model and are used to present how they structure their knowledge and beliefs (Axelrod, 1976; Eden et al., 1992). Cognitive maps have two main functions. The first, a descriptive function by which the visual representation of the mental model allows people to have a clear view of the issue at hand, communicate it and making it easier to solve it (Ferreira, Jalali, Ferreira, Stankevičienė, & Marques, 2016; Jetter & Kok, 2014). The second, a reflexive and learning function, in which the map can be used as an instrument to facilitate the development and discussion of new ideas and identify potential sources for miscommunication, agreement and disagreements between individuals (Ferreira et al., 2016; Senge, 1994; Simcic Brønn & Brønn, 2003). Both functions, in turn, are relevant for collaboration, coordination, encouraging negotiation and promoting consensus within the domain (Gray, Chan, Clark, & Jordan, 2012; Gurtner, Tschan, Semmer, & Nägele, 2007; Kontogianni, Papageorgiou, & Tourkolias, 2012; Özesmi & Özesmi, 2004). Therefore, it is highly relevant in the context of corporate sustainability, where cross-functionality in terms of coordination and collaboration is required for its implementation (Lozano, 2012).

Causal cognitive mapping is an elicitation approach useful for capturing causal relationships concerning a particular area of interest at a particular point in time (Langfield-smith & Wirth, 1992; Sucheta Nadkarni & Shenoy, 2004; Sloman, Barbey, & Hotaling, 2009). This type of elicitation technique is relevant to this research because it allows to capture the causal relationship between the drivers of corporate sustainability and how they may influence each other. This mapping approach allows participants to visually display their reasoning process by putting together information as a cause-effect series connected by arrows leading to certain outcomes (Sucheta Nadkarni & Shenoy, 2004).

Causal maps have three main components: (1) causal concepts, that are the concepts of a domain, which in this case are the drivers of CS, (2) causal connections, that are unidirectional arrows that represent an antecedent-consequence relationship between two concepts; and (3) causal values, that are the strength of the causal connection between two concepts (Sucheta Nadkarni & Shenoy, 2004). Conceptual mapping and repertory grids are alternative approaches less suitable for answering the research question as they do not identify causal relationships (Fassin et al., 2015; Pedersen, 2010). Even though fuzzy cognitive maps overcome this limitation, this research does not aim to explore dynamic behaviours of the system (Gray, Hilsberg, McFall, & Arlinghaus, 2015; Kosko, 1986; Özesmi & Özesmi, 2004; Xirogiannis & Glykas, 2004).

Functional Areas and Mental Models

Corporations are dynamic and complex systems with sets of interrelated functions engaging in collaborative decision making and problem solving to achieve goals (Rogers, 2003). The diverse functions within this complex system play a role in CS (Lozano, 2011). According

to Schaltegger et al. (2014) and Epstein et al. (2008), each functional area is a unit with its own objectives and responsibilities and is characterised by its own working culture and environment. It is possible to distinguish a functional area from another area in terms of motivations, information acquisition, decision-making, and actions (Epstein et al., 2008; Schaltegger et al., 2014)

Similarly, some authors state that functional units are like different worlds of thoughts, each one focusing on different aspects of a problem, understanding and interpreting information differently and making sense of the issues in different ways (Dougherty, 1992). According to Hodgkinson and Johnson (1994), experiences and operational tasks influence mental models as managers in each function face different contingencies which shape their specific beliefs and perceptions of the system. Thus, the following hypothesis has been developed.

H_1. Mental models within functional areas are more similar than across functional areas.

Mental Models Content and Communication

Functional areas are not isolated from each other, especially when it comes to collaboration and coordination for implementing CS initiatives that require the involvement of different functional areas. Functional areas are part of a larger system (Lozano, 2012) with communication networks across functions (Pegels, 1991). Research has found that the similarity in mental models impacts a team's performance as it facilitates different dynamics such as coordination and cooperation (Mathieu et al., 2005). Therefore, it is crucial to understand the role of communication across functional teams and its impact on their mental models of the drivers of corporate sustainability as they play a role in guiding their aligned actions within the company.

According to Denzau and North (1992), communication between people results in the convergence of an individual's mental models as individuals can express their motivations, ideas, beliefs, learning and experiences. These similarities in mental models provide those individuals with a shared language and concepts that make communication easier as they can encode and decode their ideas and conceptualisations (Mohammed & Dumville, 2001). This convergence is expressed as cognitive consensus regarding key issues. As people continue learning and experiencing their surrounding environment, better communication links would converge their mental models rather than diverge them (Denzau & North, 1992). The representation of these cognitive convergence helps to analyse the reasoning behind the decision making of teams with similar mental models.

Communication is how people can process information, reduce misunderstandings and ambiguity and coordinate tasks (Dawes & Massey, 2005). Aligned mental models, because of communication, are associated with improved performance as it enables better coordination when undergoing tasks (Klimoski & Mohammed, 1994; Mathieu et al., 2000; Waller et al., 2004). Research in this field has found that frequency of communication facilitates mental model alignment (Waller et al., 2004) and that the impact of mental model convergence on a teams' performance is mediated by communication (Mathieu et al., 2000; Waller et al., 2004). According to Mathieu et al. (2000), this convergence in mental models suggests adaptable teams who can understand and predict how team members interact.

Existing research has mainly focused on the context of command-and-control crews (Waller et al., 2004) and military teams (Mathieu et al., 2000). In these reached contexts, tasks are highly structured, and roles and tasks are clearly defined within a group with clear objectives.

Therefore, it becomes relevant to understand how these communication dynamics work across functions and how they can influence their perceptions of what drives corporate sustainability. In this context, it is important to understand that sustainability issues are complex and multi-dimensional and, as such, require subjective evaluation judgement (Islam et al., 2019).

The reviewed literature on mental models and communication indicates a lack of empirical research on issues that require more subjective evaluation judgements, such as corporate sustainability. It is highly relevant to understand the communication dynamics within corporations aiming to integrate CS in their operations as cross-functionality is considered essential for its implementation.

Cross-Functional Communication

Cross-functional communication is defined as the ongoing process in which different functions have a reciprocal flow of information to support decision making process (Pellathy et al., 2019). Research on cross-functional communication has found that communication between functions is associated with positive outcomes such as teamwork and knowledge management (Hoegl & Gemuenden, 2001) and increase understanding and harmony between functions (Souder, 1981) and increase team performance (Hauptman & Hirji, 1996). Yet, despite the insightful findings, no research has revealed the mental models of the teams involved in cross-functional challenges.

Existing research has mainly focused on cross-functional communication to create new products and services and involve one or two functional areas in their studies (Dawes & Massey, 2005; Fisher et al., 1997; Hoegl & Gemuenden, 2001; Souder, 1981). Additionally, no focus has been placed on the concept of sustainability within cross-functional projects. Therefore, it is

highly relevant to have insights into sustainability across functions in a company aiming to integrate sustainability in its operations. Mainly because the implementation of corporate sustainability is a process that requires all functions to be involved (Baumgartner & Ebner, 2010; Epstein et al., 2008; Hoffman, 2001; Lozano, 2013; Shrivastava & Hart, 1995). An important limitation regarding research on cross-functional communication is the reliance on frequency as the only measure for communication (Hauptman & Hirji, 1996; Hutt, 1995). Frequency is about to the number of times information is exchanged between functional areas over during a timeframe (Fisher et al., 1997). Focusing solely on this measurement does not provide a complete picture of the communication flows between functional areas. According to various authors, communication frequency is necessary for cross-functional projects, but not enough, as it also requires communication to be bidirectional (Dawes & Massey, 2005; Fisher et al., 1997; Hauptman & Hirji, 1996; Mohr, Fisher, & Nevin, 1996). Bidirectionality refers to the two-way communication between functional areas (Fisher et al., 1997). Hauptman and Hirji's (1996) research involving 50 cross-functional project teams found that the frequency of bidirectional communication within teams influences positively performance. As such, it is engaging in dialogue, receiving feedback, and having a communication channel to explain and clarify is important for positive cross-functional outcomes (Fisher et al., 1997)

Bringing to together the theory from mental models and communication which states that communication between people fosters similarities in their mental models as they can express their motivations, ideas, believes, learning an experience and the theory from cross-functional regarding the positive outcomes of the frequency of bidirectional communication on team's performance, the following hypothesis was developed.

H_2. The frequency of cross-functional communication between functional areas is negatively correlated with similarities in mental models of the drivers of corporate sustainability.

Mental Model Structural Complexities and Communication

To have nuances on the relationship between cross-functional communication and mental models of the drivers of corporate sustainability, this research also aims to look into the structural properties of the mental models. Besides analysing the content similarities, structural properties provide insights into how individuals perceive the system in terms of how the concepts in the system interconnect with each other (Özesmi & Özesmi, 2004; Uitdewilligen, Waller, Roe, & Bollen, 2021)

Mental model density has been used as a structural parameter of complexity within the mental model research field (Gray et al., 2015; Hodgkinson & Johnson, 1994; Klein & Cooper, 1982; Özesmi & Özesmi, 2004). Mental model complexity has been found to be crucial for teams to outperform and succeed in complex environments (Uitdewilligen et al., 2021). The density parameter provides a measure of connectivity which is based on the number of causal connections an individual perceives between the concepts within a mental map. Studying the density of mental models is highly relevant in corporate sustainability because of its dynamic environment and implications regarding performance, decision-making, problem-solving and strategy (Özesmi & Özesmi, 2004; Yang, Narayanan, Baburaj, & Swaminathan, 2016). It has been suggested that the denser a mental map is, the more options the individual has to influence the system based on their strategic flexibility in their approach to decision making and actions (Özesmi & Özesmi, 2004).

The research focused on the density of mental models of experts compared to novices in the context of resource management (Hmelo-Silver & Pfeffer, 2004; Özesmi & Özesmi, 2004), organisational knowledge (Bradley, Paul, & Seeman, 2006), and psychology (Chi & Koeske, 1983). Studies on expert-novice mental model comparison regarding complex systems found that novices tend to identify simple casualties compared to the multiple casualties identified by experts (Bradley et al., 2006; Chi & Koeske, 1983; Hmelo-Silver & Pfeffer, 2004; Perkins & Grotzer, 2000). Chi and Koeske (1983) found that people with more developed knowledge levels identify more elements and interrelations between them within a system.

Even though research tends to find experts' mental models denser than novices, the opposite has also been found (Hmelo-Silver, Marathe, & Liu, 2007). According to Hmelo-Silver et al. (2007), there is minimal difference in recognising the concepts within a system. Therefore, what distinguishes an expert from a novice is identifying the underlying causal relationship regarding abstract mechanisms in the system. Valuable insights regarding mental model density are provided from research that compares mental model densities of experts and novices. However, the role of communication on the density parameter has not yet been studied. Even though this research does not focus on expert-novice perceptions comparison, the insights provided will shine a light on this comparison in the context of CS.

According to Tjosvold (2008), engaging in discussion with people with diverse mental models is a fundamental social process that facilitates the development of a complete picture, awareness and understanding of the complexity of a situation. In turn, this allows one to include and integrate diverse ideas into one's perception of the problem at hand (Tjosvold, 2008). Incorporating new information into mental models has been positively related to improved

performance as it fosters adaptation and learning when dealing with complex and dynamic issues (Uitdewilligen et al., 2021). Therefore, understanding the complexity of mental models provides insights into how capable individuals are to process and integrate novel information (Uitdewilligen et al., 2021). This is highly relevant as the implications of complex mental models suggest that these mental models are attractive in the highly dynamic and complex context of corporate sustainability.

Additionally, according to Driver & Streufert (1969), the extent to which individuals seek sources of knowledge and integrate the various and possibly conflicting information is being driven by the complexity of mental models and the need to adapt to a dynamic changing environment. Similarly, it has been found that for effective operations in a complex and dynamic environment, groups need to search for external information that might be useful for performing their tasks (Cummings, 2004)—additionally, influencing the structure of their mental models with the new information acquired (Tjosvold, 2008). Therefore, suggesting that there is a positive relationship between sources of information and mental model complexity. Based on previous literature, the following hypothesis was developed to understand the effect of cross-functional communication on mental model density,

H_3. The number of functional areas an individual communicates with is positively correlated with the density of mental models of the drivers of corporate sustainability.

Methodology

This research uses an exploratory single case-study methodology to uncover the mental models of the drivers of CS and empirically test the effect of communication on manager's similarity in mental models of what drives CS across different functional areas. A standardized

Mental Model Mapping Tool (M-Tool) and a survey regarding cross-functional communication were used. This section will elaborate on the selected case study, sampling and participants, materials, measurements, and data analysis.

Case Study

The case study was selected based on three criteria: (1) being a large corporation with multiple functional areas, (2) having CS formally integrated into the business mission statement, where CS efforts are reported frequently; and (3) being recognised for its CS performance to expect experience with the context and concept.

Following such criteria and based on accessibility to a company and the employees, the selected case was a large multinational corporation in the food and beverage sector engaged in integrating sustainability into their operations and has formally integrated sustainability into their business mission. Furthermore, it has been included in the Dow Jones Sustainability Index, recognising its economic, environmental, and social performance. As a large company, functional areas are the basis of their organisational structure and pay special attention to the coordination between them. It is important to highlight the high relevance of investigating a consumer goods company as they have received increased attention and pressure to become more sustainable (Bashir et al., 2020).

Sampling

According to Aminpour et al. (2020), a minimum sample of 10 individuals is required to provide an accurate mental model when mental model aggregation is carried out. The aggregation procedure will be further discussed in the measures section. Following this approach, 10 individual mental models per functional area were necessary to develop the teams'

mental models. Senior, middle and junior managers were approached to reach this target number of participants per functional area.

Participants per functional area were selected using snowball sampling, which is a chain-referral sampling method. This non-probabilistic sampling method was chosen to ensure communication and coordination between the members of the same functional area. Additionally, also allowing to reach a population that is difficult to sample due to these requirements. Even though it has been suggested that this type of sampling generates biased samples as respondents often suggest others with whom they share similar characteristics (Erickson, 1979), the probability of biased samples was reduced by asking each participant to provide 2 or 3 contacts within their functional area. Therefore, avoiding that a single person would provide all the contacts for a given functional area. To initiate the snowball sampling process, a manager from each functional area was identified by convenience based on their participation in cross-functional projects regarding corporate sustainability. These were managers with whom the researcher had contact before initiating the research and therefore was easier to reach.

Participants

Participants *(N=50)* taking part in the investigation were current employees from 5 different functional areas. Five different functional areas were selected for this study to ensure comparability between the areas. The selection of functional areas was based on their participation in diverse projects such as new product development, value engineering, supplier changes, promotions, redesigns, new markets, and recipe changes. The relevance behind having a wide range of projects is that corporate sustainability is expected to be integrated into every

aspect of business operation. The involvement of the areas in these projects implies that they are all working within the same boundaries of the company's operations. Based on this approach, the functional areas selected were Marketing, Marketing Operations, Regulatory, Procurement, and Research & Development (R&D).

Managers from these functional areas were the participants for this research. Managers play an important role in CS decision-making, and these decisions stem from their mental models (Basu & Palazzo, 2008; Stubbart, 1989). The complexity of their cognitions has been identified as a significant, influential factor for decision-making, strategic choices and performance (Stubbart, 1989).

The data collection tool was sent out to 64 participants reached out through the snowball sampling technique who agreed to participate in the research. Participants were informed that their responses would remain anonymous and confidential. The data collection process lasted three weeks. Email reminders were sent out at the end of every week to ensure participants completed the survey before the due date. The completion rate of the survey was 78,13%.

A total of 50 responses were collected (*N = 50*), all of which were used for the analysis. The participants were from 5 different functional areas: marketing *(N = 11)*, Marketing Operations (N = 10), Regulatory *(N = 9)*, Procurement *(N = 10)*, and R&D *(N = 10).* The demographics of the survey respondents are listed below in **Table 2**.

Table 2

Survey Respondent Demographics, Listed by Functional Area

Functional area	*N*	Gender		Management level			Age ($\bar{x}$)	Nationalities
		Female	Male	Junior	Middle	Senior		
Marketing (MKT)	11	8	3	4	5	2	31	10
Marketing Operations (MKT ops)	10	8	3	6	3	1	31	8
Regulatory (Reg.)	9	9	1	3	6	0	34	7
Procurement (Proc.)	10	4	6	6	4	0	32	8
R&D	10	4	6	5	4	1	34	5
Total	50	36	14	24	22	4	32	
Total (%)	100	72	28	48	44	8		

The gender distribution of the respondents was 72% female and 28%, male. The average ages per functional area ranged between 31 and 34, with a total average of 32 years. Participants were from three different managerial levels, 48% junior managers, 44% middle managers and 8% senior managers. Individuals from 25 different nationalities participated in the research. Therefore, not having a dominant nationality within the sample.

Materials

To provide an overview of the mental models of the drivers of corporate sustainability and to test the developed hypotheses, two sets of materials were developed for collecting the data regarding each variable. For the mental model variables, the Mental Model elicitation tool (M-tool) was built, and for the cross-functional communication variable, a survey was developed. Both materials were later combined into a single survey to proceed with the data collection step.

Following, a detailed description of the reasoning behind the selected tools and the procedures for their elaboration.

Mental Model Elicitation Tool (M-Tool)

There are diverse cognitive mapping approaches for the elicitation of mental models. For this research, causal cognitive maps have been selected because they are used to capture causal relationships regarding a particular topic of interest at a specific point in time (Langfield-smith & Wirth, 1992; Sucheta Nadkarni & Shenoy, 2004; Sloman et al., 2009). Other cognitive mapping elicitation approaches such as conceptual maps and repertory grid did not fit this research as they do not identify the perceived influence of a concept on others (Kearney, Bradley, Kaplan, & Kaplan, 1999; Pedersen, 2010). Therefore, limiting the possibility of understanding decision-making processes. Even though fuzzy cognitive mapping allows to overcome this limitation, this approach was not considered for this research as it does not aim to explore the system's dynamic behaviours.

Direct causal cognitive mapping was selected for this research as it allows participants to make diagrammatic representations of their mental models with the use of drawings, words, cards and symbols (Jones et al., 2011). Indirect elicitation method, which consists of eliciting mental models by extracting the information from semi-structured interviews (Hockerts, 2015; Kontogianni et al., 2012; Otto-Banaszak, Matczak, Wesseler, & Wechsung, 2011; Shokouhyar, Pahlevani, & Mir Mohammad Sadeghi, 2019; Vihervaara & Kamppinen, 2009) surveys (Naude, 2009; Pedersen, 2010) text and document (Hielscher & Will, 2014) was no considered as the results mental models may include the researcher's bias interpretation or their interviewing and data analysis skills (Jones et al., 2011).

Even though it is possible to reflect causal connections with a direct elicitation approach (Özesmi & Özesmi, 2004), unstandardised concepts can limit the comparability between mental models (Gray et al., 2015). According to van den Broek (2020), when unstandardised methods are used, aggregation may result in mental maps that have duplicate concepts and that are too large and complex to support decision-making. To overcome the limitation, Gray et al. (2015) direct elicitation methodology provides participants with predetermined concept cards and a set of arrows with positive or negative signs with different weights for them to represent their perceived dynamic of the system. Standardised concepts imply providing participants with predefined concepts to construct their cognitive maps (Gray & Zanre, 2013). This approach was selected for this research because standardised concepts facilitate aggregation (van den Broek, 2020), increase the comparability between cognitive maps (Gray et al., 2015) and improve the reliability of the results as it provides the possibility of reproducing them under similar conditions. Additionally, this approach does not require coding procedures to identify whether two similar freely developed concepts belong to the same overarching category. These coding procedures can be tedious and time-consuming (Hodgkinson & Johnson, 1994) and require a more subjective researcher's subjective involvement in the coding process (Gray & Zanre, 2013).

Even though Gray et al. (2015) manage to overcome the main limitations regarding unstandardised concepts, it is important to highlight the researcher's presence in the elicitation scene as this may influence the elicitation process. To keep distance from the participants, computerised mental model assessments were selected as the best alternative.

The M-Tool software was selected as the most suitable tool for this research compared to other tools such as MentalModeler. Even though they both allow participants to draw their mental model through a web-based application, the M-Tool was selected for the following reasons. First, it will enable participants to use a finite and unified list of concepts to build their mental models. Unlike the M-tool, MentalModeler requires participants to enter the system concepts themselves. Second, it allows direct mental model elicitation of participants through a standardised, intuitive, and easy to operate procedure (van den Broek, 2020). In this way, it is ensured that all participants receive the same instructions. Therefore, reducing the need of relying heavily on a facilitator, which can also influence the elicitation process.

Following, a detailed description of the procedures to set up the M-Tool to meet the purpose of this research. The setup of the M-Tool consisted of a set of steps which will be described and explained below.

Researcher-Generated Standardised Concepts. A literature review was done to identify the drivers of corporate sustainability. The driver was then selected as a concept for the research if three or more authors mentioned them as drivers of corporate sustainability. This was done to avoid such a long list which may overwhelm the participants (Gray & Zanre, 2013). **Table 1** presents the list of drivers identified in the literature, their definitions, and references.

To identify any other concepts that participants may find relevant to include, a pilot was carried out. Even though the validity was improved with a pilot survey to identify any missing concepts, such a pilot test was completed by a reduced number of participants. A short survey was developed to present the list of drivers identified in the literature with their definitions and ask participants if any other drivers should be considered part of the presented list of drivers (see

Annex 1). If so, they had to write down the additional driver/s and describe them at the end of the survey. The definitions were added next to the drivers to make sure they all understood and interpreted the concepts similarly (Markóczy & Goldberg, 1995). Definitions were provided with a very simple and common language to make sure participants would understand them. To ensure this, the survey was shared beforehand with friends and family to check if the definitions provided were clear to understand.

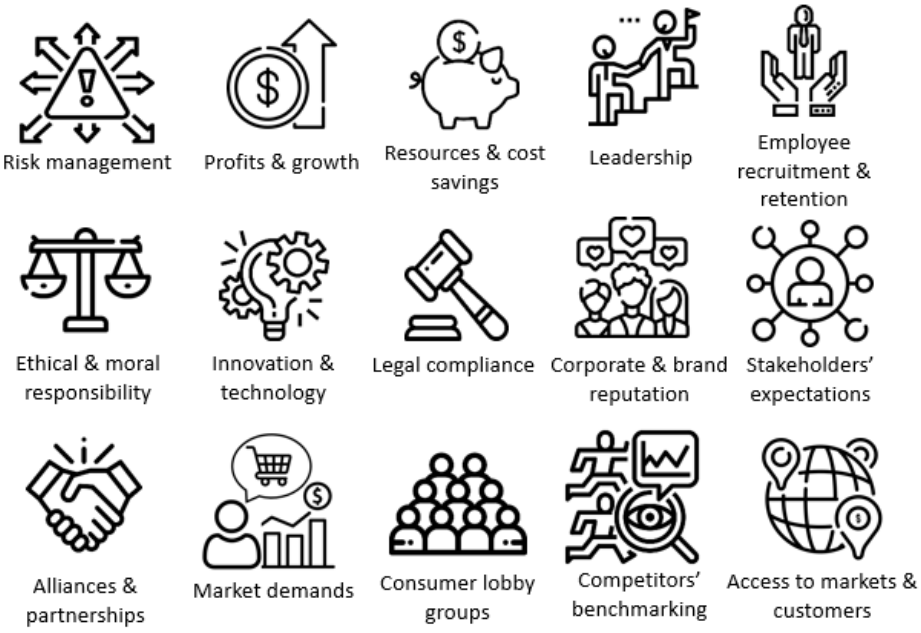
All extra drivers mentioned in this survey were to be included in the final concept list, which would then be the standardised concepts for this research. The results of this pilot survey to finalise the concept list yielded the identification of one additional driver mentioned by one of the participants. The driver included in the concept list was 'consumer lobby groups', defined as the civil society targeting corporations to drive their agenda of change.

M-Tool Set Up for Current Research Purposes. Once the list of standardised concepts was finalized, it was possible to set up the M-Tool using the web-based version. The following steps were followed based on the M-Tool Manual web-based version (van den Broek, 2021).

First, the concepts were turned into images extracted from freelance graphic designer platforms (e.g., Flaticons). To select the images for each driver, the full term or key term of the concept was searched in the platform search engine, and the most representative image was chosen (see **Figure *1*)**. The same style of graphic design was desired for all the images selected; therefore, it was also part of the criteria for selection. Once the images were selected for each driver and the driver's name was placed underneath the image to facilitate recognition.

Figure 1

Drivers of CS (concepts) as Images



The definition of each image/concept was recorded, and some audio explaining the upcoming tasks so participants could have an overview of what they expected to complete. A video was recorded to explain mental modelling tasks and introduce each concept with its image and definition. This video was an essential part of the tool as it introduced the drivers to the participants and allowed participants to associate the image/concept with the definition. All these media inputs were uploaded into the M-Tool and used to populate the tool.

With all these media inputs developed, the "study creation" section of the M-Tool could be completed (see **Annex 2**). "Corporate Sustainability" was selected as the target/fixed variable and placed at the right of the screen. This display facilitates participants' understanding of the task in terms of explaining what drivers precede the implementation of "corporate sustainability". Therefore, reducing respondents' cognitive effort to understand the task and map

the drivers of "Corporate Sustainability". Furthermore, to avoid overwhelming and confusing the participants with positive and negative relations, "neutral" arrows were selected as they only represent cause-effect connections between concepts.

Additionally, the cross-functional communication survey link was added to the M-Tool so that participants could complete the survey at the end of the elicitation task. The details of this survey will be further described in the below section.

The finalised tool presented the purpose of the study and an overview of the upcoming tasks. First, participants had to complete an example task to get to understand how the tool works. Then, their elicitation task regarding the drivers of CS was explained in terms of selecting and connecting the drivers they found relevant to include in their mental models. Each driver's definition was presented next to its corresponding image. An audio of the definition accompanied the presentation of each driver. Presenting the definition of each driver before the elicitation task is highly important to ensure the participants understand and interpret the concepts in a similar way (Markóczy & Goldberg, 1995).

Once the participants got to the main mapping screen, they were instructed to select the drivers they found relevant to map their perception of what drives corporate sustainability (see **Annex 3**). Then, they were also asked to identify the influence relationships between these drivers and the strength of such relationships. The causal connection arrows had different thicknesses representing small, medium, and large influences. In turn, each arrow thickness has a corresponding value.

Cross-Functional Communication Survey

Cross-functional communication is the ongoing process in which different functions maintain a reciprocal flow of information to support decision making processes (Pellathy et al., 2019). Both frequency and bidirectionally are important to understand cross-functional communication behaviour better (Dawes & Massey, 2005; Fisher et al., 1997; Hutt, 1995; Mohr et al., 1996). A survey to measure the frequency of cross-functional communication with the different functional areas was developed. Additionally, this survey also served to determine the variable regarding the number of areas an individual communicates with (see **Annex 4**).

As participants belong to 5 different functional areas, 5 single-item constructs referring to communication with each area were developed. The corresponding questions to each item asked about the frequency of reciprocal communication about CS-related topics in the past month with a functional area. This question was asked for each functional area in the scope of this research. A time reference of 'past months' was used to increase the precision of their responses. Reflecting on the latest month would allow participants to provide a more accurate approximation to the real frequency of their cross-functional communication. The communication channels chosen were video calls and/or calls, as these channels ensure a reciprocal mode of communication. Furthermore, participants were also provided with the definition of corporate sustainability and context related information regarding the efforts and initiatives made by the company under three broad CS pillars. To ensure the understandability of the questions, simple and common language was used (Rowley, 2014). The focus was set on making the survey user-friendly to ensure that completion was achieved easily (Rowley, 2014).

The survey was designed using five Likert scale frequency questions derived from the developed items. This type of scale only permits a limited possibility of response categories, therefore impeding the possibility of outliers in the data (Treiblmaier & Filzmoser, 2011). An extra Non/Applicable option was added to the scale so the people belonging to the functional area communication which was being asked for had to mark this option. This was done because the snowball sampling technique per functional area implied that the people within a functional area communicate with each other as this was a condition for referrals. Additionally, the aim of the survey is to measure communication frequency with other functional areas and not within.

Single-item constructs have been catalogued as more vulnerable to measurement errors because their internal consistency reliability cannot be computed statistically or because they are vulnerable to unknown biases regarding meaning and interpretations (Hoeppner, Kelly, Urbanoski, & Slaymaker, 2011). However, Fuchs and Diamantopoulos (2009) demonstrate that single-item measures can also be an attractive alternative for development construct measures.

Based on Fuchs and Diamantopoulos's (2009) guidelines to assess the potential use of single-item measures to operationalise constructs, the following reasons back up this research's decision. First, and mainly, the constructs measured have concrete meanings that are perceived similarly by all participants (Fuchs & Diamantopoulos, 2009). The constructs were made clear by providing a thorough explanation of cross-functional communication and corporate sustainability before the questions. According to Bergkvist and Rossiter (2009), based on empirical findings, single-item measures are, if carefully developed to make it highly concrete, valid as multi-item measures of that construct. Therefore, multi-times measures become unnecessary. Second, as this research works with a limited sample size, single-item constructs

become a programmatic solution to achieve high response rates (Fuchs & Diamantopoulos, 2009). Even though not all criteria proposed by the guidelines were fulfilled, the two mentioned above were considered highly relevant for this research. Especially considering that the cross-functional communication survey came after the mental modelling task, which is a highly demanding cognitive task.

Survey Pilot Test

Once the M-Tool with the survey were ready in the form of a web link, it could be shared for a pilot test. The pilot was done with M-Tool developer and expert in mental models, 10 friends/family and 5 knowledgeable people in CS. Revisions and improvements were made based on the feedback received, which included providing an overview of the upcoming tasks, giving more a clear explanation of the mapping task, and fixing audio issues,

Measures

Mental Models

The output of the individual elicited mental models were coded into adjacency matrices to be able to aggregate them and to calculate the distance ratio and density index. An adjacency matrix is a n x n matrix, where n is the number of concepts in the corresponding cognitive map (Axelrod, 1976). The number at the intersection of each row and column of the matrix indicate the existence of a relationship, direction of such relationship and the strength of the relationship two concepts (Langfield-smith & Wirth, 1992). The outcome of this procedure was 50 adjacency matrices corresponding to each of the participants' mental models of the drivers of corporate sustainability.

Following, the mental models of the members of the same functional area were aggregated into a functional area mental model. Aggregation was done by finding the mean strength that the individuals of the same functional area connected concepts in their models. When aggregating maps, the resulting map is considered a representation of the shared knowledge of the group; demonstrating the dominant relationships and influences as perceived by the group of individuals(Gray, Shwom, & Jordan, 2012; Gray & Zanre, 2013; Hockerts, 2015; Moon et al., 2019; Özesmi & Özesmi, 2004). This approach is beneficial for comparing mental models across groups (Gray & Zanre, 2013). It was assumed that all individual maps are equally valid, and therefore, they had the same weight assigned (Özesmi & Özesmi, 2004). The outcome of this operation was an aggregated matrix for each functional area.

Aggregation was chosen for this research as, according to Zenger & Lawrence (1989), it is expected that people within the same functional area develop a common language that represents how the members analyse, understand, and respond to information in similar ways. Additionally, function experience shared surrounding environments that enhance better communication links that converge their mental models (Denzau & North, 1992).

Functional Areas Mental Models. To answer the first research question regarding what do the mental models of drivers of corporate sustainability look like, parameters of their content were measured. These parameters were also calculated for the whole sample to have a complete overview. First, the frequency of the presence of each driver on the elicited mental models per functional area was calculated to identify the most frequently perceived drivers. Second, the frequency of the connections between drivers was also measured per functional area to determine the more frequently perceived connections. These content parameters allowed to identify the top

three drivers and connections that participants within each functional area consider most relevant in their perception of what drives corporate sustainability.

To provide further insights on the relevance of each driver in the aggregated functional area mental model, the centrality of each driver was calculated. The centrality is a structural parameter that indicates how connected the driver is to the other concepts by calculating the cumulative strength of these connections (Özesmi & Özesmi, 2004). According to Kosko (1986), the centrality indicates the conceptual importance of the variables, in this case, the drivers of corporate sustainability. The top three central drivers were reported for each of the functional areas.

Regarding the structure of the mental models per functional area, the mean number of drivers and connections was measured based on the participants' mental models within each functional area. These are common measures to provide an overview of the elicited mental (Klein & Cooper, 1982; Langfield-smith & Wirth, 1992; Özesmi & Özesmi, 2004).

Distance Ratio. The content comparison calculation followed the resulting aggregated functional area mental model to quantify the similarities or differences regarding causal concepts between multiple maps based on three differences (see **Table 3**) (Langfield-smith & Wirth, 1992). Content comparison index is called distance ratio and can be calculated when each map is expressed as an adjacency matrix (Langfield-smith & Wirth, 1992).

Table 3

The Basis of Content Analysis Difference (Distance Ratio)

Types of differences	Description
Content	Existence or non-existence of concepts. One model presents certain concepts within the area of interest as important, whereas the other does not.
Causal relationship belief	Existence or non-existence of causal relationship beliefs. One model presents a causal relationship belief that the other does not hold. This type of difference is dependent on the previous type as both individuals need to believe that both connected concepts are important.
Strength	Identical beliefs held with differing strengths. The compared models hold display the same causal relationship belief between the same concepts, but one presents a belief more strongly than the other.

The distance ratio allows to determine the most different and most similar pair of cognitive maps in terms of content, causal relationships, and strength. Distance ratio values can range between 0 and 1 (Langfield-smith & Wirth, 1992; Markíczy & Goldberg, 1995). If the distance ratio is 0, the mental models are identical. If it is 1, the distance between the mental models is at its maximum. Therefore, the shorter the distance between the two cognitive maps, the greater the similarities between them.

Further insights into the details and explanation of the formula to calculate the distance ratio used can be found in Markiczy & Goldberg (1995). In simple terms, the formula divides the similarities of the pair of mental models by the maximum number of possible similarities

between the two models. To do so, a series of parameters need to be determined (see **Table 4**) (Langfield-smith & Wirth, 1992; Markíczy & Goldberg, 1995)

Table 4

Distance Ratio Parameters

Sign	Parameter	Value
α	Self-influencing concepts	No = 1
β	Maximum strength of influence arrows	3
γ	Fulfilment of the assumption: if the concept is not in the map, then there is no belief of causal relationship AND if there is no influence arrow between two concepts, then there is no belief of causal relationship.	Yes = 1
δ	Constant strength difference	Yes = 0
ε	Relationships with a positive or negative value	No = 1

Distance ratios were measured to test the different hypotheses of this research. For the first hypothesis that states that mental models within functional areas are more similar than across functional areas, the distance ratio between the mental models of the members of the same functional area and their aggregated mental model was calculated. This was calculated for each of the 50 participants with regard to their own functional area aggregated mental model, therefore obtaining 50 distance ratio measures. Similarly, the distance ratio between the mental model of each participant and the aggregated mental models of the functional areas they do not belong to were calculated. In this case, this was calculated for each of the 50 participants with regard to the other four functional areas. Therefore obtaining 200 distance ratio measures. These measures were then used to identify a difference between the distance ratio within and across functions.

For testing the second hypothesis that states that cross-functional communication frequency between functional areas is negatively correlated with similarities in mental models of the drivers of corporate sustainability, previous distance ratio measures were used: the distance ratio between the mental model of each participant and the aggregated mental models of the functional areas they do not belong.

The minimum, maximum, mean and standard deviation values were calculated for each set of measures. Additionally, the outliers were also identified using boxplots with a step of 1.5x interquartile range. This method to identify outliers was used because quartile range statistics are less sensitive to outliers (Kwak & Kim, 2017).

Mental Model Density. Quantifying the density of a cognitive map is highly important when aiming to understand a complex concept such as corporate sustainability. Having more relationships between the concepts in a mental map will yield a higher density value. According to Özesmi & Özesmi (2004), more perceived relationships suggest more options to influence the system. This structural analysis is based on the number of connections compared to the maximum number of possible connections between the concepts (Özesmi & Özesmi, 2004).

As this research provides participants with a list of predetermined concepts, when it comes to the maximum number of possible connections between concepts, there are two ways in which this can be approached. The first is to only focus on the chosen concepts used to elicit the map (Klein & Cooper, 1982; Özesmi & Özesmi, 2004). The second is to focus on all the possible concepts available for incorporation in the map (Hodgkinson & Johnson, 1994). Both approaches have been used in previous research to analyse structural complexities of mental models (Hodgkinson & Johnson, 1994; Langfield-smith & Wirth, 1992; S. Nadkarni, 2003). For this

research, the term *density of selected driers* was used to refer to the measure obtained from focusing on the included concepts in their mental model. The term *density all possible drivers* was used to refer to the measure obtained from considering all the possible available concepts for incorporation in a map. The number of concepts that were available for incorporation in a map was the 15 drivers of corporate sustainability.

When all possible concepts available are taken into consideration, the density value also captures the number of concepts being included in the map (Hodgkinson & Johnson, 1994; Y. Yang et al., 2016). This approach to density represents the richness and comprehensiveness of the knowledge representation, which is highly relevant in complex environments where individuals need to makes sense of the situation at hand for decision-making (Özesmi & Özesmi, 2004; Uitdewilligen et al., 2021). However, when only the selected concepts on the map are taken into consideration, these are the core concepts that are considered to be of central importance to the system (Klein & Cooper, 1982). According to Klein and Cooper (1982), the more concepts a decision-maker employs, the less probably any of these concepts will directly influence any of the other concepts in the map as some may be peripheral concepts with limited influence.

Cross-Functional Communication

From the cross-functional communication survey, two measures were made. First, one to calculate the perceived communication frequency with other departments. For this measure, the perceived cross-functional communication frequency responses with each functional area were collected. Second, the number of functional areas an individual communicates with. For this measure, the number of areas an individual communicates with a perceived frequency of

"sometimes" or higher was counted. This was done to ensure that communication between departments was existent at regular basis. The range, mean and standard deviation was calculated for both measures.

Data Analysis

To test H_1 that states that mental models within functional areas are more similar than across functional areas an Independent Samples *t-Test* was performed. This parametric test was chosen as it is suitable for testing statistically significant differences between two independent sample means (Allen & Bennett, 2012). However, to proceed with such a test, four assumptions were required to be met: (1) scale of measurement, (2), interdependence, (3) normality and (4), homogeneity of variance. The first two assumptions are methodological assumptions, meaning they can be addressed before the data collection (Allen & Bennett, 2012). The first assumption regarding the nature of the scale of the measure was met as this hypothesis has distance ratio, which is scale data, as the dependant variable. The second assumption of interdependence was also met as two categorical groups represented the independent variable. The first group representing mental models within functional areas and the second group representing mental models across functional areas.

The third and the fourth assumptions were tested after data collection (see **Annex 5**). The third assumption states that data has to be approximately normally distributed. To test for normality, the skewness and kurtosis were computed to evaluate their proximity to zero and a Shapiro-Wilk test was calculated (Allen & Bennett, 2012).. Both skewness and kurtosis were reasonably close to zero, with none of the values going below or above -1 and 1. Values below or above -1 and 1 are considered non normally distributed (Hair, Hult, Ringle, & Sarstedt, 2016).

Based on the result of the Shapiro-Wilk test with the data belonging to the group representing mental models within functional areas, the normality assumption was not violated. The results of the Shapiro-Wilk test with the data representing mental models across functional areas violated the normal distribution assumption. However, the *t*-test is considered a highly robust test against small or moderate violations of the normality assumption and severe violations are only considered when the fourth assumption regarding the homogeneity of variance is not met (Allen & Bennett, 2012). The results of Levine's Test of Equality of Variance were not significant, meaning that the assumption of homogeneity was not violated.

A follow-up analysis to determine the population effect size was performed and interpreted based on Cohen's (1992) conventions. To do so, the calculated mean difference between the two independent groups was divided by pooled standard deviation. With the calculated size effect, an $\alpha = .05$ and the sample size, a power analysis was performed using G*Power software. The alpha value refers to the probability of incurring a type I error which implies rejecting the null hypothesis where in fact it is true. The power analysis allows determining the probability that a difference that is there will be detected. Based on Cohen's (1992) conventions, statistical tests need to reach a power of at least 0,80; otherwise, it is too risky to incur a type II error, which implies failing to reject a false null hypothesis. The probability of a type II error is expressed by β. Therefore, this research aims for a $\beta < 0.20$.

One of the aims of this research is to understand the relationship between cross-functional communication and mental models to explain mental models' similarities or their structure. A correlation test was chosen as the analytical method. This analytical method was used for testing both H_2 and H_3. H_2 states that the frequency of cross-functional communication

between functional areas is negatively correlated with similarities in mental models of the drivers of corporate sustainability. H_3 states that the number of functional areas an individual communicates with is positively correlated with the density of mental models of the drivers of corporate sustainability. Even though this analytical method does not allow to draw inferences about causal relationships between the studied variables, it does allow to make predictions of future events based on their relationship.

To select the appropriate correlation test to test the developed hypotheses in this research, it was first necessary to see whether the data met a set of assumptions. Pearson's correlation test was not an alternative as this test requires variables to be of scale nature (Allen & Bennett, 2012). Both mental model variables did comply with the assumption. However, the corresponding cross-functional communication variable was of ordinal nature. Therefore, applying a parametric test like Pearson's *r* for correlations was not an option. Spearman's rho, a non-parametric test, was applied to test for correlation as it appropriate when one of the variables is ordinal (Allen & Bennett, 2012). The two assumptions required for Spearman's rho were met. The first one regarding the scale of measurement where both variables must be at least ordinal, and the second regarding the independence where each participant should only participate once in the data collection process (Allen & Bennett, 2012). This was ensured with the formatting of the online survey, only requiring participants to fill in the survey once.

In the case of Spearman's rho, the effect size of the correlation is the actual value of r_s (Cohen, 1992; Maher, Markey, & Ebert-May, 2013). The same procedure for the power analysis was followed in order to calculate the power of the statistical test based on the sample size, size effect and an $\alpha = .05$.

Results

Mental Models of the Drivers of CS Across Functional Areas

To answer the first research question regarding how the mental models of the drivers of corporate sustainability areas look, the content and structural parameters of the mental models per functional area were calculated. These parameters were also calculated for the whole sample to have a complete overview (see **Table 5**). Based on all the participants, the mean number of connections was 10.8 (SD = 4.8), ranging from 9.6 to 12.0. Value ranged from 9.6 to 12.0, having marketing functional area (MKT.) in the lower bound and regulatory functional area (Reg.) in the upper bound. The mean number of connections was slightly higher than the mean number of drivers in each functional area. Every included driver in the map needs to be connected with at least one arrow to be included in the model. The greater difference between the number of drivers and the number of connections is from the procurement functional area (proc.) with a difference of 1.9. The smaller difference is from the marketing functional area (MKT.) with a difference of 0.7.

Table *5*

Based on all the maps from the sample *(N* = 50), the mean number of drivers mapped was 9.5 (*SD* = 3.8), ranging from 8.9 to 10.4. The maximum number of drivers available for mapping was 15. The marketing functional area (MKT.) was at the lower bound 9.4 while the regulatory functional area (Reg.) was at the upper bound of the range with 11.4. The functional areas of marketing operations (MKT Ops.), procurement (Proc.) and R&D presented the same mean number of drivers of 9.4.

Based on all the participants, the mean number of connections was 10.8 (*SD* = 4.8), ranging from 9.6 to 12.0. Value ranged from 9.6 to 12.0, having marketing functional area (MKT.) in the lower bound and regulatory functional area (Reg.) in the upper bound. The mean number of connections was slightly higher than the mean number of drivers in each functional area. Every included driver in the map needs to be connected with at least one arrow to be included in the model. The greater difference between the number of drivers and the number of connections is from the procurement functional area (proc.) with a difference of 1.9. The smaller difference is from the marketing functional area (MKT.) with a difference of 0.7.

Table 5

Content Overview of Mental Models, by Functional Area and Whole Sample

Indices	**MKT**	**MKT Ops**	**Reg.**	**Proc.**	**R&D**	**All**
No. of maps	11	10	10	10	9	50
No. of drivers (*M*)	8.9	9.4	10.4	9.4	9.4	*M* = 9.5 *SD*= 3.8
No. of connections (*M*)	9.6	10.8	12.0	11.3	10.5	*M* = 10.8 *SD* = 4.8
Top 3 drivers	Market demand, Leadership, Reputation	Profits, Innovation & Tech. Leadership,	Profits, Legal, Ethical	Leadership, Market demands, Benchmarking	Leadership, Innovation & Tech., Ethical.	Leadership, Innovation & Tech., Profits
Top 3 connections	Reputation-CS, Leadership -CS, Legal-CS	Profit-CS, Reputation-CS, Innovation-CS	Profits-CS, Legal-CS, Reputation-CS	Benchmarking -CS, Market demand-CS, Legal-CS	Ethical-CS, Leadership-CS, Reputation-CS	Reputation-CS, Profit-CS, Legal-CS
Top 3 central drivers	Leadership, Reputation, Market demand,	Innovation & Tech, Profits, Leadership	Legal, Profit, Ethical	Leadership, Market demand, Stakeholders' expectations	Leadership, Innovation & Tech., Ethical	Leadership, Innovation & Tech., Reputation

Note. The following abbreviations have been used in this table. MKT for Marketing, MKT Ops for marketing operations, Reg. for regulatory, Proc, for procurement, CS for Corporate sustainability, Reputation for Corporate brand and reputation, Legal for Legal compliance, Profit for Profit and growth, Innovation & Tech. for Innovation and technology, Benchmarking for Competitor's benchmarking, and Ethical for Ethical and moral responsibility.

The top three drivers and connections were also identified per functional area and from the whole sample (see **Table *5***). The most frequently used variable from the whole sample was *leadership*, followed *by innovation & technology* and then by *profits & growth*. Various functional areas share the variables within their top three most frequently used. The only driver which was not shared with other functional areas are *corporate & brand reputation* from marketing, *legal compliance* from regulatory, and *competitors' benchmark* from procurement.

Regarding the top connections, all the top connections were variables connecting to CS variable, meaning direct influences on CS. These variables connected to CS were in some cases also from the top three drivers per functional area. The most frequent connections from the whole sample were *corporate & brand reputation-CS*, followed by *profits & growth-CS* and then by *ethical & moral responsibility-CS.* The only connections which were not shared with other functional areas were *innovation-CS* from the top three of marketing operations, *competitors' benchmark* from the top three of procurement, and *ethical & moral responsibility* from R&D.

Market demand was perceived in the top 3 drivers and/or connections by Marketing and procurement. All functional areas perceived *leadership* except for Regulatory. In the case of *corporate brand and reputation*, this driver was perceived by all functions except for Procurement. Regarding *profits and growth* driver, this one was perceived by Marketing

operations and Regulatory. In contrast, innovation and technology was perceived by Marketing operations and R&D. In the case of *legal compliance*, Regulatory and Procurement perceived this driver. *Ethical and moral responsibility* was only perceived by R&D, whereas competitors benchmarking was only perceived by procurement.

The top three central drivers per functional were the same as the top three elicited drivers, and they were also a driver in the top three connections. This was true for all functions except for procurement which had the driver *Stakeholders' expectations* as a central driver; however, not in the top three elicited drivers or perceived connections.

Mental Models Within and Across Functional Areas

To answer the second research question regarding if mental models within a functional area are more similar than across functions, H_1 was developed based on the existing theory. H_1 states that mental models within functional areas are more similar than across functional areas. To test this hypothesis, an Independent Sample *t-Test* was performed. This test allowed to identify if there was a difference between the distance ratios of the people within a functional area with their aggregated mental model and the distance ratio between the mental model of each participant and the aggregated mental models of the functional areas they do not belong to. **Table 6** provides an overview of the distance ratio variables that were compared.

Table 6

Distance Ratio Variables Overview

	N	Min.	Max.	Mean	SD
Distance Ratio within a functional area	50	0.04	0.13	0.08	0.02
Distance Ratio across functional areas	200	0.04	0.14	0.08	0.02

Table 6 show some of the main characteristics of how the distance ratio variables are distributed for each group. Both groups presented a mean distance ratio of 0.08 (*SD* = 0.2). The *N* value varies between both groups. This is because the distance ratio within a functional area (*N* = 50) was calculated for each participant with the aggregated mental model of their own functional area. The distance ratio across the functional areas (*N* = 200) was calculated from the distance ratio of each of the 50 participants with aggregated mental models of the 4 functional areas they do not belong to.

The results of the Independent Sample *t-Test* showed that the distance ratios of the people within a functional area and their aggregated mental model was lower (*M* = 0.08, *SD* = 0.02) than the distance ratio between the mental model of each participant and the aggregated mental models of the functional areas they do not belong to (*M* = 0.08, *SD* = 0.02), *t*(248)= -3.00, *p*= .003. Even though the difference between the two means was similar at two decimal places, the actual difference between them was 0.009. The results obtained from the test suggest that mental models within a functional area are more similar than across functions.

Based on the follow-up analysis, Cohen's effect size value (*d* = .48) suggested a close to medium effect size. This was followed by a statistical power analysis based on the sample size of each group, the effect size and $\alpha = .05$. The power analysis result was 0.86, meaning that the sample size was adequate for testing this hypothesis and that the probability of a type II error is .14. This β value is even lower than the acceptable range in statistics (Cohen, 1992)

Overview of Cross-Functional Communication

The third and the fourth research questions of this research aim to understand how does cross-functional communication affect mental models of the drivers of corporate sustainability. The third research question focuses on the content similarities, while the fourth research question focuses on the structure of the mental models. Before going into the descriptive statistics of the investigated variables and the correlation test results, an overview of cross-functional communication is provided below.

Table 7 presents an overview of the frequency of cross-functional communication between paired functional areas. Based on the whole sample, the mean frequency in which participants communicate with other functional areas 2.7 (*SD* = 1.4). The mean frequency of cross-functional communication between functional areas ranges from 1.5 to 3.8. It is apparent from this table that very few functional areas perceive their communication frequency with other functional areas with a mean higher than 3, which corresponds to a frequency of 'sometimes' or more frequent communication. This shows that, in general, the means of communication across functions is relatively low. The lowest mean value corresponds to the communication between regulatory with procurement (*M* = 1.3, *SD* = 0.5), while the highest mean corresponds to the communication between procurement and R&D (*M* = 3.8, *SD* = 01.5).

Table 7

Cross-Functional Communication Overview

	MKT		**MKT ops**		**Reg.**		**Proc**		**R&D**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
MKT	-	-	2.3	1.3	2.4	1.7	2.3	1.6	3.0	1.8
MKT ops	3.7	1.2	-	-	3.4	1.3	2.3	1.4	3.3	1.4
Reg.	3.1	1.2	2.6	1.7	-	-	1.3	0.5	2.8	1.4
Proc.	2.9	1.4	2.2	1.0	2.1	1.3	-	-	3.8	1.5

R&D	3.4	1.2	2.2	1.2	2.6	1.3	2.5	1.1	-	-

Continuing with the results from **Table 7** it is interesting to know the mean frequency in which each functional area communicates with other functional areas to identify with which functional area they communicate with the higher frequency and which functional area they communicate with the lowest frequency. From marketing functional area perspective, they communicate with R&D with the highest frequency (*M* = 3.0, *SD* = 1.8) and with procurement (*M* = 2.3, *SD* = 1.6) and marketing operations (*M* = 2.3, *SD* = 1.3) at the lowest frequency. Marketing operation and regulatory functional areas share a similar perspective as they both communicate with marketing with the highest frequency (*M* = 3.7, *SD* = 1.2) and (*M* = 3.1, *SD* = 1.2) respectively, and with procurement with the lowest frequency (*M* = 2.3, *SD* = 1.4) and (*M* = 1.3, *SD* = 0.2) respectively. It is interesting that marketing, marketing operations and regulatory communicate with procurement with the lowest frequency. From procurement functional area perspective, they communicate with R&D with the highest frequency (*M* = 3.8, *SD* = 1.5) and with regulatory with the lowest frequency (*M* = 2.1, *SD* = 1.3). Finally, from an R&D perspective, they communicate with marketing with the highest frequency (*M* = 3.4, *SD* = 1.2) and with marketing operations with the lowest frequency (*M* = 2.2, *SD* = 1.12). Interestingly, marketing operations, regulatory and R&D communicate with marketing with the lowest frequency.

Descriptive Statistics: Mental model and Cross-Functional Communication Variables

This section of the results will present the descriptive statistics of the mental model variables, and cross-functional communication variables used to test the hypothesis H_2 and H_3 to answer questions three and four of this research respectively. H_2 states that the frequency of

cross-functional communication between functional areas is negatively correlated with similarities in mental models of the drivers of corporate sustainability. H_3 states that the number of functional areas an individual communicates with is positively correlated with the density of mental models of the drivers of corporate sustainability.

Mental Model Variables

Table 8 also presents the descriptive statistics of the density variables. Two approaches to this variable were calculated. The first was the *density of selected concepts* (*N* = 50) which refers to the measures of density obtained from focusing on the chosen concepts on the elicited map. The second was the *density of all possible concepts (N* = 50), which refer to the measure obtained from taking into consideration all the possible available concepts for incorporation in a map. The density for each approach was calculated for every participant's mental model. The mean *density of selected concepts* was 0.13 (*SD* = 0.06), with values ranging from 0.06 to 0.30. The mean density values for the *density of all possible concepts* were lower (*M* = 0.05, *SD* = 0.02), with values ranging from 0.01 to 0.09. with a mean value of 0,045. What is interesting about this data is that the values of the *density of selected drivers* were higher than the values of the *density of all possible drivers.*

Table *8* Table 8 provides an overview of the three different variables concerning mental models. The distance ratio variable (*N* = 200) represents the distance ratio of each participant's mental model with the aggregated mental model of the functional areas they do not belong to. The mean distance ratio was 0.08 (*SD* = 0.02), with values ranging from 0.04 to 0.14.

Table *8* also presents the descriptive statistics of the density variables. Two approaches to this variable were calculated. The first was the *density of selected concepts* (*N* = 50) which

refers to the measures of density obtained from focusing on the chosen concepts on the elicited map. The second was the *density of all possible concepts (N* = 50), which refer to the measure obtained from taking into consideration all the possible available concepts for incorporation in a map. The density for each approach was calculated for every participant's mental model. The mean *density of selected concepts* was 0.13 (*SD* = 0.06), with values ranging from 0.06 to 0.30. The mean density values for the *density of all possible concepts* were lower (*M* = 0.05, *SD* = 0.02), with values ranging from 0.01 to 0.09. with a mean value of 0,045. What is interesting about this data is that the values of the *density of selected drivers* were higher than the values of the *density of all possible drivers.*

Table 8

Descriptive Statistics of Mental Model Variables

	N	**Min.**	**Max.**	**Mean**	**SD**
Distance Ratio	200	0.04	0.14	0.08	0.02
Density of selected drivers	50	0.06	0.30	0.13	0.06
Density of all possible drivers	50	0.01	0.09	0.05	0.02

For the distance ratio variable, 7 outliers were identified outside the upper whiskers of the boxplot (see **Annex 6**). For the *density of selected concepts*, 4 outliers were identified outside the upper whiskers of the boxplot (see **Annex 6)**. There were no outliers identified for the density of all possible concepts. Outliers were kept as part of the data because they are a natural part of the studied population and are part of the variability of the data. Yet, there were identified to check whether there were very extreme values falling outside the possible ranges of the data possible cause by human mistakes during the systematization process.

Cross-Functional Communication Variables

Two cross-functional communication variables were measured for this research. The first one was the perceived frequency of cross-functional communication. The second one was the number of functional areas an individual communicates with a frequency of 'sometimes' or more. **Table 9** presents the descriptive statistics of the measured variables.

Table 9

Descriptive Statistics of Cross Functional Communication Variables

	N	Min.	Max.	Med.	Mode	Mean	SD
Communication frequency	200	1	5	3	1	2.7	1.4
Number of areas an individual communicates with	50	0	4	3	3	2.2	1.4

For the cross-functional communication frequency variable *(N* = 200*)* the data points correspond to the perceived frequency in which each participant communicates with the other functional areas. The mean communication frequency was 2.7 (*SD* = 1.4), with values ranging from 1 to 5. Interestingly, the figures of this variable are the modal value of 1; meaning that most people 'never' communicate with other departments regarding CS. The mean number of areas an individual communicates with was 2.2 (*SD* = 1.4), with values ranging from 1 to 4. For this variable, the mode is 3; meaning that most people communicate with three other departments at a frequency of 'sometimes' or more.

Correlation Results

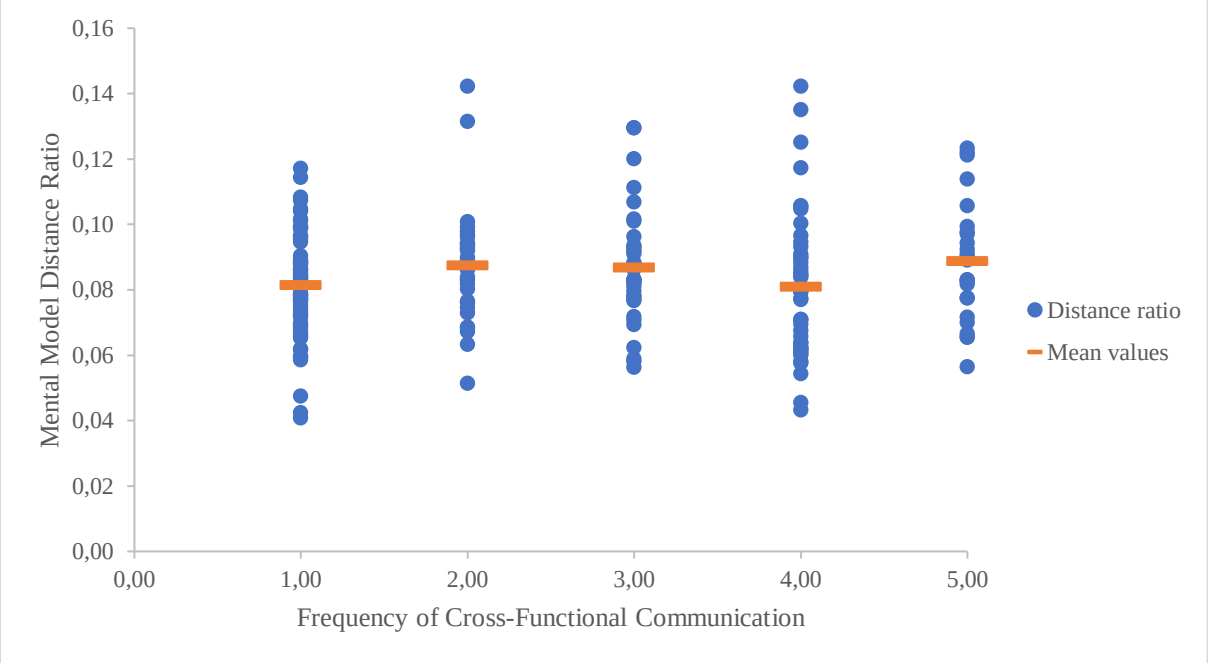
Correlation Between Mental Model Distance Ratio and Frequency of Cross-Functional Communication

To answer the third question of this research regarding how mental models' similarities be explained with the frequency of cross-functional communication, H_2 was developed. This hypothesis states that the frequency of cross-functional communication between functional areas is negatively correlated with similarities in mental models of the drivers of corporate sustainability. Spearman's rho was computed to test this hypothesis.

The results showed no significant correlation between the mental model distance ratio and the frequency of cross-functional communication $r_s(198) = 0.04$, $p = .619$. The lack of a linear relationship between the two variables can be seen in **Figure *2***. The distance ratios per cross-functional communication frequency is very dispersed from the means. Additionally, the means distance ratio for each cross-functional communication frequency is not far apart from each other.

Figure 2

Mental model Distance Ratio vs. Frequency of Cross-Functional Communication



An additionally complimentary analysis between the two variables was performed with a Mann-Witney *U* test. This test allowed us to see whether there was a difference between the distance ratio of the people who communicate with a frequency of 'sometimes' or more (*N* = 108) and the distance ratio of the people who communicate with a frequency of 'rarely' or less (*N* = 92). This test does not aim to identify a correlation between the variables but to compare two independent samples of ordinal data and see whether these two groups differ in their distance ratio values by comparing the mean ranks. The results show that there were no statistically significant differences between the distance ratio of the people who communicate with a frequency of 'sometimes' or more (*Mdn* = 0.08) and the distance ratio of the people who communicate with a frequency of 'rarely' or less (Mdn = 0.08), U = 4917, *p* = .901.

Correlation between Mental Model Density and Number of Functional Areas an Individual Communicates With

To answer the fourth question of this research regarding how cross-functional communication affect the structure of the mental model of the drivers of corporate sustainability, H_3 was developed. This second hypothesis states that the number of functional areas an individual communicates with is positively correlated with the density of mental models of the drivers of corporate sustainability.

The number of functional areas an individual communicates with (N = 50) was correlated to two different approaches of mental model density. The first was *density from selected concepts* (N = 50) which refers to the measures of density obtained from focusing on the actually chosen concepts on the elicited map. The second was *density from all possible concepts* (N = 50), which refer to the measure obtained from considering all the possible available concepts for incorporation in a map. Spearman's rho was computed for all the possible variables combinations. **Table 10** presents the results obtained from the test.

Table 10

Correlation Between Mental Model Density and Number of Areas an Individual Communicates With

Variable	N	M	SD	1
1. Number of areas an individual communicates with	50	2.2	1.4	-
2. Density from selected concepts	50	0.13	0.06	.048*
3. Density from all possible concepts	50	0.05	0.02	.076

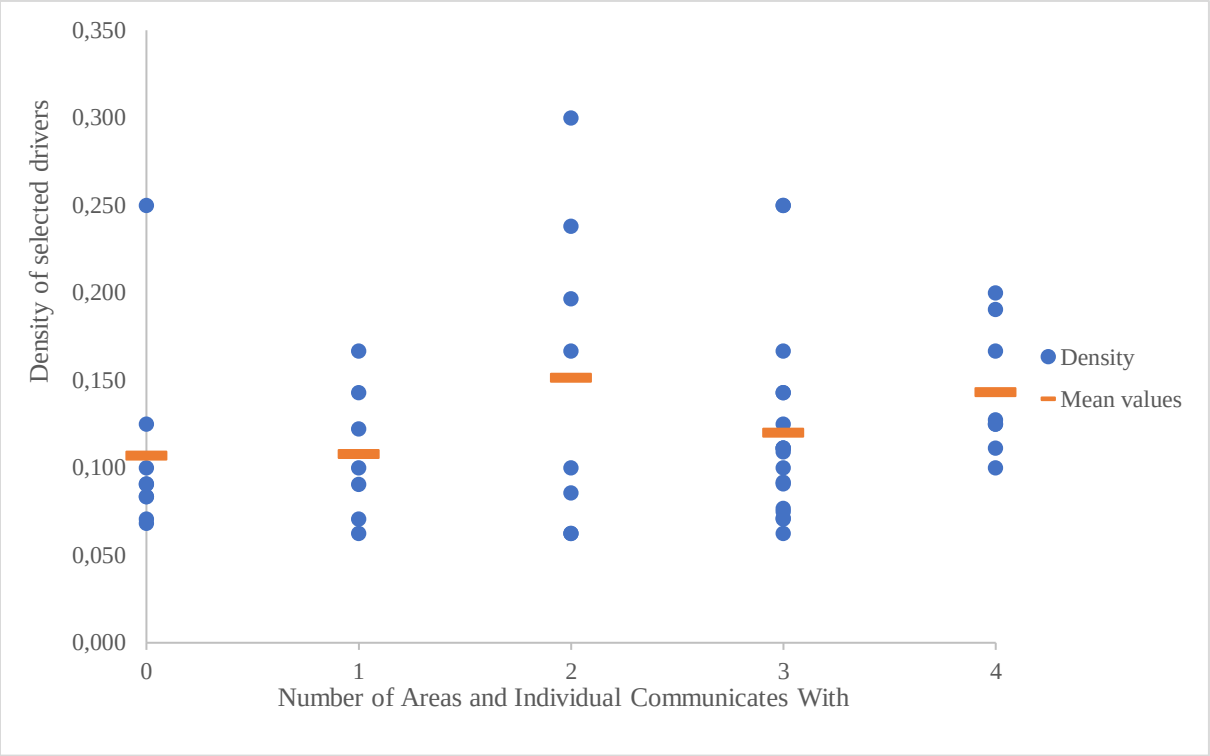
*p < .05

As shown in **Table 10**, the results indicate the presence of a weak positive correlation between ranked *density from selected concepts* and the number of functional areas an individual communicates, r_s (48) = 0.28, p = .048. This means that the participants who communicate with more functions have a denser mental model considering selected concepts in a map and their causal relationships. The effect size of this correlation was the actual value of r_s, which, based on Cohen's (1992) conventions, falls between a small to medium effect size. This was followed by a statistical power analysis based on the sample size of each group, the effect size and α = .05. The power analysis result was 0.53, meaning that the sample size was too small for testing this hypothesis and that there is a high probability of a type II error of β = .47. This β value not in the acceptable range in statistics to conclude from the results obtained (Cohen, 1992).

Figure 3 presents the scatter graph of the correlated data. It is important to point out that for the people that communicate with zero functional areas at a frequency of 'sometimes' or more, the mean of the category is highly influenced by an individual having a density highly above average. Therefore, raising the mean and influencing the correlation. Another interesting point is the highly dispersed density of the people who communicate with three functional areas, having the highest mean average across the different communication categories.

Figure 3

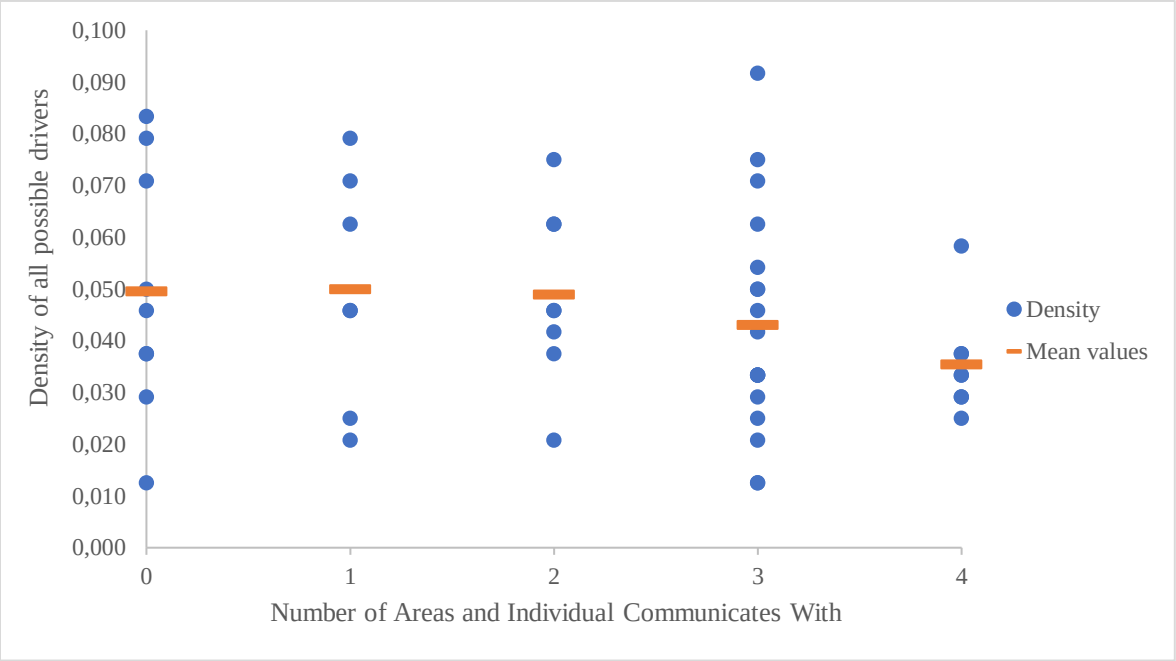
Density from Selected Concepts vs. Number of Areas an Individual Communicates With



The computed correlation between the number of areas an individual communicates with and the density from all possible concepts approaches shows that there is no significant correlation between the two variables, r_s (48) = -0.25, p = .076. **Figure 4** presents the scatter graph of the correlated data. The data points per number of areas an individual communicates are highly dispersed, making the mean average per category relatively similar.

Figure 4

Density from All Possible Concepts vs. Number of Areas an Individual Communicates With



Discussion

This research aimed to shine a light on the mental models of the drivers of corporate sustainability and the effect of cross-functional communication on these mental models. To do so, this research aimed to answer four research questions. The first one, regarding what mental models of drivers of corporate sustainability look like; the second one, to identify whether mental models within a functional area more similar than across functions; the third, to find whether mental models' similarities across functions can be explained with the frequency of cross-functional communication and, fourth, to understand how cross-functional communication affect the structure of the mental model of the drivers of corporate sustainability.

To answer the first research question, a detailed analysis of the content of the mental models of each functional area was performed. The results of the main drivers perceived by the

participants per functional area aligned with what the literature states regarding their tasks and responsibilities in the implementation of corporate sustainability. In the case of the marketing functional area, the main drivers and/or main drivers with direct connections with CS were market demands, corporate and brand reputation, and leadership. This matches with the literature that states that marketing responds to customer demands of more sustainable products and services and safeguarding and enhancing positive brand reputations (Baumgartner, 2014; Epstein & Roy, 1998; Maignan & Ferrell, 2004). In the case of marketing operations, the identification of innovation & technology and profits and growth as the main driver is also aligned with the literature that states that operations seek efficiencies through innovative processes (Baumgartner, 2014; Epstein & Roy, 1998). Additionally, marketing operations also had leadership and corporate brand reputation as main drivers and/or in main connections. The literature states that procurement answers to market and social demands and aim to reduce the use of harmful resources and buy from responsible suppliers (Epstein & Roy, 2001; Lozano, 2012; Schneider et al., 2014). Therefore, the findings were aligned in terms of answering stakeholders' expectations and benchmarking to enhance a more responsible supply chain. Yet, legal compliance was also identified as the main driver and/or connections. R&D identified innovation and technology, reputation, ethical and moral responsibility, and leadership as the main drivers and/or connections. The innovation & technology identification is in line with existing literature that states that R&D integrates sustainability expectations into the products and services through innovation (Epstein & Roy, 1998; McWilliams & Siegel, 2001). The regulatory department identified brand reputation, legal and profits. Based on their knowledge of regulations required to comply with the legal requirements, it is not surprising that they include the legal compliance driver. Failing to comply with regulations can damage the corporate and brand reputation.

Additionally, it is important to discuss that leadership was identified by all functional areas except for legal. According to Lozano (2015) leadership, followed by the profitability of CS, are the main internal driver identified by top managers. The profits and growth drivers were identified by marketing operations and legal. Regarding the external drivers, corporate brand reputation was identified by all functions except for procurement. According to Lozano (2015) reputation was identified as the main external driver by top managers. Other external drivers also identified in Lozano's research were identified; market demands were identified by marketing and legal compliance by procurement and regulatory.

To answer the second research question, H_1 was developed. This hypothesis stated that mental models within functional areas are more similar than across functional areas. The results of the test that compared the similarities of the mental models within the same functional area with the similarities of mental models across functional areas showed a significant difference between them. This means that the mental models from the individuals within the same functional area are more similar between them than to those of other functional areas. Therefore, supporting the developed hypothesis.

The above findings align with the existing literature that states that it is possible to distinguish a functional area from another area in terms of motivations, information acquisition, decision-making, and actions (Epstein et al., 2008; Schaltegger et al., 2014). Additionally, it has been claimed that each function is like different worlds of thoughts, each one focusing on different aspects of a problem, understanding and interpreting information differently and making sense of the issues in different ways (Dougherty, 1992; Zenger & Lawrence, 1989).

Furthermore, functions experiencing shared surrounding environments enhance better communication links that converge their mental models (Denzau & North, 1992)

Although the identified difference between the level of similarities of the mental models within the same functional area and the level of similarities of mental models across functional, the aggregated mental models per functional areas share in various cases the same most frequently perceived drivers and connections. This is further evidenced by the relatively low distance ratio values across the whole sample, which mean more similarities between mental models. This suggests that the mental models of the individuals are relatively similar to the aggregated mental models of other functional areas. Yet, there is still a difference between the similarities within functional areas and across them. However, this interesting finding suggests that, in general, the participants perceive the drivers of CS in a similar way.

To answer the third research question regarding whether mental models' similarities can be explained with the frequency of cross-functional communication. H_2 was tested with a correlation. The lack of significance in the results means the hypothesis was not supported. This result suggests that there must be other factors influencing the mental model's similarities across functional areas. Similarly, when comparing the difference between the similarities in mental models of people who communicate with a frequency of 'sometimes' or more and the similarities of the people who communicate with a frequency of 'rarely' or less. The results show that there were no statistically significant differences between the two groups, meaning that the frequency of cross-functional communication does not create a difference between how similar mental models are.

The above findings contrast with the existing literature regarding communication and mental models that found that communication influences mental model convergence (Mathieu et al., 2000) and that the frequency of communication facilitates mental model alignment (Waller et al., 2004). The effects identified by Mathieu et al. (2000) and Waller et al. (2004) are based on empirical research in highly controlled and technical environments which require expert knowledge to achieve objective and precise outcomes. These contexts are different from the current research that focused on CS drivers rather than the outcome. Drivers are the reasons and motivations behind CS implementation and are considered to act as change leverage towards CS (Lozano, 2015; Sroufe, 2017). The complexity and multi-dimensionality of CS require subjective judgment evaluation (Islam et al., 2019) and, thus, a possible reason for contrasting results with previous studies.

H_3 stated that the number of functional areas an individual communicates with is positively correlated with the density of mental models of the drivers of corporate sustainability. To test this hypothesis, two approaches to mental model density were applied. For the first one, the density was calculated based on the selected drives on the elicited map. The density was calculated based on all possible concepts available for incorporation in the map for the second one. All the possible concepts were the 15 drivers of CS.

The correlation test performed between the density of all selected drivers and the number of areas an individual communicates with revealed a significant weak positive correlation. This implies that the number of functional areas an individual communicates with is associated with identifying more connections between the selected drivers of corporate sustainability. This means that people who communicate with more functional areas at a frequency of 'sometimes' or

higher identify more causal connections between the selected drivers, which they consider highly relevant. Therefore, when applying the density based on selected concepts, H_2 is supported.

These results align with the existing literature that states that engaging in discussion and therefore communicating with people with diverse mental models is a very important process that facilitates the development of a more complete understanding of the complex systems (Tjosvold, 2008). As shown in previous results from this research, the mental models of other functional areas are different from those within the same functional areas. Aligned with Driver and Streufert (1969), the identified correlation suggests that people seek to engage with other functional areas and integrate the external information into their mental models; thus, affecting their structures.

Additionally, according to some authors, a high density indicates a higher level of cognitive complexity of the mental model (Langfield-smith & Wirth, 1992; S. Nadkarni, 2003). Therefore, having a denser mental model suggests that their cognitive structures regarding CS are more complex. A large number of causal connections between the selected drivers may imply that an individual has more options to influence the system based on their strategic flexibility and adaptiveness (Özesmi & Özesmi, 2004). In turn, this flexibility and adaptiveness facilitate cross-functional communication (Mohr et al., 1996). This flexibility and adaptiveness, and capacity to influence the system are restricted to the selected drivers of CS. Yet, according to Klein & Cooper (1982), these are the core concepts that are considered to be of central importance to the system.

When considering the density from all possible drivers to test H_3, the results obtained fail to support H_3 for this research. The correlation test showed no significant correlation between the

number of areas an individual communicates with at a frequency of ‘sometimes’ or higher and the mental model density. This density approach is more sensitive to the number of drivers included on the maps as it considers all possible connections between the 15 drivers of CS. There is no association between the number of functional areas an individual communicates with, and the number of drives perceived by this research individuals. This result is not aligned with the existing literature that suggests that communicating with diverse mental models provides a more complete picture of the complex system. Even though the previous finding suggests that individuals who communicate with more functional areas have a denser mental model when considering the selected drivers, this does not imply that their mental models consider more drivers.

Limitations

The study provides valuable insights; however, some limitations should be pointed out that could have affected the results.

When assessing the validity and reliability of the variables used for this research, it is important to state that a formal validation of cognitive maps is not possible in mental model research (Özesmi & Özesmi, 2004). Validity in this context is the extent to which the mental model is accurately measured, and the results measure what they are supposed to be measuring. According to Özesmi & Özesmi (2004), each individual’s mental model is a qualitative model presenting a different understanding and interpretation of the system, which does not result in measurable outputs. However, to a certain extent, the use of predefined drivers of corporate sustainability as the mental model content can be biased since predefine concepts may shape an individual’s cognitive processes (Gray & Zanre, 2013)

Using limited predefined concepts was chosen because of its methodological advantages regarding standardised procedures for mental model aggregation and comparisons (Gray & Zanre, 2013; van den Broek, 2020). This standardisation also suggested improved reliability of the results as it provides the possibility of reproducing the results under similar conditions. Even though the validity was improved with a pilot survey to identify any missing concepts, such a pilot test was completed by a reduced number of participants. Therefore, to be aware of all the possible drivers to be included in the mental model, and thus, further increase its validity, the mental modelling task could include the option to add new concepts into the list or follow the mental model task performed by a question regarding if there were any missing concepts that they considered relevant to include in their maps. This could have provided further insights on the content of the mental models of the drivers of corporate sustainability.

As has been previously discussed, the relatively high similarities between the mental models of the sample suggest that the participants perceive the drivers of CS in a similar way. Based on the results obtained, this research was not able to explain such similarities with the frequency of cross-functional communication. Therefore, other factors influencing these similarities need to be considered, such as the different cross-functional communication channels and one-way communication.

Following with the previous limitation, even though cross-functional communication is about both frequency and bidirectionality (Dawes & Massey, 2005; Fisher et al., 1997; Hauptman & Hirji, 1996; Mohr et al., 1996), communication in corporate environments can also be one-way. Not including this dimension of communication may also limit the results of this research as mental models may be influenced by the information being provided through

corporate newsletters, corporate reports and presentations that reach all the functional areas within the company. The information provided through these means reaches all individuals regardless of their functional area. Therefore, they can influence similarities in their mental models as they can integrate the same information into their existing mental models.

Additionally, other than frequency and bi-directionality, cross-functional communication can also be assessed in terms of modality and content (Mohr & Nevin, 1990). Therefore, posing an important limitation to this research as more dimensions of cross-functional communication can be taken into consideration to identify a relationship between the similarities of mental models and cross-functional communication. For example, assessing the content can also give insights on the type of information being exchanged and the type of influence strategy applied to the information being exchanged (Mohr & Nevin, 1990). In this sense, it could be expected that exchanging options and information can yield more similar mental models than just giving and receiving orders.

Furthermore, this research only focused on calls and video calls as the communication channels between individuals. This was decided to ensure the notion of bidirectionality when applying a single-item construct to measure cross-functional communication. Yet, other modes of communication also allow bidirectionality but do not ensure it. Emails are an example of such a mode of communication. It is possible to engage in email exchange which implies bidirectionality; however, it can also just be one-way communication when no exchange from both sides occurs. Therefore, email exchange should also be included as part of the modes of communication when aiming to understand the bidirectional communication dynamics.

Another important limitation is that this research was methodologically set up to compare individuals' mental models with the aggregated mental models of the functional areas they do not belong to and assess whether communication frequency has an influence on the identified similarities. Yet, it is also possible that an individual may not communicate with all members of other functional areas but extensively with a few and therefore perceive a high frequency of communication. This may imply that the individual is limited from engaging with the complete picture of the aggregated mental model of that functional area. This may suggest higher similarities with the mental models of those few individuals yet, not with the aggregated mental model of that functional area. Therefore, to increase the precision, future research could also include the number of people with which individuals communicate at given frequencies.

Another important limitation of this research was the limited sample size. The sample size for this research was based on the number of individuals needed for making accurate mental models when aggregation was carried out (Aminpour et al., 2020) and the functional areas involved in cross-functional projects. Even though the power analysis of the significant difference between mental model similarities with functional and mental model similarities across functional areas suggested that the sample size was adequate, this was not the case for the identified correlation between the frequency of cross-functional communication and similarities in mental models across functional areas. The low statistical power of this correlation suggests a need to increase the sample size to detect correlations with a low to medium effect size (Cohen, 1992). Having a larger sample size can reduce the variability of the sample mean.

Finally, as this research applies an exploratory single case study methodology, the provided limitations give further insights into the degree of uncertainties associated with the

obtained results. Generalisation beyond the organisation of this case study is limited to similar organisations with the same level of corporate sustainability integration in their business operations, similar managerial level of participants and highly diverse samples in terms of nationalities as cultural backgrounds may influence the perception of the drivers of corporate sustainability. Even though it cannot be claimed that the results are generalisable, the results do serve as a foundation for developing hypotheses that may be used in further research and testing that will be further developed below.

Implications

Research Implications

The results of this research have several theoretical implications and avenues for future research. The first theoretical implication is the uncovering of the mental models on the drivers of CS across functional areas. The results regarding that the most important and relevant drivers identified per functional extend the literature on tasks and responsibilities of functional areas regarding CS by also including their aligned perceptions of the main drivers of CS.

The second theoretical implication is the finding that individuals within the same functional area have more similar mental models than those of other functional areas. Therefore, supporting and extending literature that suggests that it is possible to distinguish a functional area from another in terms of motivations (Epstein et al., 2008; Schaltegger et al., 2014), and in this case, with a specific focus on how each function perceives the motivations for integrating CS.

The third theoretical implication is the extent to which cross-functional communication is related to mental models of the drivers of corporate sustainability. The results obtained in this

research were not able to prove that the similarities between mental models are associated with the frequency of cross-functional communication. Even though this has been proved in other research in the context of command-control crews (Waller et al., 2004) and military settings (Mathieu et al., 2000), the current research results suggest that this relationship may not apply in the context of corporate sustainability.

Fourth, the identified positive relationship between cross-functional communication and the mental model density of the selected drivers of corporate sustainability contributes to a new insightful theoretical finding regarding the mental models of the drivers of corporate sustainability and cross-functional communication. A weak relationship means that there is an association between the frequency of cross-functional communication and the perceived connectedness of the drivers of corporate sustainability, which suggest a higher level of the perceived complexity of the system, yet limited to the selected drivers.

While this study provides empirical insights into the relationship between cross-functional communication and mental models of the drivers of corporate sustainability, diverse limitations and insightful findings have been identified, which pose avenues for future research. First, as one of the aims of this research is to understand the communication dimension of cross-functionality, future research could investigate different dimensions such as coordination and collaboration to identify their relationship with mental models of the drivers of corporate sustainability across functional areas and have a better picture of the importance of cross-functionality for the implementation of CS. This further research could provide direct empirical support linked to tangible outcomes to assess performance such as the number of successful cross-functional sustainability-related projects.

Second, even though this research focuses on the frequency of cross-functional communication to understand its effect on mental models' content similarities and structure, other dimensions of collaborative communication can provide further insights to explain the nature of these associations. Apart from the frequency and bidirectionality of cross-functional communication, further research could include content and modality dimensions of such communication between functions.

Third, as the results of this research suggest that participants perceive the drivers of CS in a similar way, there might be other factors influencing these similarities that need to be further investigated, such as one-way communication. One-way communication in the form of corporate newsletters, corporate reports and presentations should also be considered in further research as they are frequently used in large corporations to communicate regarding corporate sustainability.

Fourth, to provide insights on how communication is associated with similarities in mental models, future research can extend current findings regarding more similar perceptions of the drivers of corporate sustainability within functional areas. This can be done by researching possible associations between such similarities and the internal communication dynamics within functional areas.

Considering that an exploratory single case study methodology was used for this research, the results are limited to organisations with similar levels of corporate sustainability implementation in their business operations. Therefore, the fifth avenue of future research could be to replicate the current research in organisations with different levels of corporate sustainability implementation to identify and explain possible differences or similarities

regarding the mental models of the drivers of corporate sustainability across functions and the cross-functional communication dynamics.

Finally, while this study provides insights on the relationship between cross-functional communication and the structure of mental models of the drivers of corporate sustainability, no conclusions can be drawn on the causality of the identified positive relationship. A possible solution is to make a longitudinal study, as this can give insights into causality in relationships (Bryman, 2012). Therefore, future research could investigate a cross-functional sustainability-related project eliciting the mental models and evaluating cross-functional communication at different stages of the project to determine whether cross-functional communication can explain the similarities of mental models or the other way round.

Practical Implications

This research provides valuable practical implications for companies aiming to integrate sustainability across their operations. Uncovering the content of the mental models of the drivers of corporate sustainability per functional area provides insights on how to approach each functional area with regards to sustainability-related projects. Drivers act as change leverage towards corporate sustainability and therefore highly relevant to know which ones are more relevant for each functional area. Additionally, it is interesting to discuss that within each functional area, a mix of both internal and external drivers was identified which implies a balance proactive perception towards sustainability and more reactive measures which are not as effective in progressing towards sustainability.

Additionally, identifying that mental models within functional areas are more similar than across functional areas suggests provides insights into the coordination and cooperation dynamics within the functional areas. According to Mathieu et al. (2005), that similarity in mental models has an impact on a team's performance as it facilitates different dynamics such as coordination and cooperation.

Finally, there are practical implications to the identified positive association between the number of areas an individual communicates with and the perceived connectedness of the selected drives of corporate sustainability. According to Özesmi and decision-making and actions approach Özesmi (2004), identifying multiple cause-effect relationships within the perceived system provides the individuals with more options to influence the system as they have more strategic flexibility in their approach to decision making and actions. Additionally, it facilitates the integration of new information (Uitdewilligen et al., 2021). Therefore, being highly desirable in dynamic organisations aiming to integrate corporate sustainability in their operations. Additionally, various authors suggest that the identification of multiple causal effects is associated with experts views of complex systems (Chi & Koeske, 1983; Hmelo-Silver et al., 2007; Hmelo-Silver & Pfeffer, 2004).

Conclusions

The purpose of this quantitative single case study research was to shine a light on the mental models of the drivers of corporate sustainability across functional areas and the effect of cross-functional communication on these mental models. Based on the data collected using a standardised mental model tool used to elicit mental models and a cross-function communication

survey, the developed research questions to meet the purpose of this investigation were approached.

Answering to first research question regarding how the mental models of the drivers of corporate sustainability across functions are, this research concludes that mental models of mental models are aligned with their tasks and responsibilities in the implementation of CS. Following, for second research question aiming to identify whether mental models within functional areas are more similar than across functional areas, this research can conclude that there is a difference and mental models within functional areas more similar to those of other functional areas. The third research question aimed to find if mental models' similarities across functions are explained with the frequency of cross-functional communication. This research concludes that mental model similarities across functions cannot be explained with the frequency of cross-functional communication. Finally, the fourth research question was on how cross-functional communication affects the structure of the mental model of the drivers of corporate sustainability. A relationship was identified between the mental model's density of the selected drivers and the number of functional areas an individual communicates with. Yet, limited to the selected drivers.

This research contributes to the literature on the drivers of corporate sustainability, mental models, and cross-functionality. The convergence of these fields calls for further research due to its large implications in the practical implementation of corporate sustainability across business operations. In conclusion, this research provides valuable insights for further research to better understand cross-functional cooperation regarding cross-functional sustainability-related projects and contribute to organisations' paths towards more sustainable business operations.

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Annex

Annex 1: Pre-Check Concept Survey

Hello,

Thank you very much for accepting to participate in this investigation. As mentioned before, this investigation is part of my Master Thesis at Utrecht University. The aim of my research is to investigate how does communication across functional areas within a company affect the perceptions of corporate sustainability.

This short survey will take no longer than 5-10 minutes to complete. The aim of this survey is to inform the participants which drivers of Corporate Sustainability were frequently mentioned in academic literature and identify any other Corporate Sustainability drivers that might be missing, and participants find relevant to include.

Mark the department you work at:

- □ Marketing Operations
- □ Legal
- □ R&D
- □ Marketing
- □ Procurement

The aim of this survey is to reviewed drivers of Corporate Sustainability drawn from academic literature and identify any other CS driver that might be missing, and participants find relevant to include. Drivers are the reasons and motivations that explain why it is important to integrate CS into the business.

Driver	Definition
Risk management	Operations and decision making apply environmental and social criteria as an opportunity to reduce costs associated with the related risks. This may reduce the occurrence and cost of emergency responses.
Profits and growth	Integration of social, environmental, and ethical aspects into business operations and decision-making because of its contribution to the financial bottom line.
Resources and cost savings	Increase in operational efficiencies through eco-efficiency. Efficiency gains are the result of waste management costs and reduce use of resources such as energy, water, and materials.
Leadership	Proactive senior leadership that pushes forward the integration and implementation of sustainability.
Employee recruitment and retention	Attract higher performance applicants and retain workers.
Ethical and moral responsibility	Corporate Sustainability as a moral duty: to do the “right thing”
Innovation and technology	Development of new products and business concepts.
Legal compliance	Working within the limits of regulation from the legal authorities.
Corporate and brand reputation	Enhance a positive corporate public image and ensure the marketability of its brand name.

Stakeholders' expectations	Answer to sustainability related expectations from suppliers, investors, employees, customers, and NGOs.
Alliances and partnerships	Sectoral or intersectoral alliances and partnerships to effectively foster sustainable goals.
Market demands	Enhance market share for products and services answering to market changes.
Competitors benchmarking	Keeping up with the new trends followed by competitors.
Access to markets and customers	The opportunity to enter new markets and access more or different customers.

Is there any other driver that should be considered as part of the following list? Please name it and describe it.

Driver: _____

Definition/description: _____

Thank you for your time.

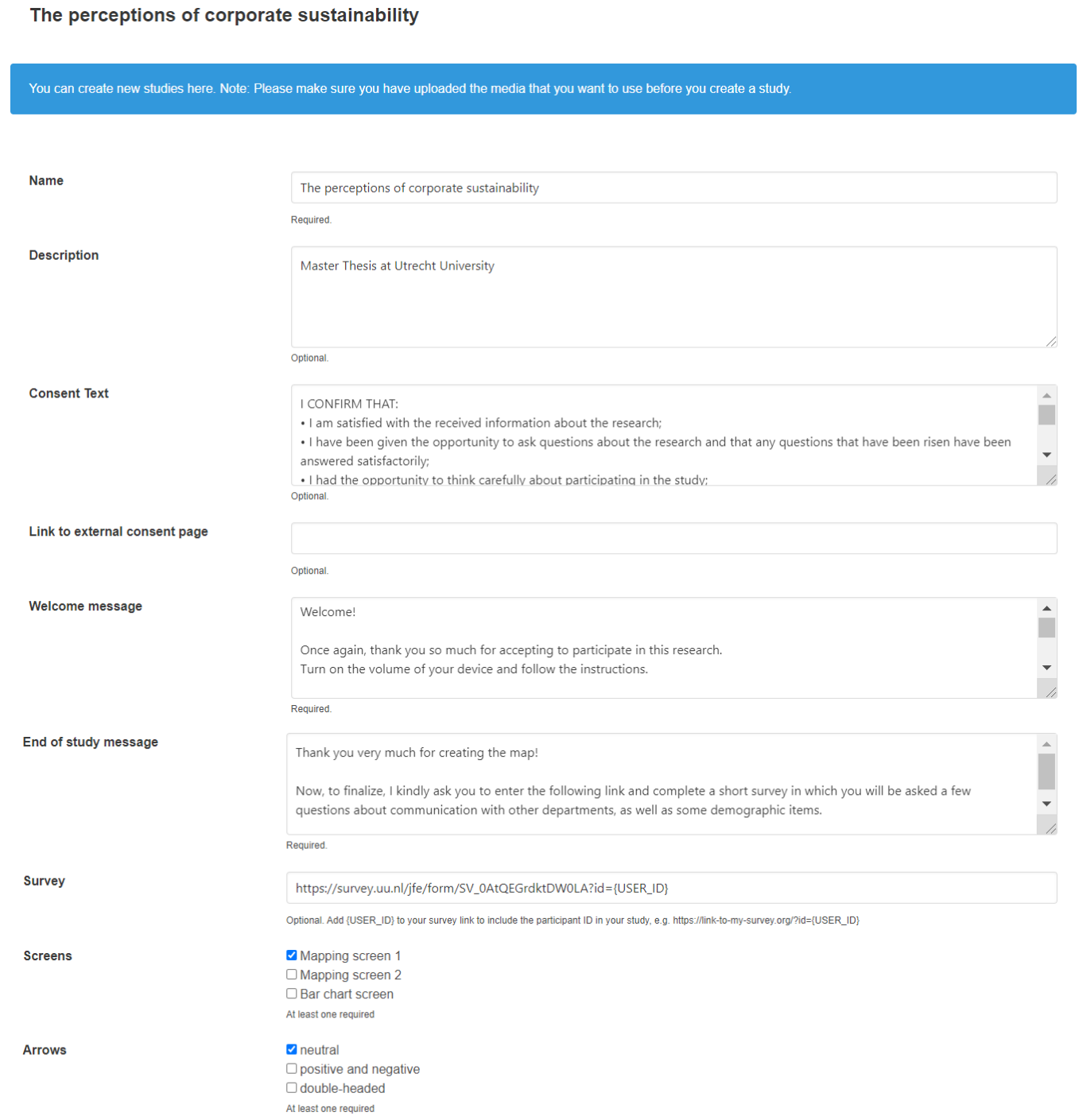
I will be contacting you for the next part of the investigation.

If you have any questions, please do not hesitate to contact me.

Annex 2: M-Tool “study creation” setting

Figure 5

M-Tool Setup Screen



Videos And Audio

Welcome audio	Welcome + task
Introduction video mental model practice task	Default
Practice audio	Default
Icon explanation video	Icons + task
Mapping screen 1 audio	Default
Thank you audio	Thanks + survey task

Mapping Screen 1

Fixed icon? Corporate Sustainability

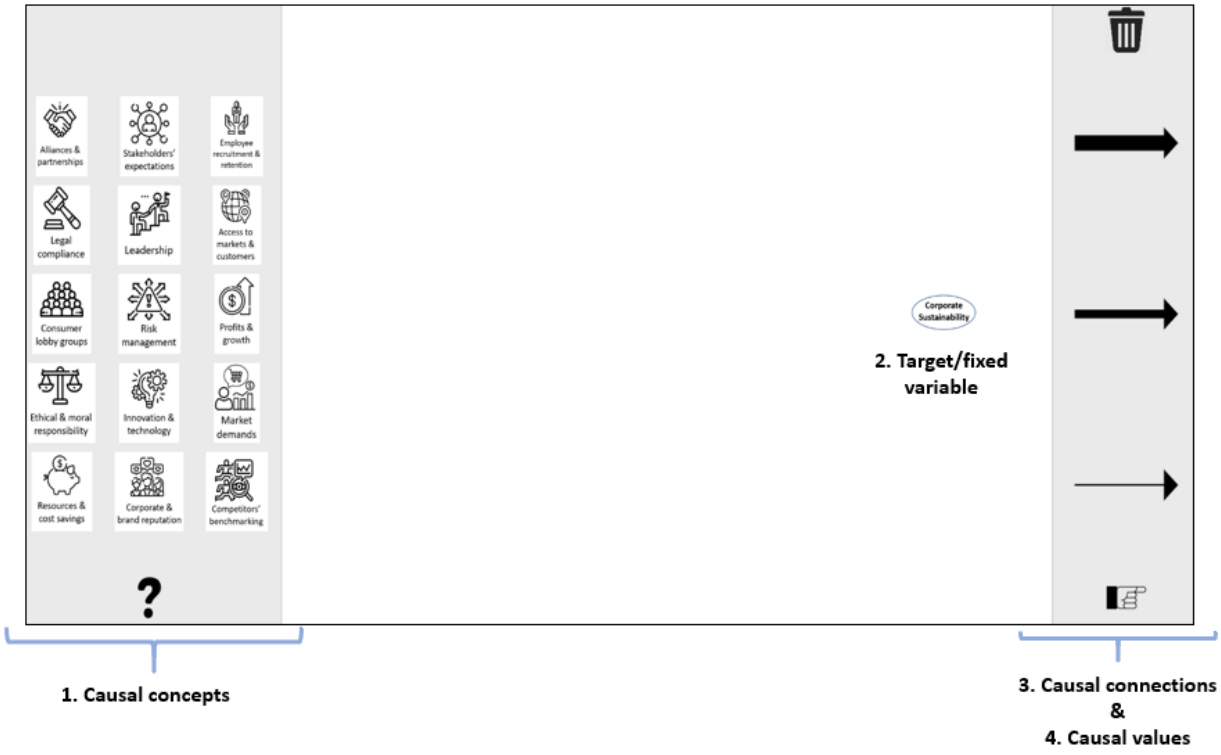
Fixed icon position? right

Use?	Image file	Audio explanation (optional)
☑	Risk management	risk management
☑	Profits and growth	profits
☑	Resources and cost savings	cost saving
☑	Leadership	leadership
☑	Employee recruitment and retention	employees
☑	Ethical and moral responsibility	ethical
☑	Innovation and technology	innovation
☑	Legal compliance	legal
☑	Corporate and brand reputation	reputation
☑	Stakeholders' expectations	stakeholders
☑	Alliances and partnerships	alliances
☑	Market demands 1	market demands
☑	Consumer lobby groups	lobby
☑	Competitor's benchmarking	benchmarking
☑	Access to markets and customers	market access
☐	Corporate Sustainability	corp sust

Annex 3: Mental Model Mapping Screen

Figure 6:

Main Mental Model Mapping Screen with Main Components



Annex 4: Cross functional communication survey

Please mark the department you work at:

- □ Marketing
- □ Marketing Operations
- □ Regulatory
- □ Procurement
- □ R&D

The next question will ask you to consider how often you communicate with other departments regarding corporate sustainability.

Communication between departments is a process by which departments exchange information. This communication is back and forth, meaning that when a department communicates a message to another department, they receive a response.

Corporate sustainability are corporate activities that proactively considers the **environmental**, **social**, and **economic** effects of business activities today and throughout time while addressing responsibilities with respect to **stakeholders** (employees, customers, investors, suppliers, NGOs, communities).

To provide you with some information regarding corporate sustainability within the company, the current efforts line up under the following 3 broad pillars:

Environmental Stewardship	**Responsible Sourcing**	**Healthy Living & Community Support**
- Energy use reduction - Renewable energy - Waste reduction - Circularity - Recyclability	- Sustainable agricultural practices - Resource traceability - 3rd party due diligence audits	- Health and nutrition - Ingredient's transparency - Meal programs for people in need

1. In the past month, how often did you communicate **via videocalls and/or calls** (NOT emails) with other departments about corporate sustainability-related topics? Please fill in the following table:

Communication	Not applicable (your own department)	1 (never)	2 (rarely)	3 (sometimes)	4 (often)	5 (always)
With marketing						
With marketing operations						
With Regulatory						
With procurement						
With R&D						

Thank you!

Thank you for your time.

If you have any questions, please do not hesitate to contact me.

Annex 5: Independent Sample t Test Assumptions Tests Results

Table 11

Testing for Normality and Homogeneity of Variance

	N	Skewness	Kurtosis	Shapiro-Wilk		Levine's Test
				Stat.	Sign	
Distance Ratio within a functional area	50	0.70	0.93	.96	.113	.654
Distance Ratio across functional areas	200	0.05	0.71	.98	.004	

Annex 6: Plot Boxes

Figure 7

Outliers of Distance Ratio Variable

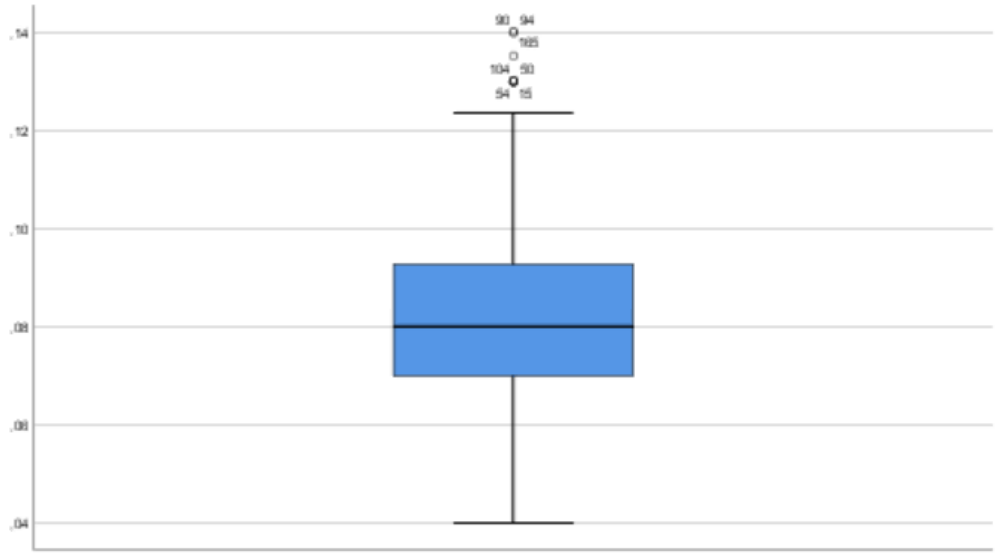


Figure 8

Outliers for Density of Selected Drivers Variable

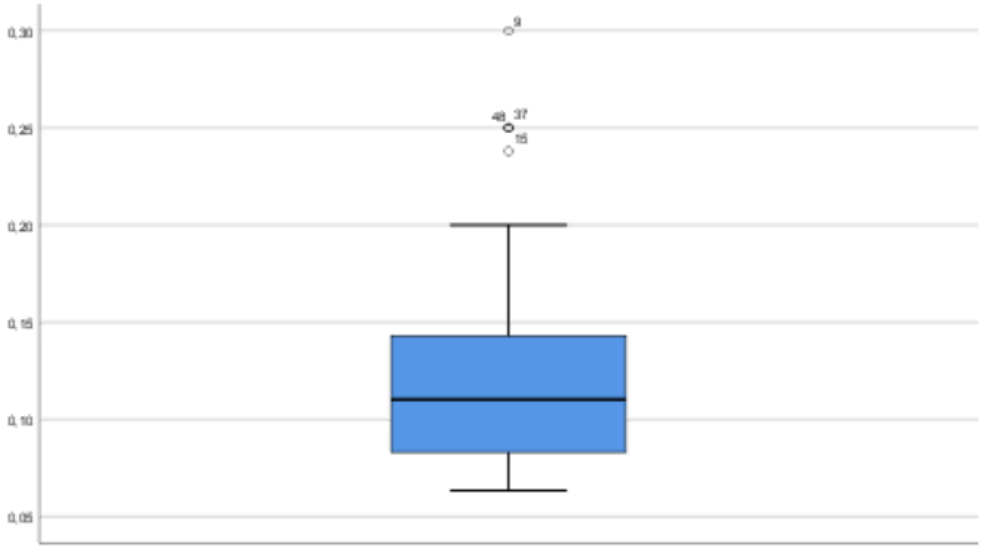


Figure 9

Outliers of Density of All Possible Drivers Variable