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Evaluating the Impacts of Green IT/IS Adoption on Individuals: An Empirical Study

par

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Pierre-Majorique Léger
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Further to your request for renewal, the Ethics Approval Certificate for the above project has been renewed as at May 01, 2022. **This certificate is valid until May 01, 2023.**

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Yours very truly,

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Abstract

A 2x2 between-subject experimental study (n=40) was conducted to provide empirical evidence to understand the role of information systems in supporting organizations and their employees to make more sustainable decisions under a carbon tax scenario. The information related to carbon footprint emissions was manipulated in scopes (individual-task-level and global-company-level emissions) and units (kilograms and euros) on an ERP dashboard using ERPsim. The study offers two useful findings to guide SCM management when nudging employees to make sustainable decisions: First, the results explain how a priori perceptions of climate change affect employees' business decisions. For instance, when decision-makers perceived the carbon footprint emissions information low in quality, decision-makers with low concern for climate change chose to maximize company valuation. However, the findings indicate that increasing the quality of the environmental information presented on the dashboard can mitigate the employee's tendency to make business decisions based on personal concern for climate change. More specifically, the results suggest that when the quality of the environmental information is increased, decision-makers who are predisposed to company valuation maximizing decisions will shift to making more sustainable decisions. This finding suggests that the environmental information presented on the dashboard can influence the employees' decision-making process by reducing personal biases about climate change, allowing the decision-makers to move the needle toward more sustainable business decisions. Second, the results reveal that communicating the environmental information on an ERP dashboard did not come at the expense of the organization's financial performance. When carbon footprint emissions information was presented with high understandability and usefulness, the decision-maker’s satisfaction level with their decision increased. This increase in decision satisfaction was able to ultimately improve the decision maker's confidence in performance as well as actual financial performance. The results of this study also show that decision-makers are favourably predisposed to the idea of using such environmental information in their decision-making when made available.

Keywords : Sustainability, Environmental Decision-Making, Carbon Footprint emissions, Enterprise Resource Planning, Green IT, Green IS

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CO2e: Carbon Dioxide Equivalents

D&M's IS success model: DeLone-McLean's IS success model

ERP: Enterprise Resource Planning

GHG: Greenhouse Gas

IS: Information Systems

IT: Information Technology

OECD: The Organization for Economic Co-operation and Development

HRM: Human Resource Management

SCM: Supply Chain Management

TAM: Technology Acceptance Model

TPB: Theory of Planned Behavior

UX: User Experience

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Chapter 1: Introduction

In a recent survey with 10,000 consumers, it was reported that 75% of the survey participants expected CEOs of businesses to do more to reduce carbon emissions. Also, consumers believe that businesses are responsible for reducing carbon emissions after the government (Deloitte, 2020). Gen Z adults around the world ranked climate change and environmental protection as the top personal concern at 28%, exceeding concerns for unemployment at 27% (Goldman & Abrams, 2021). Growing concerns of climate change and increasing demand for carbon reduction by future consumers propose a need for businesses to change their behaviours more imminently than before.

Carbon footprint, usually expressed as tons of carbon dioxide equivalent (t CO2e), is a technique exclusively for measuring the total amount of GHG emissions within a defined supply chain (Liu et al., 2016). Understanding the consequences of carbon footprint and climate change is ambiguous because of its intangible nature. Carbon footprint's odourless and colourless characteristics impede the internalization of associated problems in individuals, which challenges the motivation to perform pro-environmental behaviours. This ambiguity creates a wide variation in the public rhetoric when discussing the severity of climate change (Roy, 2021). Moreover, these ambiguities in identifying the consequences of carbon footprint, led to individuals believing that climate change will occur in the "future" and mostly in "distant geographical locations" (Tvinnereim et al., 2020). Air is considered a public good because individual consumption of air does not deprive consumption of others (non-rivalrous) and because it is impossible to exclude someone from consumption (non-excludable). The care for public goods is especially controversial because “everybody’s property is nobody’s property” (Scott, 1955). This ambiguity of ownership and accountability in carbon footprint can lead to over-consumption and ultimately depletion of the environment, which is named as “Tragedy of Commons” in economics (Hardin, 1968; Ostrom, 1990). The ambiguity of ownership, caused by shared ownership, leads to diffusion of responsibility where individuals defer responsibility to other stakeholders (Darley & Latané, 1968).

In efforts to regulate businesses to make more sustainable business decisions, carbon tax schemes are currently practiced in 14 out of the 31 high-income OECD countries, such as Canada, France, and the United Kingdom (Yunis & Aliakbari, 2020). Despite various social and economic pressures on organizations to reduce carbon footprint, best practices for balancing the environmental costs and economic profits in organizations are yet unknown.

In this sense, sustainability goals may not be achieved without Information Systems (IS). Dwivedi et al. (2022) argues that digitalization is one of the most important ways to limit the acceleration of global warming. Sustainable IS solutions, including smart cities, smart manufacturing, smart offices, smart home can promote pro-environmental behaviours by providing feedback on resource consumption (Papagiannidis & Marikyan, 2022).

In the domain of Information Systems (IS) and Human-Computer Interaction (HCI), technologies that aid sustainability initiatives are defined as Green Information Technology (IT) or Green Information Systems (IS). Green IT or IS uses “IT and IS to empower (support, assist, and leverage) enterprise-wide environmental initiatives" (Murugesan, 2008).

Research in Green IT/IS considers identifying the impact of carbon footprint a most pervasive concern (Corbett, 2013). However, limited studies are conducted to understand the impacts of adopting Green IT/IS. More specifically, it is yet undiscovered how actual decision-makers (i.e., logistics managers) within the supply chain make environmental related decisions in their day-to-day operations, and how the adoption of Green IT/IS impacts the practitioners and organizations.

This research aims to investigate how providing carbon footprint emissions information can impact individual IS users’ decision-making, hence impacting the organization as a whole. Thus, the following research questions are proposed:

RQ1: What effects does having access to carbon footprint emissions information (measured in carbon dioxide equivalent – CO2e) have on user’s decision-making, and on the organization?

More specifically,

RQ1a: What are the effects of communicating carbon footprint emissions information (measured in CO2e) on users' business decisions?

RQ1b: What are the effects of communicating carbon footprint emissions information (measured in CO2e) on users' decision satisfaction?

RQ1c: What are the effects of communicating carbon footprint emissions information (measured in CO2e) on actual organizational performance, as well as confidence in performance?

The secondary aim of this study is to discover the role of user's characteristics in environmental decision-making when the users have access to carbon footprint emissions information. This leads to the following research question:

RQ2: How do users' preconceived notions in climate change (i.e., concern for climate change and perceived instrumentality) influence their decision-making processes?

The tertiary aim of this study is to know which presentation of carbon footprint emissions information led to lower diffusion of responsibility, and higher information quality. Therefore, the following research questions will be used to guide this research:

RQ3: Which framing of carbon footprint emissions information, presented on an ERP dashboard, is more effective in nudging environmental decision-making?

More specifically,

RQ3a: What are the effects of communicating carbon footprint emissions information in varying scopes (showing CO2e emissions to correspond to the individual employee's decisions versus to the company's operations at large) on the diffusion of responsibility and information quality?

RQ3b: What are the effects of communicating carbon footprint emissions information in varying units (showing CO2e emissions in biophysical unit versus monetary unit) on the diffusion of responsibility and information quality?

Hence, this research seeks to understand the effects of communicating carbon footprint emissions information on decision-makers performing logistics tasks, and its downstream effects on companies operating under a carbon tax scenario. To answer our research questions, a research model that is partially based on DeLone-McLean's Information System (IS) success model (1992) is developed. In this regard, this research will uncover the effects of information quality (information understandability, reliability, usability) on individuals (impacts on decision and satisfaction) and on organizations (impacts on financial and economic performance). The findings from this study may guide management in the supply chain industry to effectively nudge employees to make sustainable decisions.

This research also incorporates an existing theory on diffusion of responsibility by Darley and Latané (1968) in the IS success model (1992). In comparing the levels of information quality and responsibility certain forms of carbon footprint emissions information was able to convey, this study may guide UX practitioners to select most effective designs to represent carbon footprint emissions information to nudge sustainable behaviours.

This thesis was conducted in the Tech3Lab, which involves several collaborators at varying levels of contributions across varying stages of the thesis. Table 1 below is meant to convey my personal intellectual contribution in each aspect of the thesis. According to the standards of the lab, an overall level of 50% in contribution is expected by the student. For dimensions where my personal contribution exceeds 50%, it suggests leadership and ownership of the corresponding phase.

Table 1. Contribution to the responsibilities of the research project

Step	Contribution
Research Question	Development of a research question - 70% Support was provided by supervisors
Literature Review	Reviewing prior literature to identify prior research, adapting relevant constructs and measures - 100% Support was provided by supervisors

Table 1. Contribution to the responsibilities of the research project (Continued)

Experimental Stimuli Development	Creation of the dashboards for the experiment - 50% Modification of the stimuli after the pre-tests - 50% Assistance was provided by the members of the ERPsim Lab
Experimental Design	Submitting ethics form from REB (Research Ethics Board) - 60% Creation of consent forms and recruitment messages - 60% Creation of the experimental protocol - 60% Creation of the training material given to participants for the experiment - 60% Assistance was provided by members of Tech3Lab operations team and ERPsim Lab
Participant Recruitment	Creating the recruitment message template - 50% Recruitment and scheduling of participants for the study - 50% Compensation management - 10% Assistance from Tech3Lab operations team was provided
Pre-tests and Data Collection	Pre-tests - 80% Data Collection - 80%
Data Analysis	Extraction and formatting of the data for statistical tests - 80% Statistical analysis - 80% Assistance from the statistician at the Tech3Lab was provided
Writing	Writing the thesis – 75% The first draft of the overall thesis was written by me. Feedback and edits in the text were provided by supervisors.

Chapter 2: Literature review

2.1 Introduction to Literature Review

Climate change, driven by greenhouse gas (GHG) emissions, has been an ongoing issue addressed by nations around the world. The 2021 United Nations Climate Change Conference addressed the need for global action to fight against ecological deterioration and discussed potential strategies to transform carbon-intensive sectors and economies (Dwivedi et al., 2022; World Health Organization, 2021). The call for cooperation for more sustainable business practices are increasingly turning to technological innovation (Dwivedi et al., 2022; Miller, 2020). This increased expectations on technology's ability to aid sustainable practices present new challenges in understanding the implications of adopting pro-environmental technologies on users' behaviour. The objective of this literature review is to define Green IT and IS and understand the primary studies that have been conducted in Green IT and IS adoption.

2.2 Green IT and IS Adoption

2.2.1 Definitions of Green Information Technology (IT) and Green Information System (IS)

Several definitions of Green Information Technology (IT) and Green Information Systems (IS) are available in the literature. The most succinct difference between Green IT and Green IS is derived from the terms IT and IS. Watson et al. (2008) referred to IT as the technology that is responsible for "transmitting, processing, or storing information" while IS was referred to as "an integrated and cooperating set of software using information technologies to support individual, group, organizational, or societal goals".

Though some scholars (Brooks et al., 2012; Esfahani et al., 2018; Dedrick, 2010; Watson et al., 2008) differentiate Green IS and Green IT, the two terms are used synonymously in many studies in the field (Malhotra et al., 2013; Mithas et al., 2010; Shevchuk & Oinas-Kukkonen, 2016a; Tushi et al., 2014). Murugesan (2008) defined Green IT as an umbrella

term referring to environmentally sound information technologies and systems, applications, and practices. The author goes onto argue that Green IT is not just about creating energy-efficient systems, but also about applying IT to create environmentally sustainable business processes and practices. Watson et al. (2008) defined Green IS as "the design and implementation of information systems that contribute to sustainable business processes". Despite the differing definitions, there is a mutual understanding that the terms refer to IT/IS that is environmentally friendly (Sarkis et al. 2013).

Moreover, it is understood that both Green IT/IS have similar roles in environmental sustainability. Murugesan (2008) identified key IT-enabled strategies for enhancing environmental sustainability as (1) efficient and effective design, manufacture, use and disposal of computer hardware, software and communication systems with no or minimal impact on the environment; (2) the use of IT and information systems to support, assist and leverage other enterprise-wide environmental initiatives; (3) the harnessing of IT to help create awareness among stakeholders and promote the green agenda and green initiatives. In a systematic literature review of Green IT/IS adoption, Esfahani et al. (2018) summarized the key roles IS in environmental sustainability as: (1) enabling to induce changes to business processes of an organization; (2) promoting changes in the behavior of individuals within the organization; (3) transforming society into an environmentally sustainable one. Thus, both Green IT and Green IS are understood to have the capabilities to achieve change and enhance sustiainable behaviours (Fuchs, 2006).

2.2.2 Antecedents of Green IT and Green IS Adoption

Majority of researchers applied either organizational-level or individual-level theories to study the predictors or antecedents of successful Green IT/IS adoption (Esfahani et al., 2018; Deng & Ji, 2015). These studies were conducted in different contexts including organizations and households. For example, Kranz & Picot, (2012) investigated factors that influence the adoption of smart metering technology in households, while Wunderlich et al. (2013) investigated the impacts of personal values on adoption of smart metering technology. Studies investigating Green IT adoption at organizational levels concluded that an organization's values and culture has an influence on the behaviour of individual

employees (Chen et al., 2009; Coffey et al., 2013; Gholami et al., 2013). In developing frameworks of Green IT/IS adoption, studies have used organizational-level theories such as institutional theory to examine the effect of mimetic, coercive, and normative pressures on Green IT/IS adoption in managers (Chen et al., 2009).

Decision-making in the supply-chain becomes complex when organizations make environmental decisions under uncertainty and ambiguity that arises from having multiple stakeholders involved in the supply chain (Wu & Pagell, 2011). Brammer and Walker (2011) researched that the implementing environmentally sustainable supply chain present conflicting priorities to the decision-makers, pressuring managers to choose between reputation and economic gain. In other words, it was discovered that the supply chain managers faced challenges having to balance costs and short and long-term trade-offs of pro-environmental decisions (Roehrich et al., 2014). Environmental decision-making is especially difficult because organizations often are not fully aware of the environmental impact of their supply chains due to vague and unclear information (Chechile, 1991; Alvesson, 1993). Organizations may lack adequate scientific knowledge on the environmental problems before them, depriving employees of information regarding the consequences of directly interacting or not interacting with the environmental problems (Wu and Pagell, 2011). According to Franken (2011), organizations make decisions that lead to sub-optimal outcomes when there are no complete or reliable information connecting the environmental and economic parameters. Therefore, firms and its employees are inclined to make decisions with limited information and available resources, which makes it easier for bounded rationality to impact decision-making (Simon, 1979).

Research applying individual-level theories were minimally conducted compared to research applying theories at organizational levels (Esfahni et al., 2018). In the investigation of Green IT/IS adoption at individual levels, most studies examined the effects of psychological influence on the behavioural intention of Green IT/IS users (Esfahani et al., 2018). For example, Molla et al. (2014) found that an IT professionals' attitudes and beliefs about Green IT was a strong predictor of intentions to perform sustainable behaviours on Green IT.

2.2.3 Benefits of Green IT and Green IS adoption

Literature discussing Green IT and Green IS study the benefits that can be gained from the adoption and usage of Green IT/IS. In their systematic literature review, Esfahani et al. (2018) concluded that most research in Green IT/IS were aimed to highlight the potential benefits of adopting Green IT/IS, which are economic (monetary) and environmental benefits. Some literatures suggests that Green IS should be viewed as an opportunity to reduce cost, and increase productivity as well as profitability. For example, it was found that energy savings and cost reduction were the primary reasons for Sun Microsystems Australia to adopt Green IT initiatives (Murugesan, 2008). Erskine & Füstös, (2013) found that adopting desktop virtualization at higher education institutions resulted in cost savings and improved environmental performance. Some research support that the adoption of Green IT and IS lay beyond cost effectiveness and energy savings purposes. According to Thambusamy & Salam (2010), being "green" is thought to have several advantages including cost reduction and risk mitigation. Rusinko (2007) have also concluded that adopting Green IS attracts new customers, and brand enhancement. More neutrally, Yim (2011) discovered that Green IS activities, such as disclosing information on energy consumption, could have either a favorable or no impact on individual energy consumption. Green IT/IS proposed to result in a number of positive outcomes, such as cost reduction, risk reduction (Murugesan, 2008; Thambusamy & Salam, 2010; Erskine and Füstös, 2013), new customers attraction, and image promotion (Rusinko, 2007; Yim, 2011). Despite the benefits of implementing sustainable supply chain management systems, some researchers argue that environmental goals are economically burdening to companies and their business practices (Wu and Pagell, 2011; Berthon et al., 2011). Seidel et al. (2012) claims that Green IS does not always result in a green business. The researchers point to organizations' need to understand the role of technologies in supporting their businesses processes in order to realize the full potential of Green IS implementation.

2.3 DeLone and McLean's IS Success Model

Prior research in Green IT/IS adoption modeled individual-level theories such as TAM (Esfahani et al., 2018;Shevchuk & Oinas-Kukkonen, 2016). Akman and Mishra (2015) researched that TAM constructs (perceived ease of use, perceived usefulness, attitude towards usage, behavioral intention to use and actual usage) had positive, significant effects on behavior in adopting Green IT. The DeLone-McLean's IS success model (D&M's IS success model) is based on Technology Acceptance Model (TAM) by Davis (1989) and replicates system quality as well as ease of use in the model (Rai et al., 2002). However, D&M's IS Success model is different from TAM in that it considers information quality as antecedents to intention to use as well as user satisfaction, which is not explicitly considered in TAM (Rai et al, 2002). In order to achieve the aims of this research, DeLone and McLean's IS success theory will be used.

Earlier research, prior to D&M IS success model, attempted to measure information system (IS) success as the dependent variable. Measuring IS success was considered inadequate because it failed in creating multidimensional and interrelationship measures (Petter et al., 2008). To resolve this issue, DeLone and McLean reviewed the literature that was published between 1981 and 1987 and created a taxonomy of IS success in their 1992 paper. The researchers listed six components of IS success to measure multidimensionally: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. However, this original model was criticized on the links between satisfaction and individual, organizational impact. Hence, it was recommended by other researchers that constructs such as perceived usefulness should be included in the model (Seddon, 1997; Alzahrani et al., 2019).

Therefore, the researchers revised the original model in 2003, adding service quality to reflect the need for assessing support in the success of IS implementation, as well as intention to use intended to gauge user's attitudes rather than actual use. Also in the revision, individual impact and organizational impact were replaced with net benefits. This revision of the model was able to account for benefits at multiple levels of analysis

and were applied to whatever level of analysis the researcher considers most relevant (Petter et al., 2008; Alzahrani et al., 2019).

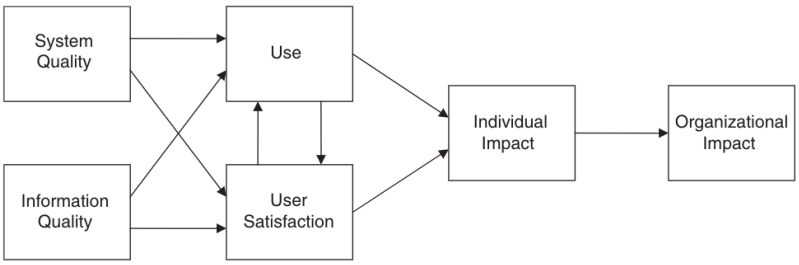


Figure 1. DeLone and McLean IS success model (1992)

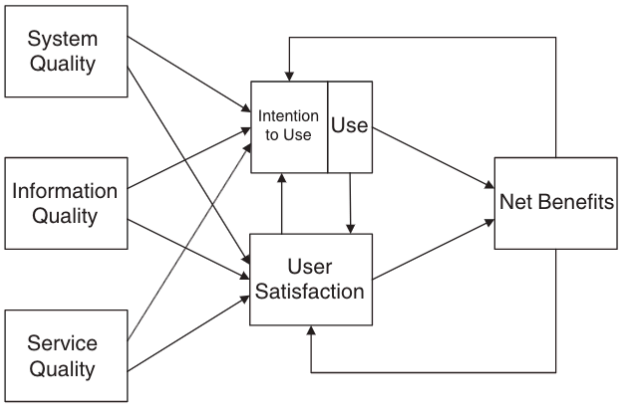


Figure 2. Updated DeLone and McLean IS success model (2003)

2.4 Research Gap and Motivation

Prior research separately discuss how organizations and employees are affected by uncertain and ambiguous environmental information. Most research in Green IT/IS discuss antecedents of Green IT/IS adoption using mostly organizational-level theories. While some studies applied individual-level theories, the theories were not applied in conjunction with organizational-level theories to predict Green IT/IS adoption. This was due to the limitations in individual-level theories, such as Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB), that cannot be extended and applied to organizational-level theories to predict Green IT/IS adoption in organizations (Deng & Ji,

2015). These research focuses on describing the antecedents of Green IT/IS adoption and fails to provide a holistic view on the impacts of Green IT/IS adoption on both organizations and individuals. Therefore, there is a need to concurrently understand the impacts and implications of Green IT/IS adoption on top management, and individual decision-makers within an organization. Top management's support is paramount to adopting Green IT/IS, but successful adoption of Green IT/IS is a decision made by individual employees (Deng & Ji, 2015). Thus, this study is motivated to investigate the impacts of Green IT/IS adoption on individuals and organizations, given that both stakeholders are of great predictors of successful Green IT/IS adoption.

Moreover, prior research has observed the difficulties faced by decision-makers when making environmental decisions, but they fall short on explaining what kind of environmental information reduce information uncertainty and induce environmental decision-making. This research aims to understand the decision process in individuals when information on the environmental information is provided.

Furthermore, existing research investigating the impacts of environmental decision-making on individuals and organizations have been conducted using surveys, interviews, and case studies (Carter & Easton, 2011; Wang et al., 2015). Literature that was discussed in the literature review have not analyzed data when participants were using an information system that is designed for environmental managements and decision-making. Thus, prior research bare limitations in that the research can only be extended marginally to suggest practical impacts of environmental decision-making on decision-makers and organizations. Therefore, opportunities exist in investigating environmental supply chain adoption and environmental decision-making through user-based, user-interactive research.

Chapter 3: Hypothesis development

This study extends DeLone and McLean's IS success model (DeLone & McLean, 1992) by integrating it with various research in decision-making (Kahneman & Tversky, 1979; Simon, 1979). The presented model aims to offer a comprehensive framework to understand the antecedents and the consequents of Green IT/IS adoption in environmental logistics decision-making. The proposed model also seeks to discover the role of user characteristics in moderating Green IT/IS adoption, which uncovers the nuances around the adoption of Green IT/IS in individuals within the supply chain field. The proposed research model can be found in Figure 3 at the end of Chapter 3. A summary linking the hypotheses with research questions can be found in Appendix: Summary of Research Questions and Hypotheses.

3.1 Framing Environmental Information

In their foundational research, Tversky and Kahneman (1979) found that the choices made by the decision-makers are influenced by the way the relevant information were framed. The researchers further developed this effect into the prospect theory, which points out that people become risk averse when a message is framed as losses, and risk tolerant when the message is framed as gains (Loroz, 2007; Tversky & Kahneman, 1986). Subsequent research has also demonstrated that framing information affected attitudes or behavioural intentions (Bolderdijk et al., 2013; Kang & Hong, 2021; Loroz, 2007; Spence et al., 2014; van de Velde et al., 2010). Research have used framing to motivate pro-social behaviour using the positive frame to emphasize gaining benefits or preventing losses, while using the negative frame focussed on losses when failing to adhere to certain behaviour (Lai & Kuo, 2007; Loroz, 2007; Maheswaran & Meyers-Levy, 1990; Obermiller, 1995; van de Velde et al., 2010).

The first type of frame we investigate are based on social ideals. Prior research has shown that people often act in accordance with social ideals (Bolderdijk et al. 2013; Spence et al. 2014). Governance of climate change scatters responsibility across multitude of

people, creating “Problem of Many Hands” or “Tragedy of the Commons” (Frantz & Mayer, 2009; Nollkaemper, 2018). Darley and Latané (1968) studied the causes of this phenomenon and found individuals’ tendency to defer responsibility on others when responsibility cannot be assigned or determined, calling it bystander effect or diffusion of responsibility. Diffusion of responsibility is a cognitive process where accountability for work is transferred to others when group size increases(Alnuaimi et al., 2010). Through this phenomenon, individuals feel a less personal responsibility given that there are others available to do the same work. Diffusion of responsibility is extended to social loafing in the domain of group decision-making and management research. Social loafing is defined as “a phenomenon in which people exhibit a sizable decrease in individual effort when performing in groups as compared to when they perform alone" (Ying et al., 2014). Individuals are more likely to engage in social loafing if they feel less personally accountable for a task (Weldon & Gargano, 2016), and know their individual efforts have little impact on the overall outcome. This phenomenon also explains loss of productivity in individuals working in various communities (George, 1992; Karau & Williams, 1997). To study the effects of diffusion of responsibility, this study used framing theory by comparing individual frame with company-wide frame. The individual frame refers to framing CO2e emissions to correspond to the individual employee’s decision (i.e., personalizing the CO2e emissions based on one’s actions), while company-wide frame refers to framing CO2e emissions to correspond to company’s entire operations. Taken together, we hypothesize that framing CO2e emissions in different scopes, in individual frame versus company-wide frame, will have an impact on diffusion of responsibility:

H1: Individual frame (framing CO2e emissions to correspond to one’s business decision) will be associated with a lower diffusion of responsibility than company-wide frame (framing CO2e emissions to correspond to company’s entire operations)

More specifically,

H1a: Individual frame (framing CO2e emissions to relate to one’s business decision) will be associated with a lower financial diffusion of responsibility than company-wide frame (framing CO2e emissions to correspond to company’s entire operations)

H1b: Individual frame (framing CO2e emissions to relate to one's business decision) will be associated with a lower environmental diffusion of responsibility than company-wide frame (framing CO2e emissions to correspond to company's entire operations)

This research seeks to understand the effects of framing CO2e emissions information on sustainable decision-making. In doing so, this study will follow previous research and compare two frames in different units to illustrate the environmental costs related to logistics behaviours. In prior research, environmental frame was used to present environmental costs in biophysical units, while economic frames presented the environmental costs in monetary units (Bolderdijk et al. 2013; Spence et al. 2014; Kang and Hong, 2021). In a study with energy display simulation showing participants' own energy use, Spence et al (2014) found that environmental frame, showing energy use in CO2 was more effective in enhancing individual intentions to engage in environmental behavior compared to energy use shown in economic frame. The researchers also found that when energy feedback was provided in pounds and pence (i.e., economic frame), individuals felt justified in consuming more energy because the financial savings from energy reduction was too minimal, and thus not worth the behavioural efforts. In contrast, Kang and Hong (2021) found that the economic frames, presenting the environmental value in Korean won, were more effective in influencing behaviour compared to environmental frames presenting environmental damages in litres of water, km^2, and CO2. Furthermore, it was researched that the economic frame was more effective in helping individuals understand the harm caused by climate change, compared to environmental frames. The context of the two studies were different, which may have impacted in different conclusions. However, the studies hypothesized the results using the same reasoning, mentioning that cost (expressed in monetary units) enables us to recognize the loss of benefits inherent in environmental issues, and can also ease people's understanding of relevant concepts because it usually is the first thing to come to people's minds when they contemplate energy-related concerns (Spence et al, 2014; Kang and Hong, 2021). Information quality will be used to measure the quality of the information conveyed in the environmental and economic frame on the system. Information quality refers to the information system's outputs perceived by users of the system. Information quality can be described in terms of outputs that are useful to decision-making, hence satisfying users'

information requirements (Gorla et al., 2010). It has been demonstrated that when examining overall IS success, information quality was identified as a key construct (Petter et al., 2008; Alzahrani et al., 2017). Following McKinney et al. (2002), the quality of information is measured in terms of understandability, reliability, and usefulness.

Based on the studies on economic and environmental framing, we hypothesize CO2e emissions presented in economic frame (carbon tax of CO2e emissions in euros) will be perceived to have higher information quality than emissions presented in environmental frame (CO2e emissions shown in kilograms). Hence, we propose:

H2: Economic frame (carbon tax of CO2e emissions in euros) will be associated with more positive perceptions of information quality than an environmental frame (CO2e emissions shown in kilograms)

More specifically,

H2a: Economic frame (carbon tax of CO2e emissions in euros) will be associated with more positive perceptions of information understandability than an environmental frame (CO2e emissions shown in kilograms)

H2b: Economic frame (carbon tax of CO2e emissions in euros) will be associated with more positive perceptions of information reliability than an environmental frame (CO2e emissions shown in kilograms)

H2c: Economic frame (carbon tax of CO2e emissions in euros) will be associated with more positive perceptions of information usefulness than an environmental frame (CO2e emissions shown in kilograms)

3.2 Environmental Decision-Making

Research on the diffusion of responsibility was found to influence pro-social behaviours in computer mediated settings. A meta-analysis on diffusion of responsibility has shown that the phenomenon can be fostered through the existence of not only physical, but also virtual and perceived bystanders (Fischer et al., 2011; Martin & North, 2015). Virtual and

perceived bystanders were found to endorse pro-social behaviours through e-mails or social media when asked for help (Barron & Yechiam, n.d.; Markey, 2000; Martin & North, 2015). Therefore, we hypothesize that decreased diffusion of responsibility in the CO2e emissions will increase decision-makers to make environmentally conscious decisions.

Performing environmental behaviours in logistics tasks is thought to be complex, having to consider the trade-offs between the financial cost of performing environmental behaviour and environmental benefits. According to Roehrich et al. (2014), making balanced decisions between financial cost of performing environmental behaviours and environmental benefits (i.e., organizational reputation) was one of managers' primary concerns when implementing environmental supply chain. For this reason, decision orientation was introduced to measure the level of decision-maker's engagement between environmentally conscious decision orientation (i.e., carbon footprint minimizing decision) and financially conscious decision orientation (i.e., company valuation maximizing decision) when performing logistics tasks. Hence, we propose:

H3: Diffusion of responsibility will affect decision orientation

More specifically,

H3a: Reducing financial diffusion of responsibility (i.e., increasing the responsibility felt for financial outcome) will result in a less environmentally conscious decision orientation (company valuation maximizing decision)

H3b: Reducing environmental diffusion of responsibility (i.e., increasing the responsibility felt for environmental outcome) will result in a more environmentally conscious decision orientation (carbon footprint minimizing decision).

Bounded rationality is the term that concerns the decision-maker's constraints in available information and computing capacity during decision-making (Simon, 2009). Under bounded rationality, decision-makers are more prone to making sub-optimal decisions because they are unwilling or unable to make optimal decision due to constraints (Autry & Golicic, 2010). Bounded rationality is researched to be propelled in environments

where there is insufficient information (Pagell et al., 2010). Keller and Staelin (1987) explored the effects of information quality and quantity on the user's ability to make decisions. Results showed that information quality or "information's inherent usefulness" was found to foster decision effectiveness or accurate assessment of the alternatives. Thus, we hypothesize that the environmental information that is presented in greater understandability, reliability and usefulness will aid the decision-making process in users, leading users to engage more in environmentally conscious decision orientation (i.e., Carbon Footprint Minimizing Decision), as follows:

H4: Increasing information quality will lead to more environmentally conscious decision orientation (carbon footprint minimizing decision)

More specifically,

H4a: Increasing information understandability will lead to more environmentally conscious decision orientation (carbon footprint minimizing decision)

H4b: Increasing information reliability will lead to more environmentally conscious decision orientation (carbon footprint minimizing decision)

H4c: Increasing information usefulness will lead to more environmentally conscious decision orientation (carbon footprint minimizing decision)

Research in D&M's IS success model suggest a strong relationship between information quality and user satisfaction, where increased information quality (measured in understandability, reliability, usefulness) increases user satisfaction (Almutairi & Subramanian, 2005; Bharati & Chaudhury, 2004; Halawi et al., 2008; McGill et al., 2003; Petter et al., 2008; Rai et al., 2002; Seddon & Kiew, 1996). These empirical studies validated the relationship between information quality and user satisfaction, measuring user satisfaction by asking the users if the system was able to meet their expectations in providing quality information (Zviran & Erlich, 2003). In this study we measure user satisfaction following the view of Garrity and Sanders (1998), who recognized that computer-based systems were used by those in the managerial and leadership roles to obtain information for decision-making and problem-solving activities. With this

recognition, Garrity and Sanders (1998) developed "decision-making satisfaction" to assess a system's capacity to assist individuals in “recognizing problems, structuring problems, and/or making decisions related to the goal of controlling a business process”. This measurement of decision satisfaction is also in line with the foundational decision-making model defined and developed by Simon (1979). The researcher incorporated additional steps after the decision-maker has made a choice, where the decision-maker evaluates how successfully the procedure was carried out using the feedback from the results. It is believed that the review or analysis of the past process can serve as the foundation for decision-making in the future (Caneiro et al., 2019). Therefore, measuring user satisfaction in terms of decision satisfaction will best represent the user’s satisfaction in making environmental or economic decisions on an information system. In this view, this research hypothesizes that increasing the quality (i.e., understandability, reliability, usefulness) of CO2e emissions information presented on the information system can increase the user’s level of decision satisfaction. Hence, we propose:

H5: Information quality will positively affect decision satisfaction

More specifically,

H5a: Information understandability will positively affect decision satisfaction

H5b: Information reliability will positively affect decision satisfaction

H5c: Information usefulness will positively affect decision satisfaction

3.3 Moderators of Environmental Decision-Making

Prior research show that willingness to act against climate change is strongly correlated with personal attitudes and perception of climate change (Maheswaran & Meyers-Levy, 1990; Spence et al., 2011, 2012; van de Velde et al., 2010). The studies highlighted that personal characteristics such as perceived importance, attitudes and perceptions of climate change can influence the pro-social behaviours after encountering environmental messages. Researchers have measured prior perceptions of climate change by measuring concern. Concern refers to ‘‘the belief that an issue is important and in need of address’’

(Obermiller, 1995; van de Velde et al., 2010). Following this definition, studies highlighted that these personal perceptions could influence pro-social behaviours. For example, Spence et al. (2011) found that those who were more concerned about climate change were more prepared to make more prepared to reduce energy use. While Spence et al. (2011) found their results using concern for climate change and perceived instrumentality as variable mediating between flood experience and preparedness to act, this research argues that the environmental messaging (i.e., CO2e information) will affect mediators such as diffusion of responsibility and information quality, subsequently influencing environmental actions. Therefore, this research will incorporate the individual perceptions of climate change as moderating variable and hypothesize that individual perceptions of climate change will moderate relationship between environmental messaging and environmental decision-making. Hence, we propose:

H6: Concern for climate change will moderate the relationship between diffusion of responsibility and environmentally conscious decision orientation

More specifically,

H6a: Concern for climate change will positively moderate the relationship between financial diffusion of responsibility and environmentally conscious decision orientation; such that as concern for climate change increases, the effect of financial diffusion of responsibility on environmentally conscious decision orientation increases

H6b: Concern for climate change will positively moderate the relationship between environmental diffusion of responsibility and environmentally conscious decision orientation; such that as concern for climate change increases, the effect of environmental diffusion of responsibility on environmentally conscious decision orientation increases

H7: Concern for climate change will positively moderate the relationship between information quality and environmentally conscious decision orientation

More specifically,

H7a: Concern for climate change will positively moderate the relationship between information understandability and environmentally conscious decision orientation; such that as concern for climate change increases, the effect of information understandability on environmentally conscious decision orientation increases.

H7b: Concern for climate change will positively moderate the relationship between information reliability and environmentally conscious decision orientation; such that as concern for climate change increases, the effect of information reliability on environmentally conscious decision orientation increases.

H7c: Concern for climate change will positively moderate the relationship between information usefulness and environmentally conscious decision orientation; such that as concern for climate change increases, the effect of information usefulness on environmentally conscious decision orientation increases.

H8: Concern for climate change will positively moderate the relationship between information quality and decision satisfaction

More specifically,

H8a: Concern for climate change will positively moderate the relationship between information understandability and decision satisfaction; such that as concern for climate change increases, the relationship between information understandability and decision satisfaction increases.

H8b: Concern for climate change will positively moderate the relationship between information reliability and decision satisfaction; such that as concern for climate change increases, the relationship between information reliability and decision satisfaction increases.

H8c: Concern for climate change will positively moderate the relationship between information usefulness and decision satisfaction; such that as concern for climate change increases, the relationship between information usefulness and decision satisfaction increases.

In addition to the level of concern, Spence et al. (2011) also confirmed that those who believed that they could impact climate change, or had higher perceived instrumentality, were more prepared to involve in sustainable behaviours. The belief that one's action can help to solve problems was found to be a necessary condition to nudge pro-social behaviours (Van de Velde et al., 2010; Obermiller, 1995). Following existing research, a meta-analysis of 106 studies suggests that self-efficacy, which measures one's belief in self that they are capable of taking relevant action, was strongly associated with climate change adaptive behaviours (van Valkengoed & Steg, 2019). It was also found that people were more likely to take action if they think their actions will help bring about a favourable outcome (Van de Velde et al., 2010). Self-efficacy was also studied in different terms in environmental communication studies as perceived consumer effectiveness and perceived instrumentality (Spence et al., 2011; Obermiller, 1995). In the context of our study, self-efficacy will be referred to as perceived instrumentality, measuring "the belief that one's actions can contribute to the solution" (van Valkengoed and Steg, 2019; Obermiller, 1995). Thus, it is hypothesized that perceived instrumentality will influence the relationship between the environmental messaging and environmental decision-making. Hence, we propose:

H9: Perceived instrumentality will positively moderate the relationship between diffusion of responsibility and decision orientation

More specifically,

H9a: Perceived instrumentality will positively moderate the relationship between financial diffusion of responsibility and environmental decision orientation; such that as perceived instrumentality increases, the effect of financial diffusion of responsibility on environmentally conscious decision orientation increases.

H9b: Perceived instrumentality will positively moderate the relationship between environmental diffusion of responsibility and environmental decision orientation; such that as perceived instrumentality increases, the effect of environmental diffusion of responsibility on environmentally conscious decision orientation increases.

H10: Perceived instrumentality will positively moderate the relationship between information quality and decision orientation

More specifically,

H10a: Perceived instrumentality will positively moderate the relationship between information understandability and decision orientation; such that as perceived instrumentality increases, the effect of information understandability on environmentally conscious decision orientation increases.

H10b: Perceived instrumentality will positively moderate the relationship between information reliability and decision orientation; such that as perceived instrumentality increases, the effect of information reliability on environmentally conscious decision orientation increases.

H10c: Perceived instrumentality will positively moderate the relationship between information usefulness and decision orientation; such that as perceived instrumentality increases, the effect of information usefulness on environmentally conscious decision orientation increases.

3.4 Outcomes of Environmental Decision-making

In traditional economic terms, it is considered rational for a business to put its best interest to maximize revenue. However, customers are increasingly demanding ethical behaviors in companies, and expect companies to behave ethically throughout the supply chain (Klassen & Vereecke, 2012; Walker & Brammer, 2009). Failing to comply to the changing customer demands can risk the organization's publicity and reputation, further influencing its financial performance (Phippips & Caldwell, 2005; Walker & Jones, 2012). However, implementing sustainable Supply Chain Management (SCM) requires extensive commitment and funds, making implementation difficult (Linton et al., 2007; Wu and Pagell, 2009; Roerich et al., 2014). Research investigating the impacts of environmental decision-making on organizations has conflicting findings. Numerous studies have discovered that businesses' environmental practices and financial performance are positively related (Wu and Pagell, 2011). Russo & Fouts (1997)

discovered that improvement in environmental performance improved company performance. Additionally, Melnyk et al. (2003) surveyed experts within United States and found having an ISO 14000 certified environmental management systems (EMS) improved operational performance in terms of costs and lead time reduction. Similarly, in their study investigating small and large firms in Taiwan and United States, Pagell et al. (2004) found strong support that environmental management systems in the supply chain are positively related to plant performance measured as costs, emissions, and lead time. Thus, we propose those who engaged in less environmentally conscious business orientation will increase financial performance, while those who engaged more in environmentally conscious business decisions will increase environmental performance. In the same vein, we hypothesize that the degree of engagement in environmentally conscious decision orientation will also be reflected in the measurement of decision-maker's subjective performance, defined as confidence in performance. Thus, we propose that those who choose to engage less in environmentally conscious decision orientation and engage more in financially conscious decision orientation (company valuation maximizing decision), will have higher financial performance and confidence in financial performance. Likewise, those who choose to engage more in environmentally conscious decision orientation (carbon footprint minimizing decision) will have higher environmental performance and confidence in environmental performance.

H11: Decision orientation will affect actual performance

More specifically,

H11a: Engaging in financially conscious decision orientation (company valuation maximizing decision) will lead to greater financial performance (sales) than engaging in environmentally conscious decision orientation

H11b: Engaging in financially conscious decision orientation (company valuation maximizing decision) will lead to greater financial performance (company valuation) than engaging in environmentally conscious decision orientation

H11c: Engaging in environmentally conscious decision orientation (carbon footprint minimizing decision) will lead to greater environmental performance than engaging in financially conscious decision orientation

H12: Decision orientation will affect confidence in performance

More Specifically,

H12a: Engaging in financially conscious decision orientation (company valuation maximizing decision) will lead to greater confidence in financial performance than engaging in environmentally conscious decision orientation

H12b: Engaging in environmentally conscious decision orientation (carbon footprint minimizing decision) will lead to greater confidence in environmental performance than engaging in financially conscious decision orientation

Decision-making is “the ability to anticipate situations and predict what will happen that allows humans to make better decisions and improve their decision-making abilities” (Carneiro et al., 2019). In an analysis of decision science literature, Higgins, (2000) suggest that a decision is related to value or worth, and it is highly psychological whereby individuals choose a decision for higher outcome utility or benefits compared to other alternative decisions. These benefits, he mentions, includes social benefits that arise from being "politically correct" or ingratiating, concluding that individuals will choose a decision that provides more utility in the outcome. Thus, Higgins propose that individuals are likely to anticipate certain outcomes at the time of making the decision. Referring to Higgins (2000), Carneiro et al. (2019) argued that asking about the satisfaction of decision after the decision-making process can indicate the outcomes or consequences of the decision. Carneiro et al. (2019) found that measuring the satisfaction with the decision reflects the process of decision-making, hence reflecting the outcomes of a decision. Hence, we propose that the users with high satisfaction in their decision will have higher financial and environmental performance, as well as confidence in anticipated performance:

H13: Decision satisfaction will positively affect actual performance

More specifically,

H13a: Decision satisfaction will positively affect financial performance (sales)

H13b: Decision satisfaction will positively affect financial performance (company valuation)

H13c: Decision satisfaction will positively affect environmental performance

H14: Decision satisfaction will positively affect confidence in performance

More specifically,

H14a: Decision satisfaction will positively affect confidence in financial performance

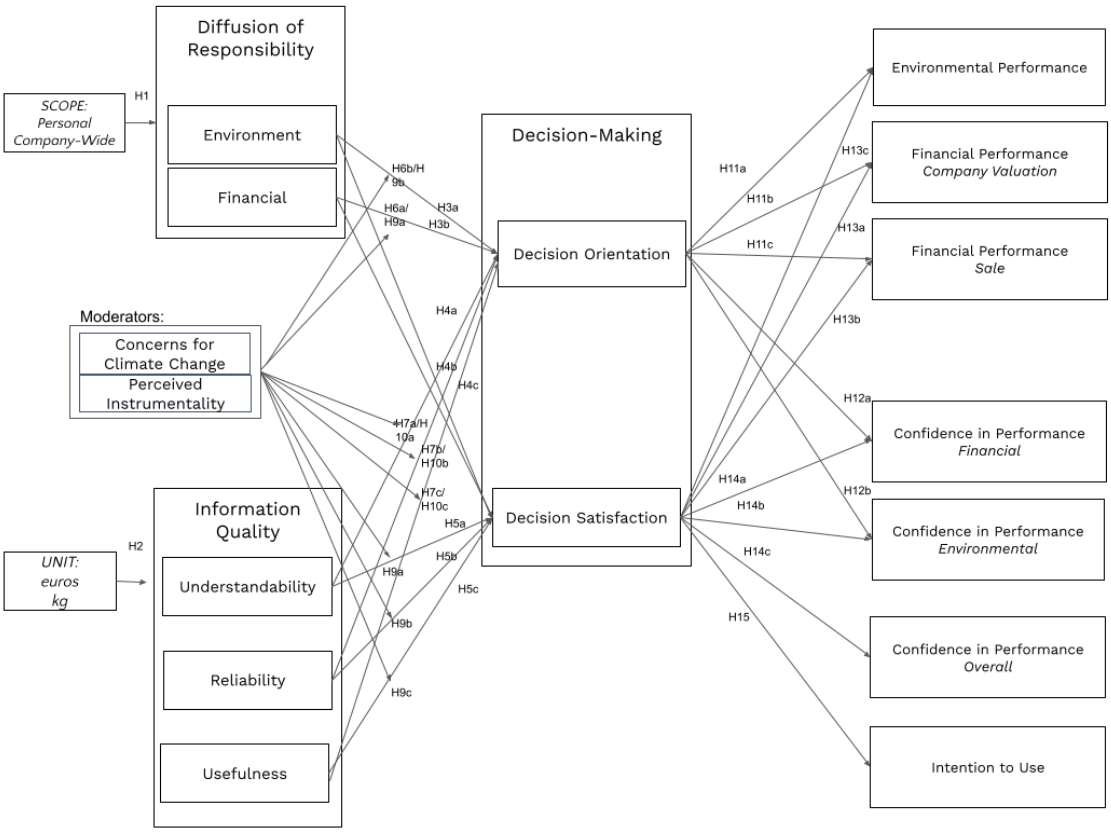
H14b: Decision satisfaction will positively affect confidence in environmental performance

H14c: Decision satisfaction will positively affect confidence in overall performance

In prior IS Success research, user satisfaction was found to be strongly related to intention to use (Bharati & Chaudhury, 2004; Halawi et al., 2008; McGill et al., 2003; Petter et al., 2008). Intention to use is considered as an individual level construct, which is used as a metric to measure personal impacts of technology acceptance (Petter et al., 2008). As mentioned previously, this study extends prior research in technology acceptance model, and measures user satisfaction as decision satisfaction. The decision satisfaction measures user satisfaction with the decision they made on an IS. Thus, we hypothesize that individuals who are satisfied with the decision will have higher intention to use:

H15: Decision satisfaction will positively affect Intention to Use

Figure 3. Proposed Research Model



Chapter 4: Materials & Methods

This experiment was built on previous work by Öz et al. (2020) and Tran-Nguyen et al. (2021) using ERPsim simulation software (ERPsim Lab, Montréal, Canada). ERPsim (Léger et al., 2007) is a simulation software that recreates realistic business scenarios where users can make business decisions to manage the operations of organizations on an SAP ERP system (SAP, Waldorff, Germany). The ERPsim simulation software has been previously used to research decision-making processes (Karran et al., 2019; Öz et al., 2020).

4.1 Experimental Design

A 2x2 between-subject experimental study was conducted to test the hypotheses. The experiment factor and carbon footprint emissions information were manipulated in both scope (Individual: CO2e emissions from individual employee's logistics decisions; Company-wide: CO2e emissions from the company's operations at large) and unit (Environmental: kilograms of CO2e emissions; Economic: euros of CO2e emissions).

4.2 Sample Methods

Participants with previous experience in ERPsim (ERPsim Lab, Montréal, Canada) or SAP system (SAP, Waldorff, Germany) were recruited for this study. A combination of convenience and snowball sampling methods were used. Participants who were previously registered on the email list for studies at the HEC Montréal (HEC Panel) were contacted by bulk email to participate. In addition to this sampling method, students and professors from Canadian universities that use ERPsim in their curriculum were contacted and the students and professors were asked to introduce this study and recommend others. All participants were screened during registration. The screening question asked participants about their previous experience interacting with ERPsim or SAP systems. Only participants with previous experience with ERPsim or SAP systems were qualified to participate in this study. A total of 48 participants were recruited. However, responses from 8 participants were eliminated due to changes in the experimental protocol. An

Interac transfer of $30 CAD was extended to each participant after their participation. This study was approved by HEC Montréal Research Ethics Board (REB) (Project Number: 2021-3926).

4.3 Procedure

The research was conducted virtually on Lookback.io (Lookback Inc, United States), a platform for real-time user testing. To participate, participants were required to have access to a computer, a microphone, and Internet connections above 5 Mbps. All participants signed a consent form on the Qualtrics platform, and verbal consent was also collected before participating in the experiment. Participants answered a pre-test questionnaire to provide their demographic information such as age, sex, and level of experience with the ERP system. Participants also answered questions regarding their level of concern for climate change and perceived instrumentality. Participants received a 10-minute video training and a five-minute technical training on the ERPsim platform.

Participants played three rounds of the sustainability game. After each round, participants completed self-reported questionnaires on the Qualtrics platform. Then, the participants were invited back to the ERPsim interface and were asked to refresh the company valuation, carbon footprint, and sales SAP tiles to reveal the impacts of their logistics decisions. After completing all three rounds, participants were asked to complete post-test questionnaire, and a semi-structured interview.

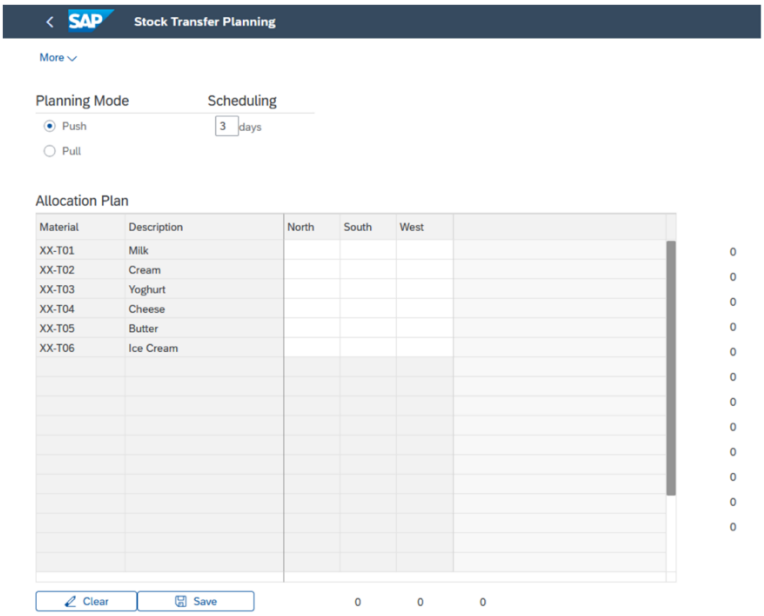
4.4 Experimental Stimuli

The experimental tasks were adapted from Öz et al. (2020) to allow participants to perform tasks on the ERPsim Sustainability Logistics game (Léger, 2006; Léger et al., 2007).

The participants were instructed to decide how much product to distribute from the main warehouse to three regional warehouses in different regions (stock transfers). To do so, participants reviewed inventory, sales, and carbon footprint emissions reports created by previous regional transfers.

In this experiment, a carbon tax was imposed at 0.05 euros per 1 kilogram of emitted CO2e. This carbon tax was applied when the participants exceeded the maximum warehousing capacity in the main and regional warehouses, and when the stock was transferred from the main warehouse to regional warehouses. Thus, the participants were instructed to make balanced decisions between maximizing organizational performance and minimizing environmental impact when planning the stock transfers. The participants played three rounds, each lasting approximately 10 minutes per round. Figure 4 shows the SAP interface presented to the participants to plan their stock transfers.

Figure 4. SAP Interface for Planning Stock Transfer



On the SAP interface, the CO2e emissions information was presented in varying scopes of emissions at either the individual level (CO2e emissions from individual employee's decisions) or company-wide level (CO2e emissions from company's operations). The CO2e emission information was presented in kilograms or euros. Participants were randomly selected to interact with one condition of CO2e emissions information throughout the simulation. Figure 5 shows the SAP interface presented to the participants in different conditions.

Figure 5. SAP interface with varying CO2e information

Figure 5a. SAP interface with CO2e Information in kilograms, reflecting personal emission

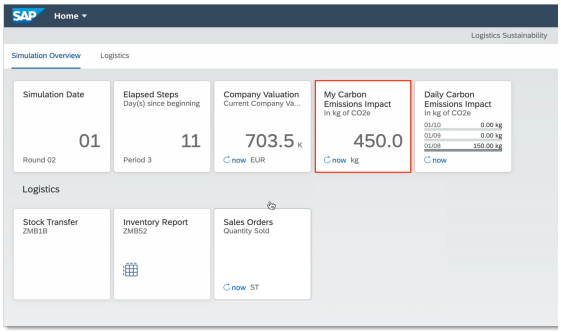


Figure 5b. SAP Interface with CO2e information in euros, reflecting personal emission

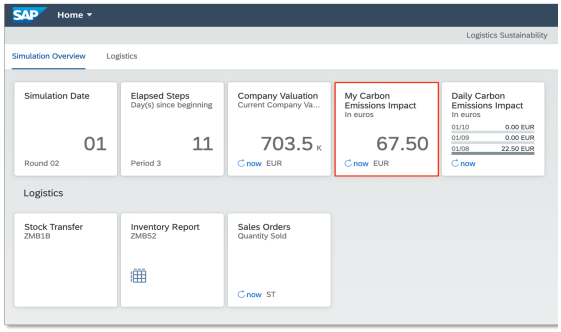


Figure 5c. SAP Interface with CO2e information in kilograms, reflecting company emissions

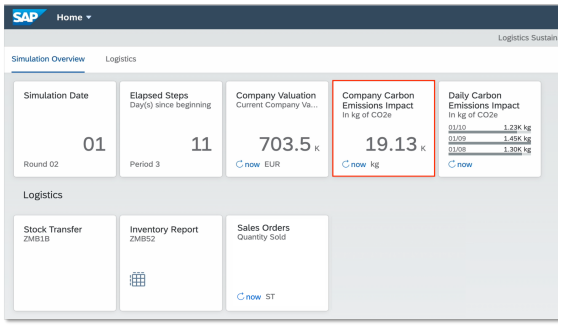
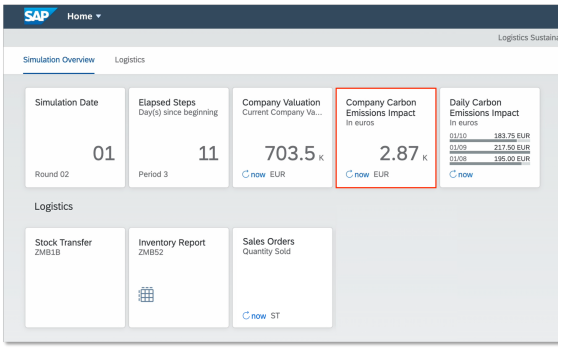
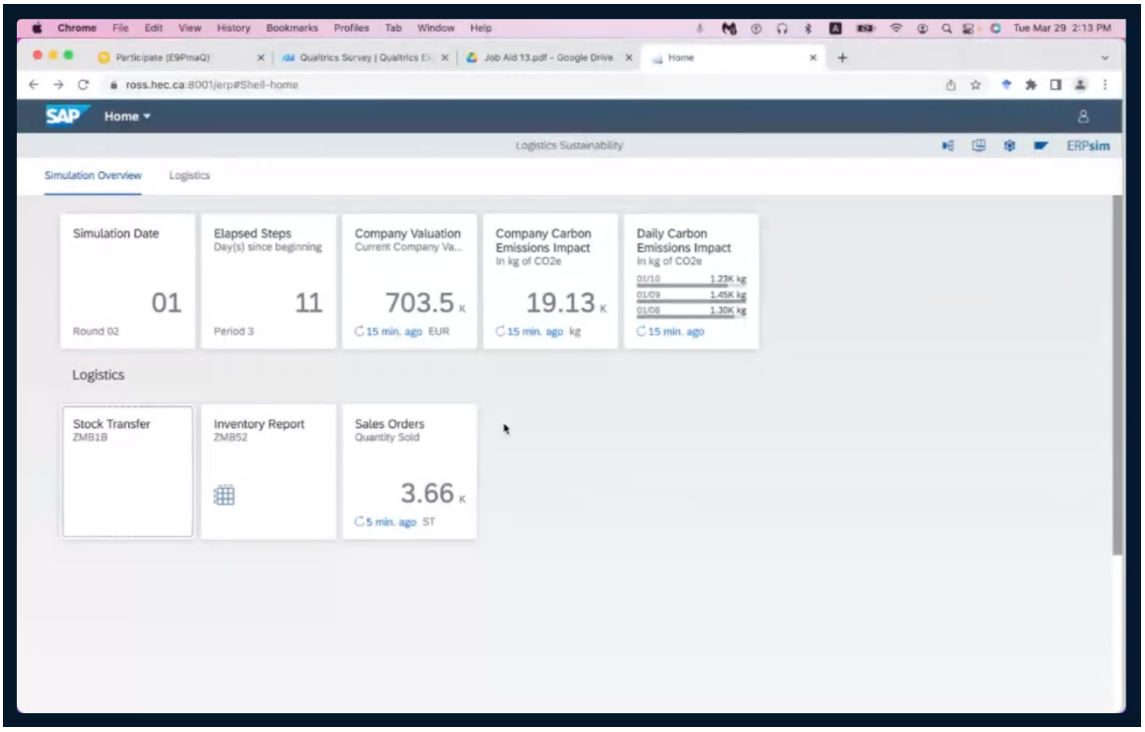


Figure 5d. SAP Interface with CO2e information in euros, reflecting company emissions



A job aid, containing all the information in the video training, was opened on a second browser tab and was available for consultation throughout the experiment. The job aid can be found in the Appendix: Job Aid.

Figure 6. Participant Browser



4.5 Operationalization of the Variables

The measures were adapted from prior literature. Constructs such as diffusion of responsibility (DIFF, DIFE), Decision Satisfaction (SAT), Perceived Instrumentality (PINS), and Intention to Use (INT) were measured by a 7-point Likert scale (i.e., strongly disagree – strongly agree). Constructs such as Information Quality (IQU, IQR, IQUSE), Concern about Climate Change (CONC), Decision Orientation (PERO), and Confidence in Performance (CONFIN, CONENV, CONO) were measured by a 7-point Semantic Differential scale (e.g., very poor – very good). The definitions of each scale and its sources is described in the list below. The detailed items and response options can be found in the Appendix: Survey Instrument.

Scopes (SCOPE) were coded as binary variables for the conditions that presented carbon footprint emissions information corresponding to individual employee's decisions (individual frame) or emissions of the company's operations at large (company-wide frame)

Units (UNIT) were coded as binary variables for the conditions that presented carbon footprint emissions information in kilograms of CO2e emissions (environmental frame) or euros CO2e emissions (economic frame).

Diffusion of Responsibility (DIFF, DIFE) measured participants' level of responsibility and contribution to the two task-related objectives (i.e., company valuation maximization – carbon footprint minimizatio n). Financial diffusion of responsibility (DIFF) measured the level of responsibility and contribution participants felt to maximize company valuation, while environmental diffusion of responsibility (DIFE) measured the level of responsibility and contribution felt to minimize carbon footprint. This scale was adapted from Alnuaimi et al. (2010).

Information Quality (IQU, IQR, IQUSE) measured the quality of the information provided by the ERP dashboard. This measure adapted scales form McKinney et al. (2002) to measure the interface's performance in providing information that is understandable (IQU), reliable (IQR), and useful (IQUSE).

Concern for Climate Change (CONC) measured general concerns, concerns about related personal impacts of climate change, and concerns about related societal impacts (Spence et al., 2012).

Perceived Instrumentality (PINS) measured participants' belief on the ability to influence climate change as a logistics manager. The scale was adapted from Spence et al. (2011)

Decision Orientation (PERO) measured participants' relative position between two task-related goals (i.e., company valuation maximization – carbon footprint minimization). This scale was inspired by (Li et al., 2010) to ask participants about the objective of their decisions when performing the logistics tasks.

Decision Satisfaction (SAT) measured the satisfaction in a participant's chosen decision orientation (relative position between two goals). This scale was adapted from the decision attitude scale by Sainfort & Booske (2016) to measure the level of satisfaction regarding choice.

Financial Performance (PERF, SALE) measured in-game sales and company valuation that was generated after 3 rounds of the logistics game. The sales and company valuation information were shown on the ERP interface along with carbon footprint emissions information before participants started making their decisions in each round. These were also the metrics used by participants to gauge the quality of their performance to measure confidence. Therefore, this study considers sales and company valuation as valid measures for financial performance. The variables were measured in euros and were extracted from the simulator which logged the sales and company valuation after each round.

Environmental Performance (PERE) measured in-game carbon footprint emissions that was generated at the company level after 3 rounds of the logistics game. The company level carbon footprint emissions were logged in the simulation in euros at the rate of 0.15 euros per 1 kilogram of CO2e.

Confidence in Performance (CONFIN, CONENV, CONO) measured participants' confidence in the quality of his or her performance. The scale was adapted from Balijepally et al. (2009) to measure confidence in financial performance (CONFIN), environmental performance (CONENV), and overall performance (CONO).

Behavioral Intention to Use (INT) measured the intended utilization of the interface by participants. The scale was adapted from Alzahrani et al. (2019)

4.6 Analysis

Stata 14.2 (StataCorp, Texas, USA) was used to run linear regression analyses to analyze the proposed conceptual model. Following previous studies by Öz et al. (2020) and Tran-Nguyen et al. (2021), the regression was run with data from all three rounds. The linear regression model was employed to control for non-independent observations because the measures were repeated in three consecutive rounds. The regression model first evaluated the direct effects of carbon footprint emissions information on diffusion of responsibility and information quality. Secondly, the regression model evaluated the effects of diffusion of responsibility and information quality on decision orientation. Finally, the regression

model identified the effects of decision orientation on financial and environmental performance and user confidence in financial and environmental performance. The interaction effects of concern for climate change on the direct relationships of diffusion of responsibility and information quality on decision orientation were also evaluated.

Chapter 5: Data Analysis

The valid sample (n=40) consisted of 52.5% males (n = 21) and 47.5% female (n = 19). The mean age of the participants 26.575 (median = 26, SD = 5.782), ranging from ages 19 to 45. Most of the participants (n=30) were enrolled in an academic program at the time of the experiment. 72.5% of the participants had completed a bachelor's degree (n =17) or higher (n=12). All participants had previous experience in Enterprise Resource Planning systems (such as SAP), where 82.5% of these participants had previous experience with ERPsim (n=33). Participants' demographic profiles can be found in Table 2: Demographics.

Table 2. Demographics (n=40)

	n	**%**
Sex		
Male	21	52.5%
Female	19	47.5%
Age		
19-25	18	45.0%
26-35	19	47.5%
36-45	3	7.5%
Highest Level of Education		
High School Diploma	6	15.0%
CEGEP	5	12.5%
Bachelor's Degree	17	42.5%
Master's Degree	11	27.5%
Doctorate Degree	1	2.5%

Table 2. Demographics (n=40) (Continued)

	n	%
Enrollment in Academic Program		
Yes	30	75.0%
No	10	25.0%
Nationality		
Canadian	13	32.5%
French	10	25.0%
Other	17	42.5%
Place of Residence		
Canada	36	90.0%
France	1	2.5%
Other	3	7.5%
Previous ERP Experience		
Yes	40	100.0%
No	0	0.0%
Previous ERPsim Experience		
Yes	33	82.5%
No	7	17.5%

5.1 Descriptive Statistics

Descriptive statistics for each variable are shown in Table 3: Descriptive Statistics. The skewness for all constructs was within the acceptable range for normal univariate distribution, -1.5 to +1.5. The kurtosis for all constructs except for Perceived Instrumentality (PINS) were between 1.5 to 4.5, after adjusting the values with Stata data

software (StataCorp, Texas, USA). A correlation matrix can be found in Appendix: Correlation Matrix.

Table 3. Descriptive Statistics

	Mean	**Std. Dev.**	**Skewness**	**Kurtosis**
SCOPE *	0.500	0.502	-	-
UNIT *	0.500	0.502	-	-
Personal x kg *	0.250	0.435	-	-
Personal x euro *	0.250	0.435	-	-
Company x kg *	0.250	0.435	-	-
Company x euro *	0.250	0.435	-	-
DIFE	4.000	1.137	0.250	2.079
DIFF	3.679	0.951	0.363	2.423
IQU	4.761	1.191	-0.375	2.777
IQR	4.815	1.187	-0.181	2.700
IQUSE	4.347	1.371	-0.186	2.405
CONC	5.800	0.819	-0.498	2.953
PERO	3.671	1.191	-0.128	2.536
SAT	4.831	0.901	-0.338	2.473
PERE	9717.656	4209.692	0.541	2.284
PERF	534587.400	356395.800	-1.118	3.776
SALE	502839.800	174308.000	0.181	2.281
PINS	5.504	0.892	-1.197	6.164
CONENV	3.892	1.395	0.035	2.120
CONFIN	4.042	1.148	-0.211	2.316
CONO	4.083	1.110	-0.382	2.810
ITN	4.769	1.351	-0.290	2.120

* Binary variables

IBM SPSS Statistics program, version 28.01.1 (IBM Corp., 2021) was used to calculate Cronbach's alpha values in each round. The reliability of the constructs in each of the three rounds is represented by Cronbach's alpha values. As seen in Table 4: Cronbach's Alpha, all constructs in round 3 had values exceeding the threshold values of 0.70 (Nunnally, 1978). However, some constructs did not have Cronbach's alpha values above 0.70 in rounds 1 and 2. For example, financial diffusion of responsibility had Cronbach's alpha values below 0.70 but above 0.60 in rounds 1 and 2. Perceived instrumentality had a Cronbach's alpha of 0.489 in round 1, but recovered to satisfactory values above 0.80 in rounds 2 and 3. Decision orientation also had values below 0.70 but above 0.60 in round 1, and also received to satisfactory values above 0.80 in rounds 2 and 3. The Cronbach's alphas between 0.60 and 0.70 are considered satisfactory value (Hair et al., 2010).

Table 4. Cronbach's Alpha

Construct	Dimensions	R1	R2	R3
Diffusion of Responsibility	Environment	0.765	0.818	0.874
	Financial	0.618[+]	0.686[+]	0.792
Information Quality	Understandability	0.824	0.808	0.807
	Reliability	0.897	0.851	0.929
	Usefulness	0.926	0.930	0.935
Information Usability		0.823	0.813	0.915
Concern Toward Climate		0.778		
Decision Orientation	Decision Orientation	0.489[+]	0.844	0.899
	Decision Satisfaction	0.838	0.873	0.819

[+] Cronbach's Alpha (CA) < 0.7

Table 4. Cronbach's Alpha (Continued)

Construct	Dimensions	R1	R2	R3
Perceived Instrumentality		0.671[+]	0.933	0.866
Confidence in Performance	Financial	0.777	0.856	0.845
	Environmental	0.877	0.909	0.904
	Overall	0.890	0.900	0.910
Intention to Use				0.927

[+] Cronbach's Alpha (CA) < 0.7

5.2 Regression Model

The research model is partially based on DeLone and McLean's IS Success model (1992) which studies the impacts of information quality on individual employees (ERP users) and organizations. This research also incorporates the existing theory of diffusion of responsibility by Darley and Latané (1968) in the D&M's IS success model (1992).

The following hypotheses were developed to test the effects of framing carbon footprint emissions information on diffusion of responsibility and information quality, hence nudging environmental decision-making:

Hypotheses 1 predicted individual frame (framing CO2e emissions to relate to one's business decision) to be associated with lower diffusion of responsibility than company-wide frame (framing CO2e emissions around the organization). Framing CO2e information in different scopes had a non-significant positive effect on financial diffusion of responsibility ($\beta = 0.142$, $t = 0.560$, $p = 0.289$). The R^2 of the model was 0.006 (F-statistic = 0.314, $p = 0.578$). Thus, H1a was not supported. This type of framing also had a non-significant negative effect on environmental diffusion of responsibility ($\beta = -0.017$,

t = 0.050, p = 0.480). The R^2 of the model was 0.000 (F-statistic = 0.003, p = 0.960). Thus, H1b was not supported. Therefore, H1 was not supported.

Hypotheses 2 predicted economic frame (CO2e emissions shown in euros) to be associated with more positive perceptions of information quality than an environmental frame (CO2e emissions shown in kilograms). Framing carbon footprint emissions information in different units had a non-significant positive effect on information understandability (β = 0.022, t = 0.066, p = 0.474). The R^2 of the model was 0.000 (F-statistic = 0.004, p = 0.948). Thus, H2a was not supported. The units of emissions had a non-significant positive effect on information reliability (β = 0.246, t = 0.720, p = 0.238), where R^2 was 0.011 (F-statistic = 0.518, p = 0.476). Thus, H2b was not supported. The units of emissions also had a non-significant positive effect on information usefulness (β = 0.128, t = 0.337, p = 0.369). The R^2 of the model was 0.002 (F-statistic = 0.113, p = 0.738). Thus, H2c was not supported. Therefore, H2 was not supported.

The following hypotheses were developed to test the effects of communicating in carbon footprint emissions (measured in CO2e) on users' business decisions:

Hypotheses 3 predicted diffusion of responsibility to affect decision orientation. H3a predicted reducing financial diffusion of responsibility (i.e., more responsibility felt for financial outcome) will lead to more financially conscious decision orientation (company valuation maximizing decision). Financial diffusion of responsibility had a non-significant positive effect on decision orientation (β = 0.082, t = 0.691, p = 0.247). The R^2 of the model was 0.004 (F-statistic = 0.477, p = 0.494). Therefore, H3a was not supported. H3b predicted decreasing environmental diffusion of responsibility (i.e., more responsibility felt for environmental outcome) will lead to more environmentally conscious decision orientation (i.e., Carbon Footprint Minimizing Decision). Environmental diffusion of responsibility does not have a significant direct effect on decision orientation (β = -0.098, t = -1.094, p = 0.140). The R^2 of the model was 0.009 (F-statistic = 1.198, p = 0.280). Therefore, H3b was not supported. Therefore, H3 was not supported.

Hypotheses 4 predicted increasing information quality to lead users to engage more in environmentally conscious decision orientation (carbon footprint minimizing decision). Information understandability (IQU) had a significant negative effect on decision orientation (β = -0.176, t = -2.073, p = 0.022). The R^2 of the model was 0.031 (F-statistic = 4.298, p = 0.045). The results indicate that increasing the understandability of the carbon footprint information led users to believe that they engaged more in company valuation maximizing decisions as opposed to carbon footprint minimizing decisions. Thus, H4a was not supported. Information reliability (IQR) had a non-significant negative direct effect on decision orientation (β = -0.087, t = -0.916, p = 0.183). The R^2 of the model was 0.008 (F-statistic = 0.840, p = 0.365). Thus, H4b was not supported. Information usefulness (IQUSE) also had a non-significant negative effect on decision orientation (β = -0.017, t = -0.201, p = 0.421). The R^2 of the model was 0.000 (F-statistic = 0.040, p = 0.842). Thus, H4c was not supported. Therefore, H4 was not supported.

The following hypotheses were developed to test the effects of communicating in carbon footprint emissions (measured in CO2e) on users' decision satisfaction:

Hypotheses 5 predicted information quality to positively affect decision satisfaction; such that high information understandability, reliability and usefulness leads users be more satisfied in their decisions. The results also showed that information understandability (IQU) had a positive significant effect on decision satisfaction (β = 0.210, t = 2.561, p = 0.007). The R^2 of the model was 0.077 (F-statistic = 6.560, p = 0.014). This suggests that increasing information understandability (IQU) of the carbon footprint information will lead to higher satisfaction in participants' business decisions. Thus, H5a was supported. Information reliability (IQR) had no significant direct effect on decision satisfaction (β = -0.123, t = 1.636, p = 0.055). The R^2 of the model was 0.026 (F-statistic = 2.678, p = 0.110). Thus, H5b was not supported. Information usefulness (IQUSE) also had a positive significant effect on decision satisfaction (β = 0.157, t = 1.729, p = 0.046). The R^2 of the model was 0.057 (F-statistic = 2.988, p = 0.092). Thus, results suggest increasing information usefulness increases users to be more satisfied with their decisions. Thus, H5c was supported. Therefore, H5 was partially supported.

The following hypotheses were developed to understand how users' preconceived notions in climate change (i.e., concern for climate change and perceived instrumentality) influence their decision-making processes:

Hypotheses 6 predicted concern for climate change to moderate the relationship between diffusion of responsibility and decision orientation. H6a predicted concern for climate change to moderate the relationship between financial diffusion of responsibility and environmentally conscious decision orientation. Specifically, it was predicted for the effect of financial diffusion of responsibility on environmentally conscious decision orientation to increase when concern for climate change increased. When concern for climate change (CONC) was introduced, financial diffusion of responsibility was also found to have a non-significant negative moderation effect on decision orientation (β = -0.280, t = -1.574, p = 0.062). The R^2 of the model was 0.040 (F-statistic = 1.234, p = 0.310). Thus, H6a was not supported. H6b predicted concern for climate change to positively moderate the relationship between environmental diffusion of responsibility and environmentally conscious decision orientation; such that an increase in concern for climate change increased the effect of environmental diffusion of responsibility on environmentally conscious decision orientation. Environmental diffusion of responsibility (DIFE) was found to have a non-significant positive moderation effect on decision orientation (β = -0.027, t = -0.203, p = 0.420). The R^2 of the model was 0.011 (F-statistic = 0.455, p = 0.715). Thus, H6b was not supported. Therefore, H6 was not supported.

Hypotheses 7 predicted concern for climate change to moderate the relationship between information quality and decision orientation. More specifically, it was hypothesized that increase in concern for climate change resulted in an increase in the effect of information understandability, reliability, and usefulness on decision orientation.

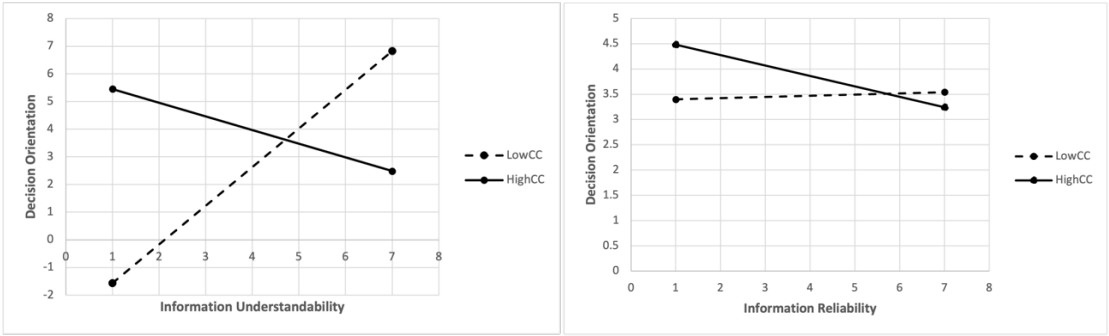


Figure 7. Interaction plot for information quality (Understandability, Reliability) and concern for climate change on decision orientation

Information understandability (IQU) was found to have a significant negative moderation effect on decision orientation ($\beta = -0.316$, $t = -2.710$, $p = 0.005$), when concern for climate change (CONC) was introduced. The R^2 of the model was 0.076 (F-statistic = 7.584, $p = 0.000$). The results indicate that as concern for climate change increases, the effect of information understandability on decision orientation decreases. Thus, H7a was not supported because the direction was opposite to the proposed hypothesis. Information reliability (IQR) was shown to have a significant negative indirect effect on decision orientation (PERO) by interaction of concern for climate change (CONC) ($\beta = -0.039$, $t = -2.599$, $p = 0.007$). The R^2 of the model was 0.042 (F-statistic = 2.701, $p = 0.059$). The results indicate that as concern for climate change increases, the effect of information reliability on decision orientation decreases. Thus, H7b was not supported because the direction of the relationship differed from the proposed hypothesis. Concern for climate change (CONC) did not moderate the relationship between information usefulness (IQUSE) on decision orientation (PERO) ($\beta = -0.069$, $t = -0.595$, $p = 0.278$). The R^2 of the model was 0.007 (F-statistic = 0.275, $p = 0.843$). Thus, H7c was not supported. Therefore, H7 was not supported.

Hypotheses 8 predicted concern for climate change to moderate the relationship between information quality and decision satisfaction; such that the effect of information understandability, reliability, usefulness on decision satisfaction increases as concern for climate change increases.

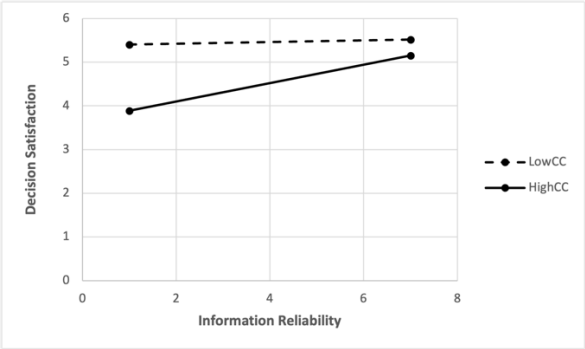


Figure 8. Interaction plot for Information Reliability and concern for climate change on Decision Satisfaction

Concern for climate change was found to have no moderation effect on the relationship between Information Understandability and decision satisfaction ($\beta = -0.068$, $t = -0.660$, $p = 0.257$). The R^2 of the model was 0.095 (F-statistic = 2.847, $p = 0.050$). Thus, H8a was not supported. Concern for climate change (CONC) had a positive significant moderation effect in the relationship between information reliability (IQR) and decision satisfaction ($\beta = 0.032$, $t = 2.165$, $p = 0.018$). The R^2 of the model was 0.088 (F-statistic = 2.863, $p = 0.049$). The results indicate that as concern for climate change increases, the effect of information reliability on decision satisfaction increases. When information reliability is increased, participants with high concern for climate change had a greater increase in decision satisfaction, while participants with low concern for climate change had a marginal increase. The decision satisfaction is always higher for participants with low concern for climate change than for those with high concerns. Thus, H8b was supported. Concern for climate change (CONC) had no significant moderation effect in the relationship between information usefulness (IQUSE) and decision satisfaction ($\beta = -0.093$, $t = -0.730$, $p = 0.235$). The R^2 of the model was 0.090 (F-statistic = 3.548, $p = 0.023$). Thus, H8c was not supported. Therefore, H8 was partially supported.

Hypothesis 9 predicted perceived instrumentality to moderate the relationship between diffusion of responsibility and decision orientation; such that the effect of financial and environmental diffusion of responsibility on decision orientation increases as perceived instrumentality increases. When perceived instrumentality (PINS) was introduced, financial diffusion of responsibility was found to have a non-significant positive moderation effect on decision orientation (β = -0.121, t =-1.110, p = 0.137). The R^2 of the model was 0.044 (F-statistic = 1.390, p = 0.260). Thus, H9a was not supported. Environmental diffusion of responsibility (DIFE) was also found to have a non-significant positive moderation effect on decision orientation (β = -0.006, t = -0.057, p = 0.476). The R^2 of the model was 0.017 (F-statistic = 0.621, p = 0.606). Thus, H9b was not supported. Therefore, H9 was not supported.

Hypotheses 10 predicted perceived instrumentality to moderate the relationship between information quality and decision orientation; such that the effect of information understandability, reliability and usefulness on decision orientation increases as perceived instrumentality increases.

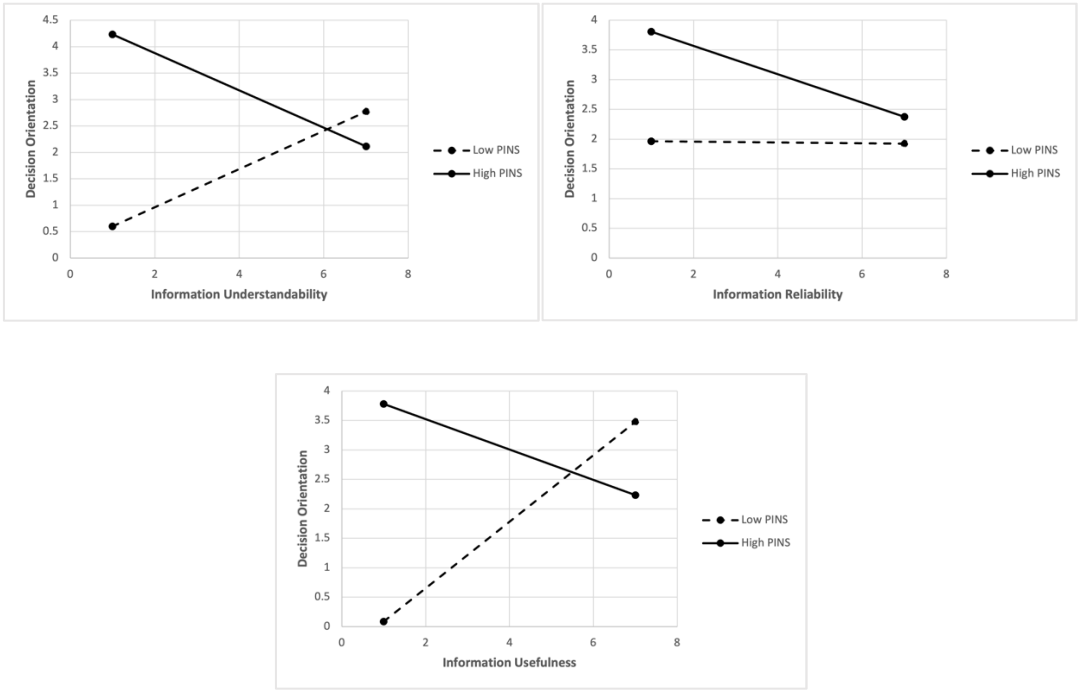


Figure 9. Interaction plot for information quality (Understandability, Reliability, Usefulness) and Perceived instrumentality on decision orientation

Information understandability (IQU) was found to have a significant negative moderation effect on decision orientation (β = -0.119, t = 1.776, p = 0.042), when perceived instrumentality (PINS) was introduced. The R^2 of the model was 0.065 (F-statistic = 4.586, p = 0.008). The results indicate that as perceived instrumentality increases, the effect of information understandability on decision orientation decreases. Thus, H10a was not supported because the direction differed from the proposed hypothesis. Information reliability (IQR) was shown to have a significant negative indirect effect on decision orientation (PERO) by interaction of perceived instrumentality (PINS) (β = -0.039, t = -2.600, p = 0.006). The R^2 of the model was 0.057 (F-statistic = 3.883, p = 0.016). As perceived instrumentality increases, the effect of information reliability on decision orientation decreases. Thus, H10b was not supported because the direction was opposite to the proposed hypothesis. Perceived instrumentality (PINS) did moderate the relationship between information usefulness (IQUSE) on decision orientation (PERO) (β = -0.137, t = 1.827, p = 0.037). The R2 of the model was 0.043 (F-statistic = 1.829, p = 0.158). Thus, H10c was not supported as the direction was found to be opposite of the proposed hypothesis. Therefore, H10 was not supported.

The following hypotheses were developed to understand the effects of communicating carbon footprint emissions (measured in CO2e) information on actual organizational performance, as well as user's confidence in performance:

Hypotheses 11 predicted decision orientation to result in greater actual performance. H11a predicted financially conscious decision orientation (i.e., company valuation maximizing decision) to result in greater financial performance in sales than environmentally conscious decision orientation. The results show that decision orientation (PERO) had a non-significant positive effect on sales (SALE) (β = 21162.559, t =1.372, p = 0.089). Thus, H11a was not supported. H11b predicted financially conscious decision orientation (company valuation maximizing decision) to result in greater financial performance in company valuation than environmental decision orientation. The results also showed that decision orientation (PERO) had a non-significant positive effect on company-valuation (PERF) (β = 4960.099, t = 0.168, p = 0.434). Thus, H11b was not supported. H11c predicted environmentally conscious decision orientation (carbon

footprint minimizing decision) to result in to greater environmental performance than financially conscious decision orientation. Participants' environmental performance was measured in monetary terms, converting carbon footprint emissions information to a financial value at a rate of 0.05 euros per kilograms of CO2e emissions. The results suggests that decision orientation (PERO) did not have a significant effect on environmental performance (β = 279.338, t = 0.755, p = 0.227). Thus, H11c was not supported. Therefore, H11 was not supported.

Hypothesis 12 hypothesized decision orientation to affect confidence in performance. H12a predicted financially conscious decision orientation (i.e., company valuation maximizing decision) to lead to greater confidence in financial performance. Decision orientation (PERO) had a non-significant, positive effect on confidence in financial performance (CONFIN) (β = - 0.010, t = -0.089, p = 0.465). Thus, H12a was not supported. H12b predicted environmentally conscious decision orientation (i.e., carbon footprint minimizing decision) to lead to greater confidence in environmental performance. Decision orientation (PERO) had a significant positive effect on confidence in environmental performance (CONENV) (β = 0.367, t = 3.483, p = 0.001). Thus, H12b was supported. Therefore, H12 was partially supported.

Hypothesis 13 hypothesized decision satisfaction to positively affect actual performance. Decision satisfaction (SAT) had a significant positive effect on financial performance in terms of sales (SALE) (β = 25363.099, t = 1.801, p = 0.040). Thus, H13a was supported. This indicates that users who are more satisfied with their decisions have greater sales within the simulation. Decision satisfaction also had a significant positive effect on company-valuation (PERF) (β = 82105.149, t = 1.715, p = 0.047). Therefore, users who are more satisfied with their decisions have greater financial performance. Thus, H13b was supported. Decision satisfaction (SAT) did not have a significant effect on environmental performance (β = -360.019, t = -0.905, p = 0.185). Thus, H13c was not supported. Therefore, H13 was partially supported.

Hypothesis 14 predicted decision satisfaction to positively affect participant's level of confidence in performance. Decision satisfaction (SAT) had a significant positive effect

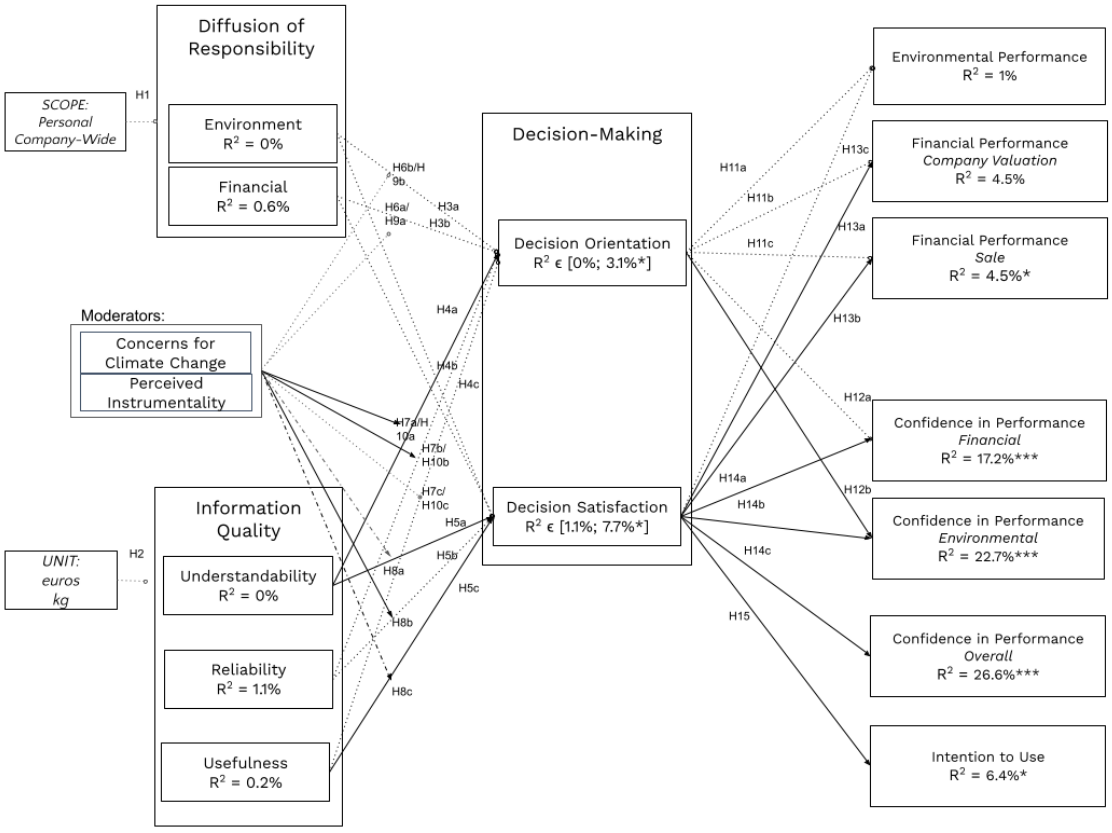
on participants' level of confidence in their financial performance (CONFIN) ($\beta = 0.531$, $t = 4.242$, $p = 0.000$). The R^2 of the model was 0.172 (F-statistic = 9.580, $p = 0.000$). This indicates that users who are more satisfied with their decisions had greater confidence in their financial performance. Thus, H14a was supported. Decision satisfaction (SAT) had a significant positive effect on participants' level of confidence in their environmental performance (CONENV) ($\beta = 0.470$, $t = 2.913$, $p = 0.003$). This indicates that users who are more satisfied with their decisions had greater confidence in their environmental performance. Thus, H14b was supported. Decision satisfaction (SAT) had a significant positive effect on participants' level of confidence in their overall performance (CONO) ($\beta = 0.588$, $t = 5.890$, $p = 0.000$). This suggests that users who are more satisfied with their decisions had greater confidence in their overall performance. Thus, H14c was supported. Therefore, H14 was supported.

The following hypothesis was suggested to test the effects of communicating carbon footprint emissions (measured in CO2e) information on user's decision satisfaction, thereby leading to user intention to adopt carbon footprint emissions information in an information system (IS):

Hypothesis 15 predicted decision satisfaction to positively affect intention to use; such that users who have higher decision satisfaction have greater intention to use. Decision satisfaction (SAT) was found to have a significant effect on intention to use (ITN) ($\beta = 0.313$, $t = 1.702$, $p = 0.048$). The R^2 of the model was 0.064 (F-statistic = 3.875, $p = 0.029$). This finding suggests that users are willing to use carbon footprint emissions information when performing their roles as logistics managers if the information is made available. Thus, H15 was supported.

Figure 10 display significant path coefficients and standard error in the research model. The results for each hypothesis are summarized in Table 5: Summary of Findings. A summary of all path coefficients, standard error and p-values for the regression model can be found in Appendix: Path Analysis.

Figure 10. Validated Model



Note:

* p < 0.05, ** p < 0.01, *** p < 0.001.

The full lines indicate unilateral significant path coefficients.

The dotted lines are unilateral not significant path coefficients.

The mixed lines are partially significant path coefficients.

The level of significance for R^2 are bilateral.

The figures in parentheses are standard error.

Table 5. Summary of Findings

H	From	To	Path Coeff.	t-Value	p-Value	Status
1	SCOPE	DIF				Not Supported
1a	SCOPE	DIFF	0.142	0.560	0.289	Not Supported
1b	SCOPE	DIFE	-0.017	0.050	0.480	Not Supported
2	UNIT	IQ				Not Supported
2a	UNIT	IQU	0.022	0.066	0.474	Not Supported
2b	UNIT	IQR	0.246	0.720	0.238	Not Supported
2c	UNIT	IQUSE	0.128	0.337	0.369	Not Supported
3	DIF	PERO				Not Supported
3a	DIFF	PERO	0.082	0.691	0.247	Not Supported
3b	DIFE	PERO	-0.098	-1.094	0.140	Not Supported
4	IQ	PERO				Not Supported
4a	IQU	PERO	-0.176	-2.073	0.022*	Not Supported♦
4b	IQR	PERO	-0.087	-0.916	0.183	Not Supported
4c	IQUSE	PERO	-0.017	-0.201	0.421	Not Supported
5	IQ	SAT				Partially Supported
5a	IQU	SAT	0.210	2.561	0.007**	Supported
5b	IQR	SAT	0.123	1.636	0.055^{+}	Not Supported
5c	IQUSE	SAT	0.157	1.729	0.046*	Supported

Unilateral Level of Significance

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

♦ Indicate hypothesis where the direction of the relationship was not as hypothesized, but the p-value is below 0.10 in a two-tail test

Table 5. Summary of Findings (Continued)

6	DIF x CONC	PERO				Not Supported
6a	DIFF x CONC	PERO	-0.280	-1.574	0.062^{+}	Not Supported
6b	DIFE x CONC	PERO	-0.027	-0.203	0.420	Not Supported
7	IQ x CONC	PERO				Not Supported
7a	IQU x CONC	PERO	-0.316	-2.710	0.005**	Not Supported♦
7b	IQR x CONC	PERO	-0.039	-2.599	0.007**	Not Supported♦
7c	IQUSE x CONC	PERO	-0.069	-0.023	0.278	Not Supported
8	IQ x CONC	SAT				Partially Supported
8a	IQU x CONC	SAT	-0.068	-0.660	0.257	Not Supported
8b	IQR x CONC	SAT	0.032	2.165	0.018*	Supported
8c	IQUSE x CONC	SAT	-0.093	-0.732	0.235	Not Supported
9	DIF x PINS	PERO				Not Supported
9a	DIFF x PINS	PERO	-0.121	1.110	0.137	Not Supported
9b	DIFE x PINS	PERO	-0.006	0.057	0.476	Not Supported
10	IQ x PINS	PERO				Not Supported
10a	IQU x PINS	PERO	-0.119	1.776,	0.042*	Not Supported♦
10b	IQR x PINS	PERO	-0.039	2.600	0.006**	Not Supported♦
10c	IQUSE x PINS	PERO	-0.137	1.827	0. 037*	Not Supported♦

Unilateral Level of Significance

$^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001

♦ Indicate hypothesis where the direction of the relationship was not as hypothesized, but the p-value is below 0.05 in a two-tail test

Table 5. Summary of Findings (Continued)

11	PERO	PERFORMANCE				Not Supported
11a	PERO	SALE	21162.559	1.372	0.089^{+}	Not Supported
11b	PERO	PERF	4960.099	0.168	0.434	Not Supported
11c	PERO	PERE	279.338	0.755	0.227	Not Supported
12	PERO	CONFIDENCE				Partially Supported
12a	PERO	CONFIN	-0.010	-0.089	0.465	Not Supported
12b	PERO	CONENV	0.367	3.483	0.001***	Supported
13	SAT	PERFORMANCE				Partially Supported
13a	SAT	SALE	25363.099	1.801	0.040*	Supported
13b	SAT	PERF	82105.149	1.715	0.047*	Supported
13c	SAT	PERE	-360.019	-0.905	0.185	Not Supported
14	SAT	CONFIDENCE				Supported
14a	SAT	CONFIN	0.531	4.242	0.000***	Supported
14b	SAT	CONENV	0.470	2.913	0.003**	Supported
14c	SAT	CONO	0.588	5.890	0.000***	Supported
15	SAT	INT	0.313	1.702	0.048*	Supported

Unilateral Level of Significance
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

♦ Indicate hypothesis that was significant, but the direction of the relationship were not as hypothesized

Chapter 6: Discussion

6.1 Discussion

The analysis revealed that framing CO2e emissions in varying scopes (SCOPE) (i.e., showing CO2e corresponding to individual employee's decisions or the company's operations at large) did not have a significant impact on diffusion of responsibility (DIF). Prior research shows that diffusion of responsibility can occur in the presence of virtual, physical, or perceived bystanders (Fischer et al., 2011; Martin & North, 2015). In studying virtual diffusion of responsibility, Blair et al. (2005) stated that diffusion of responsibility is dependent on the communication medium as individuals recognize the existence of bystanders differently in virtual or face-to-face interactions. In a face-to-face interaction, individuals can see and hear other group members, making it easier for people to acknowledge the presence of others. In comparison, a virtual setting makes it difficult for people to be sure about the presence or absence of others. The non-significant results in diffusion of responsibility (DIF) may have occurred because the collection of data was done virtually, and the presence of other virtual bystanders were not clearly announced to other participants during the companywide CO2e emissions setting.

The findings indicated that diffusion of responsibility (DIF) did not significantly impact participants to lean toward environmental decision orientation (PERO) nor push participants to have higher satisfaction in their decision (SAT). Research by Martin and North (2015) demonstrated that, in a virtual setting, diffusion of responsibility occurred only for dated or older requests for help. This finding in virtual diffusion of responsibility was inconsistent with other research conducted in a face-to-face environment where participants were more responsive to recent or current requests for help (Fischer et al., 2011). Martin and North (2015) also concluded that the time delay may have occurred because diffusion of responsibility operates differently in the virtual world. Therefore, the non-significant findings in this current research may have been a result of participants reviewing the CO2e information soon after it had been generated. The results might have

been different if the experiment was conducted in a company setting with a longer timeframe.

The results indicate that framing the CO2e information in different units (UNIT) (i.e., CO2e emissions shown in euros or kilograms) did not significantly impact information quality (IQ). Prior research in carbon labelling studied consumer responses towards different methods of communicating carbon footprint on consumer products but could not find a consensus (Hartikainen et al., 2014). The findings varied in that some consumers wanted more specific information on a carbon label, and some preferred less informative labels (Feucht & Zander, 2017; Leire & Thidell, 2005). However, the detailed analysis was made using a methodology tailored to explore the implications of carbon labels by conveying different environmental information. This methodology included experiments where participants compared static images of different carbon label designs organized in focus groups to explore participant opinions on the carbon labels (Meyerding et al., 2019; Hartikainen et al., 2014). The findings in these studies had a larger sample size with more than 100 participants. Thus, the non-significant results in this study may have ensued from asking a small group of participants to provide feedback on the quality of CO2e information after performing highly cognitive tasks. The study may have yielded different results if the manipulations were studied with a larger sample, using a comprehensive research methodology to explore the design implications.

Contrary to the hypothesis, the results indicated that increasing the understandability of the carbon footprint information (IQU) led users to believe that they were more engaged in decisions that maximized company valuation as opposed to decision that would minimize carbon footprint (PERO). Kumarasiri and Gunasekarage (2017) found that managers in companies are more likely to act when climate change issues are framed as threats or harm to organizational performance. In addition, the researchers revealed that the managers used management accounting techniques (measuring and reporting carbon emissions) to mainly protect “economic interests, regulatory pressure, and reputational pressure” (Kumarasiri and Gunasekarage, 2017). Therefore, one explanation for the results may be that participants chose to protect the economic interests and organizational performance over the environment when performing the tasks as logistics managers.

The findings suggest that increasing the understandability and reliability of the CO2e information presented on the dashboard, minimized the participant's tendency to make business decisions based on prior perception of climate change.

The results indicate that when participants perceived the environmental information low in understandability and reliability, participants with low concern for climate change chose to maximize company valuation. This suggests that when the quality of the environmental information is increased, participants with low concern for climate change and predisposed to maximizing company valuation will shift to making more sustainable decisions.

On the contrary, participants with high concern for climate change chose to minimize their carbon footprint when environmental information quality (IQ) was low. However, these participants leaned toward maximizing company valuation when environmental information quality (IQ) increased. Research by Green Human Resource Management (Green HRM) found that green feedback and incentive programs influenced indifferent employees to be more environmentally friendly than pro-environmental employees (M. C. Davis et al., 2020; Kim et al., 2019; Unsworth et al., 2021). The crowding-out of intrinsic motivation was proposed as the reason for the ironic findings (Davis et al., 2020). The crowding-out effect is said to occur when individuals lose intrinsic desires to perform the tasks due to external intervention, which is perceived to limit their autonomy and self-determination (Frey & Stutzer, 2012; Yang & Thøgersen, 2022). Therefore, the results of the current study may be showing hints of the crowding-out effect. The participants with high concern for climate change originally had a higher intrinsic motivation to combat climate concerns. However, as environmental information quality increased, participants may have felt that the information about their environmental progress and performance was intervening with their freedom of choice, consequentially undermining their internal environmental motivation. Nonetheless, the result of this study suggests that the CO2e information presented on the dashboard can influence the users' decision-making process. The findings suggest that increasing the understandability and reliability of CO2e information can reduce personal biases about climate change, subsequently encouraging users to make more sustainable business decisions.

It was also found that information understandability (IQU) and usefulness (IQUSE) have positive effects on decision satisfaction (SAT). Prior research in decision support systems highlighted that improved information quality increased user information processing, subsequently increasing decision-making satisfaction (Gao et al., 2012; Simpson & Prusak, 1995). Bharati & Chaudhury (2004) also empirically validated that increased information quality augmented decision-making satisfaction, indicating higher satisfaction in the system's ability to support decision-making related to the business process (Bharati & Chaudhury, 2004). In line with previous research, the findings in this study indicate that making environmental information more understandable and useful increases user satisfaction in their decisions.

Moreover, the results also highlighted that users' perception of information reliability (IQR) was the only dimension in information quality (IQ) that correlated with increased concern for climate change (CONC). In line with the above results, the other two dimensions may not have had significant impact on decisions satisfaction (SAT) because the information understandability (IQU) and usefulness (IQUSE) augmented the decision satisfaction (sat) regardless of the degree of concern for climate change (CONC).

In low information understandability (IQU), reliability (IQR), usefulness (IQUSE), results indicate that participants with low perceived instrumentality (PINS) or belief in self to influence climate change, leaned toward company valuation maximization decisions. As Information understandability (IQU), reliability (IQR), usefulness (IQUSE) increased, participants were found to choose carbon footprint minimizing business decisions. This is in line with prior research by Spence et al. (2011), where perceived instrumentality (PINS) was a strong predictor of pro-environmental behaviours, such as preparedness to reduce energy use.

Surprisingly, decision satisfaction (SAT) was always higher in participants with low concern for climate change compared to high concern for climate change, even when information reliability (IQR) increased. when information reliability (IQR) increased, the decision satisfaction (SAT) increased marginally for the low concern group, while the increase was quite considerable for the high concern group.

The higher starting point in decision satisfaction (SAT) for the low concern group may be explained by prior research in decision-making. In his study, Dijksterhuis (2004) explored the role of conscious and unconscious thought in decision-making, defining conscious thought as a thought process that one is consciously aware when performing the task, and unconscious thought as a thought process occurring outside one's conscious awareness. In extending this theory, Dijksterhuis and Nordgren (2006) established that conscious thoughts were more guided by expectancies, leading to more stereotyping than unconscious thoughts. Gao et al. (2012) validated this theory through a study in online purchase decision-making where they found that high information quality led to higher satisfaction under unconscious logistics decisions compared to conscious logistics decisions.

Thus, literature suggests that participants with high concern for climate change were driven by their orientation and crowding effect to make conscious environmental decisions. This conscious thought process may have influenced participants to be guided by their stereotypes and expectations, making them more critical in assessing the system's ability to provide reliable information to aid their decision-making. In contrast, participants with low concern for climate change may have made unconscious environmental decisions which may have heightened the level of decision satisfaction. Nevertheless, the results also indicated a more significant increase in decision satisfaction with increased information reliability in the high concern group. This significant increase in decision satisfaction may have resulted because increasing information reliability successfully met highly concerned participants' expectations for higher information reliability. This finding iterates the importance of increasing information reliability to increase decision satisfaction in participants with high concern for climate change.

The result in the current study corresponds to a study using ERP systems by Law and Ngai 2007), which highlighted a positive relationship between user satisfaction in information content and organizational performance which includes sales growth rate and profitability of the company (Petter et al., 2008). In line with previous research, the results indicate that participants were more satisfied with their decisions when information quality was increased, subsequently leading to higher organizational performance.

Moreover, the findings also indicate that decision orientation (PERO) is not significantly linked to sales or company valuation. This finding may be due to participants' fluctuating business decisions in the three simulation rounds, limiting to conclude which business decision (i.e., profit maximizing or carbon minimizing) led to higher organizational performance. Therefore, the current study strongly suggests that participants who were satisfied with their decision had higher organizational performance, regardless of what business goals participants chose to focus on.

The results indicate that participants' intention to minimize CO2e influenced participants' confidence in environmental performance (CONENV). Also, it was found that participants with higher satisfaction in their decision (SAT) had higher confidence levels in environmental, financial, and overall performance. The current research provides new insight into the effects of users' decision choice and decision satisfaction on their confidence in performance. The results suggest that confidence in environmental performance is highly malleable with the orientation of participant's decision, while confidence in environmental, financial, and overall performance can be augmented by increased decision satisfaction. However, in line with the previous discussion, pushing participants to choose certain logistics decision with external intervention can lead to fallouts in participants with high concern for climate change. Therefore, these findings place an importance on increasing confidence in performance through increasing decision satisfaction to reduce externalities caused by prior perceptions of climate change.

The result of this study is aligned with previous research in investigating the relationship between user satisfaction (SAT) and intention to use (INT). In line with previous research, the results revealed that user satisfaction is strongly related to intention to use (Kim et al.,2002; McGill et al., 2003; Wu & Wang, 2006; Bharati &Chaudhury, 2006; Halawi et al., 2007). Thus, the current study revealed that the participants were favourably predisposed to using carbon emissions information whenever it is made available.

6.2 Limitations

This study did not find hypothesized effects from the manipulations, which can be explained by a few limitations inherent in this research:

First, this research was conducted virtually which may have limited the manipulation to be fully manifested. The simulation game was adjusted so that one person could perform logistics tasks without having to worry about other tasks in the simulation. However, this modified experimental design does not portray a regular environment where the game is played with others. Thus, results from this study should be extended to other contexts with caution.

Second, this study was limited by its short experiment length. Participants had 10 minutes to review inventory, sales, company valuation, and carbon footprint emissions information to complete the experimental task. Although all participants had previous experience with ERPsim and SAP, the time constraint may have made the experiment complex, preventing participants from spending adequate time interacting with the carbon footprint emissions information presented on the dashboard. Therefore, lengthening the experiment may have found significant differences in information quality and diffusion of responsibility between conditions.

Third, the study did not have manipulation checks to understand whether the manipulations were perceived correctly. Asking participants about how the environmental information was framed would have determined how much the participants paid attention to the manipulations, thereby validating the effectiveness of the manipulations.

Finally, this research had no control group where the participants were not exposed to any carbon footprint emissions information. By having a control group, this research would have confirmed what results were created by presenting CO2e information and what effects were created by framing the environmental information. The experimental design with a control group may have allowed this research to accurately measure the relationship between the manipulation and other variables in the research model.

6.3 Future Research

This research established that the environmental information was understood at a comparable level regardless of its presentation, making it insufficient to conclude on the best representation of carbon footprint emissions information to enhance information quality and reduce diffusion of responsibility.

However, the user experience with the ERP dashboard indicated that the quality of environmental information is related to sustainable decision-making, thereby increasing decision makers' confidence in the performance and actual financial performance.

The results indicate that carbon footprint emissions information has had a positive cascade effect on decision-makers and organizations. This encouraging result warrants further exploration to best present carbon footprint emissions information to evoke greater information quality in information systems.

In building upon this research, future research should consider addressing the limitations mentioned in the previous section:

First, future studies can consider exploring the effects of diffusion of responsibility on decision-making in an authentic setting involving face-to-face bystanders or teammates. The current research acknowledges its limitation with virtual bystanders, and a fundamental difference in the occurrence of diffusion of responsibility depending on face-to-face or virtual interaction. Thus, future research can further explore the effects of diffusion of responsibility on environmental decision-making by utilizing the authentic ERPsim setting in which participants are playing in person and in teams.

Second, future studies should consider extending the time for participants to thoroughly review the inventory, sales, company valuation, and carbon footprint emissions information before starting each decision-making round. Allowing participants to spend a long time reviewing the data from the previous round is expected to increase the interaction participants have with the manipulations.

Third, in addition to extending the time, future research should consider doing online survey-based research using static images of the manipulations. The current study was only able to gather responses after participants interacted with other functions of the interface and lacked manipulation checks. Thus, online survey-based research will allow researchers to collect more direct answers about the manipulations and their potential effects on diffusion of responsibility and information quality from a larger sample.

Finally, control groups are suggested in future research to better categorize the effects caused by presenting carbon footprint emissions and the effects caused by the manipulations. This modification may offer more comprehensive insight into the relationship between the research model's independent and dependent variables.

Some possible future research avenues to investigate the best presentation of environmental information include the following:

First, future research can investigate ways to present the environmental information with a reduced psychological distance between individuals and carbon footprint emissions. Psychological distance is defined as an individual's subjective experience that something is close or far in terms of time, distance, social contexts, and ideas (Trope & Liberman, 2010). Therefore, to reduce psychological distance, future research should consider contextualizing carbon footprint emissions by converting volumes of CO2e into more relatable objects or situations in participants' daily lives. Presenting carbon footprint emissions information with reduced psychological distance may provide insights into how users understand the environmental information while also investigating how a decrease in the psychological distance can influence users' engagement in pro-environmental behaviours (Maiella et al., 2020).

Second, future studies can explore presenting the carbon footprint emissions information with social normative feedback. The normative feedback has been previously studied to promote sustainable behaviours in curbside recycling, residential water consumption, hotel towel consumption, and electricity consumption (Loock et al., 2012; Schultz, 1999; Schultz et al., 2008, 2016). This communication of social norms is expected to influence the decision process by telling participants how others are performing and what behaviour

is socially desired (Loock et al., 2011). Future research can implement social normative feedback by utilizing the leaderboard function already embedded in the ERPsim system. The future research can extend and build on previous research that uses the leaderboard (Léger et al., 2014; Thériault et al., 2021). The leaderboard can provide competitive reference points to participants, allowing participants to distinctively compare their carbon footprint emissions against others in relevant reference groups. Therefore, future research can design the experiment to test the different types of normative feedback in increasing information quality and performance.

6.3 Theoretical Implications

From a research perspective, the contribution of this study to existing knowledge is twofold:

First, the proposed comprehensive model extends Green IT/IS adoption literature, which has previously focused on researching Green IT/IS adoption with theories at organizational levels. The findings identified by the proposed research model shed light on individual decision-maker's acceptance of Green IT/IS. Through this model, it was highlighted that presenting carbon emissions information with high understandability and usefulness led to higher decision satisfaction in users, which led to an increase in user's level of confidence in the anticipated company performance.

Moreover, the findings revealed the decision-maker's prior perception of climate change impacted the decision-maker's perception of information quality. The results of this study reveal the importance of considering user characteristics in environmental decision-making and Green IT/IS adoption literature.

6.4 Practical Implications

The results bring essential insight to the sustainability officer in providing useful clues to nudge employees to be more mindful of the environment and to make sustainable decisions. It is evident from the data that increased understandability of carbon footprint information led users to perceive that they engaged more in company valuation

maximizing decisions. This indicates that users emphasized maximizing company valuation over carbon footprint minimization, even when their concern for climate change was high. This relative position toward company valuation maximizing decisions implies that employees place more consideration on the organization's financial impacts when performing logistics tasks in an enterprise setting. Based on this evidence, sustainability officers should offer internal campaigns to educate employees on climate change and communicate the company's sustainability policies and goals. The campaigns will help create a shared understanding of organizational values on sustainability, encouraging employees to follow sustainability goals.

Furthermore, the results also offer insights into explaining how a priori perceptions of climate change affect users' business decisions. From examining the findings, the user's level of concern for climate change influenced the user's perceptions of information quality, thereby influencing decision satisfaction and the relative position between financial and sustainable decisions. However, results offer evidence that this individual disposition toward climate change can be managed by increasing the quality of carbon footprint information. Therefore, sustainability officers and logistics managers should provide regular education and training to encourage sustainable behaviours in employees. The training courses will likely mitigate employees' noncompliance in meeting sustainability goals caused by their personal disposition toward climate change. When providing the training, a simulation system showing carbon footprint emissions information can be used to train employees to operationalize sustainability-related information in employee decision-making. The training with the simulation system will not only optimize employees' use of carbon footprint emissions information when performing job-related tasks but also shape the employees' mindset toward sustainable decision-making.

The results of this study offer suggestions to CIOs and directors of logistics about how employee performance and confidence levels can be optimized by communicating carbon footprint emissions information on an information system. This study highlights how making sustainability-related information available can augment the decision-making process. For instance, top management should be aware that when carbon footprint

emissions information is presented with high understandability and usefulness, users' satisfaction with their decision increases. This increase in decision satisfaction ultimately improved user confidence in performance and users' actual financial performance through increased sales and company valuation.

The types of carbon footprint emissions information presented on the dashboard had no significant effect on augmenting diffusion of responsibility and information quality. However, results indicate that the quality of carbon footprint emissions information influenced users' decision-making and their level of satisfaction with their decisions. This implies that adopting a system that provides carbon footprint emissions information is expected to influence employees' sustainable decision-making, allowing employees to make informed decisions. Furthermore, this study confirms that users are favourably predisposed to the assertion of using such sustainable information when made available. Therefore, CIOs and directors of logistics should consider the implementation of dashboards that offer task-related carbon footprint emissions information to maximize employees' decision satisfaction, hence leading to higher confidence in the decision-making and financial performance.

Chapter 7: Conclusion

This research investigates the potential role of information systems in supporting organizations and their employees to make more sustainable decisions under a carbon tax scenario.

The findings explain how a priori perceptions of climate change affect employees' business decisions by showing that decision-makers are more likely to adopt environmentally friendly decisions when they have high concerns for climate change. Increasing the quality of carbon footprint emissions information was found to nudge decision-makers with low concern for climate change to make a more environmentally conscious business decision. This finding raises the possibility of using environmental dashboards with high-quality carbon footprint emissions information to reduce personal biases about climate change and help to move the needle toward more environmentally friendly business decisions and practices.

The study's findings also show that displaying information on the environmental impact on an ERP dashboard did not come at the expense of the organization's financial performance. More specifically, the decision-maker's level of satisfaction with their business decision increased when information about carbon footprint emissions was presented with high levels of understandability and usefulness. This increase in decision satisfaction led to the decision maker's greater confidence in the anticipated company performance and actual financial performance. The study also revealed that decision-makers are favourably predisposed to using such carbon emissions information whenever it is made available.

The results offer empirical evidence to support the powerful role of the IT artifact in aiding users to make sustainability-informed business logistics decisions while concurrently maximizing the company's bottom line and valuation.

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Appendix

Appendix. Summary of Research Questions and Hypotheses

Variable Dictionary

Scope	Individual vs. Company-Wide	**PERO**	Decision Orientation
Unit	Euros (Economic) vs. Kilograms (Environmental)	**SAT**	Decision Satisfaction
DIFE	Environmental Diffusion of Responsibility	**PERE**	Environmental Performance
DIFF	Financial Diffusion of Responsibility	**PERF**	Financial Performance (Company Valuation)
IQU	Information Understandability	**SALE**	Financial Performance (Sale)
IQR	Information Reliability	**CONENV**	Confidence in Environmental Performance
IQUSE	Information Usefulness	**CONFIN**	Confidence in Financial Performance
CONC	Concern for Climate Change	**CONO**	Confidence in Overall Performance
PINS	Perceived Instrumentality	**ITN**	Intention to Use

RQ1	What effects does having access to carbon footprint emissions (measured in Carbon Dioxide Equivalent – CO2e) information have on user's decision-making, and on the organization?	
RQ1a	What are the effects of communicating in carbon footprint emissions (measured in CO2e) on users' business decisions?	H3ab: DIF → PERO H4abc: IQ → PERO
RQ1b	What are the effects of communicating carbon footprint emissions (measured in CO2e) information on user's decision satisfaction?	H5abc: IQ → SAT H15: SAT → INT
RQ1c	What are the effects of communicating carbon footprint emissions (measured in CO2e) information on actual organizational performance, as well as confidence in performance?	H11abc: PERO → SALE/PERF/PERE H12ab: PERO → CONFIN/ CONENV H13abc: SAT → SALE/PERF/PERE H14abc: SAT → CONFIN/ CONENV / CONO
RQ2	How do users' preconceived notions in Climate Change (i.e., Concern for Climate Change and Perceived Instrumentality) influence their decision-making processes?	H6ab: DIF*CONC → PERO H7abc: IQ*CONC → PERO H8abc: IQ*CONC → SAT H9ab: DIF*PINS → PERO H10abc: IQ*PINS → PERO
RQ3	Which framing of carbon footprint emissions information, presented on an ERP dashboard, is more effective in nudging environmental decision-making?	
RQ3a	What are the effects of communicating carbon footprint emissions information in varying scopes (showing CO2e emissions as those corresponding to the individual employee's decisions versus those of the company's operations at large) on the Diffusion of Responsibility and Information Quality?	H1ab: SCOPE → DIF
RQ3b	What are the effects of communicating carbon footprint emissions information in varying units (biophysical versus monetary units) on the Diffusion of Responsibility and Information Quality?	H2abc: UNIT → IQ

Appendix. Correlations Matrix

	SCOPE	UNIT	Personal x kg	Personal x euro	Company x kg	Company x euro	PERF	PERE	SALE	DIFE
SCOPE	1.000									
UNIT	0.000	1.000								
Personal x kg	-0.577***	-0.577***	1.000							
Personal x euro	-0.577***	0.577***	-0.333***	1.000						
Company x kg	0.577***	-0.577***	-0.333***	-0.333***	1.000					
Company x euro	0.577***	0.577***	-0.333***	-0.333***	-0.333***	1.000				
PERF	0.075	0.013	-0.128	0.042	0.113	-0.027	1.000			
PERE	-0.032	-0.004	0.047	-0.010	-0.043	0.006	-0.696***	1.000		
SALE	-0.010	-0.018	-0.045	0.056	0.066	-0.077	0.003	0.680***	1.000	
DIFE	-0.007	0.063	0.030	-0.021	-0.102	0.094	-0.058	-0.024	-0.068	1.000
DIFF	0.075	0.119	-0.094	0.008	-0.043	0.130	-0.077	0.097	0.057	0.683***
IQU	-0.201*	0.009	0.062	0.170*	-0.073	-0.160*	0.179*	-0.201*	-0.145	-0.019
IQR	0.012	0.104	-0.056	0.042	-0.064	0.078	0.202*	-0.112	0.002	-0.150
IQUSE	-0.116	0.047	0.013	0.121	-0.067	-0.067	0.157*	-0.148	-0.066	-0.089
CONC	0.143	0.184*	-0.165*	0.000	-0.047	0.212**	0.145	-0.055	0.034	-0.241**

PERO	0.088	0.067	-0.116	0.014	0.039	0.063	0.057	0.064	0.170*	-0.094
SAT	-0.198*	-0.016	0.039	0.189*	-0.020	-0.208*	0.211**	-0.062	0.159*	0.106
PINS	0.080	-0.023	-0.035	-0.057	0.062	0.030	0.150	-0.202*	-0.136	-0.592***
CONENV	0.054	0.018	-0.177*	0.114	0.156*	-0.094	0.047	-0.025	0.072	-0.002
CONFIN	-0.080	0.095	-0.072	0.164*	-0.038	-0.055	0.132	-0.173*	-0.092	0.092
CON	0.053	0.023	-0.174*	0.113	0.148	-0.087	0.111	-0.104	0.008	0.058
ITN	-0.163*	0.051	0.067	0.121	-0.126	-0.062	0.174*	-0.055	0.075	-0.097

* p < 0.05, ** p < 0.01, *** p < 0.001

Correlation Matrix Continued

	DIFF	**IQU**	**IQR**	**IQUSE**	**CONC**	**PERO**	**SAT**	**PINS**	**CONENV**	**CONFIN**	**CON**	**ITN**
DIFF	1.000											
IQU	-0.080	1.000										
IQR	-0.165*	0.633***	1.000									
IQUSE	-0.093	0.601***	0.655***	1.000								
CONC	-0.120	-0.201*	-0.170*	-0.087	1.000							
PERO	0.066	-0.176*	-0.087	-0.020	0.066	1.000						
SAT	0.176*	0.277***	0.163*	0.240**	-0.174*	0.193*	1.000					

PINS	-0.460***	-0.015	0.070	0.070	0.245**	0.130	-0.092	1				
CONENV	0.067	0.302***	0.211**	0.253**	-0.126	0.372***	0.364***	-0.011	1			
CONFIN	0.137	0.380***	0.242**	0.401***	-0.060	0.070	0.414***	0.035	0.551***	1		
CON	0.112	0.303***	0.188*	0.282***	-0.055	0.216**	0.501***	-0.009	0.669***	0.782***	1	
ITN	-0.123	0.267**	0.392***	0.517***	0.161*	0.148	0.229**	0.142	0.167*	0.285***	0.175*	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix. Path Analysis

	DV:	DIFE	DIFF	IQU	IQR	IQUSE
Scope	Coef.	-0.017	0.142	-	-	-
	s.e.	(0.330)	(0.253)			
	p-value	0.480	0.289			
Unit	Coef.	-	-	0.022	0.246	0.128
	s.e.			(0.337)	(0.342)	(0.379)
	p-value			0.474	0.238	0.369
Constant	Coef.	4.008***	3.608***	4.750***	4.692***	4.283***
	s.e.	(0.245)	(0.170)	(0.220)	0.20778	0.215221
	p-value	0.000	0.000	0.000	0.000	0.000
N		120	120	120	120	120
F		0.003	0.314	0.004	0.518	0.113
r2		0.000	0.006	0.000	0.011	0.002
p		0.960	0.578	0.948	0.476	0.738

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	DV:	PERO	PERO	PERO	PERO	PERO	PERO	PERO	PERO	PERO	PERO
	Coef.	-0.098	0.069	-	-	-	-	-	-	-	-
DIFE	s.e.	(0.090)	(0.767)								
	p-value	0.140	0.464								
CONC	Coef.	-	0.183	-	1.255	-	1.485**	-	0.219	-	0.379
	s.e.		(0.609)		(0.745)		(0.589)		(0.131)		(0.514)
	p-value		0.383		0.050		0.008		0.051		0.233
DIFE*CONC	Coef.	-	-0.027	-	-	-	-	-	-	-	-
	s.e.		(0.133)								
	p-value		0.420								
DIFF	Coef.	-	-	0.082	1.766	-	-	-	-	-	-
	s.e.			(0.119)	(1.071)						
	p-value			0.247	0.054						
DIFF*CONC	Coef.	-	-	-	-0.280	-	-	-	-	-	-
	s.e.				(0.178)						
	p-value				0.062						
IQU	Coef.	-	-	-	-	-0.176*	1.715*	-	-	-	-
	s.e.					(0.085)	(0.736)				
	p-value					0.022	0.013				

IQU*CONC	Coef.	-	-	-	-	-	-0.316**	-	-	-	-
	s.e.						(0.116)				
	p-value						0.005				
IQR	Coef.	-	-	-	-	-	-	-0.087	0.063	-	-
	s.e.							(0.095)	(0.110)		
	p-value							0.183	0.285		
IQR*CONC	Coef.	-	-	-	-	-	-	-	-0.039**	-	-
	s.e.								(0.015)		
	p-value								0.007		
IQUSE	Coef.	-	-	-	-	-	-	-	-	-0.017	0.382
	s.e.									(0.084)	(0.669)
	p-value									0.421	0.285
IQUSE*CONC	Coef.	-	-	-	-	-	-	-	-	-	-0.069
	s.e.										(0.116)
	p-value										0.278
Constant	Coef.	3.064***	1.953	2.369***	-5.146	3.510***	-5.452	3.089***	2.153*	2.744***	0.549
	s.e.	(0.373)	(3.550)	(0.455)	(4.482)	(0.436)	(3.761)	(0.478)	(0.886)	(0.374)	(3.005)
	p-value	0.000	0.585	0.000	0.258	0.000	0.155	0.000	0.020	0.000	0.856
N		120	120	120	120	120	120	120	120	120	120

F	1.198	0.455	0.477	1.234	4.298	7.584	0.840	2.701	0.040	0.275
r2	0.009	0.011	0.004	0.040	0.031	0.076	0.008	0.042	0.000	0.007
p	0.280	0.715	0.494	0.310	0.045	0.000	0.365	0.059	0.842	0.843

* p < 0.05, ** p < 0.01, *** p < 0.001

	DV:	**PERO**	**PERO**	**PERO**	**PERO**	**PERO**	**PERO**	**PERO**	**PERO**	**PERO**	**PERO**
	Coef.	-0.098	0.009								
DIFE	s.e.	(0.090)	(0.587)								
	p-value	0.140	0.494								
PINS	Coef.		0.183		0.733		0.725		0.346		0.753
	s.e.		(0.479)		(0.438)		(0.310)		(0.139)		(0.339)
	p-value		0.352								
DIFE*PINS	Coef.		-0.006								
	s.e.		(0.105)								
	p-value		0.476								
DIFF	Coef.			0.082	0.883						
	s.e.			(0.119)	(0.640)						
	p-value			0.247	0.088						

DIFF*PINS	Coef.	-0.121						
	s.e.	(0.109)						
	p-value	0.137						
IQU	Coef.		-0.176*	0.481				
	s.e.		(0.085)	(0.378)				
	p-value		0.022	0.106				
IQU*PINS	Coef.			-0.119*				
	s.e.			(0.067)				
	p-value			0.042				
IQR	Coef.				-0.087	0.031		
	s.e.				(0.095)	(0.109)		
	p-value				0.183	0.388		
IQR*PINS	Coef.					-0.039**		
	s.e.					(0.015)		
	p-value					0.006		
IQUSE	Coef.						-0.017	0.703
	s.e.						(0.084)	(0.397)
	p-value						0.421	0.042
IQUSE*PINS	Coef.							-0.137*

	s.e.										(0.075)
	p-value										0.037
Constant	Coef.	3.064***	1.767	2.369***	-2.204	3.510***	-0.487	3.089***	1.626*	2.744***	-1.233
	s.e.	(0.373)	(2.820)	(0.455)	(2.709)	(0.436)	(1.765)	(0.478)	(0.800)	(0.374)	(1.801)
	p-value	0.000	0.535	0.000	0.421	0.000	0.784	0.000	0.049	0.000	0.498
N		120	120	120	120	120	120	120	120	120	120
F		1.198	0.621	0.477	1.390	4.298	4.586	0.840	3.883	0.040	1.829
r2		0.009	0.017	0.004	0.044	0.031	0.065	0.008	0.057	0.000	0.043
p		0.280	0.606	0.494	0.260	0.045	0.008	0.365	0.016	0.842	0.158

* p < 0.05, ** p < 0.01, *** p < 0.001

	DV:	**SAT**	**SAT**	**SAT**	**SAT**	**SAT**	**SAT**	**SAT**	**SAT**	**SAT**	**SAT**
	Coef.	0.084	0.259	-	-	-	-	-	-	-	-
DIFE	s.e.	(0.074)	(0.444)								
	p-value	0.131	0.281								
CONC	Coef.	-	-0.019	-	0.006	-	0.176	-	-0.285	-	0.213
	s.e.		(0.382)		(0.466)		(0.512)		(0.120)		(0.590)
	p-value		0.480		0.495		0.367		0.011		0.360

DIFE*CONC	Coef.	-	-0.036	-	-	-	-	-	-	-	-
	s.e.		(0.076)								
	p-value		0.321								
DIFF	Coef.	-	-	0.167	0.407	-	-	-	-	-	-
	s.e.			(0.101)	(0.602)						
	p-value			0.053	0.251						
DIFF*CONC	Coef.	-	-	-	-0.043	-	-	-	-	-	-
	s.e.				(0.099)						
	p-value				0.333						
IQU	Coef.	-	-	-	-	0.210**	0.599	-	-	-	-
	s.e.					(0.082)	(0.639)				
	p-value					0.007	0.177				
IQU*CONC	Coef.	-	-	-	-	-	-0.068	-	-	-	-
	s.e.						(0.104)				
	p-value						0.257				
IQR	Coef.	-	-	-	-	-	-	0.123	-0.013	-	-
	s.e.							(0.075)	(0.077)		
	p-value							0.055	0.432		
IQR*CONC	Coef.	-	-	-	-	-	-	-	0.032*	-	-

	s.e.								(0.015)		
	p-value								0.018		
IQUSE	Coef.	-	-	-	-	-	-	-	-	0.157*	0.678
	s.e.									(0.091)	(0.717)
	p-value									0.046	0.175
IQUSE*CONC	Coef.	-	-	-	-	-	-	-	-	-	-0.093
	s.e.										(0.127)
	p-value										0.235
Constant	Coef.	4.495***	4.725*	4.217***	4.216	3.833***	2.834	4.237***	5.670***	4.147***	2.981
	s.e.	(0.328)	(2.295)	(0.405)	(2.845)	(0.407)	(3.193)	(0.376)	(0.779)	(0.441)	(3.358)
	p-value	0.000	0.046	0.000	0.146	0.000	0.380	0.000	0.000	0.000	0.380
N		120	120	120	120	120	120	120	120	120	120
F		1.290	1.978	2.726	3.278	6.560	2.847	2.678	2.863	2.988	3.548
r2		0.011	0.036	0.031	0.056	0.077	0.095	0.026	0.088	0.057	0.090
p		0.263	0.133	0.107	0.031	0.014	0.050	0.110	0.049	0.092	0.023

* p < 0.05, ** p < 0.01, *** p < 0.001

	DV:	PERE	PERF	SALE	CONENV	CONFIN	CONO	ITN
PERO	coef.	279.338	4960.099	21162.559	0.367***	-0.010	0.116	0.123
	s.e.	(369.914)	(29518.020)	(15429.986)	(0.105)	(0.110)	(0.093)	(0.098)
	p-value	0.227	0.434	0.089	0.001	0.465	0.110	0.109
SAT	coef.	-360.019	82105.149*	25363.099*	0.470**	0.531***	0.588***	0.313*
	s.e.	(397.774)	(47866.314)	(14081.349)	(0.162)	(0.125)	(0.100)	(0.184)
	p-value	0.185	0.047	0.040	0.003	0.000	0.000	0.048
Constant	coef.	10710.935***	124669.253	323782.616***	0.639	1.505*	0.935	2.931**
	s.e.	(2125.225)	(240980.500)	(65087.696)	(0.683)	(0.580)	(0.556)	(0.874)
	p-value	0.000	0.608	0.000	0.355	0.013	0.101	0.002
N		120	120	120	120	120	120	120
F		0.627561	1.61027	3.620324	16.475651	9.579578	18.045308	3.874791
r2		0.009831	0.044647	0.045374	0.22696	0.171758	0.265551	0.063766
p		0.539197	0.212837	0.036124	0.000007	0.000413	0.000003	0.029181

Appendix. Survey Instruments

Demographics

Please enter your participant ID given by the experiment moderator.

_____

Please select the condition given by the experiment moderator.

- ○ Condition 1 (1)
- ○ Condition 2 (2)
- ○ Condition 3 (3)
- ○ Condition 4 (4)

What is your sex?

- ○ Male (1)
- ○ Female (2)
- ○ Intersex (3)

How old are you?

_____

What is the highest level of education you have achieved?

- ○ Less than high school diploma (1)
- ○ High School Diploma (2)
- ○ CEGEP (3)
- ○ Associate's Degree (4)
- ○ Bachelor's Degree (5)
- ○ Master's Degree (6)
- ○ Doctorate Degree (7)
- ○ Other - please specify (8)

_____

Are you currently enrolled in an academic program?

- ○ Yes (1)
- ○ No (2)

What is your nationality?

- ○ Canadian (1)
- ○ American (2)
- ○ French (3)
- ○ Other - please specify (4)

_____

In which country do you currently reside?

- ○ Canada (1)
- ○ USA (2)
- ○ France (3)
- ○ Other - please specify (4) _____

How much experience with Enterprise Resource Planning (ERP) systems do you have?

- ○ None at all (1)
- ○ Very little (2)
- ○ A little (3)
- ○ A moderate amount (4)
- ○ A lot (5)
- ○ A great deal (6)
- ○ Expert (7)

Have you ever played a simulation game by ERPsim of any kind (excluding Cortex)?

- ○ No (1)
- ○ Yes (2)

CONC - Concern for Climate Change

How concerned, if at all, are you about climate change (sometimes referred to as global warming)?

- ○ Not at all concerned (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very Concerned (7) (7)

Considering any potential effects of climate change which there might be on you, how concerned, if at all, are you about climate change?

- ○ Not at all concerned (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very Concerned (7) (7)

Considering any potential effects of climate change there might be on society in general, how concerned are you about climate change?

- ○ Not at all concerned (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very Concerned (7) (7)

PINS - Perceived Instrumentality

To what extent do you agree or disagree with the following statements?

As a logistics manager, I can personally help to reduce climate change by changing my behaviour

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

As a logistics manager, I personally feel that I can make a difference with regard to climate change.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

PERO - Decision Orientation

Which company objective did you put more emphasis on when making your decision?

- ○ Maximizing Company Valuation (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Minimizing Carbon Footprint (7) (7)

What was the aim of your business decision?

- ○ Maximize Benefit to Company (1) (0)
- ○ (2) (1)
- ○ (3) (2)
- ○ (4) (3)
- ○ (5) (4)
- ○ (6) (5)
- ○ Maximize Benefit to Environment (7) (6)

SAT - Decision Satisfaction

I am comfortable with this business decision

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

I am satisfied with this business decision

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

My business decision is sound

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

My business decision is the right one for my situation

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

IQU - Information Understandability

The **SAP** tile showing the generated carbon footprint's performance in...

Providing information that is clear in meaning was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is easy to comprehend was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is easy to read was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

IQR - Information Reliability

The **SAP tile showing the generated carbon footprint**'s performance in...

Providing information that is trustworthy was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is accurate was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is credible was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is, in general, reliable for making your allocation decision was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

IQUSE: Information Usefulness

The **SAP tile showing the generated carbon footprint**'s performance in...

Providing information that is informative to your allocation decision was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is valuable to your allocation decision...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

Providing information that is in general, useful in your allocation decision was...

- ○ Very poor (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very good (7) (7)

DIFF - Diffusion of Responsibility (Financial)

It is unfair to blame an individual employee who had only a small part in managing the company's supply chain if the business objective of maximizing company valuation was not achieved

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

I had limited responsibility for achieving the company's objective in maximizing company valuation

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

I had a large responsibility for achieving the company's objective in maximizing company valuation

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

My share of responsibility for achieving the company's objective in maximizing company valuation was large

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

DIFE - Diffusion of Responsibility (Environment)

It is unfair to blame an individual employee who had only a small part in managing the company's supply chain if the business objective of minimizing carbon footprint was not achieved

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

I had limited responsibility for achieving the company's objective in minimizing the carbon footprint

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

I had a large responsibility for achieving the company's objective in minimizing the carbon footprint

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

My share of responsibility for achieving the company's objective in minimizing the carbon footprint was large

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

CONFIN - Confidence in Financial Performance

How do you feel about the quality of your upcoming financial performance?

- ○ Not at all confident (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very Confident (7) (7)

Imagine that we selected seven results (including yours) at random from those who participated in this task.

How would your upcoming financial performance of the task rank among these seven results?

- ○ Worst result out of seven (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Best result out of seven (7) (7)

CONENV - Confidence in Environmental Performance

How do you feel about the quality of your upcoming environmental performance?

- ○ Not at all confident (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very Confident (7) (7)

Imagine that we selected seven results (including yours) at random from those who participated in this task.

How would your upcoming environmental performance of the task rank among these seven results?

- ○ Worst result out of seven (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Best result out of seven (7) (7)

CONO - Confidence in Overall Performance

How do you feel about the quality of your upcoming overall performance in making both financially and environmentally optimal allocations?

- ○ Not at all confident (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Very Confident (7) (7)

Imagine that we selected seven results (including yours) at random from those who participated in this task.
How would your upcoming overall performance in making both financially and environmentally optimal allocations rank among these seven results?

- ○ Worst result out of seven (1) (1)
- ○ (2) (2)
- ○ (3) (3)
- ○ (4) (4)
- ○ (5) (5)
- ○ (6) (6)
- ○ Best result out of seven (7) (7)

ITN - Intention to Use

I believe it is worthwhile for me to use the Carbon Footprint SAP tile

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Based on my experience today, I am very likely to use the Carbon Footprint SAP tile when the carbon tax is implemented in my industry

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

I plan to use the Carbon Footprint SAP tile very often in the future when the carbon tax is implemented in my industry

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

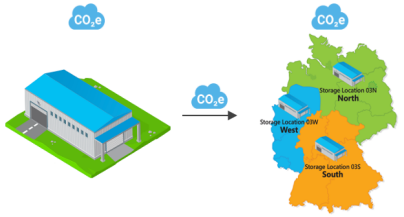
I will recommend other people to use Carbon Footprint SAP tile

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Appendix: Job Aid

Page 1 for Condition 1 (Individual x kg) and 3 (Individual x euro)

Warehousing & Distribution



Main Warehouse — Regional Warehouses

You are hired as a Logistics Manager,

You are expected to contribute to **maximizing Company Valuation** by making optimal allocation decisions from the Main Warehouse to Regional Warehouses while **minimizing carbon footprint.**

Maximum Warehousing Capacity

4000 Units (Main Warehouse and Regional Warehouses combined)

When exceeded:

DAILY WAREHOUSING COSTS *per Additional 1000 Units*	
Daily Base Cost	€300
CO2e Emissions	500 kg CO2e

*****Carbon Cost will be calculated at 0.15 Euro per 1kg CO2e*****

Cost of Transferring Goods:

TRANSFER COST *Per transfer to one region*	
Base Cost	€100
CO2e Emissions	50 kg CO2e

*****Carbon Cost will be calculated at 0.15 Euro per 1kg CO2e*****

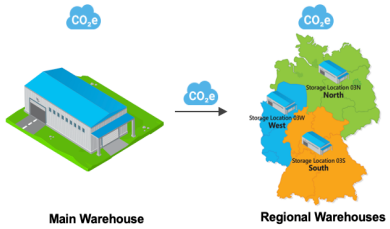
You are planning for the next 10 days.

Stock is replenished in the Main Warehouse Every 5 days

Milk ($$-T01)	Cream ($$-T02)	Yoghurt ($$-T03)	Cheese ($$-T04)	Butter ($$-T05)	Ice Cream ($$-T06)
Starting Inventory 950 units	Starting Inventory 300 units	Starting Inventory 700 units	Starting Inventory 350 units	Starting Inventory 400 units	Starting Inventory 300 units
Initial Price €25.25	Initial Price €79.78	Initial Price €28.43	Initial Price €90.96	Initial Price €65.87	Initial Price €47.47

Page 1 for Condition 2 (Company-wide x kg) and Condition 4 (Company-wide x euro)

Warehousing & Distribution



Main Warehouse | Regional Warehouses

You are hired as a Logistics Manager,

You are expected to contribute to **maximizing Company Valuation** by making optimal allocation decisions from the Main Warehouse to Regional Warehouses while **minimizing carbon footprint.**

You are planning for the next 10 days.

Stock is replenished in the Main Warehouse Every 5 days

Maximum Warehousing Capacity without Additional Fees

4000 Units (Main Warehouse and Regional Warehouses combined)

When exceeded:

DAILY WAREHOUSING COSTS *per Additional 1000 Units*	
Daily Base Cost	€300
Carbon Cost	€75

*****Carbon Cost calculated at 0.15 Euro per 1kg CO2e*****

Cost of Transferring Goods:

TRANSFER COST *Per transfer to one region*	
Base Cost	€100
Carbon Cost	€7.5

*****Carbon Cost calculated at 0.15 Euro per 1kg CO2e*****

Milk ($$-T01)	Cream ($$-T02)	Yoghurt ($$-T03)	Cheese ($$-T04)	Butter ($$-T05)	Ice Cream ($$-T06)
Starting Inventory 950 units	Starting Inventory 300 units	Starting Inventory 700 units	Starting Inventory 350 units	Starting Inventory 400 units	Starting Inventory 300 units
Initial Price €25.25	Initial Price €79.78	Initial Price €28.43	Initial Price €90.96	Initial Price €65.87	Initial Price €47.47

Page 2 for all Conditions

Step 1: Retrieve Relevant Information

STOCK LEVELS

Inventory Report (ZMB52)

Shows the stock levels for all the products in the main warehouse and the three regional storage locations

Visualization

1. **Click & Shift**
   - From: Stock
   - To: Material
2. **Click [Σ] sigma**
3. **Ctrl/Command Click**
   - From: Stock
   - To: Material
4. **Click [Σ/ Σ] sigma over sigma**

SALES DATA

Detailed Sales Report (ZVA05)

Shows sales related info such as sales revenue by product and by region

Step 2: Distribute Goods

PLAN STOCK TRANSFER

Stock Transfer (ZMB1B)

1 Select between a *Push* or *Pull Planning Mode*

2 In *Scheduling*, enter your delivery frequency

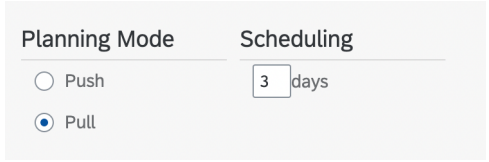
3 Enter the amount of each product you wish to send/ maintain in each region

4 Save

A "Push" strategy: The defined quantity of each product will be shipped to each location according to the delivery schedule *(Scheduling)*.

A "Pull" strategy: The difference between the target quantity and the inventory available in each location is calculated and shipped according to the delivery schedule *(Scheduling)*.

Logistics Decision (ZMB1B) made by Previous logistics manager (Round 1)



Allocation Plan

Material	Description	North	South	West
GG-T01	Milk	316	316	316
GG-T02	Cream	100	100	100
GG-T03	Yoghurt	200	200	200
GG-T04	Cheese	110	110	110
GG-T05	Butter	130	130	130
GG-T06	Ice Cream	100	100	100