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Business Intelligence and Analytics for Sustainability

A Study on the Swedish Food Industry

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Business Intelligence and Analytics for Sustainability: A Study on the Food Industry

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ABSTRACT (MAX. 200 WORDS):
The food industry is facing challenges in responding to the climate crisis, and research highlights the potential of using Business Intelligence & Analytics for organizations sustainability efforts. The aim of this study is to holistically map through the affordance lens, what capabilities organizations in the food industry may potentially gain by using BI&A for sustainability. The study investigates how data collection and integration, data or analysis driven strategy, predictive analytics and dashboards and visualizations aid in efforts related to food wastage and resource consumption reduction, governance of suppliers' sustainability efforts, customer awareness and sustainability reporting. The study has an inductive approach and interviews were conducted with food retailers and producers to collect data which was then analysed. The results show how organizations view the use of BI&A for sustainability positively, however with a few cautions kept in mind to ensure successful use for their sustainability efforts. Multiple affordances were identified in relation to the BI&A elements under scrutiny and it can be concluded that BI&A provides many capabilities for organizations in the food industry.

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1 Introduction

As one of the largest industries in the world, the food industry has a significant impact on the environment as well as society, and sustainable manufacturing, transportation and consumption is a major challenge. As a consequence of increasing globalization and world population, the food industry faces increasing pressure to respond to demands (Otles, Despoudi, Bucatariu & Kartal, 2015). One identified key challenge the food industry faces is to offset future demands and sustainability, and introducing innovative technology is considered a promising solution (Otles et al. 2015). Capgemini (2021) describes how using technology will be central to establish functional sustainability practices, and agreeingly, multiple researchers believe in the potential of Information and Communication Technology, Big Data in particular, to drive sustainability matters forward (GeSI, 2019; Gijzen, 2013; Hilty & Aebischer, 2015; Seele & Lock, 2017), which supports Otles et al.'s (2015) solution of utilizing innovative technologies to manage sustainability issues within the food industry.

Organizations become ever more reliant on Information Systems (IS) and technology to optimize value chains and processes, in order to maintain agility and a competitive edge (Jaklič, Grublješič & Popoviča, 2018). Therefore, multiple benefits present itself by utilizing Business Intelligence and Analytics (BI&A) for decision-making due to the technology's foundation for agility (Jaklič, Grublješič & Popoviča, 2018). Decision making for a sustainable food supply chain is required in multiple areas, such as supplier selection and quality (Kumar, Mangla & Kumar, 2022). Ahmad, Miskon, Alabdan and Tlili (2020) describe Business Intelligence (BI) systems as important tools to support the decision making and aid in the strategic management of sustainability issues, for example through environmental analysis. Dao and Abraham (2021) describe the significant role IS plays in reducing organizations environmental impacts by making the best use of resources to achieve sustainability goals. Investing in modern technology is deemed essential to tackle the challenges the food industry must manage (Government Office for Science, 2011; FAO, 2022).

Malhotra, Melville and Watson (2013) establish that IS applications related to ecological sustainability can mitigate harmful value chains. They continue by emphasizing how IS can drive transformation towards more sustainable businesses and society. However, in relation to the amount of information businesses acquire and process, sustainability data remains unconcerned (Malhotra, Melville & Watson, 2013). Pan, Carter, Tim and Sendeep (2022) concur that IS research has been lacking focus on climate related challenges. Hampton, Strasser, Tewksbury, Gram, Budden, Batcheller, Duke and Porter (2013) agreeingly describe how the climate challenge cannot be faced without commitment from multiple fields, and the need for ecological information as well as the ability to manage it increases. Gholami, Watson, Hasan, Molla and Bjorn-Andersen (2016) agreeingly state that the IS field needs to incorporate a multi-disciplinary perspective when investigating solutions related to environmental problems.

There are examples of successful convergences of BI and sustainability. Akkerman and Pieter van Donk 's (2008) decision support tool to reduce product loss in the food processing industry, in which the tool's purpose was to scrutinize planning decisions and production

parameters, and decreased losses related to planning by nearly 20 % when implemented. Asif, Hina and Mushtaq (2017) explore the addition of BI-solutions to the food industry and exemplify the benefit of doing so by presenting a decision support system created to assist decision makers. By utilizing BI, decision makers can get better, faster, and improved quality of information to base their strategic decisions on (Olexova, 2014; Agarwal, 2014). Research by Olexova (2014) shows that managers in retailing organizations consider improved decision-making the most significant benefit of using BI. The managers reported that efficiency was decreased due to delays or changes of decisions as they were sometimes lacking information or relevant data (Olexova, 2014). Kariyawasam, Liyanaarachchi, Chathurabhani, Jayakody and Attanayaka (2021) remark how there were no proper system to manage the food supply chain in Sri Lanka and developed the first mobile app using BI for this. In Hungary, almost 71 % in middle management and 82 % senior management decision support of businesses in the food industry reported that BI tools were utilised (Debrenti, Csordás & Herdon, 2019). It is evident that BI&A holds big potential in supporting organizations in their sustainability practices. This is fortified by other researcher who concludes that there is a good use of BI (Yu Yin & Ai Ping, 2020; Petrini & Pozzebon, 2009) and big data (Del Río Castro, Gonzalez Fernandez & Uruburu Colsa, 2020) as a support of sustainable efforts.

However, reasoning must go beyond taking advantage of organizational opportunities by IS responses, as the climate threat is ever increasing, threatening, and alarming (Malhotra, Melville & Watson, 2013). The food supply chain makes out 22% of total greenhouse gas emissions and outputs around 1.3 billion tonnes of waste yearly (Kumar, Mangla & Kumar, 2022). Food systems at large are in dire need to respond to climate changes, population growth, water usage, and toxic emissions (Kumar, Mangla & Kumar, 2022). The United Nations Development Programme (2015) has also highlighted the need to improve and optimize food supply chains by setting “Responsible Production and Consumption” as one of the Sustainable Development Goals for 2030, which is included in a resolution that aims for a sustainable future in a social and planetary perspective. The food industry must currently manage fluctuating food prices, food waste, food loss, lacking natural resources, and climate change, and is still expected to grow its production by 60 % as a response to the world population that will be reaching nine billion in 2050 (Otles et al. 2015). Many of the current systems of food production are deemed unsustainable, and if no actions are taken, the global food system will continue to eradicate biodiversity, have a heavy impact on the environment, emit large amounts of greenhouse gasses, and compromise its function to feed the world population (Government Office for Science, 2011). There simply cannot be sustainable development without sustainable food supply chain management (Kumar, Mangla & Kumar, 2022). Malhotra, Melville and Watson (2013) and Gholami et al. (2016) make the point of IS having a significant role of globalizing and transforming organizations as well as entire industries, and by taking on an active role, could contribute to solving one of the world's most urgent problems. Furthermore, information technology is key to making the agriculture supply chain more efficient and responsive by increased access to information and possibilities of managing processes more efficiently according to Routroy and Behera (2017).

1.1 Research Problem

As described in the introduction, BI shows signs to hold potential regarding supporting sustainability practices and actions in the food industry. Furthermore, as more interest and adoption of big data analytics (Columbus, 2017; Capgemini, 2021), in combination with the

expanding trend and pressure to be sustainable increases (Lichtenthaler, 2021) as well as the need for technological solutions to be implemented in the food industry (Otles et al. 2015; Government Office for Science, 2011), there is a great opportunity of using BI&A in matters related to sustainability. This opportunity is also widely recognized by multiple researchers (Yu Yin & Ai Ping, 2020; Petrini & Pozzebon, 2009; Del Río Castro, Gonzalez Fernandez & Uruburu Colsa, 2020), as well as the United Nations Environment assembly (2018), who positively view the use of data and analytics for sustainability. This great potential BI&A holds should therefore also be taken advantage of to face the aforementioned challenges posed in the food industry.

However, Malhotra, Melville, and Watson (2013) criticize the role of previous IS research, as there has been a focus on solely conceptualizing and analysing the early stages of reducing environmental impacts and allowing practitioners to be in charge of designing and implementing it instead of establishing the actual impact of systems. IS scholars are called to have a more active role and enable IS to be more impactful in terms of engaging in solving the problems related to sustainability (Malhotra, Melville & Watson, 2013; Pan et al. 2022). This goes along with the fact that most papers are limited to primarily assessing the potential of using BI, and the lack of research fusing the fields of BI, and sustainability is criticized (Petrini & Pozzebon, 2009; Muntean, 2018). Gholami et al. (2016) provide possible explanations to Malhorta, Melville, and Watsons' (2013) criticism by describing how practical research has not been positively viewed in the field of IS, which has resulted in few publications on the topic of IS and sustainability.

As research has identified that there is room for improvement of sustainability within food retailing (Govindan, 2018), and technological innovations are offering new opportunities to tackle environmental challenges within the food industry (Government Office for Science, 2011; Martin-Rios, Hofmann, & Mackenzie, 2020), utilizing BI&A would be a sensible step for organizations within the industry to take. Petrini and Pozzebon (2009) go on to explain how in literature within the field of BI there has rather been a focus on technical aspects, rather than methodological and conceptual issues of actually implementing the technology in an efficient and successful manner. It becomes evident that there is lacking research and insights on how to design systems and how to use them to become more sustainable (Malhotra, Melville & Watson, 2013; Petrini & Pozzebon, 2009), which would be beneficial in order to tackle the environmental challenges the food industry is facing. Gholami et al. (2016) reviewed the eight green IS papers that have been published by the Association of Information Systems (AIS) basket of eight journals. They concluded that most were conceptual or analytical with ambiguous or theoretical outcomes, which fortifies Malhotra, Melville and Watson's (2013) statement on IS as well as Petrini and Pozzebon's (2009) statement on BI of lacking actual design and implementation,

Lange, Busch and Delgado-Ceballos (2012) express concerns regarding the research on sustainability, as why and how sustainable practices are adopted is investigated, but little attention is paid to how these practices are maintained over time, which is reflective of Malhotra, Melville, and Watsons (2013) concern of leaving implementation up to practitioners. As for the food industry, research shows that the primary concerns lie with consumer relationships, and few activities are implemented to increase ecological efficiency (Delai & Takahashi, 2013). Furthermore, retailers, including the ones in the food industry, are not integrating their sustainability practices with management systems (Delai & Takahashi, 2013), but rather included in disconnected activities, confirming Lange, Busch, and Delgado-Ceballo's (2012) research.

It is clear that both the fields of IS and sustainability are lacking research on practical use after the adoption stage in their separate ways (Malhotra, Melville & Watson, 2013; Hampton et al. 2013; Gholami et al. 2016), evidently even more so when investigating the use of BI supporting sustainability practices. Moreover, it has been investigated that conceptually, it is fully possible to integrate sustainability dimensions into already implemented BI systems (Muntean, 2018). Two aspects of this showcase the lack of research related to sustainability within the IS-field, as it does not extend beyond the adoption stage of BI as well as not being investigated in practice. The alarms raised calls for more research regarding the practical and continuous use of BI&A in support of sustainability.

This paper is focused on investigating the usefulness and capabilities of BI&A in support of organizations in the food industry being able to conduct their sustainability practices. This is relevant as the actual use of BI has seldom been under scrutiny (Muntean, 2018; Haupt, Scholtz & Calitz, 2015; Petrini & Pozzebon, 2009), and it may aid in unveiling how to successfully support an organization in the food industry's efforts related to sustainability by utilizing BI. As the food industry is under a lot of pressure (Kumar, Mangla & Kumar, 2022), investigating IS ability to transform practices to become more sustainable is ever more important (Malhotra, Melville & Watson, 2013).

1.2 Research Aim

The introduction presents multiple reasons to investigate the practical and maintained use of BI&A in support of sustainability, in general, as well as in the food industry, as research on the topic is limited and the climate issue continues to put pressure on the industry to increase environmental sustainability. With this gap of knowledge confirmed, this paper focus on:

Investigating, through the lens of affordance theory, how organizations in the food industry find BI&A useful for their sustainability efforts. The study thereby aims to increase the understanding of the intersection of BI&A and sustainability in organizations and thereby contribute to the convergence of the IS and sustainability field. The purpose is to map a holistic image of how BI&A is useful to organizations in the food industry. These insights could provide future opportunities to develop strategies for the usage and development of IT-solutions for sustainability.

1.3 Research Question

To achieve this aim, the question is formulated as:

What capabilities do BI&A technologies afford organizations in their sustainability efforts?

1.4 Delimitations

The scope of this research is limited to food retailing and producing organizations based in Sweden. To be eligible, the companies are also required to have implemented internal BI&A

solutions related to sustainability efforts. The scope also calls for interviewing people with a role within departments related to sustainability or IT.

As the concept of BI&A is quite broad, this study is limited to investigating the use of specific technologies and techniques, namely data warehousing, advanced analytics, and corporate performance management. Similarly, the efforts within sustainability have been limited to only concern certain environmental elements, which includes reduction of food wastage, reduction of resource consumption, governing suppliers' sustainability efforts, customer awareness regarding sustainability and sustainability reporting. As the research has a focus on BI&A use for sustainability, it excludes the topic of whether the technologies themselves are sustainable.

2 Literature

The literature review first introduces the concept of BI&A. An explanation of BI and BI&A's convergence is presented along with brief descriptions of the relevant tools for this study. Next, elements that relate to the use of BI&A in the food industry are presented and described. The next subchapter elaborates on the concept of sustainability and the idea of multi-level impacts in the food supply chain, along with some identified key elements of sustainability efforts, namely reduction of food waste and loss, reduction of resource consumption, governing suppliers' sustainability efforts, customer awareness and sustainability reporting, within each level of impact. Lastly, the affordance theory is presented as it will be used as a theoretical lens to identify and analyse the mechanisms of usefulness of BI&A tools for sustainability.

2.1 Business Intelligence & Analytics

2.1.1 Business Intelligence & Analytics Overview

BI is a modern adaptation of the original concept decision support system, which was introduced in 1971 by Scott Morton (Power, Sharda & Burstein, 2015). From the beginning, the key concept revolved around supporting managers, by processing data, documents, models, and knowledge for activities related to problem solving and decision-making (Power, Sharda & Burstein, 2015). BI is a general umbrella term, encompassing technologies, tools, strategies, and processes in use to transform data into information (Power, Sharda & Burstein, 2015). In that regard, BI is more of a concept rather than a specific system or product (Dvarioniene, Grecu & Lai, 2017; Grecu & Nate, 2014). Through technological advances in both hard- and software, as well as progress within referential research fields such as artificial intelligence, organizational and management studies, and behavioural sciences, decision support systems were able to evolve into more advanced and holistic systems (Power, Sharda & Burstein, 2015).

Watson (2009) describes how the concept of BI is constantly evolving, due to technological advancements, changes in business needs as well as the desire to improve existing processes. Through technological advancements, businesses have been able to deploy analytics to streamline their various processes and calculations for competitive advantages (Davenport, 2006). Business Analytics (BA) emerged in the mid-2000s by Davenport (2006) as a key analytical component in BI (Davenport, 2006; Chen, Chiang & Storey, 2012), which encompasses "techniques, technologies, systems, practices, methodologies, and applications that analyse critical business data to help an enterprise better understand its business and market and make timely business decisions." (Chen, Chiang & Storey, 2012, p. 1166). The introduction of analytics into BI created the concept of BI&A (Côrte-Real, Ruivo & Oliveira, 2014). Many researchers claim that BI, BA, and sometimes BI&A can be used as interchangeable terms (Chen, Chiang & Storey, 2012; Côrte-Real, Ruivo & Oliveira, 2014; Bayrak, 2015) while others claim that BA is a subset of BI (Mashingaidze & Backhouse, 2017). Chen, Chiang, and Storey (2012) describe the foundation of BI&A to be the database management field and currently most applications that have been implemented by practitioners are considered BI&A 1.0. The foundation of BI&A 1.0 is data management and warehousing, and dashboards and

predictive modelling are BI components that are also considered to be BI&A 1.0 capabilities (Chen, Chiang & Storey, 2012). This thesis will adapt the former view and collect all relevant knowledge from the literature about BI, BA and BI&A and base the oncoming discussion on the unified term of BI&A as the elements of BI that are investigated are included in the term BI&A.

2.1.2 Business Intelligence & Analytics Use

The use of BI systems has excelled over the years as a tool to manage fast paced changes within an industry, increase productivity, and stay competitive (Jaklič, Grublješič & Popoviča, 2018). Gangadharan and Swamy (2004) describe how making use of data and analytics is necessary for businesses to match the increasingly shorter product life cycles and the competitive and volatile behaviour of consumers and competitors (Gangadharan & Swamy, 2004). BI&A provides value to organizations by increasing performance and providing higher quality decision making (Jaklič, Grublješič & Popoviča, 2018).

BI is commonly composed of a variety of technological solutions, which aids in decision making by aggregating and facilitating structured and unstructured data, processing big data and producing reports, analytic solutions, and forecasts in order to provide end users with insights and knowledge (Ain, Vaia, DeLone & Waheed, 2019). Negash and Gray (2008) explain how BI is an outcome of innovations of the past, such as the early decision support systems, data warehouses, OLAP, and data mining, which has constituted the foundation of the components included by the concept of BI today.

2.1.3 Business Intelligence & Analytics Tools

Ranjan (2009) presents the core concept of BI and the included components, which are among others; data warehouse and data marts (Ranjan, 2009; Watson, 2009), advanced analytics (Ranjan, 2009) as well as corporate performance management (Ranjan, 2009; Watson, 2009). A data warehouse stores detailed and clean data from various sources, ready for processing and analysis (Ain et al. 2019). Data warehousing provides the infrastructure for decision making by integrating data from different systems and sources, transforming the input into a standardized format, and then storing it in a database to be used for decision making (Meredith, O'Donnell & Arnott, 2008). Depending on the organization, it may be beneficial to utilize data marts in their infrastructure, meaning that a smaller data warehouse is implemented to service specific needs and end goals (Meredith, O'Donnell & Arnott, 2008). The data warehouse is recognized as a significant component of BI (Ranjan, 2009; Watson, 2009; Meredith, O'Donnell, and Arnott, 2008; Olexova, 2014), as it manages collection, cleansing and aggregation of records (Ranjan, 2009; Meredith, O'Donnell, and Arnott, 2008). More recent development has resulted in the addition of data lakes and data lakehouses as options to having a data warehouse (Armbrust, Ghodsi, Xin & Zaharia, 2021). The data lake can store unstructured data at a lower cost, but lacks data quality and governance downstream according to Armbrust et al. (2021). They continue by stating that the data lakehouse is an option in between, which captures the advantages of data lakes and data warehouses by being less costly and very accessible while having powerful management characteristics.

Ranjan (2009) refers to advanced analytics as data mining, forecasting and predictive analytics, which uses statistical analysis techniques for predicting or providing certainty measures

on facts. As a result of technological developments, advanced analytics make use of machine learning as a central technique in the area of BI, among others (Sparks, Venkataraman, Kaftan, Franklin & Recht, 2017). Negash and Gray (2008) describe the role of analytics in an organization as a means to utilize information provided by BI-tools in order to adhere to tactical and strategic goals and thereby improve managerial decisions. There are various forms of analytics, with differing levels of advancement (Negash & Gray, 2008). These include functions such as ad hoc reports, drill downs and alerts, which focus on questions on an operational level. More complex forms encompass statistical analysis, forecasting, predictive modelling, and optimization, which revolves around analysing potential future scenarios and possible explanations (Negash & Gray, 2008).

Business performance management allows organizations to effectively plan, enhance and deploy their strategies through an IT-enabled approach, as they are able to easily monitor, control and manage their strategic implementations. Business performance management is not itself considered as BI, according to Frolick and Ariyachandra (2006), as it is a wider concept that includes a range of business processes and applications which may leverage BI technology. Ranjan (2009) describes corporate performance management as a general category that delivers displays of aggregated information, for instance balanced scorecards, portals, and dashboards. Dashboards act as the interface, providing visualizations and opportunities for performance management (Chen, Chiang & Storey, 2012). End users are able to create their own visuals and reports through dashboards (Ain et al. 2019).

2.2 Business Intelligence & Analytics elements

Based on Ranjan's (2009) basic components of BI, and Chen, Chiang and Storey (2012) recognized components of BI&A, the following element of each component was identified in the literature that relates to the use of BI&A in the food industry:

Table 2.1: Table of BI&A elements

Tool	Element	Reference
Data warehouse and data marts	Data collection and integration	Haupt, Scholtz & Calitz, 2015; Zhou, Xia, Xue, Zeng, Han & Li, 2017; Olexova, 2014; Ngo, Le-Khac & Kechadi, 2017; Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009; Watson & Wixom, 2007; Albano, 2015; Girsang, Arisandi, Elysisa & Saragih, 2019
	Data or analysis driven strategy	Meredith, O'Donnell & Arnott, 2008; Grecu & Nate, 2014; Ramakrishnan, Jones & Sidorova, 2012; Albano, 2015; Golfarelli & Rizzi, 2009
Advanced Analytics	Predictive analytics	Eckerson, 2007; Asif, Hina & Mushtaq, 2017; Olexova, 2014; Agarwal, 2014; Albano, 2015; Kariyawasam et al. 2021; Bose 2009; Banerjee & Mishra, 2017; Horoś & Ruppenthal, 2021; Khan, Ganguly & Gupta, 2008; Negash & Gray, 2008; Hlaváč & Štefanovič, 2020; Wazurkar, Bhadoria & Bajpai, 2017; Attaran & Attaran, 2019; Selvaraj & Marudappa, 2018; Zhou et al. 2017

Corporate performance management	Dashboards and visualizations	Elias & Bezerianos, 2011; Kumar & Belwal, 2017; Furmankiewicz, Furmankiewicz & Ziuziański, 2015; Hall Jr., 2003; Asif, Hina & Mushtaq, 2017; Marcus, 2006; Guidotti, Gabrielli, Monreale, Pedreschi & Giannotti, 2018; Kariyawasam et al. 2021; Zheng, 2018;

2.2.1 Data Collection and Integration

Generally, integrating data into a data warehouse is complex in terms of achieving consistent formatting from various data sources, which requires sufficient governance to avoid poor data quality (Haupt, Scholtz & Calitz, 2015). Traditional systems in the retailing industry are unable to provide the correct information in today's fast paced marketplace, as their capabilities are unable to manage automated forecasting of demands, detecting abnormalities, and large amounts of inventory data, which would be possible by utilizing data warehousing (Zhou, Xia, Xue, Zeng, Han & Li, 2017). In the context of retailing, implementing intelligent inventory management systems presents challenges related to the amount of data needed as information about the stocks needs processing, further showcasing the importance of collecting and storing data in an effective manner (Olexova, 2014). Reportedly, effective use of data warehousing and scalable data management platforms may provide analyses resulting in increased food production with lower impacts on the environment (Ngo, Le-Khac & Kechadi, 2017). For instance, Ngo, Le-Khac and Kechadi (2017) presented a data warehouse solution which combined agriculture information, orders and sales which enabled outputting information based on complex queries to optimize various operations.

Organizations commonly store data and information in various systems, resulting in difficulties of achieving a holistic perspective, which may have negative effects on decision-making (Meredith, O'Donnell & Arnott, 2008). In response to this, data warehousing could be implemented in the data supply chain to enable collection and integration of data and information from various data sources into one central data storage (Meredith, O'Donnell & Arnott, 2008; Olexova, 2014; Golfarelli & Rizzi, 2009). The data sources may exist internally or supplied by an external data provider or a business partner (Watson & Wixom, 2007).

How to collect and integrate data for data warehousing could be performed in multiple ways. For one, an enterprise data warehouse-approach could be applied (Meredith, O'Donnell & Arnott, 2008), in which all data is stored in one central space (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009). Raw data from various sources is identified and reformatted into the standard applicable to the data model the data warehouse is founded on, and then via the ETL processes loaded into the warehouse (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009). The tool solves issues related to storing data in disparate sources, standardization of formation, and data quality, resulting in organizations not having to start over each time a new decision support tool is required (Meredith, O'Donnell & Arnott, 2008).

Another approach would be the independent data mart approach (Meredith, O'Donnell & Arnott, 2008), in which each end user group has access to a smaller data warehouse, namely a data mart, containing data related to their needs specifically (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009). There are some obstacles related to this approach, such as a complex ETL-process as each data mart sources its relevant data, and activities concerning

data quality and integration have to be reiterated for each mart (Meredith, O'Donnell & Arnott, 2008).

A third approach is a hybrid of the aforementioned ones, the dependent data mart approach (Meredith, O'Donnell & Arnott, 2008), where a central data warehouse's purpose would be to manage the ETL-process and data integration, in which data marts are derived from to respond to end user needs (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009). This approach ensures a greater consistency and integration whilst still allowing for customization adhering to user needs. However, this poses a greater expense for organizations as both a data warehouse and marts are needed to be implemented (Meredith, O'Donnell & Arnott, 2008).

Inmon and Hackathorn (1994) introduced four key features, which separates a data warehouse from a transactional database, being (1) subject-orientation, (2) integration, (3) time variance, and (4) non-volatility. The first relates to the schema design, which is focused on concepts related to decision-making, resulting in a design with a perspective of decision-making from the beginning with subject-oriented tables, meaning only relevant and useful data is collected and stored, instead of having concepts being covered over multiple ones (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009; Albano, 2015). Integration combats disjointed data being stored in separate source systems, in different formats and lacking standardization (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009; Albano, 2015). The two latter features include a temporal aspect that is often discarded in transactional databases, as a data warehouse should provide the opportunity to analyse the change of data over time (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009; Albano, 2015). This results in both being able to provide reports with historical accuracy and maintaining previous data instead of simply overwriting it (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009; Albano, 2015). Girsang, Arisandi, Elysisa and Saragih (2019) agreeingly state that data warehouses aids in analysing trends over time.

2.2.2 Data or Analysis Driven Strategy

Data has always played a key role in technology-based decision support (Meredith, O'Donnell & Arnott, 2008). One of the main potentials of BI systems is the possibility to gather and make large amounts of data accessible to an organization (Grecu & Nate, 2014; Ramakrishnan, Jones & Sidorova, 2012) and present information at convenience (Ramakrishnan, Jones & Sidorova, 2012). Therefore, BI systems rely heavily on what data is available as well as its quality and consistency, which encourages organizations to maintain a valid data strategy in order to receive the benefits of utilizing BI (Ramakrishnan, Jones & Sidorova, 2012). Collecting and integrating data for BI purposes derives into two recognized strategies, data driven, or analysis driven (Albano, 2015). Albano (2015) highlights that both of these strategies can be useful in certain cases, and they can be combined.

The former encompasses a top-down approach of collecting, integrating, and storing data in a central data warehouse, and later creating data marts from it based on what data is available from various operational systems once certain information is demanded (Albano, 2015; Golfarelli & Rizzi, 2009). A data driven strategy requires for there not to be a need for information before the data warehouse is usable (Albano, 2015). According to Golfarelli and Rizzi (2009) and Albano (2015), this gives organizations the opportunity to design, construct and implement consistent and well-integrated data warehouses based on global business needs.

However, it does come with a higher demand for resources, such as time and cost (Golfarelli & Rizzi, 2009). Furthermore, analysing all relevant data sources at once is a challenging task itself, as well as a dependency of all data sources to be available simultaneously (Golfarelli & Rizzi, 2009). Forecasting as well as fulfilling user needs and trust also poses challenges (Golfarelli & Rizzi, 2009), as the end user is usually not involved in the development and analysis process.

The latter is initiated by a bottom-up approach, in which data marts are designed, based on what data analysis the end users require, and then integrated into constructing the data warehouse (Albano, 2015; Golfarelli & Rizzi, 2009). In this manner, it is possible to more quickly deliver useful information to end users as the scope is more focused (Albano, 2015). This provides the opportunity for reducing the time and cost related to implementing a data warehouse (Golfarelli & Rizzi, 2009). However, it poses some risks as users may request information that requires unavailable data, or disregard relevant data that is available due to a too narrow focus (Albano, 2015). Golfarelli and Rizzi (2009) fortify this by remarking how a data mart should utilize already available data. Therefore, according to Golfarelli and Rizzi (2009), the development of the first data mart plays an important part as it should be viewed as a reference point so the coming data marts could more easily be added.

2.2.3 Predictive Analytics

Predictive analytics is defined as (Eckerson, 2007, s.5) “a set of business intelligence (BI) technologies that uncovers relationships and patterns within large volumes of data that can be used to predict behaviour and events”. This is fortified by Kariyawasam et al. (2021) who describe predictive analytics as a means to identify patterns in available data through algorithms to predict future behaviour. Bose (2009) remarks the growing interest and relevance of advanced analytics, as it provides opportunities to drive new decisions related to customers and resources, as well as possibilities to align with customer demands more effectively. Banerjee and Mishra (2017) show proof of great advantages on company performance and competitive advantages of applying BI to supply chain management operations. Inventory management is one part of it, which by being improved can reduce the costs of over-stocking and avoid losing sales due to inventory shortage, according to Banerjee and Mishra (2017). General inventory overstocking is costly as it requires space and management (Banerjee & Mishra, 2017; Olexova, 2014), but in a food-retail setting it could also lead to food waste (Horoś & Ruppenthal, 2021). To avoid this, Horoś and Ruppenthal (2021) mention ordering systems as the key to analyse and estimate the future need of products to place more accurate orders.

Agarwal (2014) stresses the importance of retailers quickly responding to demand spikes, which BI tools help to do by providing information on patterns and such things as predicted shortages. Khan, Ganguly, and Gupta (2008) fortify this by highlighting how traditional markets have transformed from being supply-driven to demand-driven, and therefore affecting production decisions. Asif, Hina and Mushtaq (2017) state that an improved understanding of customer needs, trends, seasonality, and analysing strategies can, among other things, improve inventory management operations. Although some of these operations are already partly automated, there is still great potential for improving the systems by increasing the accuracy of the analysis (Horoś & Ruppenthal, 2021). By adding certain variables, such as weather and seasons (Horoś & Ruppenthal, 2021; Asif, Hina & Mushtaq, 2017), BI can be utilized to create intelligent ordering systems (Horoś & Ruppenthal, 2021).

Predictive analytics is usually based on the available data from a data warehouse and incorporates into a variety of suitable algorithms (Negash & Gray, 2008). Data mining, predictive analytics and forecasting are used for more sophisticated analytics related to making predictions, where forecasting specifically centres around analysis related to the future (Negash & Gray, 2008). Predictive analytics is often recognized as forecasting based on data mining, however there are other approaches to this technique (Negash & Gray, 2008). The output can be scrutinized to identify patterns and trends to forecast where the future is plausibly heading (Negash & Gray, 2008; Eckerson, 2007; Hlaváč & Štefanovič, 2020). Predictive analytics utilizes statistical techniques (Wazurkar, Bhadoria & Bajpai, 2017), such as linear and logistic regression, as well as descriptive statistics, meaning median, standard deviation, mean and mode, to process data (Eckerson, 2007). The range of useful technologies and techniques is extended by including predictive algorithms, for instance decision trees, neural networks, and other mathematical algorithms (Eckerson, 2007; Attaran & Attaran, 2019; Selvaraj & Marudappa, 2018).

By implementing predictive analytics, organizations are able to optimize processes, discover new opportunities or upcoming issues, as well as understand their customers' behaviour (Eckerson, 2007; Attaran & Attaran, 2019). Zhou et al. (2017) present the possibility for advanced analytics to identify when there is a risk of overstocking and based on that assist in adjustment of the inventory automatically. This is possible due to the utilization of data mining techniques that identifies attributes and helps the user to notice which items that might be at risk of overstocking due to similar attributes (Zhou et al. 2017). Data mining contributes to identifying patterns by aiding in processing large amounts of data in order to enhance knowledge discovery (Khan, Ganguly, and Gupta, 2008) and predictive modelling (Bose, 2009). The technology provides opportunities to automatically discover associations, patterns, changes, abnormalities, and structures in the available data (Bose, 2009). Data mining can increase the efficiency of the management of large-scale as well as complex analysis tasks (Zhou et al. 2017).

2.2.4 Dashboards and Visualizations

Visualizing is to graphically represent information, and by data visualization end users are able to easily comprehend the output from processing large amounts of data into understandable information (Kumar & Belwal, 2017; Kariyawasam et al. 2021). The ability to visually represent data in a comprehensive manner was deemed important early on in the development of the field and is presented to users on a visual graphics display called Dashboards (Elias & Bezerianos, 2011). Zheng (2018) describes dashboards as a composition of data, visualization, and a user interface. The purpose of dashboards is to present data with uncomplicated graphics, and through visualization, relationships and dependencies among data are more easily identifiable (Furmankiewicz, Furmankiewicz & Ziuziański, 2015; Kariyawasam et al. 2021). These interfaces utilize charts, graphs, colour, size, and shape in order to more easily govern monitor, and process information (Furmankiewicz, Furmankiewicz & Ziuziański, 2015; Elias & Bezerianos, 2011), with simplicity and efficiency constituting the key elements of the presentation (Furmankiewicz, Furmankiewicz & Ziuziański, 2015).

In order for the dashboards to provide the most benefits, the information should be current, reliable and presented in such a manner that enables comparisons to historical data or target values (Furmankiewicz, Furmankiewicz & Ziuziański, 2015). In terms of visualizing this, deciding on forms, placement, colour selection, and degree of precision of the information is

vital for clarity and transparency, and should preferably be displayed on one screen (Furmankiewicz, Furmankiewicz & Ziuziański, 2015; Zheng, 2018). It is also recognized that dashboards and visualizations aid managers in decision making with analytical systems and tools (Zheng, 2018) with an emphasis on user friendliness (Hall Jr., 2003; Asif, Hina & Mushtaq, 2017). Therefore, Elias and Bezerianos (2011) highlight the importance of feedback from the end users, so dashboards are structured and provide the correct information that correlates to users' needs. In more recent developments, users have been enabled to create and customize their own dashboards, specifically to their own needs (Elias & Bezerianos, 2011).

Furmankiewicz, Furmankiewicz and Ziuziański (2015) list multiple purposes of utilizing dashboards, such as optimizing the process of decision-making, performance, and efficiency improvements, making correct information available to the relevant users at the right time, and presenting analytical results. Dashboards support holistic and integrated analysis and enable presentations of intricate relationships and performance metrics in an understandable manner (Furmankiewicz, Furmankiewicz & Ziuziański, 2015; Hall Jr., 2003). In the decision-making process, drawing conclusions and insights from a dashboard may be considered as the first step (Furmankiewicz, Furmankiewicz & Ziuziański, 2015). Through what is presented on the dashboard, the user may discover problems and its source (Furmankiewicz, Furmankiewicz & Ziuziański, 2015). Depending on the level of advancement, dashboards may support users in their decision-making throughout the entire process (Furmankiewicz, Furmankiewicz & Ziuziański, 2015).

Marcus (2006) describes how technological advancements, such as the Internet and mobile devices, invites a broad range of people to utilize dashboards, allowing for the client side to more easily be informed by the provided information. It is highlighted by Guidotti, Gabrielli, Monreale, Pedreschi and Giannotti (2018) how implementing personal dashboards for customers within retail may make them more aware of their behaviour and purchasing patterns. Through visualizing, a customer may gain insights on their behaviour, which may result in improved self-awareness. Furthermore, integrating a collective perspective by providing information of other customers' behaviours may also have an effect on individuals (Guidotti et al. 2018).

2.3 Sustainability

2.3.1 Introducing Sustainability

The term sustainability was coined in 1712 by a German Forester, who advocated for long-term management of forests (Scoones, 2007). The relevance of sustainability as a topic skyrocketed as environmental movements were organized in the 1960’s and 70’s (Scoones, 2007). A major centre piece of the sustainability debate was introduced in the report Our Common Future, where Brundtland presented the modern definition of sustainability (Scoones, 2007), being: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987, p. 35).

Sustainability and sustainable development sparked multiple debates across research disciplines, businesses, and governmental bodies. As sustainability was debated within the field of

economics, businesses slowly approached the topic as an important objective, causing new auditing and accounting measures being developed and then integrated in business planning and practice (Scoones, 2007). By the 1990's, multiple definitions of sustainability were formed from the various actors participating in the aforementioned debates, and the resulting confusion led to difficulties of transforming the discussions into practice (Scoones, 2007). As Portney (2015) discusses, the exact definitions and concepts of sustainability and its adjacent notions are not fully untangled, however at its core, it clearly revolves around the condition of the Earth and achieving a state in which neither the environment, society or economic growth is staggered or threatened. As the climate debate raged on and caused worrying headlines, both public and political responses pushed progress forward. Commonalities of the issues were that they all had intertwined ecological, sociological, and economic dimensions on both a global and local level (Scoones, 2007).

There are several concepts from previous debates that were taken rather for granted today, one of them being the notion of sustainability being encompassed by three equal parts; environment, economy, and equity (Portney, 2015), or as more commonly known as the three pillars, depicting a balance between environment, economy and society as a means to achieve sustainability (Hilty & Aebischer, 2015). Hilty and Aebischer (2015) call for a critical examination of the current description, implying that it creates a misconception of the weight of each pillar. By definition, the economic system is a part of society and is therefore unable to exist without it (Hilty & Aebischer, 2015). Overlooking the relationship between the environment and society, all natural resources would be substitutable by resources created by humans for the two pillars to be equal, and not having society completely dependent on the environment (Hilty & Aebischer, 2015). Hilty and Aebischer (2015) argue that representing the dimensions as nested and not equal showcases how complete balance cannot be achieved.

2.3.2 Sustainability Impacts in the Food Industry

Supported by the United Nations Environment Programme (UNEP), Delai and Takahashi (2013) state that retailers in general should manage their own sustainability impacts by implementing environmental management systems to manage energy and water conservation, waste management and recycling. However, they stress that managing the internal impact is not enough, there are two more categories of activities that should be taken into consideration: supply chain management and education of customers. Spang, Moreno, Pace, Achmon, Donis-Gonzalez, Gosliner and Tomich (2019) also point out the linkages between the different actors across the food supply chain. As certain pressures and drivers influence other actors, they state the importance of for example considering food waste holistically to understand the waste at each stage (Spang et al. 2019). An actor within food production or retail should hence keep track of their impacts on multiple levels of the supply chain as it can provide great opportunities to reduce the environmental impact (Davies & Konisky, 2000). To distinguish between the levels, a division into three categories of environmental impact in the food industry will be used, as suggested, and defined by Davies and Konisky (2000).

- Direct environmental impacts, from the service itself - such as energy use, air and water emissions and solid waste generation

- Upstream environmental impacts, from the supply influence on the supply chain operations

- Downstream environmental impacts, which is the link to the impact caused by consumer behaviour

2.4 Sustainability elements

Table 2.2: Table of sustainability elements

Impact	Element	References
Direct impact	Reduction of food wastage	Delai & Takahashi, 2013; Fritz & Matopoulos, 2008; Otles et al. 2015; FAO, 2019; Spang et al. 2019; Govindan, 2018; Martin-Rios, Hofmann & Mackenzie, 2020
	Reduction of resource consumption	Fritz & Matopoulos, 2008; Davies & Konisky, 2000; Bekele, Bosona, Nordmark, Gebresenbet & Ljungberg, 2012; Kumar, Mangla & Kumar, 2022
Upstream impact	Governance of supplier sustainability	Davies & Konisky, 2000; Delai & Takahashi, 2013; Fuchs, Kalfagianni & Havinga, 2011; FAO, 2019; Kumar, Mangla, Kumar, 2022; Bekele et al. 2012; Spang et al. 2019
Downstream impact	Customer awareness	Delai & Takahashi, 2013; Davies & Konisky, 2000; FAO, 2019; Bekele et al. 2014; Spang et al. 2019; Martin-Rios, Hofmann & Mackenzie, 2020
Overall impact	Sustainability reporting	Herzig & Schaltegger, 2006; Lozano, Nummert & Ceulemans, 2016; Klovienė & Speziale, 2014; Bunclark & Barcellos-Paula, 2021

2.4.1 Reduction of Food wastage

Martin-Rios, Hofmann and Mackenzie (2020) highlight the issue of food wastage in all steps in the food supply chain and argue how innovations can benefit companies in the industry. Throughout the chain there are occurrences of food waste and loss caused by technological, cultural, weather-related, economic, and societal reasons according to Otles et al. (2015). The direct impact of the retailing operations specifically includes the actions and decisions that lead to decreasing quality or quantity of food, as defined by FAO (2019). Food waste in the retail setting is often due to a limited shelf life, aesthetic standards of colour, shape and size, and a varying customer demand (FAO, 2019). One barrier to the reduction of food waste is that there is often a lack of accurate information about the amount of waste and what the benefits of reducing it are, which might repel risk-averse stakeholders from taking action according to FAO (2019). In food production, the issue is instead referred to as food loss as that considers the spillage of food throughout the food supply chain (Otles et al. 2015; FAO, 2019). Food producers are responsible for the post-harvest stage of the supply chain, where it is important to reduce the risk of food loss by proper handling, processing, storage, and packaging of the products (Spang et al. 2019). Investments in management practices can optimize the use of resources, which might also lead to an economic value gain (Otles et al. 2015). Govindan (2018) collectively describes food waste and loss at the different stages of the supply chain as food wastage.

2.4.2 Reduction of Resource Consumption

This aspect relates to the general direct impacts of the consumption of such things as energy and water in the stores and production. The consumption of such resources can be reduced by tracking usage and upgrading inventory to reduce consumption of electricity from lightning, heating, and cooling, but also redesigning store layouts to become more energy efficient (Bekele, Bosona, Nordmark, Gebresenbet & Ljungberg, 2012). Bekele et al. (2012) reported that the refrigerator to be a main source of greenhouse gas emissions and that the leakages of such was a big part of the problem. As there is significant energy input required to preserve food that needs to be kept cold throughout the food supply chain, research confirms that it is necessary to manage, evaluate and track the energy footprint, and minimize the energy input from such operations (Kumar, Mangla & Kumar, 2022).

2.4.3 Governance of Supplier Sustainability

Limiting the environmental harm from the direct impacts of the retailers makes up for one part of the problem, but many retailers aim to go further than that by making an upstream impact. This, by governing and putting set requirements on their suppliers (Fritz & Matopoulos, 2008) and influencing the sustainability of the production activities (Delai & Takahashi, 2013). Global food and agricultural governance have been found to not only be created by governmental actors, but to a high degree also by private actors within the food industry according to Fuchs, Kalfagianni and Havinga (2011). Fritz and Matopoulos (2008) state that especially market-leaders are actively working on this and mentions that Walmart is one retailer that audits their suppliers to ensure a sustainable supply chain (Walmart, 2019), another one is Coop. According to research by Bekele et al. (2012), Coop (at that time called Konsum) required their food suppliers to follow sustainable business practices by requiring them to set up internal control and inspection of their temperature control, water supply, quality management, etc, which they had to document and report back on. Spang et al. (2019) mention the possibility of retailers to have an upstream influence on the food waste reduction from what requirements they decide to set on their suppliers. Similarly, food producers can have an influence on the ecosystem of their suppliers and producers of raw materials as well as the retailers they collaborate with (FAO, 2019). Kumar, Mangla, and Kumar's (2022) literature review highlight the vitality of supplier engagement and supplier relationship management to create a sustainable food supply chain. This due to the research showing that supplier collaboration through information sharing can reduce costs and emissions and improve production and decision making.

2.4.4 Customer Awareness

Suppliers and producers of food cannot be seen in isolation as their decisions and actions are strongly conditioned by the behaviours and demands of the customers (FAO, 2019; Martin-Rios, Hofmann & Mackenzie, 2020). Retailers can affect customers to such things as reducing their food waste levels by adjusting packaging (FAO, 2019). Proactively managing the demand side of the environmental impacts includes raising awareness of the customers on how to act more efficiently to increase the demand of more environmentally friendly products, and then provide what they demand (Bekele et al. 2012). Spang et al. (2019) claim that especially the retailers are expected, and have the possibility to, make an impact downstream by promoting and creating possibilities for sustainable consumption of the customers. A common

strategy for changing the behaviours of the consumers is by utilizing information and technology (Spang et al. 2019).

2.4.5 Sustainability Reporting

Companies working towards more sustainable practices face the challenge of depending on stakeholders that must accept the efforts for sustainability and participate to make the full ecosystem sustainable (Herzig & Schaltegger, 2006). To get the stakeholders on board, the management needs to communicate the benefits and report on the activities (Herzig & Schaltegger, 2006). Herzig and Schaltegger (2006, p. 301) firmly states that "No participation is possible without communication". Sustainability reporting has become increasingly important during the last years and many stakeholders push companies to become more transparent about their sustainability activities (Klovienė & Speziale, 2014). Companies are dependent on their suppliers' transparency and will to share their information in such thing's sustainability reports, to be able to report on the sustainability of their supply chain (Bunclark & Barcellos-Paula, 2021). Sustainability reports can hence improve the sustainable management of supply chains and have upstream impact by providing more information to make decisions and analysis out of (Bunclark & Barcellos-Paula, 2021). Although many of the benefits of sustainability reporting have external focus, such as improving legitimation, reputation and competitive advantages, there are also some benefits that are company internal (Herzig & Schaltegger, 2006; Lozano, Nummert & Ceulemans, 2016). It can be a driver of transparency within the organization as it provides clarity of responsibilities and accountabilities of the efforts (Herzig & Schaltegger, 2006). It can also provide reasons for the company to deal with sustainability as it can trigger awareness and the inclusion of sustainability-information in business-information (Herzig & Schaltegger, 2006). Lozano, Nummert and Ceulemans (2016) report that the process of collecting the data necessary for sustainability reporting increased the visibility of the data and triggered management discussions on the topic. Further, the development and publication of a sustainability report were found to drive sustainability changes in organizations (Lozano, Nummert & Ceulemans, 2016) which can be considered a direct impact. Hence, sustainability reporting can make an impact by raising awareness externally and internally at multiple levels, but also by increasing the inclusion of sustainability into the core activities of corporations. Due to this, it has the possibility to have an effect on at least two levels of impact as defined by Davies and Konisky (2000), direct and upstream.

2.5 The theory of Affordances

To understand and identify what possibilities a user or a group of users perceive related to using a system, the Theory of Affordances can be used (Wieneke, Lehrer & Jung, 2016). IS researchers have frequently been using the affordance theory within their field, although it originates from the ecological psychology domain (Volkoff & Strong, 2017) This has required some adaptations and translations to clarify how it can be used within the IS research field (Volkoff & Strong, 2017). One definition of an affordance, which considers the nature of affordances in organizational settings, is suggested by Strong, Volkoff, Johnson, Pelletier, Tulu, Bar-On, Trudel and Garber (2014, p.69) as "the potential for behaviours associated with achieving an immediate concrete outcome and arising from the relation between an artifact and a goal-oriented actor or actors".

Gibson (1977) first presented the idea of affordances as something that substances offer, but that needs to be perceived by the observer to be available. Hence, different observers might provide different affordances of the same object based on what goal the observer has (Gibson, 1977). Affordances do not require conscious cognitive analysis of the attributes of the object, but are directly perceived (Volkoff & Strong, 2017). At the same time, the affordances exist even if the observer does not perceive them and constantly analyses the possible use of the object (Volkoff & Strong, 2017). For example, a surface can provide support for one actor, but the same surface does not necessarily for another actor if they have differences in size or weight (Gibson, 1977; McGrenere & Ho, 2000). Another example is the affordance of walkability, which is when an actor perceives that it can walk when it sees a solid and opaque surface extending under its feet (Gibson, 1977; McGrenere & Ho, 2000). Affordances does not depend on value, meaning, or interpretation but needs an actor as a frame of reference, according to McGrenere and Ho (2000). Hence, an affordance is neither objective, nor subjective. Volkoff and Strong (2017, p. 1) exemplify an IS-related affordance by explaining that "an email system affords a user who has appropriate capabilities the possibility of communicating". The strength of the affordance theory is that it makes it possible to apply a socio-technical perspective and combine details about technology with the social context of its environment (Volkoff & Strong, 2017). When the theory is applied in research, it can be used as a lens to see things in a new way which can simplify the identification of mechanisms, it does not serve as an explanation (Volkoff & Strong, 2017).

The discussion has provided multiple alternative uses of the Affordance Theory over the years, such as one by Norman (1988) that referred to both perceived and actual properties of an object, where the actual properties do not require an associated actor to exist, as described by Volkoff and Strong (2017). However, McGrenere and Ho (2000) explain that Norman's view describes the usability of an object, while the original view describes its usefulness. Volkoff and Strong (2017, p. 2) refer to the one describing usefulness as the functional perspective and states that it has a focus on "what the potential actions afforded by the technology-user relationship are intended to accomplish, rather than the details of those actions in any particular situation" which they claim makes it appropriate to apply to the field of IS. Accordingly, Hartson (2003) states that functional affordance ties usage to usefulness. Based on the idea of actual properties as described by Norman (1998) and the affordances of them, Hartson (2003) claims that there is a mandatory component of utility or purpose included in all functional affordances. A functional affordance hence helps or aids the user to do something (Hartson, 2003). As noted by Volkoff and Strong (2017), it is important to distinguish between the affordance itself (the possibility of acting), its actualization (the action), and the outcome of the action.

An example of functional affordance research is a study by Seidel, Recker and vom Brocke (2013) which had the goal of identifying functional affordances of IS related to establishing environmentally sustainable work practices. They state that this can increase the knowledge about green IS with the purpose of tackling sustainability issues like energy consumption, waste reduction, resource utilization and emission management. By looking at the functional affordances Seidel, Recker and vom Brocke (2013) mean that they were able to study how users with action goals within the subject of improving sustainability interpret the material properties of IS with the objective to improve the sustainability of work practices.

Going forward, we will mainly rely on the concept of functional affordances and use it as a theoretical lens. This as the research looks at the capabilities of the tools related to being useful for the purpose of sustainability, which requires the inclusion of a purpose to be explored.

When referring to affordances of using BI&A for sustainability, there is always an objective, a purpose, of being sustainable included in the affordance. The actual properties of the BI&A tools allow affordances to occur to aid the user in its sustainability efforts.

3 Research Method

This section presents our selected choices of research design, including motivations based on the nature of the problem and research question. We initially present the research philosophy and approach, move on to explaining the data collection and analysis methods, and end by reflecting on ethical considerations and scientific quality aspects of the study.

3.1 Research Philosophy

Having a clear research philosophy is a way to ensure quality of research (Hassan, Mingers & Stahl, 2018). It guides the actions throughout the process as it provides guidelines of the nature of knowledge and on what assumptions that can be made.

This thesis aims to understand the human interpretation of the usefulness of BI&A tools, which is why we approached the topic with an interpretive research philosophy. The interpretive method of research views knowledge of our reality as a social construction by human actors (Walsham, 1995a). This social view of reality over natural sciences better explains people's actions and behaviours in context according to the interpretive research philosophy (Goldkuhl, 2012). The research question in this study has a focus on the social mechanisms and interpretations of the system in use, as they intend to explore the perception of the BI&A tools' usefulness and explain the usage of them to fulfil sustainability goals. The reasoning behind the selection of the philosophical stance is that the question seeks to find the interpretation of the situation - something that can be accessed through someone's subjective description of it (Walsham, 1995a). The interpretive research philosophy resulted in knowledge derived not only from the interviewed person’s perception but also includes our interpretations from the process of collecting that information as we as researchers, according to the interpretive approach, never act without affecting the results (Walsham, 1995a). In contrast to the pragmatist stance, the interpretive stance looks towards understanding of what is interesting instead of knowledge about what is useful in action (Goldkuhl, 2012). As our research aim has a clear focus on finding interesting aspects about the organization’s perception of usefulness and benefit of using BI&A, rather than driving actions, the interpretive approach was considered the most suitable in this case. The knowledge derived from doing interpretive research provided insights on how the people representing the companies in question experience and describe the usage and usability of these systems, in great detail, which created an understanding of the affordances of the BI&A tools. This subjective understanding provided enriching answers in the specific social setting and context, which we consider to be highly contributing to facing the current issue within research related to sustainability practices and BI&A.

3.2 Research Approach

The focus of this paper was to explore how BI&A tools and systems are used and perceived useful to support sustainability efforts within companies. To achieve this, we chose a qualitative research method which is a common and suitable method for interpretive studies (Goldkuhl, 2012). Patton (2014) describes qualitative methods as capturing people’s stories about how things work and it can provide detailed and descriptive information on the

phenomenon, which we consider was highly sufficient to address the research question at hand. The qualitative research methodology has a focus on words according to Recker (2013) which is another reason it suits our study as it aims to capture the interpreted usefulness and get a rich description of the tools in use. Rich and thick descriptions make it possible for the reader of the study to access the meaning and significance of the behaviours (Schultze & Avital, 2011). To study the perceptions of usefulness of using BI&A for the purpose of sustainability, we were interested in the detailed and underlying reasons as to why, which was possible to capture in qualitative research.

As the qualitative method has broader and more open data-collection procedures, it allows more insights and contributions, which is aligned with our study as we investigated a quite unexplored phenomenon, rather than the opposite quantitative method which provides measurements of phenomena (Recker, 2013). On the same note, Harboe (2013) describes the qualitative method as very flexible. This makes it suitable for studies that lack some background information that makes it difficult to fully determine all relevant aspects at the very start, as they potentially grow, shift, or evolve during the research period based on what insights are captured (Harboe, 2013). When interesting aspects were uncovered during the data collection that was not identified in the previous research, the qualitative method allowed for exploration of them. Especially when exploring a constantly emerging technology, it is highly likely to uncover such new aspects. Due to the nature of the problem, a qualitative approach that results in a thick description of the behaviour based on the interpretations of the participant was considered suitable for the study.

The arguments in favour of selecting a qualitative method are also relevant to motivate the choice of the reasoning approach, which is the inductive. We believe that inductive reasoning would be a more fruitful approach to provide general conclusions from concepts and patterns of observations, rather than the opposite deductive reasoning approach that could provide conclusions from applying known theory to observations (Recker, 2013). The research did not test or hypothesize anything regarding the elements but aimed to find out more about how these tools were being used by looking at a couple of identified elements. The research question was bound but the inductive nature of the study left room open for exploration rather than what testing would have done.

3.3 Data Collection

3.3.1 Literature Review

To get an overview and understanding for the topic and previous research on the subject, an exploration of the relevant literature was necessary. Initially, one purpose was to specify the gap of knowledge and to formulate the research problem and question. Further into the process, the literature provided a theoretical and methodological ground to shape the research based on (Rienecker & Stray Jørgensen, 2008). In order to target the research to the most relevant aspects of the use of BI&A for sustainability, findings from other researchers were used to formulate the specific elements that we decided to investigate. The sustainability-elements were chosen based on what previous research highlighted as the most crucial efforts within sustainability relevant to the food industry, related to the use of technology. Similarly, the BI&A-elements were found by looking at previous findings on how actors within the food

industry, or retail in general, can make use of BI&A tools, as well as their importance in specific contexts. The tools and impacts themselves were also provided to guide the research, based on categorizations made by established researchers. As the intersection of BI&A, sustainability and the food industry are relatively untouched, complimentary articles focused on retail in general were included in order to create a foundation of these elements being applicable to the food industry as well.

Literature was mainly found by searches in scholarly databases such as LUBsearch and Google Scholar and accessed through the university authorization. By combining a number of keywords, the articles were found. Some of them were: “business intelligence,” “analytics", “data”, “sustainability”, “retail”, “grocery”, “production”, “food”, “food supply chain”, “emissions”, “impact,” “eco business intelligence”, “measure”, “affordance”, and “useful”. When the elements (see table 2.1 and 2.2) had been identified, these were also used as search terms in combination with the keywords to explore them further. Articles were selected in favour of being well-cited and peer-reviewed, factors we also had in mind when considering how much of an influence they were to have on our theoretical framework. Peer reviewed material has a higher scientific quality as it has been checked by experts and is hence preferable (Rienecker & Stray Jørgensen, 2008). Websites and white papers were sparsely included, when we deemed it to be able to provide recently published general information that has not been formally researched yet.

3.3.2 Interview Setting

The most common way to collect data in qualitative research is through interviews, which are collaborative conversations between participants and the researcher who seeks to get first-person accounts of the social reality in rich descriptions (Schultze & Avital, 2011). By deciding to conduct such qualitative interviews to capture these rich descriptions, we got to understand the underlying meanings and learn from them. As mentioned, the interpretive stance and qualitative methodology values rich descriptions and personal interpretations in a social context, which can very successfully be captured through conducting interviews (Schultze & Avital, 2011). To get rich descriptions and to ensure highest possible comfort for the participants who were all Swedish, the interviews were conducted in Swedish and later translated into English. This naturally comes with the risk of altering statements during the interpretive process of translating them, but we considered it the best option as we believe that conducting the interviews in English would have restricted the informants verbally in a way that also could have altered the meanings of their statements. To ensure we made the translations and interpretations of the meanings behind what was said as accurate as possible, we revisited the recording and Swedish transcript multiple times throughout the process.

The interviews were planned to all be held individually, as we believe it ensured that the participant answers were not being affected by group pressure or another participant's opinion and to create a safe space where the participant felt comfortable expressing their thoughts and experiences, as corroborated by Harboe (2013). Individual interviews were also considered the most convenient as it made it possible for the informant to choose a time without being constrained to fit someone else's schedule. However, these plans slightly changed as two informants invited a colleague to also participate in the meeting, which we welcomed and appreciated as it opened up for even more insights and since the scheduling was not an issue. Most importantly was the participants’ own decision of inviting a colleague instead of us pushing it, as their choice of collaborating together ensured that the space was considered safe

for opinions to be raised truthfully and comfortably. The two combined interviews can also have had a positive influence on the results as group interviews can increase creativity and spontaneity and make it possible for the participants to remind each other of important points or topics (Harboe, 2013), which we considered was reflected in the interviews.

The setting of all the interviews was through video calls at Google Meets to make it accessible and easy, both considering the post-pandemic situation and potential geographical distance. A face-to-face interview has the potential to increase the comfort and richness of the conversation, while the strengths of a phone-interview is the simplified interview setting as it can be done from anywhere (Harboe, 2013). We believe the video-call interview combined the strengths of the two interview settings, as the video function added more depth than regular phone interviews.

3.3.3 Developing the Interview Guide and Conducting Interviews

The interviews were conducted in a semi-structured manner with mainly open-ended questions. This interview format makes it possible for the participant to elaborate and express their opinions in an open way, increasing the chances of the researchers capturing a full and truthful description of their interpretation (Recker, 2013; Patton, 2014). The semi-structured interview has an interview protocol that works as a framework for the interview (Recker, 2013). Based on previous research and literature, the questions were written and benchmarked towards Patton's (2014) guide, to make sure they were open-ended and clear. The semi-structured interview resulted in the interview being centred around some questions that were formulated beforehand in each area, but left room for new and more specific questions to emerge during the interview as the participant raised interesting aspects in accordance with what Recker (2013) states. We also had the possibility to get clarifications when needed (Patton, 2014). However, Patton (2014) mentions that one of the weaknesses is that the flexibility in questions and the variety of the order of them might result in inconsistent answers and a lacking comparability of the results between the different respondents. We had to consider this factor in deciding upon the data collection method since it has an impact on the result but opted for semi-structured interviews as we believed it suited our aim and research question the best. That is, because it allows the deep descriptions and flexibility that is needed to capture each respondent's detailed experience of using BI&A in their organization which was found more critical than the absolute comparability of the answers.

The comparability was further affected by the different profiles of the informants, as some had an IT focus and others had a sustainability focus. As the expertise differed, they were asked different sets of questions as shown in Appendix I. As all informants had some level of knowledge within both areas and many possessed a cross-functional role, some questions from the second part of the interview guide were asked based on what level of knowledge in the field we perceived the informant to have. Hence, when possible and time allowed, the informant got to answer questions from both question guides. To increase comparability and set the focus, all the interviews started with a short definition of BI&A and sustainability. We also mentioned the identified elements and welcomed some extra elaboration within those areas, while not restricting to those only. The informants did also receive the interview questions well in advance by email, to ensure they understood the scope and focus of the research and had some time to reflect beforehand.

3.3.4 Sampling Method

As the study only focuses on Sweden-based well-established food retailers and producers with some level of BI&A practices in place, the number of eligible organizations was limited. To collect relevant data to answer the research question, purposive sampling was considered appropriate which Bell, Bryman and Harley (2018) mention to be common in qualitative research. It is a form of non-probability sampling which does not seek participants in a random or population-generalizable way, but in a strategic way to find certain relevant people to answer the research question (Bell, Bryman & Harley, 2018). We strived to have variety in the sampling by having members with different characteristics as recommended by Bell, Bryman and Harley (2018), this mainly by welcoming participants with different educational backgrounds and profiles, one technical and one sustainability related. Ideally, we wanted to interview one person from the IT department, preferably knowledgeable about BI&A and corporate responsibility, and one working purely with sustainability matters in the same organization. To interview key informants is in line with what Recker (2013) and Harboe (2013) recommend for an interview as their positions give them specialist knowledge about the studied topic which can bring more valuable information than regular people (Recker, 2013). We hence aimed to find key informants with as much knowledge as possible on the topic of the thesis. Based on these requirements, the selection of participants was made purposive (Bell, Bryman & Harley, 2018). We made sure the informants were suitable to interview by sending them the interview questions, and if they considered themselves knowledgeable enough to answer at least some of the questions we booked an interview. A maximum of two people from each company were interviewed, with the requirement of them having different profiles, either IT or sustainability.

We found possible informants through information from the companies' websites, a contact-list from Hållbar Livsmedelskedja (n.d.), reaching out to our personal contacts, LinkedIn searches, google searches, and other sources such as podcasts or news articles which we found during the earlier stages of the research. Most LinkedIn searches were conducted by combining the name of an eligible organization with a word from relevant role titles such as "IT", "BI", "Analyst", "Data", and "Sustainability". Based on information found in the profiles of the people appearing in the search results, many were contacted by sending a contact request with a short message about participating in the study. If there was an e-mail address accessible, a longer message and more information about the study was sent during the first point of contact. This selection of relevant people to contact might result in biases occurring from the judgment process of the researchers (Bell, Bryman & Harley, 2018), with that in mind we consciously included everyone with an appropriate job title regardless of their personal demographics and the characteristics of their LinkedIn profiles. Most of the contacted people never reached back, and a big part turned down interviews due to a lack of time. Many of the people that were contacted recommended us to reach out to a more knowledgeable or less busy colleague. Some responded that they did not consider their organization to utilize BI&A for sustainability, yet which made them ineligible for our study and unwilling to participate. Based on this, we consider that the informants participating might be from organizations at the very forefront which is highly likely to have an impact on what results that were found.

Table 3.1: Table of informants

Organization	Type	Informant	Profile	Date	Duration
Org1	Retailer	Inf1	Sustainability	29/4	40 min
Org2	Retailer	Inf2	IT	2/5	30 min
Org3	Retailer	INF3a	IT	3/5	43 min together + 16 min INF3b only
		INF3b	Sustainability		
Org4	Producer	INF4	IT	6/5	30 min
Org5	Producer	INF5a	IT	13/5	48 min
		INF5b	Sustainability		

3.4 Data Analysis Method

3.4.1 Inductive Approach

After the interviews, we had audio recordings which we transcribed to be able to analyse, supported by our notes and comments made both during and after the interview, which Patton (2014) recommends as it supports the transcription with a context for interpreting and making sense of the interview in a later stage. Next, the transcript was translated from Swedish to English. The analysis of the data collected from the interviews was done through an inductive approach. Recker (2013) describes the inductive analysis as analysing data from the bottom up, and then transforming concepts, patterns, and themes of the data into abstract units. This is in line with what Patton (2014, p. 791) explains, that the qualitative inductive analysis can be used to generate "new concepts, explanations, results, and/or theories from the specific data of a qualitative study". Based on this, we considered inductive analysis to be the suitable stance as our research aimed to find answers by looking at key informants' descriptions and through an analysis creating an abstract picture of this complex phenomena.

3.4.2 Coding

Table 3.2: Coding schema

Area	Colour	ID	Element
BI&A	Orange	BI1	Collecting and integrating data
		BI2	Data or analysis driven
		BI3	Predictive analytics
		BI4	Dashboards and visualizations
Sustainability	Green	S1	Reduction of food wastage
		S2	Reduction of resource consumption
		S3	Governance of supplier sustainability
		S4	Customer awareness
		S5	Sustainability reporting
Usefulness	Blue	A1	Identified usefulness
	Red	A2	No identified usefulness
	Purple	A3	Non-sustainability related usefulness

As inductive analysis involves finding patterns, themes, and categories in data (Patton, 2014), we found coding suitable for processing the big amounts of data that our interviews resulted in. It also provided structure to make connections between the literature and the empirical result, as we chose to include the identified elements of BI&A and sustainability. Coding is the most common technique to analyse and reduce qualitative data to create useful information (Recker, 2013). Open coding is a part of the Grounded Theory approach, characterized by uncovering and naming concepts in data to then group it into categories at a higher level (Recker, 2013). We believe open coding is suitable based on the inductive approach and characteristics of the research as we are looking to capture the participant's description of what is useful and how. When doing open coding, Recker (2013) guides the researcher to read each line, sentence and paragraph and apply codes to it based on what it is about and what is being referenced, which supports the mapping of what BI&A-elements are found useful. As the limitation of the research was to primarily focus on some elements that have been identified in the literature, these elements were used as predefined codes to mark when the informants provided information on the topics, as seen in table 3.1. In addition to the elements, more codes emerged during the process, in line with how Patton (2014) describes inductive analysis. Mainly, these codes emerged from studying the material through the lens of the affordance

theory which simplified the identification of mechanisms as it made it possible to capture the perceived and the actual properties of technology simultaneously. Hence, the coding approach is a hybrid, it starts by pre-defined codes in a deductive manner but further adds and adapts codes according to inductive standards. This to ensure the research question can be answered with the familiar terms in mind while not being restricted to those topics only. This has similarities with the technique described by Fereday and Muir-Cochrane (2006), highlighting the benefits of balancing deductive coding categories derived from a philosophical framework and inductive coding categories emerging from conversations.

The process of open coding started by studying one of the interviews and applying the predefined codes based on the elements as well as creating the codes by covering all the important aspects as described in the interviews. The next step was an iterative process of applying the codes to another interview, evaluating them, and adjusting them accordingly until all relevant areas were covered. This type of revision ensured capturing the essence of the collected material and made sure that all the data was coded similarly (Patton, 2014). We conducted the iterative process independently which resulted in two sets of coding patterns that were compared and discussed to highlight the differences between them which Patton (2014) suggests as a type of analytical triangulation that increases the quality of the result. When the iterative process and coordination of the coding patterns resulted in a final coding pattern that was not changed when applied to another interview, the coding pattern was considered done. By then, it had resulted in patterns, themes and categories based on where the different participants' stories differed or shared similarities. These insights could then be combined with theoretical findings from previous research to answer the research question and create a contribution to the field of science.

By approaching the coding process in this way, we ensured that we consistently adopted an inductive reasoning approach while remaining focused on the elements as identified in the literature. Insights from the coding process were generated from the observations and could later be applied to known theory to draw conclusions. The coding process encompassed two iterations. During the first iteration, more free based words were used to describe and highlight important aspects of an informant's answer, which was then applied to the next interview. After coding each interview, the first iteration of each interview was compared to find commonalities, patterns, and themes, which derived into a set of words which was then included in iteration two. The key words generated in iteration two made out the basis and structure for the results, ensuring that all areas and topics would be covered. An example of how the coding has been conducted is presented below.

Table 3.3: Excerpt from Interview 1, see appendix B, row 23

Row	Transcription	Code	Iteration 1	Iteration 2
23	Absolutely, "or why isn't anything happening here?" Then you can discover; "God, you're not working enough. You have to focus. You have to prioritize this issue because you don't seem to be able to do this properly," so that's one way. Food waste is a good example actually. When we've said we're going to kind of halve it and now 6 years have passed and every year we have like a little curve; "we're going to go from there to there" and then we measure, send out to every CHAIN and CHAIN and see how they are doing. So far, they're pretty much on the curve like that. So that's a way to follow up and see. Like this; "Have they done their homework?" If they don't, go back. Do it right, "You have to focus". Or, like applause, "God, how good you are." So I want it to be a little competition there, and between the CEOs there.	BI1, S1	Possibility to follow up, prioritize, instrument to engage, monitor, discover findings related to performance	food wastage, comparability - organization

3.5 Ethical Considerations

While ethical considerations are important for all types of research, there are some additional concerns related to qualitative interviews which are extra exposed to ethical dilemmas (Patton, 2014). As all IS research collects data involving humans, there are certain ethical requirements listed by Recker (2013), which Bell, Bryman and Harley (2018) agreeingly present as these four ethical principles for ethical research: avoidance of harm, informed consent, protection of privacy through confidentiality, and preventing deception.

1. Avoidance of harm means that the participants should not suffer any harm or stress due to their position or information they provide to research (Bell, Bryman & Harley, 2018) This was fulfilled by granting the organizations and participants the option of anonymity to make sure their stories cannot be connected to them easily and check up on their feeling about the participation throughout the process. They also got the chance to take part of and make changes to the transcriptions before they were included, and we specifically highlighted the possibility to exclude parts of there were things they regretted saying or felt uncomfortable publishing.

2. The principle of informed consent highlights that a participant must be informed of the aims of the study, the participation process and the techniques and recording equipment used, before agreeing to participate (Bell, Bryman & Harley, 2018). We believe this study has no reason to hide any information or the purpose of the research from the participants, which sometimes can cause ethical dilemmas according to Bell, Bryman and Harley (2018). Informed consent was ensured by emailing a study information sheet as recommended by Bell, Bryman and Harley (2018) and at the beginning of every interview a verbal consent on a number of points were required before participating as Recker (2013) encourages. By verbally informing we also made sure the participant had taken part of the information before starting the interview.

3. The principle of protection of privacy through confidentiality regards the notion that information that is shared by the participants are treated rightfully and confidentially and that they have the right to decline responding to questions that they do not want to answer (Bell, Bryman & Harley, 2018). The participants received this information along with the knowledge of being able to withdraw statements or keep information from being included in the research, for example certain sensitive details about their role or company. No names of participants or organizations were included in the transcriptions; however, they were informed of the possibility of them being traceable due to the information they shared. We hence asked for allowance before including the transcripts in the thesis.

4. The principle of preventing deception is about only using the collected information for the research stated, and only collecting information relevant to the purpose of it (Bell, Bryman & Harley, 2018). This will first and foremost be avoided by our awareness and recognition of the importance of this matter during the research process. For instance, the interview questions were reviewed with this principle in mind to make sure they were relevant to the topic and within the scope of the research.

Except for these principles, Bell, Bryman and Harley (2018) further mentions the importance of storing and handling the data in a safe and appropriate way, which in this study will be done with caution and according to GDPR.

Apart from the ethical principles, Recker (2013) recommends researchers to reflect upon the ethicality of the research question, which we have done and reach the conclusion that it neither violates ethical principles nor puts the investigators or subjects at any kind of risk. In the end, we are aware that no results are important enough to cause harm due to infringing on ethical principles. Even if some secrecy and trade secrets are aligned with the subject, we believe that the level of detail investigated is lower than what would cause any crucial ethical issues but remain cautious and recognize the importance of awareness of the avoidance of harm principle. It is also important to consider the ethical importance of providing fair and true results, and not let biases or conflicts of interest significantly affect the results (Bell, Bryman & Harley, 2018). This is a challenge for all researchers as confirmation bias and presumptions are natural parts of the human mind, but we believed being aware of biases, questioning and revisiting them through the process were important actions to mitigate the harm. The presence of ethical dilemmas was constant in the research process, but just like Ryen (2011, referenced in Patton, 2014) recommended, we discussed these dilemmas and when necessary, handled them in collaboration with a more experienced researcher, our supervisor.

3.6 Scientific Quality

The qualitative and interpretive characteristics of the research naturally results in a scientific contribution derived from understanding of a small sample of interpretations of the situation. Based on the qualitative characteristics of the research, there are some quality aspects that need some extra attention.

Traditional descriptions of validity and reliability are concerned with the adequacy of measures, more relevant in quantitative than qualitative research (Bell, Bryman & Harley, 2018). There are however some variations of it that can be adopted in qualitative studies. Validity is describing the level of correctly made interpretations of the finding, but as the researcher is part of the measuring instruments and procedure (Patton, 2014) which affects the reality that is researched, it is a complex matter. In line with Bell, Bryman, and Harley's (2018) suggestions, we described the process and method of this research in as much detail as possible and put focus into understanding the context of the research to ensure validity, as well as question assumptions of dependency of variables to increase the confidence that the relations between variables are valid. Moving on, the reliability is the degree to which the results of a study are repeatable (Bell, Bryman & Harley, 2018) and not due to accidental circumstances of the research (Patton, 2014). This is difficult as the sample could never provide answers that were fully generalizable, but thick descriptions might provide some help along the way of ensuring a high reliability as it increases the chances of recreating the study and its results - the replicability of it (Bell, Bryman & Harley, 2018). LeCompte and Goetz (1982) argues that the generalizability is a big issue for qualitative studies due to the very nature of it. As this study has a small sample of companies and key informants representing them could not be used to predict or explain all occurrences of all similar situations as it depends on a big number of variables, and such things as cultural limits exist (Patton, 2014) that needs to be considered. This is a recognized insufficiency and issue in the project; however, it provided some insights and understandings with potential to be quantified and tested to reach generalizability in future research. In line with how Walsham (1995b, pp.79) further states that case study results can be seen as "explanations of particular phenomena derived from empirical interpretive research in specific IS settings", we believe that the results of qualitative interviews can be viewed in a similar manner. That is, as valuable explanations based on the past and current, but that are not predictive for the future or any similar situation like Walsham (1995b) further elaborates. We realize that our methodological choices did not generate results that may be viewed as fully generalizable, but we believe they still hold value as a further step of understanding the fusion of BI&A and sustainability practices.

Objectivity is needed to realize as much validity and reliability as possible, even if complete objectivity is impossible (Patton, 2014). Objectivity is unattainable according to the interpretivist stance which acknowledges the participation and understandings of the participant and researcher as a part of the constructed reality (Walsham, 1995a). We recognize the impossibility of objectivity and would not prioritize it due to the interpretivist stance, however we aimed to be adequately objective and address in what ways our participation affected the study, when possible, to make sure our results can be considered to reach a sufficient level of validity and reliability. Setting out to find or verifying the truth is considered less important than getting an understanding of reality, which this research was aiming to.

4 Empirical results

The empirical results are first presented by an overview of the organizations current stance on using BI&A for sustainability, followed by a brief introduction of how the organizations generally work with the identified sustainability elements. The following sections separate each BI&A element and describe the findings of how the tools affords benefits in relation to the organizations' sustainability efforts.

4.1 The Organizations Stance on Sustainability and BI&A

All the organizations have deployed BI&A, to various degrees, for their sustainability efforts. When being asked about the current stance on using BI&A for sustainability, INF1, INF2, INF3a, INF3b and INF5b describe how there is great potential and use of BI&A, but it is still in its early stages from a sustainability perspective (INF1:14; INF2:10; INF3a:8; INF3b:9; INF5b:11). INF4 recognizes multiple uses of BI&A for sustainability (INF4:7; 19; 29; 39; 41; 45), and expresses, in terms of potential, that the IT department aims to be as prepared as possible once the sustainability department comes forward with a request, rather than being a driving force for sustainability. Multiple informants also speak of the potential of expanding the use of BI&A for their sustainability efforts (INF1:97;105; INF2:68; INF3b:90: INF4:29;43; INF5b:11).

Increased use and improvement of sustainability efforts can be made possible by BI&A, by BI&A resulting in greater understanding, commitment, engagement, and motivation (INF1:22; INF2:56, INF3b:54). INF3a (8) also remarks that great developments are made, such as launching their sustainability declaration, which maps sustainability factors of products. Informants from all organizations highlight the important aspect of being able to measure, see trends, follow up and deploy needed counter actions as made possible through BI&A, and thereby is a cause for improvement of sustainability efforts (INF1:95; INF2:42; INF3a:11; INF3b:9; INF4:7; INF5b:8;63). INF5b (11) also remarks how BI&A structures their work and unveils potential for sustainability efforts through existing implementations.

Most of the informants identify an increased demand and need for data and analysis for sustainability. INF1 (93) describes how there are more demands from investors in terms of reporting figures, which drives formulating, following up goals and increasing transparency. INF2 (10) and INF5b (61) similarly speak of increased demands, and resource allocation eventually followed to enable responding to them. INF5b remarks how increased demands emerge from various actors, such as customers, suppliers, as well as legal requirements, and how sustainability reporting will grow in importance and in the future possibly outweigh financial and business descriptions (INF5b:72;11). INF5a and INF5b express how the number of demands outweighs the sustainability department's resources, resulting in difficulties to adhere to them all and also staggers the ability to communicate the information the sustainability department produces (INF5a:96; INF5b:72;95;97). However, INF5a (98;100) still believes that promoting the information could afford the organization. INF1 (97) sees a great potential for organizations to make use of the technology, as it enables structuring efforts, and maps out what is needed, how it should be developed, in what form, how it should be distributed and what importance these factors carry.

> *"...Okay, but if you kind of put it in relation to analysing to get the right numbers and analyse it on your company's business. If, that's what we're talking about, which I guess we do. That is extremely important. Yes, absolutely, it's not possible. You have to, and I think that both we and many, many companies can get much, much better at it."* - INF1, see appendix B, row 101

The progress of using BI&A for sustainability mostly stems from decisions related to resource allocation and organizational structure, affecting what areas within sustainability receive attention. INF1 (103;105), INF2 (66), INF3b (9), INF4 (9) and INF5b (90) highlight the organizational influence on the current work with BI&A and sustainability. They all concur that structure, purpose and responsibility are vital in order to make good use of the technology (INF1:97; 103; 105; INF2:66;68; INF3b:9; INF4:67; INF5b:72). INF1 (97) remarks how there is a lot of potential, not solely to standardize, but to continue to improve beyond that as well. INF2 (66) emphasizes the need for a purpose of reports and analysis within the organization, and how analysis itself does not create value unless there is a goal with it. INF3b (9) also comments on needing the whole organization to commit to achieve sustainability goals, resulting in it being crucial to have BI-tools to provide information to make this possible. INF1 (105) similarly describes how possibilities go beyond numbers, as organizational thinking is also very important in order to create structure to profit from the implemented technology.

> *" If you say so, it's like an organizational topic, too. We are an incredibly large company indeed. There are a lot of employees and different companies and departments and so on. So it takes an organization as well, so that who works with this and who does what then and who follows up; so it really requires thinking, who will do what and why just that, everything you asked about."* - INF1, see Appendix B, row 103

It appears to be a matter of prioritizing, as there are many opportunities and possibilities that require resources to be realized. Time, area of focus and assigned responsibilities are three prerequisites to progress the use of BI&A (INF1:14;16; INF2:68; INF5b:90;46; INF5a;45). In some cases, organizational change would be required to accommodate the expansion of what sustainability areas are analysed. For instance, INF5a (6;45;48) and INF5b (44;46;49) discuss the need of staff and automation functions to achieve set requirements. INF1, INF4 and INF3b highlight the wish of improving capabilities at the organizations, as INF1 (15; 97) and INF4 (11) express that educating employees on how to analyse data and information themselves would lead to them improving on creating and reading reports related to sustainability. INF3b (6) comments on how sustainability reporting is generally under-developed, and attention should be paid to standardize what format and information is relevant. They (90) expand upon this by emphasizing that beyond reporting, how to use the data and actually act upon it needs to be investigated.

The informants provided some final insights on critical thinking related towards the current implemented technology. INF3b (92) highlights the fact that there are precautions to keep in mind, so information is presented holistically, resulting in taking the right actions. The point is to not move too fast and improve something that has a negative effect on something else, by missing certain information (INF3b:92). INF4 (67) also highlights the importance of not just producing reports without establishing that the right data is fetched, used, and interpreted in a correct way. INF5a similarly speaks positively of their approach of recognizing how data cannot represent a 100% of the truth and therefore continuously question what is still unknown to

increase the quality of the data (INF5a:91). INF2 (68) makes the point of businesses needing time to implement the changes as well, calling attention to how too many initiatives cannot be pushed simultaneously.

4.1.1 Reduction of Food Wastage

Food wastage is a grand priority among all the participating organizations and various efforts are made to reduce it. INF2 (68), INF3a (3;55), INF4 (5;41) and INF5b (79) highlight how reducing food wastage is also an economic incitement, as it otherwise results in big costs.

All the organizations have implemented routines regarding reducing food wastage. INF1 (INF1:4) and INF2 (8;22) carry out various analyses to discover food waste among both specific stores and food groups at different levels in their organization. ORG3 also has implemented efforts of reducing food waste, by understanding consumer needs (INF3a:35) and, as ORG1, adjusting assortment (INF3a:43; INF3b:47; INF1:95). INF1 (10), INF2 (40), INF3b (65) and INF4 (7) highlights that measurement and follow up is highly important to enable working on this issue. ORG5 also follows up on food wastage as a part of their code of conduct (INF5b:25) and works on minimizing it to the best of their abilities (INF5b:110).

INF1 (22;23) describes their approach as stores reporting food waste weekly, which is then analysed, and appropriate counter actions are deployed if needed. ORG2 has a similar approach and deploys actions such as having sustainability coaches and banana controllers who focus on aiding stores in reducing their waste once it is detected that a store is struggling (INF2:8). In ORG4, their production chain is monitored and followed up on a daily, weekly, and monthly basis (INF4:41) and they continuously work on ensuring that waste is reduced (INF4:7).

INF2 (68) expresses that there is not necessarily a need for more reports, as stores, the contributors to the largest share of food waste, require time to accommodate and adapt. INF1 (14) similarly speaks of how they would be able to create more reports, but time and effort is needed to avoid overwhelming the stores. INF3b (69;71) expresses difficulties of measuring what actually turns into food waste in reality and current measuring methods need to be improved.

4.1.2 Reduction of Resource Consumption

How the organizations work with reducing resource consumption somewhat varies and there is an indication of prioritizing affecting to what degree it is implemented. However, a majority of organizations work to reduce electricity consumption to some extent (INF1:34; INF3b:74; INF4:43; INF5b:88). Other forms of resource consumption were not something that was mentioned during the empirical data collection.

At ORG1 and ORG5, there is a goal of reducing electricity use and the consumption is monitored. INF1 (32) expresses how they most likely follow up less on electricity consumption compared to food waste as there is no one positioned to work on it. At both ORG1 and ORG3, efforts such as replacing and upgrading fridges and freezers are made (INF1:38; INF3b:74). INF3b (74) expresses how energy efficiency is monitored by following up on new implementations and seeing whether they have had an effect on electricity consumption. INF3b (74)

highlights the importance of being able to follow up and monitor if the desired outcomes are achieved, and thereby stress the need for relevant information.

At ORG5, they follow up on electricity consumption both automatically and manually (INF5b:88;90). INF5b (88) describes how they monitor energy efficiency through measurement devices placed in their facilities. They also express how their monitoring process is divided into multiple steps. Collecting data for this is done by communicating with their heat or electricity supplier, and that information is registered in a system which is sent to ORG5 upon request (INF5b:88).

INF4 (43) states that resource consumption is an area they are working on, as for instance electricity consumption is currently monitored. However, the data may be stored in separate systems and not all of it is integrated central storage, which reports are run against (INF4:43). INF1 (38) speculates that monitoring electricity consumption comes down to priority and focus. INF5b (90) similarly expresses how focus and priority determines whether the automation process of monitoring their electricity consumption will continue.

4.1.3 Governance of Suppliers Sustainability Efforts

Within production, INF4 (47) mentions that they get information on the scrap they have from their retailers, and similarly INF2 (60) states that they, a retailing organization, report to the supplier if they notice a recurring waste due to broken packages for example. However, the demands seem to be from the top down, as all retailers want to impact the suppliers (INF1:46; INF2:58; INF3b:80) but the supplier in question requires nothing from them (INF4:53; INF5b:105). INF5b (105) believe they do monitor their retailers, but only on other aspects than environmental sustainability.

One way for the retailing organizations to impact their suppliers is to set demands, which all the retailers do (INF1:46; INF2:58; INF3b:80). INF4 (49) also collects information from suppliers and farmers to measure the impact from the value chain. INF1 (46) mentions that they are discussing increasing the demands of sustainable practices regarding, for instance, setting goals. INF3b (14) says that they require the suppliers to share lots of product information, it is a quality factor that needs to be fulfilled to collaborate with ORG3. This is noticed by the producers at ORG5, INF5a (17) who notice an increased pressure further ahead in their flow of goods, where the retailers require lots of data. As mentioned, INF5b (17;72) expresses that it is tough to handle all the demands from actors such as the retailers. This leads to that they can no longer be in the forefront, which they previously were, as there are too many demands to handle and data to deliver (INF5b:12;72). They no longer have time to answer all these questions from the retailers and other stakeholders, which has created the need for increased automation of such matters (INF5b:44;72; INF5a:20). ORG1 collaborates with external governing organizations but they do limited governance and follow-ups of the efforts themselves (INF1:48;58).

ORG3 collects data from suppliers to their sustainability declaration, INF3a (13) and INF3b (78) state that they need to know exactly what the products contain, where and how they are produced, and any certifications or other climate related efforts. INF3b (82) wishes and would find it useful to get even more data, but it is challenging for them to collect it (INF3a:13; INF3b:82). INF1 (48;54) also expresses difficulties of collecting, it would also require them to have a purpose and staff to manage the numbers (INF1:54). Instead, ORG1 they only work

with requirements and provide help (INF1:48). Similarly, the producing organization ORG5 is collecting data from their suppliers, which are the primary producers, and INF5a (105;113) states that it gives them lots of information that can possibly be used and economically beneficial for them, but the main point is to provide help and a service to the primary producers through data growth. ORG1 is currently about to release a new function, a site where the suppliers can get help to figure out their climate impact and mapping their efforts (INF1:46). INF1 (46) says this help and influence is what they can do to have an impact on the suppliers and reckon the need for reducing emissions in agriculture and production. ORG1 also audits suppliers by visiting, testing, and using a reporting system to colour code their status (INF1:48). If a supplier does not fulfil the needs, they work to help them instead of immediately stopping purchasing from them (INF1:48).

> *"... they receive warnings. Like 'you have to improve this, otherwise we will stop selling, or buying' but we don't stop buying immediately because we'd rather affect them and change, instead of us stopping to buy, because then they'll just go to someone else."* - INF1, see appendix B, row 48

Both ORG3 (INF3b:14;16; INF3a:18) and ORG1 (INF1:76) state that they believe in increased collaboration between the competing retailers in collecting supplier data, and ORG3 even have their sustainability declaration open source for anyone to use (INF3b:16).

4.1.4 Customer Awareness

On the general question of how BI&A contributes to improvements in their sustainability work, INF3a (5) highlights the importance of it by stating that influencing the customer is one of two main aspects. INF2 (50), INF1 (46), INF3a (27), INF3b (86) all say that they are trying to make an impact by guiding customers into choosing more climate-friendly products, such as plant-based proteins and articles from the organic assortment (INF1:46). What they as retailers try to do is to raise awareness, and INF3b (86) says that although the customers are the ones who make the final purchasing decision, they cannot put all the pressure on them. On the producer side, INF4 (59) states that a lot is in the hands of the consumers, but that their responsibility and role is to adapt the range to the wants of them.

> *"We also have a responsibility as a chain as well, to buy in and market, place, campaign, make offers on things that are sustainable, because we are also kind of involved in controlling consumption in that way."* - INF3b, see appendix D, row 86

> *"And if the customer in turn chooses to buy plant-based products, then we should be there and be able to provide and sell those products as well, so that we can continue to survive as a company. But then exactly how the development is going is a little bit out of our control."* - INF4, see appendix E, row 59

Most of the efforts of raising customer awareness are outside of the scope of BI&A according to INF1 (66; 68), INF2 (50) and INF4 (61). INF3b (86) thinks that BI&A assists greatly by providing the opportunity to work with this in a systematic and measurable way. INF1 (46) however say that the current ability to follow up is limited to measuring things, for example sales of organic products after a campaign on it, but it is difficult to draw those conclusions.

However, INF1 recognizes the potential of future use of technology for customer awareness, for example a function where customers can follow up on their purchases by finding out what climate emissions and share of organic articles their purchases have (INF1:76). ORG3 have developed the sustainability declaration, which INF3b (86) says is making the customers aware of what impacts the food they consume has. INF3b (86) highlights the possibility to develop the sustainability declaration further, so the customers can see the total impacts of the products they have bought from them, and that the organization can develop a way to analyse a possible change of behaviour by using the sustainability declaration (INF3b:88).

4.1.5 Sustainability Reporting

When answering questions about sustainability reporting, informants refer to both annual and continuous reporting, indicating how it is interpreted in different ways. INF1 (28) mentions that they publish goals and follow up on them externally in their annual reports. There has been increased pressure from investors to set sustainability goals and be transparent about the work they do (INF1:93). INF4 (55;57) states the importance of demonstrating the numbers of how they are improving within sustainability, to handle the demand from customers and owners. According to INF5b (11;42), those demands on reporting numbers externally are exponentially increasing, and there is great potential to improve how they work with delivering on the demands.

> *"They demand more and more, our investors demand that we report a lot of figures."* - INF1, see appendix B, row 93

> *"...there will also be great demands on us, or requirements for reporting and transparency, that we can't really deliver on today…"* - INF5b, see appendix F, row 42

They also use a lot of periodic reporting internally, such as following up on eco-sales on a monthly basis, which they send out to relevant people such as sales leaders and managers (INF1:4). The stores and chains also get information about the food waste to follow up on those goals and numbers (INF1:20; INF2:8).

When being asked about the company-internal effects of sustainability reporting, INF1 (99) thinks that it might increase the demand to actually follow up on goals and make them more targeted. INF1 (99) expresses that there are benefits related to sustainability reporting that makes it clear who is responsible. INF5b (66) states that the external requirement of reporting affects the line organization, however, there are also great challenges included in the increased demand of reporting. The increased requirement has increased the pressure on the group to produce the numbers and information needed, which leaves little room for driving efforts themselves. INF5b (70;72) answers that it is difficult to know if the increased demand leads to improved internal processes regarding sustainability, but he thinks and really hopes so.

> *"There is a risk otherwise that you set up goals and then no one really copes with them and then you push it in front of you and you have not really talked about who should be responsible. And if you put someone who should follow it up, I almost think that you might go through it a little more to*

clarify who is responsible for things. So yes absolutely. "- INF1, see appendix A, row 99

4.2 Data Collection and Integration

Multiple benefits and challenges related to data collection and integration are displayed in the empirical material. Overall, the informants view data collection and integration positively (INF1:27;28; INF3a:27; INF3b:28; INF4:19; INF5b:42) and afford organizations with new and different ways to work with data to improve their sustainability efforts. Challenges are mostly faced due to factors they cannot directly affect, such as gathering data from suppliers (INF1:48;52; INF3b:82), and by organizational decisions on how certain areas or topics should be approached, such as resources being allocated to analyse electricity consumption (INF1:38; INF4:43). Due to the multi-faceted ways organizations can utilize data, this element is applied to the most sustainability areas compared to the other BI&A elements, as well as providing the most diverse benefits.

Table 4.1: Schema of Data Collection and Integration Intersecting with the Sustainability Elements

	Reduction of Food Wastage	Reduction of Resource Consumption	Governance of Suppliers Sustainability Efforts	Customer awareness	Sustainability reporting
Making use of collected historical data	X	X			X
Comparing			X	X	X
Detecting and Alerting by Measuring	X	X			X
Making Decisions based on Data	X				
Collecting and Integrating from External Sources	X		X		X

4.2.1 Making use of collected historical data

Most of the informants answered that historical data is stored for beneficial purposes; ability to see trends of food wastage and resource consumption, (INF2:22; INF1:4; INF5b:25), progress (INF1:4; INF3a:23) and using it to train predictive models (INF3a:23).

As ORG5 collects data through a survey tool, adhering to their code of conducts, in tertiary periods, they are able to showcase only long-term trends (INF5b:25), which is partly included in their sustainability report (INF5b:84). INF4 (15) brought up different factors that affect the way historical data is stored, such as need, decisions on what historical data should be stored

and for how long, as well as technological advancement enabling less cost related to storage. Their overall impression (INF4:17) is that the historical aspect of data is not particularly important in terms of sustainability features. INF4 was a bit more hesitant of storing historical data, meaning that:

> *"there is no need to lag on old data that is not relevant or current then."* - INF4, see appendix E, row 15

By collecting and storing historical data, both INF1 (4) and INF2 (22) highlight the ability to see trends for specific food groups in relation to trends of food waste, whilst INF3a encourages it in a general sense (23). They all recognize the ability to detect trends and act upon them if needed positively. INF1 (4) mentions the ability to make comparisons in between years, both generally and for specific food groups, as a way to follow up on how the organization is performing in relation to reducing food waste. INF2 (22) also highlights the ability to detect trends in the long term, which would be difficult without several years' worth of data. Without that, spotting food waste dependent on seasonal variations would be challenging. INF3a (23) describes the benefits of historical data more generally, how historical data is interesting as it provides the ability to see actual results and whether their sustainability efforts make a difference as a way to follow up on their efforts.

INF3a also highlights the access to historical data as beneficial to enable training of predictive models, which in itself benefits sustainability efforts, as it is described in chapter 4.4.

> *"But the history is good to be able to see, if we start there, why it is interesting with history? It is to be able to see movements, i.e., so that we actually make a difference in the efforts we make. If you just look at following up. Then if we're talking then predictive analytics, it is good with a lot of data to be able to train a predictive model. There is a very big advantage to have a lot of historical data."* - INF3a, see Appendix D, row 23

4.2.2 Comparing

By collecting and integrating data, the informants speak of the ability to make comparisons of sustainability performance in various ways, comparison to other types of data, to other stores and chains, and to other organizations. This provides benefits such as detecting performance, motivation, and industry-wide collaboration.

INF2 and INF3b highlight the ability to work with sustainability data in new ways, for instance by comparing it to other types of company data, such as sales (INF2:70), financial (INF3b:56), and customer related data (INF3b:88). INF4 (41) did not give any indication of instances in which collected data was compared for sustainability efforts in a similar manner, but as they emphasize the importance of being able to follow up on food wastage in their production, comparisons on some level could be made. INF5a (91) describes how they tried approaches in which a base value is set as a guessing point, which information is integrated into to increase the quality of the data. This information is later compared to detect changes in the data quality (INF5a:91).

INF1 (95; 20) and INF2 (44) both describe how their organizations are able to make comparisons between specific chains and stores' efforts to reduce food waste. INF1 (4) describes how

they follow up on customer behaviour to detect what most common product each specific store has by collecting and integrating sales data. Weekly reporting of food waste is conducted by each store individually, which is then integrated to follow up on performance related to food waste on store, chain, and organizational level (INF1:20). By following up, ORG1 (INF1:22; 23) can detect whether different chains start to lag behind, which they then are able to counteract in order to ensure that their performance correlates to the goals that have been set. INF2 (8) also attests for in-between store comparisons sparking actions to improve sustainability efforts, by tracking food waste in all stores and deploying counter actions. INF2 (8) expresses that they are able to aid stores with their performance if it is detected that they are performing worse in relation to referential stores. They were also able to detect a higher amount of waste related to specific products, and thereby counteract it (INF2:8). INF2 (8) expresses how these types of comparisons allow for visibility in a different way.

INF1 (22) mentions how it is beneficial to operate in this manner as it creates a fighting spirit and healthy competitions in between stores and chains to improve their work on food waste. INF2 (54) similarly speaks of comparing targeted efforts and putting information in relation, thus comparing it to each other, motivates people. Furthermore, INF1 (95) describes how discovering differences during comparisons instigates deducing and analysing why certain stores or products perform well or not.

> *"We have to see what we are and where we want to and then set goals and then analyse what the way there is. But it's super important in every way. Everything from analysing which stores are doing well and what they are doing. What is it that they sell that makes them have such high eco-shares compared to others? It's really important to look at all that stuff then and what goods you should remove because otherwise they just stand in the shelf and maybe create waste and so on. No, but I mean. It's really important. It's like 10 out of 10"* - INF1, see Appendix B, row 95

INF3b (28) highlights the shareability of sustainability information being increased when data is collected and integrated into a common platform, which enables working with sustainability the same way as financial numbers. INF3b (56) highlights that to enable comparisons, you have to ensure that current numbers from the sustainability reporting for it to be valuable. INF3a (32) describes how it is a work in progress to integrate sustainability information into the organization's central storage, and then enable analysing that data in different departments. INF2 (8) also details company-wide efforts, by describing how the central organization is somewhat unable to affect the stores, but may help by reporting these numbers, which sustainability coaches are put in to help a specific store. At ORG3, the sustainability department is a support function, and by retrieving and analysing data, they are able to collaborate on sustainability cross-functionally (INF3b:33). They (INF3b:88) exemplify this by describing how customer analysts could fetch sustainability data and run their own analysis with it in the future.

> *"The customer analysts as well as on e-commerce would kind of just be able to fetch that data and plug it in and do things like this, it's called A/B testing, they could do it using that sustainability data right on the same line as we do with sales data. But we're not quite like that yet, haven't done as far as I know anyway. "*- INF3b, see appendix D, row 88

INF3b means that this constitutes working with sustainability in a common language (INF3b:28), crossing over multiple departments such as marketing, purchasing and the digital platforms (INF3b:28). INF1 similarly speaks positively of having a common, industry-wide climate database, which they consider to be a few years down the line, and then provide the opportunity for all organizations to work with the same sustainability numbers and share information with each other (INF1:76). INF5a (16) also speaks positively of data sharing, as they send information forward in the supply chain.

4.2.3 Detecting and Alerting by Measuring

The informants spoke of the ability to detect, discover, and alert indicators related to sustainability performance by the comparisons that are made. They all concur that it is important to measure their performance, follow up and take actions to improve their sustainability efforts (INF1:10; INF2:40; INF3a:27; INF3b:74, INF4:29; INF5a:36 INF5b:42). This ability enables them to work with their sustainability data and analyse food wastage in new ways and creates a structure in their sustainability work.

INF5a (9) positively extends upon demonstrating facts and figures in a new way, by integrating the current available data in mass balance calculations to produce new data, which could result in a more data-driven image of their stance. INF4 (65) expresses how measuring their efforts through data is crucial to improve their sustainability work.

> *"...in order for us to be better, we need to be able to measure and measure it, we do it through business intelligence, so that we create reports and statistics on our data then so that it is a key factor for us to be better."* - INF4, appendix E, row 65

INF1 (20) expresses how they are also able to do analysis of the degree of food waste at different organizational levels. INF1 (27;28) describes how it would be difficult to work on the food waste issue if they were not able to conduct these measurements and see if the efforts have an impact. INF1 (10;28;84) emphasizes the importance of being able to do this multiple times to enable working with sustainability. INF2 (8) similarly describes how previously, there was no proper way to measure food waste and by doing it now, they can put it in relation to other figures and create a new type of visibility, which has had a significant impact on the organization. As mentioned, managing faulty packaging at ORG2 is an example of possible discoveries to be made through collecting and analysing data (INF2:60) that enables organizations to battle food waste in new ways.

> *"So I don't know what the follow-up looks like, but you work very closely when we look at, for example, food waste and then for example if we have wasted a ton of sugar this month because, on that, registered on broken packaging, for example. Then maybe you should review the packaging sugar and contact the supplier then and just: We have a lot of waste on this product because, the packaging can not handle our transports, for example. So that and it has a lot connected to our range and purchasing organization and it is those who have contact with the suppliers. So that is the kind of findings that you can see and look at in our reports that we've produced, the sustainability organization then. So in that way, you want them to kind of*

work together with assortment and purchasing then, to find cases like this where you can make improvements." - INF2, see appendix B, row 60

As mentioned in 4.1.4, there are some challenges to utilize technology for customer awareness efforts. INF1 expresses difficulties with measuring customer awareness, as they are able to see changes in purchasing behaviour, but no way of determining whether it depends on information the organization provides (INF1:72). INF2 (52) describes how they detected how customers' purchasing habits would result in not achieving their CO2-goals and would require changes. INF3a (27) and INF5a (36) concurs that collecting and integrating data allows for detecting performance and learning what changes have to be made to increase performance. The transparency the organization gains from this is also communicated to customers to ensure better decision making on the customer's behalf (INF3a:27).

INF1 (32) expresses that the organization follows up less on electricity consumption compared to food waste, but still refers (INF1:34) to a colleague who works with sustainability reporting and monitors electricity consumption on an organizational level, meaning that focus is put on it to a certain extent. INF3b (74) also speaks of measuring improvements on energy efficiency as important to establish actual impact. Similarly, INF4 (7) expresses how they track energy efficiency in their production chain, which increases its sustainability. INF5b (25) describes how measurement devices are placed in their facilities to track energy efficiency, which is in progress to be standardized and collected so it is available to the entire organization. INF5b (90) expresses the need of maintaining focus and prioritizing to ensure that these initiatives persist. INF1 (38) points to lacking resources and focus to properly follow up the electricity consumption.

"I think so. I don't think there's a lot of focus on that to be honest, but it also probably depends on how much you prioritize. I think it's a little more difficult, but sure yes, we kind of change fridges and freezers and put doors and stuff like that. So no, I would say: we use it [BI&A], we absolutely use it." - INF1, see appendix B, row 38

INF1 (28) expresses how they are able to include their current stance, the desired improvements and current progress in their annual reporting by being able to identify and scrutinize their performance on food waste. INF5b (42) similarly highlights how being able to showcase progress from a sustainability perspective in their annual reports is crucial for the organization to maintain their operations.

However, the aforementioned challenges of accurate data and critical thinking re-emerges when data is collected and analysed. INF3b (71) describes how it may be difficult to accurately identify the amount of food waste there is, as data does not always correspond to what happens in real life. This correlates to INF4's (67) statement regarding how the right, accurate data needs to be properly retrieved, used, and interpreted. The accuracy and quality of data is also discussed by INF5a (93), who highlights that improving the quality is a continuous process, which results in being able to see changes with the possibility of it not being completely accurate is kept in mind. However, some organizational pushback may be faced as some people prefer to have poor quality consecutively than high quality data in fluctuation (INF5b:92).

INF5b (27) expresses how their strategy to collect and integrate data creates structure and order. INF2 (8) similarly accounts for how they were previously in the unknown regarding how

much food waste was generated due to lacking structure but being able to compare and discover findings was ground-breaking as it brought a whole new visibility of food waste.

> *"but above all that it has made things visible in a different way. Before, waste was, you didn't know how much you wasted basically. There was kind of no structure around it."* - INF2, see appendix C, row 8

4.2.4 Making Decisions based on Data

Informants also described how collecting and integrating data results in a basis for decisions. As mentioned, the opportunity to compare and detect, identify, alert, discover section also informs decisions as they instigate counteractions to ensure sustainable practices are maintained.

INF1 (6) describes how they were able to influence organizational decisions related to sustainability by providing figures of sales and effects of a pending decision concerning whether disposable grills should be taken of the self. INF3b (56) also describes how sustainability information may substantiate decisions by integrating it with financial data so management can process financial and sustainability information along the same lines. INF5a (9) also highlights that by presenting a data-driven image of their current status lends itself to strategic decision making, and INF5b (42) similarly emphasizes data access as necessary to make tough decisions to enable future operations. Thus, it is indicated that collecting and integrating data serves improved sustainability related decision making.

INF1 (6), INF2 (24) and INF3b (9) remarks the importance of accurate data during decision making. INF3b (9) highlights that during decision making on how to proceed with a sustainability effort, for instance reducing climate footprint by altering product assortment, it is crucial to have the right information stored, that it is accurate and received at the right time. INF2 (24) similarly speaks of the importance of having good, accurate data at the right time, for there be any trust in the data within the organization. Agreeingly, INF5b (8) expresses how they gain more credibility in their sustainability work by being able to measure and make use of data. INF1 (6) spoke of, by substantiating figures, management could make more well-founded decisions and the sustainability department has a more grounded standing when lobbying new ideas.

4.2.5 Collecting and Integrating from External Sources

Most of the informants describe the benefits of collecting and integrating external data for their sustainability efforts. The informants were able to provide both positive and negative aspects related to integrating external sources, and a key factor contributing as to why some companies do not integrate certain external data is the organizational decision making or decided approach. Due to the organizational structure of ORG5, their suppliers are not viewed as external sources.

INF2 (14;70) explains how they are able to work with estimation of food waste in new ways, by purchasing sustainability data from an external vendor to integrate it with the organization's data, to map products to CO2 emissions. As ORG2 discovered that customers' purchasing behaviour would affect their ability to reach their CO2 goals (INF2:52), integrating this external data could benefit actually achieving it. INF4 (49) similarly describes how they

collect information to encompass their entire value chain in order to keep track of it to ensure that they will reach their goal of carbon neutrality. This indicates that integrating external sources affords the organizations to reach their goals.

INF3b (16) describes how their sustainability declaration is partly dependent on external data, as competitors and suppliers are able and encouraged to connect to the platform and share data. They (INF3b:14;16) describe how this increases openness and shareability, so all relevant parties have access to environmental data. As mentioned, INF1 (76) also speaks of the benefit of an industry-wide common database, fortifying the idea of integrating external sources for sustainability efforts. Furthermore, INF3b (16) expresses how they can follow up suppliers through the sustainability declaration, and possibly receive even more specific information, by having suppliers upload information themselves.

There are evidently some difficulties that come with integrating supplier data, as detailed in chapter 4.1.3. INF3b (14) describes how previously it has been a challenge, but due to some pressure, data has at last been shared. INF3a (13) also comments on the difficulty of integrating certain data to determine how sustainable a product is, as it is challenging to collect various information for hundreds of thousands of products. INF3a (18) and INF3b (14) further emphasize how they aim for this to be a standard for the entire country and industry and increase acceptance of sharing data. INF1 (48) describes a similar challenge as it is difficult to integrate suppliers' data into their own, and therefore do not monitor and measure suppliers to the same extent as their own organization, which affects their ability to follow up on suppliers. INF1 (48) describes how they have taken another approach, by having a tool in which suppliers can report their data, but with the purpose of putting demand on suppliers and helping them. INF4 (47;53) similarly accounts for not having demands on retailers to provide data and that there is solely a downstream perspective.

> *"You want to get this information and so, it's been a pretty big challenge actually to get the suppliers to share the information, but it's still been possible because, now we at ORGANIZATION have said "We're going to do this. All suppliers must submit it because it is a quality-factor for being able to be at ORGANIZATION" and at the same time work in the industry as a whole." ... "just because it should be an increased acceptance to do this in the industry because all the suppliers have not committed to it yet, most of them have, but not all of them. So more actors need to go into this as well."*
> - INF3b, see appendix D, row 14

INF1 (54) extends upon governing suppliers by problematizing collecting data without an organizational purpose, highlighting how there is no reason to do this if it is to no beneficial use. They mention, with some hesitation, that this is a first step and using BI&A is "probably useful" to govern suppliers (INF1:58). INF3b (82) also describes prospects, in terms of how more information is required from suppliers and the multiple benefits it would constitute, such as risk awareness, richness of detail, enhanced control and increased traceability. The informants' answers indicate that there are a lot of potential and benefits in terms of integrating external data, but faced with both practical and organizational challenges to realize them.

> *"Yes, quite a lot, but it would require quite a lot of information from the suppliers. One thing I've been thinking about, it's that we have countries of origin, which kind of... Yes, but how much does it tell you if you have China or like Russia? It's a big country. Brazil. It's really different depending on*

the mass, but we kind of grow soy in like an old rainforest area or in serradon, or whatever it may be. yes, but kind of being told... It's my dream to know, like this, but where is it actually grown? Better, as well. Where is the geographical location? Because then you can kind of say a lot more about the risk of deforestation, you can say the risk of overfertilization hazards, you can kind of have a completely different control there then, so I think that's what I'm thinking like the traceability of value chains in a completely, completely different way there. But given that the country of origin, just that, wasn't easy, I can... Imagine that information, then we are a few years in the future." - INF3b, see appendix D, row 84

4.3 Data or Analysis Driven Strategy

Table 4.2: Schema of Data or Analysis Driven Strategy Intersecting with the Sustainability Elements

	Reduction of Food Wastage	Reduction of Resource Consumption	Governance of Suppliers Sustainability Efforts	Customer awareness	Sustainability reporting
Accessing data easily and timely		**X**		**X**	
Providing mobility and presence					
Providing structure					

4.3.1 Accessing data easily and timely

INF3a (11) and INF4 (21) answer the question on what kind of strategy they have as being the data driven one. INF3a (11;32) expresses that they have a data lakehouse to be able to have all the data available, in one place, to be able to always provide data based on the sustainability department's needs. INF4 (4;21) express that they are working on extracting data from data sources into data cubes to create the possibility for users to gather data for analysis without asking several different surrounding systems. An advantage of not interacting directly with the surrounding systems is that it has no impact on the performance and has benefits from a security perspective as well according to INF4 (11).

"I think we're maybe a mix between a data lake and a data warehouse, which is a lakehouse. And maybe that's more on the part of gather all the data in one place. The purpose of this is to be able to ask more questions later if you have all the data gathered. [...] So you have another question and then it is important that all the data is gathered in one place, at least that you do not have to stretch too far to be able to get answers to these

follow-up questions that such an analysis is leading to." - INF3a, see appendix D, row 11

When discussing the usefulness of BI&A for reducing resource consumption, INF4 expressed uncertainties as he does not work with the efforts specifically, but he expresses that they may not have the data collected in one place for such measurements to be simply accessible. This differs from their general approach of collecting data and centralizing it (INF4:4;21). Hence, there is sustainability-related data that has not been extracted, the features are instead within their respective systems (INF4:43). INF4 (43) clearly states that it is an area they are working on and aim to improve on.

"...if you look at all the functions and systems that we have, they have some kind of follow-up in them then, then it may not be certain that we extract all the data to central data sources" - INF4, see appendix E, row 43

The centricity and democratization of data are important in ORG3, meaning that the user with a need does not need to come with requests to a small unit at the organization (INF3a:32). INF3b (33), describes the cross-functional work on informing different functions such as assortment and purchasing on the sustainability related analysis they should do, where they collaborate with INF3a's group because they have the expertise about how to retrieve data and analyse data in an effective way.

"... you don't democratize everything. Bring in new data sources, structure data, there are certain parts that we manage centrally and then it's pretty much exactly as you describe. You come up with a wish, a story about why you want to do something and then it is prioritized against other initiatives." - INF3a, see appendix D, row 32

INF2 (16;28) creates their own data marts according to needs for analysis. INF2 wants to make, and expresses that they often have the data that they need available for the purpose of reducing food waste, which is something INF2 (68) mainly works with and the organization has put much of their focus on, they have a lot of data available in the warehouse for any of them to use (INF2:14).

"It varies, but I myself get to create data marts if I need it as well and put together my own tables and views with the variables that I need to make a report. So it's not something that's provided by our IT department or anything, it's something that we analysts get to create according to the business needs." - INF2, see appendix C, row 16

A situation where accessibility of timely sustainability data is important is provided by INF3b (56). If the management looks at current data and they get financial data from last week, they cannot have lagging sustainability data as it would be misleading (INF3b:56). Therefore, sustainability data requires proper integration to ensure timely and accessible information on the same line as other types of data (INF3b:56).

"It [the sustainability data] needs to be more up-to-date and on time and that you can kind of sit and look at this, here and now on the same line with financial figures." - INF3b, see appendix D, row 56

In general, there is a lot of accessible data according to INF1 (105). The challenge is more so to structure it and find the right use of it, to satisfy the users own role-specific needs. Similarly, INF3b (88) states that there is data available to make, for instance, analysis on the customer behaviour and how to influence them to improve. It would be possible to do such customer analysis, it is being done within sales, but not yet for the purpose of sustainability (INF3b:88). INF3b (88) states that they are not there yet but he reckons the possibility to do such things as A/B testing as there is data ready to be fetched.

> *"We have numbers today. It's more about the numbers there are, it's more about kind of organizing it, what are we going to measure and how and who and who's going to get to take part of it and what are we going to do with it?"* - INF1, see appendix B, row 105

INF5a (31) describes their current solution as a traditional data warehouse, and they restack information to make it easier to consume and for instance filter it from different perspectives. However, INF5a (52;57) express problems regarding the traditional idea of centralization, as they do not have a simple top-down or bottom-up structure which makes it difficult for them to stick to only the centricity, while it is necessary to keep the centricity for some parts of the organization. Specifically, INF5a (57) mentions legal and other requirements to demand the traditional, structured data collection method. They are currently looking at also including a more modern Kafka-oriented event streaming platform, where each application does their own thing, but the important things and news are published in a common square/stream to make it possible for someone else to reach it (INF5a:31;33). The different strategies have different advantages, as described by INF5a in the following two parts:

4.3.2 Providing mobility and presence

By building the new event-streaming platform solution they expect to get a more impact-resistant system, which reminds more of a data mesh (INF5a:31;38). This approach and structure make it possible to react to signals and move more easily (INF5a:38;59). It also relates to getting better at making simulations with what if analyses for strategic decision making in the future (INF5a:31).

> *"... we see that it is not sustainable in the long term to have central control on everything."* - INF5a, see appendix F, row 52

4.3.3 Providing structure

The centralized, Kimball-structured systems are by INF5a (52) described as the backbone of finance, trickle up reporting and such operations. The importance of a structured collection is also highlighted to handle the legal requirements (INF5a:57). INF3a (32) also states the importance of, at least to a certain extent, having structure and central control. The importance of structure can hence not be neglected in favour of mobility and presence, by planning on having both the traditional and adding the new one, ORG5 aims to keep the structure and accessibility while adding mobility and presence (INF5a:54;57).

> *"You will never be able to escape the legal and other requirements that will require a structured collection as well."* - INF5a, see appendix F, row 57

4.4 Predictive Analytics

Three of the informants (INF2, INF3a, INF3b) clearly see the potential and usefulness of making predictive analysis for sustainability efforts of various kinds. The current practices of ORG3 are described as descriptive rather than prescriptive (INF3a:39;41). Whilst clearly also stating the importance of descriptive, INF3a (41, 39) sees potential in increasing the work on predictive analysis as well.

> *"... in terms of sustainability, well the weight is in descriptive analysis rather than predictive analytics. So going forward, there's a lot more predictive to do. "*- INF3a, see appendix D, row 39

When discussing predictive analytics, INF4 (25;29) showed some hesitation on the concept of and expressed a lack of knowledge on how the different functions around the organization possibly uses it. This stems from the fact that INF4 works at the IT department, which only provides the tool and is hence unaware of the analysis process. INF4 (29;33) says that the IT-department at ORG4 does not provide a function that analyses patterns of data to make predictions. However, INF4 (29; 27) described the usefulness of general forecasting as a core part of analysing data. With that, INF4 (27) pointed to the importance of knowing where you are going, and how forecasting is helping in developing such understanding of sustainability. Similarly, INF5a (31) sees potential of utilizing predictive analysis within all the areas of sustainability. However, they have also had a number of failed machine learning projects due to the lack of commercial usefulness, and similarly some advanced analytics efforts that have not taken off yet (INF5b:77; INF5a:79). INF5a (79; 81) believes the failures are partly due to the lack of focus at a central level, and that they have not come far considering the data growth they have had.

Table 4.3: Schema of Predictive Analytics Intersecting with the Sustainability Elements

	Reduction of Food Wastage	Reduction of Resource Consumption	Governance of Suppliers Sustainability Efforts	Customer awareness	Sustainability reporting
Comparing	X				
Understanding					
Forecasting Demand and Managing Replenishment	X				
Optimizing Price	X				

4.4.1 Comparing

In ORG2 the sustainability coaches use predictive analytics to study trends and, for instance, projectize in the future by looking at the amount of food waste they think they will have in the upcoming years (INF2:36). By using numbers of what they are currently doing, they can estimate if the current efforts will be enough to reach their set goal within the set time frame, or if

they need to adjust to get there. INF2 (42) thinks that these predictions, combined with visualizations, can be shown to people in all parts of the company and is an effective way to make the issues more visible and easier to understand for everyone. ORG2 also has AI models in place to predict CO2 emissions of the products they sell, but most of INF2's knowledge concerns how they utilize predictive models related to food waste.

> *"Yes, but it's kind of like we have goals to reduce food waste by a certain percentage and then this is how we will find out if we'll reach it if we continue at this pace. I guess that's what you want to see. And otherwise, what adjustments are needed to reach the goal."* - *INF2, see appendix C, row 40*

> *"it becomes difficult for the business to act on the data if you don't show them clearly that "now the trend looks like this and we're going to continue like this unless we do something drastic." What specific efforts do we make to sort of remedy these problems that exist. So that again that yes, but lift up and show the data to the people, so they understand."* - INF2, see appendix C, row 42

4.4.2 Understanding

INF3b (37) stresses the need for increased predictions within the area of understanding the effects from the moves they make. The informant further states that there is a lot of information to consider, across multiple different issues which all have their own parameters that should not be infringed on. INF5a (81) expresses the usefulness of predictive analytics to get closer to the ground and understand more at the production sites, for example concerning weather conditions, and to improve decision making.

> *"It shouldn't be at the expense of animal welfare, biodiversity, social conditions, and it's also kind of an optimization problem there that's not easy when you have 10 other parameters to relate to."* - INF3b, see appendix D, row 37

> *"But more in the future, we see that we will also do simulations with what if analyses, so that you can also make strategic decisions and extrapolate things like that."* - INF5a, see appendix F, row 31

4.4.3 Forecasting

INF3a (35) advocates the use of predictive models to increase understanding of what the demand there is, which can be used to make more accurate purchases which in turn might result in less food waste. It can also be used to keep better track of goods that are about to expire and increase the understanding of how to get them out to the customer (INF3a:43).

> *"... the core of what we've done so far is about understanding what demand there is, and to know what the demand is, you can use predictive algorithms. If we know that, it will be easier to buy in correctly and then there will be less waste."*- INF3a, see appendix D, row 35

4.4.4 Optimizing Price

To be able to predict the right price of a product is not only useful to improve the sustainability operations but can be beneficial from an economic point of view too. INF3a explains how it is used to maximize the benefit between waste and revenue, as they can make predictions of what discount should be applied if they want to sell all of them while maximizing the revenue.

> *"If products get old, you can sell them at a lower price so that we do not have to throw them away and then you can do it in differently sophisticated ways. So, if you're going to lower the price, how much should you lower it to maximize the benefit between waste and revenue?"* - INF3a, see appendix D, row 35

4.5 Dashboards and Visualizations

All the informants find it very useful and maybe even necessary to work with visualization of sustainability data (INF1:76, INF2:4, INF3a:62, INF3b:65, INF4:39, INF5b:86). To be able to do analysis from visualizations is very important according to INF4 (39), who even express that it is the only way forward. INF4 (37) also says that there are significant efforts put into training the users on how to use tools, as there is a great need for visualizing and analysing data at ORG4. INF2 (2) works a lot with data visualization and describes it to be one of her main tasks. So far, ORG2 has come a long way within visualizing and reporting on food waste (INF2:44).

> *"Yes, but that's why we work hard with training internally on these tools. The need is within ORGANIZATION to be able to visualize and analyse data"* - INF4, see appendix E, row 37

> *"... it's an incredibly important, I think, kind of step in as well as the sustainability work to be able to kind of visualize and see actually how it's going, that you're doing it well."* - INF3b, see appendix D, row 65

Table 4.4: Schema of Dashboards and Visualizations Intersecting with the Sustainability Elements

	Reduction of Food Wastage	Reduction of Resource Consumption	Governance of Suppliers Sustainability Efforts	Customer awareness	Sustainability reporting
Comparing	**X**				
Understanding	**X**			**X**	
Motivating	**X**				

4.5.1 Comparing

Dashboards are important tools to visualize the differences between two stores within food waste results for example and make decisions and provide help based on those insights (INF2:44). Important to include in a dashboard according to INF2 (54) is something to put the number in relation to, to be able to compare. Exemplified are last year's numbers and numbers from other stores (INF2:54).

> *"There you can compare stores with each other. Which ones are performing well, which are performing less well, and so you can kind of actively contact these stores to see if they have special problems, do you get help with anything from the central side?"* - INF2, see appendix C, row 44

Similarly, INF3b (47) mentioned the possibility to easily compare sustainability measures and sales of products within the same category to one another. Dashboards have specifically been useful for ORG3's sustainability declaration project, to be able to present a lot of information, both on overarching and detailed levels (INF3b:47). INF3b (47) elaborates in great detail on the benefits. It helps the internal process of mapping how many and which products and suppliers that have sustainability data, and how those products perform. To assess the sustainability of the products that have all kinds of data, it provides a good overview of all relevant sustainability aspects to consider. With all these aspects mapped, the organization can compare products to one another and if there are areas to improve or that is found to be driving sales, for example related to what kind of milk is used in a chocolate bar. With the help of these analyses through making comparisons, INF3b (47) further say they can understand causes and effects and make movements.

4.5.2 Understanding

INF3a (62) see dashboards as a crucial part of changing and improving the sustainability of the organization as it is necessary to understand how you stand today and where there is potential to develop, which INF3a connects to the use of visualizations. INF2 (44) similarly expresses that the use of dashboards and visualizations has made a stark difference to increase the visibility of the data in the organization, for example within food waste, which is helping them to understand and learn from the data. It also makes it more interesting and easier to grasp when store-level data can be visualized. INF5b (84) also mentions the usefulness of dashboards when managing sustainability, as different requirement points are broken down, mapped, and used as metrics to follow up on the goals and issues. It helps by visualizing what efforts are insufficient and INF5b (86) states that the visualizations trigger reactions and lead to sustainability issues being taken more seriously.

> *"I'd say it was a big, sort of game changer for us when we could visualize the data so that people understood what kind of volumes it's about. You can put it in relation to things and kind of make it visible…"* - INF2, see appendix C, row 4

> *"We've kind of started to do dashboards, and it's specific to the sustainability declaration in order to see, well, how are we doing like, which... What*

> *share of our sales have sustainability declarations and what share of suppliers do have it? And that's because our buying department should be able to increase that share, so that's a part then that dashboard can show, and kind of information over time."* - INF3b, see appendix D, row 47

As mentioned in the part above, comparing aspects of products can help ORG3 to increase the understanding on multiple levels which helps them make the right movements (INF3b:47). INF3a (68) adds that the dashboard fills a function by helping them to understand the causality between different initiatives and what effect it has on food waste.

Dashboards can also be used to represent information to customers, INF1 (76) believes this is something that is about to come when they have the right data in place. For example, the informant exemplifies that dashboards with information about the climate impact of the purchase can be shown to customers to increase awareness and understanding. INF3b (86) similarly talks about their efforts towards increasing customer awareness through the sustainability declaration, which aims to increase knowledge by presenting sustainability related information and ratings. INF2 (50) does not think they visualize anything towards the customer to increase engagement or awareness, and unlike the statements by INF1 (76) there is no expressed usefulness. INF2 (50) rather believes those kinds of efforts are related to other initiatives.

> *"But STORE we owned and there they could go in and see how big the climate impact their purchase had. COMPETITOR has something like that as well. And they also have an organic share and so on. We are discussing it and it is just, so there will probably be more to come, that customers will be able to go on their side to follow up on the type of share of organic, share of climate emissions, and such."* - INF1, see appendix B, row 76

4.5.3 Motivating

INF2 (56; 48) expresses great usefulness of visualizations to increase motivation and commitment concerning sustainability within the organization. INF3b (54;52) also say that the overview provided by dashboards can increase the motivation of the employees and highlight improvements, for example for reduction of food waste in a specific store, and reward those who have worked hard to get there, which INF3a agrees on. INF3b (65) expresses that people at ORG3 show great happiness and motivation to improve when they get the information about obligations and goals visible in a uniform and structured way. It has changed the way they view the topic of sustainability (INF3b:65). Similarly, people in various parts of the company at ORG2 can reach out with questions regarding them, which has made INF2 realize that these reports are actually used by people. INF2 (48) can also notice that the use of them has increased a lot.

> *"it motivates people too, to see improvements or if you have made some kind of targeted effort. It's hard if you don't kind of get it that way on print or what to say. So that, yes but it's really important to engage people in this issue I would say. Really."* - INF2, see appendix C, row 56

> *"A lot of people get this motivated and happy and like this just: "yes shit, now we can see like the sustainability topic in a way that we haven't done*

before like, we can see our obligations and we can kind of set what goals, set in a completely different way". So that need to have this information, it's there, but when it kind of never really, there haven't been conditions for like having it in this, as well as uniform, structured way that we're now starting to get." - INF3a, see appendix D, row 65

4.6 Summary of Expressed Abilities

The empirical results describe how the organizations work with each sustainability element as well as how the BI&A elements are used in relation to these. The results highlight various capabilities the organizations gain by using BI&A for their sustainability efforts, which are summarized in table 4.5 below.

Table 4.5: Summary of Identified Abilities in Relation to BI&A and Sustainability

Element	Capability		Sustainability element	Informant
Data collection and integration	Making use of collected historical data	See trends	Food wastage, resource consumption	INF1, INF2, INF5b
		Progress	General, sustainability reporting	INF3a, INF1, INF2
		Train predictive model	General	INF3a
	Comparing	Compare to other types of data	Food wastage	INF1, INF2
		Compare specific stores, food groups	Food wastage, customer awareness, sustainability reporting	INF2, INF3a, INF3b, INF5a
		Deploy actions to enhance performance	Food wastage	INF1, INF2
		Motivation, understanding	Food wastage	INF1, INF2
		Company-wide efforts	General	INF1, INF2, INF3a, INF3b
		Industry-side efforts	General, governing suppliers	INF3b, INF1, INF5a
	Detecting and Alerting by Measuring	Establish current efforts	Food wastage, general	INF1, INF2, INF3a, INF3b, INF4
		See effects	General, resource consumption, sustainability reporting	INF1, INF2, INF3a, INF5a

		Identify need of improvements	food wastage	INF1, INF2, INF3b, INF5b
	Making Decisions based on Data	Substantiating with correct data	General	INF1, INF2, INF3b, INF5a
		Motivate decisions and ideas	General	INF1, INF3b, INF5a
		Integrate sustainability data with other data types for decisions	General	INF3b
	Collecting and Integrating from External Sources	New way of measuring	Food wastage	INF2
		Measure and follow up on goals	Sustainability reporting, governing suppliers	INF3b
		Track value chain and traceability	Carbon neutrality	INF4, INF2, INF3b
		Industry-wide openness and shareability	General	INF1, INF3a, INF3b
Data or analysis driven strategy	Accessing data easily and timely	Possibility to create new functions	Customer awareness, Resource consumption	INF3b, INF4
		Avoidance of security issues	General	INF4
	Providing mobility and presence	Simulations and decision making	General	INF5a
	Providing structure	Delivering on standardized requirements	General	INF5a
Predictive analysis	Comparing	Measure progression towards goal	Food wastage	INF2
	Understanding	Map effects of complex issues	General	INF3b
		Improve decision making	General	INF5a
	Forecasting Demand and Managing Replenishment	Smarter ordering and understanding of demand	Food wastage	INF3a
	Optimizing Price	To find the balance of maximum economic and sustainability benefits	Food wastage	INF3a
	Comparing	Baselines to drive action	Food wastage, General	INF2, INF3b

Dashboards and visualizations	Understanding	Making data understandable	Food wastage, General	INF2, INF3a, INF3b, INF5b
		Showcasing information	Customer awareness	INF1, INF3b
	Motivating	Possibility to reward and show results	Food wastage	INF2

5 Discussion

The discussion begins with overall comments on the organizations general stance towards using BI&A for sustainability, which is followed by a comparison of the degree of focus on the sustainability elements, as well as which BI&A elements are used. The discussion continues by viewing each finding from the result of a BI&A element being recognized as useful for sustainability efforts in table 4.5 through the lens of affordances. The discussion is summarized by listing the identified affordances in chapter 5.8.

5.1 The Organizations Stance on Sustainability and BI&A

Based on the empirical results in chapter 4.1, it can be deduced that organizations in the food industry view the possibilities and potential of using BI&A for sustainability efforts in a positive light, which corresponds to Petrini and Pozzebons (2009) as well as Yu Yin and Ai Pings (2020) conclusions on BI supporting sustainable efforts. The empirical results also highlight the extensive work organizations have put in that has led to multiple successful implementations and uses that contribute to enhancing organizations sustainability efforts, indicating a positive response to what previous literature has been calling for. Chapters 4.1.1-4.1.5 in the empirical results showcases how prioritization and recognized potential affects for what sustainability elements resources are allocated. For instance, food wastage is prioritized according to all the informants, whilst views differ on other sustainability elements, such as governing suppliers' sustainability efforts. As it can be viewed in table 4.5, this results the higher a sustainability element is prioritized, the more capabilities are related to it. Thereby, we see the tendency that the more the organizations are allocating resources into putting sustainability efforts using BI&A in practice, the more affordances emerge, such as the case of food wastage.

It is stated by the informants that the progress of implementing BI&A is in its early stages, and given the potential future uses the informants have described, it is highly likely that the organizations will continue to expand the use of BI&A for their sustainability efforts. The way organizations allocate more resources to analysis for sustainability efforts to respond to increased demands further depicts the organizational encouragement of BI&A. This evidently results in an increased convergence of the sustainability and IT departments, as technical resources are provided to the former and is encouraged to collaborate more cross-functionally with the latter.

It is also indicated that this will be a process over an extended amount of time, as most of the informants highlight the importance of ensuring proper use of data and allowing the organization to adapt to changes, which presumably will require time due to the sheer size of the organizations. As a general statement, the positive responses to the actual and future use implies that organizations in the food industry benefit from BI&A for their sustainability efforts.

In chapter 4.1, several interesting factors are listed that are important to consider in terms of using BI&A for their sustainability efforts. The way informants spoke of organizational considerations and critical thinking regarding current use of data and information shows a holistic mindset, which is reflected in the progress they are making. Interestingly, structure is simultaneously recognized as prerequisites and capabilities provided by BI&A, as there are multiple

organizational factors to consider enabling use of the technology, whilst it also structures the work with sustainability, by for example enabling putting a finite number on food wastage.

5.2 Comparisons between Sustainability Elements

Interestingly, the results showcase a clear focus on reducing food wastage compared to the other sustainability elements, as displayed in tables 4.1, 4.2, 4.3 and 4.5 in the empirical results chapter. Otles et al. (2015) presented reducing food wastage as a way to optimize resources and prompt economic gain. As food is the primary product of each organization, and as this element presented the greatest economic incentive to focus on, it would be reasonable to conclude that optimizing the reduction of food wastage and economically gain on it are the primary reasons as to why reducing food wastage has received more attention than other elements. Contradictory to the finding regarding the priority towards economic gain is the increased will of sharing of data between actors in the industry reported by the informants, as well as systems being developed to help suppliers. This rather suggests that there is a will to do good and help others become more sustainable rather than just making interorganizational economic profits.

Although the findings show heavy focus on reducing food wastage, it should be heavily emphasized that they do not exclude the efforts related to the remaining elements. As it is detailed in 4.1.2-4.1.5, the organizations spend time and resources on all elements, but simply have approaches that currently do not rely on BI&A to the same extent. Although affordances do not require actualization (Volkoff & Strong, 2017), having practices in place seem to create more affordances related to it. Furthermore, the literature details optimizing energy input (Kumar, Mangla & Kumar, 2022), supplier collaboration through information sharing (Kumar, Mangla & Kumar, 2022), changing customer behaviour (Spang et al. 2019), and collecting data for sustainability reporting (Lozano, Nummert & Ceulemans, 2016), which are all activities that organizations partake in, which is enabled by BI&A to various degrees. This can be correlated to how multiple informants recounted that resources for their efforts are fairly recently allocated, demands are increasing and too many initiatives should not be pushed simultaneously to paint a picture of the balancing act organizations have to perform and serve as an explanation as to why some elements are paid less attention. Furthermore, a conclusion could be drawn that due to the positive view of BI&A, in time, current obstacles could be overcome, such as the case of collecting information from suppliers, and then using BI&A could go from being a future potential to actuality. In relation to the impact levels described by Davies and Konisky (2000), the upstream impact and downstream impact are more associated with such challenges, while direct impacts are more straight forward to handle with BI&A.

The results are found to show relatively few occurrences of informants highlighting usefulness of BI&A related to increasing sustainability by official reporting of their numbers. They often express that there are lots of expectations to act sustainably to please the public, customers, and owners, so the results show that it is an area that matters. The results show few examples of direct relationships between sustainability efforts related to sustainability reporting and affordances of using BI&A, however, the informants often mention the usefulness of BI&A when setting goals, following up on the goals, and communicating the results. We see how such statements can be considered related to sustainability reporting, but due to the risk of applying too much meaning to the sayings of the informants they have not been linked. Hence,

this can vaguely be considered part of our findings, without it appearing in a clear way. We believe this is because the sustainability reporting element can be considered an effort with a multi-level impact (Davies & Konisky, 2000) and more complexity than the other ones. The goals and scrutiny from stakeholders hence show signs of pushing and highlighting the importance of sustainability activities within the organization, even if there are few affordances directly connected to BI&A elements and sustainability reporting. Worth noting however, is that the trend of stakeholders demanding increased reporting comes with the risk of taking the focus away from the actual efforts of improving.

5.3 Comparisons between BI&A Elements

By further comparing the aforementioned tables, it is also possible to deduce that data collection and integration provides the most varied capabilities of working with sustainability efforts through BI&A. However, it should not be discarded that all the BI&A-elements also provide capabilities in a more general sense, which could be applied to the specific sustainability elements in the future. A reasonable explanation as to why data collection and integration is more multifaceted could be that multiple organizations aim to be more data driven, as well as the fact that elements such as predictive analytics (Eckerson, 2007) and dashboards (Kumar & Belwal, 2017) are reliant on data to serve a function. How each BI&A-element affords organizations with capabilities is detailed in the following chapters.

The intertwining of the different elements of BI&A are apparent throughout the result and clearly noticeable by looking at the sub headers of each element. Key words such as comparing, understanding, and motivation are recurring on multiple elements. Many of the identified cases of usefulness also rely on another element of BI&A. For example, visualizations to base decisions out of are showcasing the output of predictive analytics which relies on good historical data which is connected to the accessibility of data which is depending on the strategy and approach of the organization. This showcases how all the BI&A elements relate to one another and should not be seen in isolation.

5.4 Data Collection and Integration

Something interesting that can be derived from the empirical results is the insight of sustainability data collection depending on what purpose the data would serve. This is based on two groundings, an economical one and an organizational one, in which the former encompasses costs related to storage, which then affects what data will be collected. The latter informs the need for there to be structure and responsibilities to ensure that the data is managed and analysed by someone, as well as a plan for the intended use of the data. This derives to the fact that organizational stance affects data collection, which is showcased regarding historical data and external sources.

5.4.1 Making Use of Collected Historical Data

The results show differing opinions of storing historical sustainability data. Related to the purpose of collecting data, it is shown that one informant does not recognize historical data as

useful unless it is relevant or current. Girsang et al. (2019) stated that data warehousing aids in analysing trends over time. This was recognized by half of the informants as the affordance of the capability of storing historical data, resulting in seeing trends related to food wastage, resource consumption and in general over time. This correlates to the opportunities Meredith, O'Donnell and Arnott (2008), Golfarelli and Rizzi (2009), Albano (2015) accompany with time variance and non-volatility, as it allows analysing change of data over time, generating reporting with historical accuracy and maintaining previous data. As INF5b described how they conducted measurements of, among other things, food wastage and resource consumption in long time intervals, it could be reflected that making use of maintained data collection and integration is affording them the capability to actualize extracting value from their historical data. INF2 similarly recognized the usefulness of storing several years of data to actualize seeing trends in the long term. Interestingly, the opportunity to provide historically accurate reports (Meredith, O'Donnell & Arnott, 2008; Golfarelli & Rizzi, 2009; Albano, 2015) is not a given benefit as INF5a mentioned how they continuously could question the correctness of the data, which could also be reflected in INF3a and INF3bs comment on the difficulties to accurately measure food waste.

INF1, INF2, and INF3a recognized how data collection and integration affords the capability to progress through the trends historical data may envision, once again corresponding to and Girsang et al.'s (2019) statement. INF1 and INF2 recognized the opportunity to detect trends related to waste of specific food groups, which in turn allowed them to act upon poor performance and discovered abnormalities, which Zhou et al. (2017) describe as a benefit of data warehousing. The responses of INF3a confirms recognized affordances of the capability to follow up on their sustainability efforts by seeing actual results. A conclusion can be drawn that historical data is useful to follow up on reducing food wastage as it actualizes progress by actions being taken based on detecting potential improvements in the trends historical data enables.

As predictive analytics utilizes available data from a data warehouse (Negash & Gray, 2008), there is an opportunity to make stored historical data useful for predictive models. INF3a recognized this as an affordance of historical data by providing the capability of training predictive models. Interestingly, Negash and Gray (2008) remark how the accuracy of the predictions depends on the context's complexity, which can be related to how multiple informants described difficulties of assuring the accuracy of data. For instance, the difficulties of measuring actual food wastage may thereby affect the affordance to be gained from using historical data related to food wastage when training predictive models. The affordances provided by predictive analytics is detailed in chapter 5.6.

5.4.2 Comparing

The empirical results showcase how organizations are able to see opportunities to further integrate sustainability to other types of company data. This reflects how organizations in the food industry have begun integrating their sustainability practices with management systems, which Delai and Takahasi (2013) had discovered was not previously the case. This showcases how data collection and integration affords the capability to compare data types, which results in organizations being able to view sustainability data in a more integrated manner, and draw new conclusions based on comparing data. For instance, the opportunity to conduct A/B testing with sustainability data included is brought up, which could afford new insights on customers. These types of collaborative opportunities indicate how comparing data instigates

cross-functional efforts, which enables organizations to have a more integrated sustainability department. It can be concluded that Muntean's (2018) finding of it being conceptually being possible to integrate sustainability dimensions in current BI systems to be possible in actuality.

The informants also spoke of how through collecting and integration data, they are able to make comparisons between stores and chains performance on food wastage and commonly bought products to gain insights on their customers behaviour. Thereby, data collection and integration afford the capability to compare specific sections, resulting in the ability to monitor and analyse food wastage on different organizational levels and review customer behaviour. Organizations could be afforded the capability to compare commonly bought products to adjust assortment to demands as a way to reduce waste. By comparing stores, a new type of visibility is enabled as organizations receive indications on performance and are able to deploy counter actions. This results in the ability to ensure stores perform at a level that adheres to the goals that have been set. Regarding specific food groups, FAO (2019) points out limited shelf life as a contributor to food waste within retailing. Through data collection and integration enabling comparisons, organizations are able to tailor actions, such as delegating responsibilities to supervise a particular food group, in order to reduce food wastage based on assortment as a way of tackling the barrier FAO (2019) remarked. It can be concluded that the ability to compare affords the capability to have a hands-on approach in reducing food wastage with targeted efforts.

Lozano, Nummert and Ceuleman (2016) found that collecting data for sustainability reporting increased visibility and instigated management discussions. This is also showcased in chapter 4.2.2 in the results, as putting information in relation to each other motivated people as they were able to see changes and progress. Thereby, organizations are afforded with the capability to motivate improving their performance by putting food wastage related information in relation to each other.

The empirical results display a positive view on comparing data on both a company- and industry wide basis. According to the empirical results, to enable proper comparisons across departments, it is important that the data is concurrent, which correlates to Olexova’s (2014) statement that lacking information or relevant data causes delays and changes in decision making. Based on INF3a and INF3b statements, their organizations are afforded the capability to work with sustainability data cross-functionally by storing data centrally, resulting in other departments being able to run their own analysis with included sustainability information. Generally, the results display how information sharing was positively viewed, and encouraged on an industry wide level. Multiple informants spoke of moving towards having a common climate database, which could be speculated to afford the capability of working with the same sustainability data, resulting in more coherent initiatives. As INF3a and INF3b spoke of increased acceptance and standards, a common platform for sustainability data could be a promising tool to elevate future decisions and analysis of sustainability efforts. The results indicate an increased pressure on suppliers and producers to deliver sustainability information, and the reason for requiring their information with the purpose of a common platform correlates with Kumar, Mangla and Kumar’s (2022) research on how supplier collaboration through information sharing can improve decision making.

5.4.3 Detecting and Alerting by Measuring

An evident positive aspect of data collection and integration is the ability to detect and alert by measuring and follow up on the organizations' sustainability efforts. All informants highlighted this as an important, and to some crucial, ability to improve on their sustainability work.

By fetching collected and integrated data, the informants recognized the opportunity to analyse their current efforts performance on food wastage. This was previously a challenging task as there were no established measurements on food wastage, which lacking structure was now provided through BI&A. It is expressed throughout chapter 4.2.3 how organizations are afforded with the capability to establish the status of their current efforts by measuring and inspecting the sustainability related data that has been collected. The results showcase how this capability concerns mostly food wastage, which was enabled to be included in annual sustainability reports. As Kumar, Mangla and Kumar (2022) remark, managing and tracking energy footprints and minimizing energy input is important to manage the food supply chain, which some informants have expressed they are. Collecting and integrating data with the purpose of monitoring resource consumption benefits mostly energy efficiency, however it is evident that organizational prioritization steers whether these types of initiatives are realized.

There are difficulties measuring the effects efforts have on customer awareness. However, there is an indicated ability to establish their current efforts and thus make them more transparent, which should be provided to customers as a way to improve on customers decision making. INF1, INF2, INF3a and INF5b all agreed on data collection and integration affording them the capability to see effects of their efforts by measuring their current performance, resulting in visibility and structure. However, multiple informants highlighted the need and difficulties of collecting, interpreting, or analysing data accurately. For instance, INF3a brought up the challenge of measuring actual food waste and generally mapping products, which correlates to Olexova's (2014) statement regarding the amount of data needed about product stock for intelligent inventory management systems. In the results it can also be seen how data collection and integration affords the capability to identify the need of improvements by detecting abnormalities or opportunities to grow, resulting in possibly enhancing their sustainability efforts. This corresponds to Zhou et al. (2017) identifying the benefit of detecting abnormalities by using data warehousing.

5.4.4 Making Decisions based on Data

Accurate, timely, and trusted data is important to inform decision making according to the informants, which correlates to Haupt, Scholtz and Calitz's (2015) statement of governance of data sources is required to avoid poor data quality, which thereby is an observed risk by the informants. The results showcase how data collection and integration affords the capability to make decisions influenced by sustainability data, by ensuring that relevant data is delivered to decision makers, which results in sustainability being incorporated in the decision-making process. By doing so, sustainability data may influence organizational steering towards correct and more well-founded initiatives, which informs how BI&A provides higher quality decision making (Jaklič, Grublješič & Popoviča, 2018). Beyond that, INF1 recognized the affordance of the capability to motivate new ideas by providing sustainability information, resulting in a possible more data driven approach to lobby sustainability initiatives.

The results show how sustainability departments could be able to provide data for comparison and substantiation to decision makers. Through data collection and integration, sustainability related information affords the capability to substantiate pending decisions with relevant and correct data, resulting in the ability to make more reliable decisions. Herzig and Schaltegger (2006) highlighted how sustainability reporting can trigger awareness and inclusion of sustainability information, which was exemplified in an interesting way as ORG1s pending decision on disposable grills. Meredith, O'Donnell and Arnott (2008), Golfarelli and Rizzi (2009) and Albano (2015) list integration as the second key feature of data warehousing, which allows for coherent formatting, standardization and joined data, which correlates to granting the possibility to integrate sustainability data with other data types. This is recognized by INF3b which informs the affordance of the capability to integrate sustainability with other types of company data for decision making.

5.4.5 Collecting and Integrating from External Sources

External data could be delivered from a provider or business partner, according to Watson and Wixom (2007). The result showcases a dependency of external sources, mostly suppliers, to enable and also improve organizations work with sustainability efforts. Fritz and Matopoulos (2008) describe how governing and setting requirements on suppliers reduces environmental harm. This correlates to the results in chapter 4.1.3 and 4.2.5, as it displays how demands on suppliers to deliver data is increasing to enable realizing sustainability efforts. Moreover, the organizations also aim to help suppliers with their sustainability efforts, which reflects on Delai and Takahashi (2013) finding of influencing the sustainability of production activities to limit environmental harm. In the latter effort, it can be concluded from the results that organizational approach affects whether BI&A is utilized for this or not. The informants spoke of difficulties of both collecting, as suppliers might not share their information, and integrating data, as this is a complex task, which is consistent with Haupt, Scholtz and Calitz (2015) statement of data integration. It can be reflected upon that data not being shared indicates a risk of fragmentation, as information appears to be lacking from both certain suppliers who choose not to participate and products that are not possible to map. This is reflected in Meredith, O'Donnell and Arnott's (2008) research, in which they emphasize storing data in different systems staggers the ability to achieve a holistic perspective and negatively affect decision making.

INF2 described how they noticed how customers' purchasing behaviour could affect the organization's ability to achieve their CO2 goals. They also have begun a process of mapping products to CO2 emissions, which was bought from an external source, allowing for viewing food wastage in a new perspective. A conclusion can be drawn that by implementing new measurements on food wastage, it provides an opportunity to link purchasing behaviour to the organizations CO2 goals. Thereby, data collection and integration afford the capability to integrate external sources, resulting in viewing sustainability efforts related to food wastage and possibly aid in achieving sustainability goals.

Multiple informants expressed how collecting and integrating data allows for tracking the value chain and increased traceability. There are also benefits related to gathering even more detailed supplier data, which encompasses more control, risk awareness and traceability. Thereby, it is recognized that data collection and integration afford the capability to track value chains, by integrating external data which results in increased traceability and more control. However, it is evident that there are immense efforts required to actualize the

affordance, which would push the possibility to enhance collecting data from suppliers a few years in the future. As Kumar, Mangla and Kumar (2022) highlight, supplier engagement and relationship management are significant in terms of creating sustainable food supply chains, which is reflected in the informants' needs to enable tracking their value chain and increase traceability.

As previously mentioned in chapter 5.4.2, industry wide efforts are encouraged by informants as they recognize the benefit of information sharing, increased acceptance, and elevating standards in terms of sustainability efforts. Simply put, the more information that is available, the more possibilities arise, such as the case of collecting more detailed supplier data. This indicates an affordance to the capability to make industry wide efforts, increasing acceptance and standard for sustainability efforts by sharing data externally. However, the organizational purpose of the data needs to be reiterated as it determines which available possibilities are acted upon. There is an interesting dynamic of requiring more data to enable sustainability efforts, such as food wastage, resource consumption, governing suppliers and sustainability reporting which has been covered in this chapter, and organizational purpose dictating whether this data will be collected or not. For those organizations who do not find any purpose or interest in collecting and integrating certain data, the opportunities to enable or enhance their sustainability efforts through BI&A will not arise.

5.5 Data or Analysis Driven Strategy

This element of BI&A provided few examples of affordances related to any specific area of sustainability. The topic was mainly discussed from a bird's-perspective rather than connected to certain efforts or thoughts on how it could improve any aspect of sustainability. Thereby, the general impression is that it is a foundational prerequisite to collect data, as a possible explanation could be that elements are closely linked to operational efforts, and this is at a higher strategic level. As the informants discussed their data collection strategy in close relation to how users approach fetching the data, it appeared suitable to discuss the overall design of the data warehouses in chapter 5.5.1, including both the strategy and the approach. Moreover, some informants described having alternative strategies which are detailed below, before discussing the affordances, which concerns easy and timely access to data for everyone, mobility and presence, and structure.

The results suggest that the organizations lean more towards the data driven strategy of collecting and integrating data for BI&A purposes as described in previous literature, however, the results showcased how there are more strategies to consider than the two suggested by Albano (2015). One of them was the event-driven architecture of the Kafka platform that INF5a is looking at implementing and explains the benefits of. The choice of strategy is also found to be dependent on the organizational structure. The informants expressed the organizations as quite complex compositions and groups of companies, which needs to be considered as INF5a indicates that strictly top-down or bottom-up organizations can have a more straight-forward strategy of collecting and storing data. Another aspect to consider is the development of recent technologies. Unlike the traditional data driven strategy where the data is stored in a data warehouse, ORG3 has a data lakehouse, which by Armbrust et al. (2021) is described as a more modern and flexible data storage technology than the traditional warehouse. This connects to the future needs to be more agile and flexible as expressed by INF5a, and it challenges some of the traditional characteristics of the strategies described, such as the analysis

driven strategy being more time and cost efficient as this is an advantage of data lakehouses (Armbrust et al. 2021) that might narrow the gap between the strategies.

Although there seems to be a clear data driven strategy in ORG4, there seems to be a lag on including sustainability-related data as it is not yet extracted. Even if there are clear affordances of BI&A related to measuring resource consumption and such found in the statements made by INF4, the data-driven strategy might face a barrier to utilize the potential due to the demand of putting time and resources into it. This is in line with Golfarelli and Rizzi's (2009) statements about that a data-driven strategy requires more resources and takes a lot of time to implement before it can be used. The opportunity to include highly qualitative data based on the business needs (Golfarelli & Rizzi, 2009; Albano, 2015) does not yet seem to include all the sustainability-related data that could be useful according to the informants, for example the data on resource consumption that is left in a separate system and historical data related to sustainability is not interpreted as important. This leaves the question of whether it is a question about allocating resources or simply a matter of not finding the data useful enough to choose to include it. In the case of the latter of the two, it reminds more of the risks related to the analysis driven strategy, where data that is requested is unavailable as it has been disregarded (Albano, 2015).

5.5.1 Accessing data easily and timely

As suggested by Albano (2015), there are two recognized strategies to collecting and integrating data for BI purposes: data or analysis driven. Most informants describe their efforts as being data driven. This is due to their aim to centralize and make sure the user will always be able to extract data by creating marts when needed, as explained in detail by INF2, INF3a and INF4. This is in line with how Albano (2015) and Golfarelli and Rizzi (2009) describe the data driven strategy as holding data in a central data warehouse for the user to later create data marts from, based on what they need and what data is available from various operational information systems. The results adhere solely to the hybrid approach of how to collect and integrate data, as described by Meredith, O'Donnell and Arnott (2008), in which the central data warehouse manages the ETL-process and integration, and data marts are derived from this to respond to user needs.

Given the results, it can be concluded that the informants positively view the opportunity of this approach that Meredith, O'Donnell and Arnott (2008) and Golfarelli and Rizzi (2009) present as being able to have greater consistency and integration whilst also customizing fetched data to user needs. INF4 recognized being afforded the capability of easy access to sustainability related data while avoiding security issues by generating data marts upon requests by users not connected directly to the systems. The BI&A strategy affords to the capability of easy access to data by having the requested data mostly already available to create a new function to improve customer awareness and reduce resource consumption, an affordance described by INF3b which relates to the expressed easy access to data in the business functions as elaborated on by the colleague INF3a. This supports the benefit of being data driven, as it can provide data to the user when the need for it occurs (Albano, 2015; Golfarelli & Rizzi, 2009). It can be concluded that all informants are mostly in line with the data driven strategy, however some were uncertain of how to label their strategy, by not talking in terms of the two options or showing that they are aware of the clear distinction between them.

All informants with data driven strategies pointed out that the centricity and data democracy of the systems afforded them the capability to make sustainability data easily and timely accessible for actors at various places in the organization. This confirms the two potentials of BI that was pointed out, to make data accessible (Grecu & Nate, 2014; Ramakrishnan, Jones & Sidorova, 2012) and information presented at convenience (Ramakrishnan, Jones & Sidorova, 2012).

5.5.2 Providing mobility and presence or Structure

A final note on the topic of the element might hence be that choosing a valid data strategy, as pointed out to be important by Albano (2015), is complex but important as the different options both affords them different possibilities related to handling the sustainability data, as well as different challenges to tackle. A decentralized strategy affords the capability of increasing mobility and presence beneficial for making simulations and decision making, whilst a strategy of centralizing affords the capability of having structured data which is necessary for more standardized reporting activities. There are more aspects to consider than the two strategies, and the finding of the event driven architecture as an appropriate choice is discrepant from what Albano (2015) suggested as the two recognized strategies. In line with how Albano (2015) expressed that there sometimes is a need for combining the two strategies, the results show that a mix of strategies has been found to afford one organization benefits when handling efforts of different nature in their organization. Hence, data strategy is found important and conditional for actualizing different affordances, but the focus is rather about adapting to the organizational needs and changes rather than choosing one and sticking to it.

5.6 Predictive Analytics

The informants showed a couple of affordances within the area of predictions related to comparing, understanding, forecasting demand for replenishing, and optimizing prices. The importance of historical data, and vast amounts of data is highlighted in chapter 5.4.1, to be able to build predictive models. This is coherent with the literature, as Negash and Gray (2008) are stating that algorithms use input from the available data in the data warehouse to make predictions. However, the concept of predictive analytics has been described in close relation to more simple forms of predictions and descriptive analytics, and the even more advanced such as AI and machine learning, the latter confirmed by Sparks et al. (2017) to be part of the development of predictive analytics. The intertwining of these concepts is acknowledged in the literature, as it is stating that predictive analytics utilizes descriptive statistics and the extension of the concept to including predictive algorithms such as decision trees and neural networks (Eckerson, 2007; Attaran & Attaran, 2019; Selvaraj & Marudappa, 2018), which are core concepts of machine learning and AI. Even if the machine learning projects have not yet been highly successful according to INF5a, it provides proof of the technology being perceived as useful. Regardless of the lacking actualization and outcomes of the projects, there is work in progress and it is clear that there is potential and affordances, but some organizational obstacles to tackle.

Although research by Bose (2009) suggests so, we found no direct connection to any understanding of customer behaviour or changing of customer demand from the empirical material. Predictive analytics for sustainability is in its initial phase according to the informants, which

might provide an explanation as to why. No affordance is hence found related to it, most focus seems to be connected to understanding how to reduce food wastage and following up on more general sustainability goals and metrics.

This derives in the conclusion that our results suggest that predictions are found more useful to make decisions and support as a general steering instrument, there is less proof of such things as understanding customer needs, automating and improving inventory management and adapting replenishment by trends and seasonality.

5.6.1 Comparing

The sustainability element in focus when discussing the usefulness of predictions is the reduction of food wastage. INF2 states that predictive analytics affords the capability of comparing current efforts and trends to the set goal to projectize if they are doing enough to reduce food wastage. This affordance is closely aligned with how Eckerson (2007) as well as Attaran and Attaran (2019) states that organizations can do such things as optimize processes and discover upcoming issues by predictive analytics. It is also in line with the possibilities to identify patterns and trends to forecast where the future is probably heading as suggested by Negash and Gray (2008), Eckerson (2007) as well as Hlaváč and Štefanovič (2020).

5.6.2 Understanding

Predictive analysis is also found useful for understanding effects and mapping a product's complex multi-parameter impacts. Hence, predictive analytics affords the capability of increasing the understanding of complex multi-parameter issues. It also affords the capability of increasing understanding through analysis of vast amounts of data which can help improve strategic decision making. The large and complex data related to production and agriculture is tough to analyse, but technology can aid in creating the understanding and drive actions based on information. INF5a states that predictions can help by increasing understanding of weather conditions, something that was highlighted as a main cause of food loss throughout the food supply chain by Otles et al. (2015), which indicates a link to the food wastage element of sustainability from this affordance.

5.6.3 Forecasting Demand and Managing Replenishment

The literature suggests great advantages of using predictions to improve inventory management, something that was also mentioned as useful by one of the informants. The costs caused by over-stocking and lost sales due to inventory shortage as mentioned by Banerjee and Mishra (2017) were right in line with how INF3a explained the use of predictions to support replenishment. The usefulness also supports Horoś and Ruppenthals (2021) findings about having an impact on food waste. As FAO (2019) reported, limited shelf life and a varying demand are two of the four main causes of food waste in retail, which relates to INF3a's identified potential of better understanding what goods are at risk of expiring through predictions. Further, as a barrier to reduce food waste is that there is often a lack of information about it (FAO, 2019), INF3a statements, which indicate the potential for predictive analytics to provide more information, could help overcome that obstacle. Hence, predictive analytics has been found to afford the capability to improve replenishment by forecasting the demand of products, which can help to reduce food wastage.

No question was directed towards asking if they used predictions for such specific things as inventory management which would make it wrong to state that no other informant finds it useful. However, as research suggested grand benefits within the area, we expected to have more findings related to smarter ordering systems, seasonal trend analysis or responses to demand spikes as suggested by Asif, Hina and Mushtaq (2017), Horoś and Ruppenthal (2021) among others. When being asked about how they work with predictions, reducing food wastage, and using BI&A for sustainability efforts in general, only one indicated an affordance which can be seen as a part of the result. Our research thereby suggests that in theory it is incredibly useful, but in reality, it is not one of the initial things that comes to mind.

5.6.4 Optimizing price

The opportunity to utilize predictive analytics to set the ideal price of goods that are approaching its expiry date was explained by INF3a. With the help of algorithms, the system decides what discount should be applied to the product to maximize revenue but avoid food waste. As overstocking has been proved expensive by Banerjee and Mishra (2017) and Olexova (2014) this can be seen as a way to mitigate the harm when it has happened, and not only reducing the economic impact but also getting products sold to avoid food waste. This results in the conclusion: Predictive analytics affords the capability to predict the optimal price for products to balance revenue with sustainability and by that reduce food wastage.

This affordance was a fully inductive finding and had not been discovered in previous literature. The usefulness of this affordance would not exist without the economic affordance directly linked to it, as the best way to avoid food waste could be to hand out products with short expiry dates for free. However, to recognize the need for most organizations to make profit, it is relevant to include as it supports the sustainable act of reducing food waste while being sustainable from an economic perspective as well. The opportunity for economic value gain is also mentioned by Otles et al. (2015) to be an advantage of investing in management practices to optimize the use of resources in production, but similar opportunities can hence be found in such practices in the food retail setting.

5.7 Dashboards and Visualizations

The importance of visualizing data was something all informants agreed on. Once again, the focus of the examples of use and usefulness were directed to food wastage efforts and related to comparing, understanding, and motivating. These three types of capabilities (described in chapters 5.7.1, 5.7.2 and 5.7.3) are clearly connected, as many statements take the full grip from providing the first understanding through comparisons which leads to increased understanding of what decisions to make and what issues are relevant, where the feeling of being informed in a user friendly way can lead to an increased motivation to do good, and point out good results and reward them which is also found to increase happiness and motivation of employees. These connections are important as it showcases the use of visualizations in various parts of the organization, and how ever user gets what they need for their tasks, and even has the external usefulness through being able to raise customer awareness. Below is a presentation of each capability and their affordances in relation to previous research.

5.7.1 Comparing

Dashboards and visualizations afford the capacity of comparing differences between stores and products and provide useful insights needed to guide actions towards reducing food wastage. In the specific case of presenting data in the sustainability declaration, INF3b highlights the usefulness of being able to present data in a way that is easy to understand, which is in line with the purpose of visualizing as stated by Kumar and Belwal (2017) and Kariyawasam et al. (2021). Further, INF3b states that visualizing the differences in relation to the sustainability aspects of the products, helps map causes and effects, and make movements. It correlates with the statements by Furmankiewicz, Furmankiewicz and Ziuziański (2015) suggesting that dashboards can be the first step in the decision-making process to draw conclusions and insights from, as it makes it possible to discover problems and the source of them. On a more operational level, comparisons are also made between stores according to INF2, to, for instance, follow up on goals and discover issues which can later be acted upon, if necessary, also in line with what research by Furmankiewicz, Furmankiewicz and Ziuziański (2015) suggested. The focus of the comparison can relate to reduction of food wastage, which several informants exemplified. INF2 particularly pointed to the importance of relating numbers to other numbers, such as last years or other stores, which is in line with how Furmankiewicz, Furmankiewicz and Ziuziański (2015) state dashboards are the most beneficial: by nesting current data with historical data or target values to enable comparisons to be made.

5.7.2 Understanding

With many similarities to the previous part about comparability, dashboards can educate and provide understanding related to sustainability according to several informants. INF3a and INF5b finds it necessary to break down requirement points, follow up, and understand where there is potential to develop, which connects to what Furmankiewicz, Furmankiewicz and Ziuziański (2015) as well as Hall Jr. (2003) state about dashboards providing holistic and integrated analysis to understand complex matters and support management. The user friendliness and comprehensiveness of visualizations expressed by researchers such as Elias and Bezerianos (2011) and Hall Jr. (2003) is found in the empirical material, for example in the statements by INF2 related to the increased interest and understanding of data when visualized at store-level. The improvement of making it possible to look at store-level data is also right in line with what Elias and Bezerianos (2011) state about listening to the end-user to make sure the right information is provided based on the actual needs in the organization. The increased understanding is useful in multiple ways but specifically also so to improve food waste operations according to INF2. Hence, dashboards and visualizations provide an affordance in the capability of increasing the understanding of numbers at various levels which for example can be used to reduce food wastage.

As stated by Marcus (2006), dashboards and visualizations can be useful for clients, and Guidotti et al. (2018) even present the case of personal dashboards for customers in retail, and how it can be used to increase self-awareness and provide insights on purchasing and behaviour. When being asked about these, informants provided had three different perspectives. INF1 expresses the usefulness of it but has not implemented it yet, INF3b already has it in place and finds it useful, and INF2 do not perceive any usefulness. INF1 and INF3b hence agree on the statements by Guidotti et al. (2018), and even exemplifies similarly of how it can be used. As two out of three retailing organizations have informants who perceived usefulness, dashboards and visualizations afford the capability of increasing the customer

understanding about sustainability matters and by that raising customer awareness. This adheres to Spang et al. (2019) claiming the usefulness of technology to raise customer awareness. It seems to be a matter that is handled at the retailing stage at the food supply chain, as the producers overall were found to put less focus on raising customer awareness, which can be explained by Spang et al. 's (2019) statements about retailers having more possibilities and expectations to raise customer awareness.

5.7.3 Motivating

Motivation can be seen as a result of being informed by dashboards, as several informants state that the employees are more motivated to change and care about sustainability matters when getting information in a uniform and structured way. It is also found usable to follow up and compare numbers to other numbers and goals, which can be used to reward those who have put in the extra work and by that push motivation to do so. Specifically mentioned is the usefulness within the area of reducing food wastage. There is no direct correlation to any of the previously identified statements literature to be found, which makes this area of motivating employees an inductive finding although it is closely connected to the benefits of providing comprehensible information to the user as elaborated on in the previous section about increasing understanding. What differs it is, however, that it does not only lead to insights but also has the effect of increasing motivation and happiness. Our findings hence suggest that dashboards and visualizations afford the capability of increasing the motivation of employees to act and care about sustainability related issues and reduce food wastage.

5.8 Summary of Identified Affordances

The following is a summarized version of the discussion in the form of a compilation of the findings from the empirical results, sorted by BI&A-element, through the lens of affordances. This list declares what potential actions a technology-user relationship intends to achieve, which is a way to identify affordances according to Volkoff and Strong (2017).

Data collection and integration:

- Affordance of the capability of storing historical data, resulting in seeing trends related to food wastage, resource consumption and in general over time
- Affordance of the capability to actualize extracting value from their data collection
- Affordance of the capability to progress through the trends historical data may envision
- Affordance of the capability to follow up on their sustainability efforts by seeing actual results
- Affordance of the capability to making use of historical data to train predictive models
- Affordance of the capability to compare data types, which results in organizations being able to view sustainability data in a more integrated manner, and draw new conclusions based on comparing data
- Affordance of the capability to compare specific sections, resulting in the ability to monitor and analyse food wastage on different organizational levels and review customer behaviour

- Affordance of comparing to tailor actions, such as delegating responsibilities to supervise a particular food group, in order to reduce food wastage based on assortment
- Affordance of the capability to work with sustainability data cross-functionally by storing data centrally, resulting in other departments being able to run their own analysis with included sustainability information
- Affordance of the capability of working with the same sustainability data, resulting in more coherent initiatives
- Affordance of the capability to establish the status of their current efforts by measuring and inspecting the sustainability related data that has been collected.
- Affordance of the capability to see effects of their efforts by measuring their current performance, resulting in visibility and structure
- Affordance of the capability to identify the need of improvements by detecting abnormalities or opportunities to grow, resulting in possibly enhancing their sustainability efforts
- Affordance of the capability to establish the status of their current efforts by measuring and inspecting the sustainability related data that has been collected
- Affordance of the capability to make decisions influenced by sustainability data, by ensuring that relevant data is delivered to decision makers, which results in sustainability being incorporated in the decision-making process
- Affordance of the capability to motivate new ideas by providing sustainability information, resulting in a possible more data driven strategy to lobby sustainability initiatives
- Affordance of the capability to substantiate pending decisions with relevant and correct data, resulting in the ability to make more reliable decisions
- the affordance of the capability to integrate sustainability with other types of company data for decision making
- Affordance of the capability to integrate external sources, resulting in viewing sustainability efforts related to food wastage and possibly aid in achieving sustainability goals
- Affordance of the capability to track value chains, by integrating external data which results in increased traceability and more control
- Affordance of the capability to make industry wide efforts, increasing acceptance and standard for sustainability efforts by sharing data externally

Data driven or analysis driven strategy:

- Affordance of the capability of providing access to the data while avoiding security issues by generating data marts upon requests by users not connected directly to the systems
- Affordance of the capability to accessing data easily and timely by having the requested data mostly already available to create a new function to improve customer awareness
- Affordance of the capability to make sustainability data easily and timely accessible for actors at various places in the organization
- Affordance of the capability of increasing mobility and presence beneficial for making simulations and decision making, by having a decentralized strategy
- Affordance of the capability of having structured data, which is necessary for more standardized reporting activities, by centralizing as a strategy

Predictive analytics:

- Affordance of the capability of comparing current efforts and trends to the set goal to projectize if they are doing enough to reduce food wastage
- Affordance of the capability of increasing the understanding of complex multi-parameter issues
- Affordance of the capability of increasing understanding through analysis of vast amounts of data which can help improve strategic decision making
- Affordance of the capability to improve replenishment by forecasting the demand of products, which can help to reduce food wastage
- Affordance of the capability to predict the optimal price for products to balance revenue with sustainability and by that reduce food wastage

Dashboards and visualizations:

- Affordance of the capacity of comparing differences between stores and products and provide useful insights needed to guide actions towards reducing food wastage
- Affordance of the capability of increasing the understanding of numbers at various levels which for example can be used to reduce food wastage
- Affordance of the capability of increasing the customer understanding about sustainability matters and by that raising customer awareness
- Affordance of the capability of increasing the motivation of employees to act and care about sustainability related issues and reduce food wastage

5.9 Method Limitations

As described in chapter 3.3.4, the scope and time constraint of the study posed challenges in finding informants to interview, which is unfortunate as more informants would have strengthened the results and increased the generalizability of the study. We see how finding informants correlates to the research problem we are investigating, as multiple felt inadequate to speak on the matter by not having the right knowledge, even if they work at the sustainability or IT department. However, the respondents had a variety of roles, backgrounds, years of experience and age, gender, years within their organization etc, which we consider quite representable for the group of people.

Due to the requirement of having BI&A practices in place, participating companies can be considered frontrunners of the development, hence the results are expected to reflect a high maturity level and excludes the less active actors when it comes to increasing sustainability efforts by utilizing technology. Additionally, as the research is limited to organizations in the Swedish market, which has a general high awareness of sustainability matters is expected to be reflected, compared to players in other markets. A strength of this is the possibility to uncover novel findings and use the results of the research as guidance for actors in less sustainability-aware markets about to take action such as the participating organizations.

As the informants had different profiles, IT or sustainability focused as elaborated on in section 3.3.3, the questions had some variety. This made the analysis challenging at times, as some sustainability-focused informants expressed thoughts that we could connect to a BI&A element, but as technical details were lacking, we had to decide on whether there would be

too much interpretation involved to make it possible to make those connections. We as researchers had to analyse the context and material several times to decide on whether it was relevant to connect it to a technical concept or if it should rather be told without a technical labelling. Due to this, results sometimes show that informants did not have anything to say within a specific element. However, this does not always mean that they are negative towards it or that there is a lack of affordance because of it, as it sometimes was implied but we did not want to assign too much meaning to the sayings. The results were presented in an as fair and true way as possible, and the discussion aims to point out the parts that were related to one another as a way of tackling this issue without inferring on the statements of the informants.

The inductive approach guided the interviews to be held with an open mind towards what the informants found important and useful. This resulted in that the informants were encouraged to somewhat direct the interviews towards the areas they felt were important rather than covering the full scope of the study. Hence, some of the interviews sometimes lacked coverage of all elements and depth within them. It could be that organizations use BI&A to a greater extent, for instance using historical data for more than food wastage, but this might not have been covered in interviews depending on informants' knowledge or that we did not ask all the relevant follow up questions. Due to the inductive approach, some affordances have only been brought up by one or a few informants, while being aware of this affecting generalizability this is considered acceptable as the study aims to paint a holistic picture of what BI&A is able to provide rather than comparing organizations or informants to one another. On the line of the inductive approach, some affordances were unanticipated findings which then would not have corresponding literature, but as it still was viewed as highly beneficial by the informants, we decided that the unanticipated findings were important to include if they were closely aligned with the topics within the scope.

6 Conclusion

The purpose of this thesis was to map a holistic image of how BI&A is useful to organizations in the context of the food industry. By investigating selected elements of BI&A and sustainability from existing research empirically, it was possible to scrutinize how the BI&A elements affords the efforts related to the sustainability elements. The question asked to guide the research was:

What capabilities do BI&A technologies afford organizations in their sustainability efforts?

The empirical findings were discussed and then summarized in a list of affordances and capabilities related to the BI&A elements as a provided answer to the question at hand. Based on them, some more general conclusions can also be drawn.

Data is central and most of the identified capabilities are related to collecting and integrating data. It can also be concluded that the capabilities provided by collecting and integrating data are prerequisites to enable the other BI&A elements to provide capabilities. This is due to the importance of having enough data to analyse trends, follow up on goals and compare results on various levels to support the following BI&A tools, as it is required to have organizational interest in the use of stored data, to build predictive models, and to visualize meaningful numbers. Thereby, it can be deemed that BI&A elements cannot be seen in isolation as the capabilities provided by them has been found to be dependent on other elements. The most common strategy among the organizations is data driven, which affords structure and accessibility. However, findings display how there are capabilities unlocked by including more flexibility to it, for example through a hybrid solution. Predictive analytics were considered increasingly important for informed decision making as it unlocks possibilities to compare, understand and forecast. Dashboards and visualizations were seen as a key element to retrieving insights from data, increase understanding and motivate continuous efforts.

Food wastage reduction is currently the element of sustainability which is the most central for what efforts BI&A were incorporated in. However, sustainability efforts were often referred to as general, including measuring and following up on sustainability issues at multiple levels and often holistically. Increased sustainability reporting was found to increase the work with sustainability issues and information in the organizations. However, handling demands was also found time consuming, indicating the need for increased use of supporting technologies. Some differences were indicated between retailers and producers, as retailers seem to put more focus into, and utilize BI&A more, to raise customer awareness and govern suppliers to a higher degree.

Some key capabilities which in different ways were found related to most elements of BI&A and sustainability efforts were; understanding, comparing, measuring, following up, informing and motivating. With these combined, it is possible map the overall usefulness of BI&A for sustainability. The informants express that everything cannot be done at once and immediately, but the results indicate a positive outlook on the current and future use of BI&A for sustainability. The summary of affordances provide concrete examples of the current and potential capabilities afforded by the technologies.

6.1 Future Work

The results from this study showcase opportunities for future research. As the focus was delimited to the identified elements, there is great potential of looking at other elements of BI&A and sustainability, for instance, it can be deduced that Self Service BI and transportation of goods are two elements that could be further investigated. Considering that the purpose of this study was to create a holistic view of the efforts, it could also be interesting to go more into detail regarding one or a few elements, and potentially look at what actual effect it has. For example, to study how customer awareness is affected by visualizing data related to sustainability impact of products, and what potential technology has to change the consumption behaviour. The holistic view also excluded the possibility and point of comparing organizations to one another. This calls for the possibility of comparisons to be made, and for example point out the differences between the different actors, such as retailers and producers or different organizational conditions. The findings from this study can also guide more deductive research and serve as a basis for quantitative studies to make more generalizable results. Case studies could also provide the full range of insights from more actors at the same organization with different roles. Similar studies can also be made in the context of other industries than food, for example fashion, by adapting the sustainability elements. Lastly, we see potential for future work within the area of measuring the result of the positive impact versus the negative impact of data dependent sustainability efforts, as this thesis does not include the sustainability of the technologies themselves and the environmental impact of storing and processing data.

Appendix A: Interview Guide

<table>
<tr><td>Warm up Questions</td><td colspan="2">Questions</td></tr>
<tr><td></td><td colspan="2">Let us hear a bit about you and the role you have at X!</td></tr>
<tr><td></td><td colspan="2">In what ways do you think technology, more specifically BI and analytics, has contributed to improvements on working with sustainability at X?</td></tr>
<tr><td></td><td colspan="2">Where do you think org X stands today in terms of using BI&A/technology for sustainability efforts and initiatives?
Now, let us go into a bit more detail about the certain tools in a BI system, which is data warehousing, predictive analytics, and corporate performance management. So let us start with data warehousing! (To questions)</td></tr>
<tr><td>BI-Tool</td><td>Element</td><td>Questions</td></tr>
<tr><td rowspan="2">Data warehousing & data marts
A data warehouse stores detailed and clean data from multiple sources, redo for analysis and processing. A data mart can be thought of as a smaller warehouse, containing information for specific purposes</td><td>Data collection and integration</td><td>• Opening; tell us a bit about how you at X are working with data collection and integration in your processes (related to sustainability efforts)!
• How would you describe the infrastructure, from data source to accessible information?
• How many data sources are normally required to deliver a sustainability function?
  ○ If this varies a lot based on what information is needed, do you store all information in one central warehouse or create data marts gathering information from each source?
• In what ways do you see having a data warehouse being beneficial for your work and tasks?</td></tr>
<tr><td>Data driven or analysis driven
data driven - gather all information available and accessible and stores in a central space
Analysis driven - starts by user needs and then create specific marts with the data for that specific need which is later integrated in a warehouse</td><td>There are two recognized approaches when designing a data warehouse, based on what data is generally available, or based on creating data marts due to user needs, and later integrated to a warehouse.
• Which of the two would you say is similar to your own approach?
  ○ If the sustainability department comes forward with needing a new function, how would you approach delivering the data/information needed?
• In what ways do you see your strategy being beneficial in your work?</td></tr>
</table>

Advanced analytics
Various techniques of analysis used to predict future effects or needs, or to make estimations of the future based on given facts
	Predictive analytics
	An assortment of techniques that discovers patterns in large amounts of data to predict behaviour, events, and needs. Based on data from data warehouses which is then analysed.
		• Do you make use of analytics to make predictions?
		  ○ If so, can you describe for what purposes related to sustainability?
		  ▪ If yes: In what areas? Is there potential to improve it even more?
		  ▪ If no: do you think that it would be beneficial if you were to implement it within sustainability functions as well?
		• How does utilizing this technology benefit your work and ability to deliver sustainability related functions?

Corporate performance management	Dashboards
	Visualizations that contain key values, graphs and more to make large amounts of data more understandable. Dashboards are the visual interface that represent data
		• How do you make use of dashboards and visualizations within sustainability? Example?
		  ○ If not, do you think that it would be useful for sustainability functions as well?
		  ○ Do you provide visualizations of sustainability measures towards the customer and what are your thoughts on that?
		• What information do you find the most important to include in a dashboard related to sustainability?
		• In what ways do you see dashboards benefitting the organization?

Sustainability		

Direct impact
Impacts from the organization and own supply of services
	Reduction of food wastage
	The internal efforts to increase the amounts of produce that reach the next step in the food value chain
		• Do you measure your food waste/loss?
		• Are you working on reducing your food waste/loss?
		• Are you utilizing BI&A to reduce your food waste/loss?
		  ○ If yes: How has it helped you to reduce waste/loss?
		  ○ If no: Have you looked into the potential benefits of doing so? How do you think it could help you to reduce waste/loss?
		• How useful do you find BI&A to be for the reduction of food waste/loss?

	Reduction of resource consumption *For example, use of electricity and water*	• Do you measure your consumption of resources? • Are you working on reducing your resource consumption? • Are you utilizing BI&A to reduce your consumption of resources? ○ If yes: How has it helped you to reduce your consumption of resources?

		○ If no: Have you looked into the potential benefits of doing so? How do you think it could help you to reduce resource consumption? • How useful do you find BI&A to be for the reduction of resource consumption?
Upstream impact *Impacts from influencing other actors in the food supply chain*	Governance of supplier (& retailer) sustainability *For example, by setting up demands or encourage reporting, certification, and control*	• Briefly, what type of suppliers do you have? • What demands do you have on your suppliers in terms of sustainability efforts? • How do you track and measure those demands on your suppliers? • Are you utilizing BI&A to track or govern your suppliers? • How useful do you find BI&A to be for the governance of suppliers? *For producers as well:* • Briefly, what type of retailers do you have? • What demands do you have on your retailers in terms of sustainability efforts? • How do you track and measure those demands on your retailers? • Are you utilizing BI&A to track or govern your retailers? • How useful do you find BI&A to be for the governance of retailers?
Downstream impact *Impact through influencing consumers*	Customer awareness *For example, by encouraging, educating and make sustainable consumer behaviour possible*	• How do you work on increasing the customer awareness of environmentally sustainable habits and products? • In case you utilize BI&A to raise awareness and educate customers, could you give some examples of this? ○ Do you measure or get any indications of what effect it has? • Do you measure or follow up what effect your sustainability efforts related to customer awareness have by using BI&A tools? • How useful do you find BI&A to be for increasing customer awareness?
Overall impact *Impacts on multiple levels, both internally and externally*	Sustainability reporting *The overall official reporting and its underlying demands on information and internal control*	• How do you receive data or information to conduct your sustainability reporting? • Does getting information from BI&A benefit you in creating the sustainability reports? If so, in what ways? • Do you think that sustainability reporting has increased the importance of sustainability information and efforts in the business as a whole? In which ways?

		• Do you have any examples of how sustainability reporting has increased the clarity of responsibilities and accountabilities of sustainability efforts? • How useful do you find BI&A to be for sustainability reporting?
General/cool down		• Is there anything regarding the topics we have talked about that you would like to add on to regarding the use of BI&A for sustainability? *Now let us end the interview by returning back to the first question we asked, now after we talked about it a bit more in depth and detail, do you have any further reflections regarding:* • In what ways do you think technology, more specifically BI and analytics, has contributed to improvements on working with sustainability at **X**? *So now the interview is coming to an end, thank you so much for your time.*

Appendix B: Transcription of Interview with INF1

Row	Text	Element	Iteration 1	Iteration 2
1	**So, a short description of what you do at ORGANIZATION and your role there would be nice.**			
2	I work as a ROLE at ORGANIZATION under NAME who is my manager, and currently work primarily with the chains CHAIN and CHAIN, to help them a lot to work towards our sustainability goals that can be read online. I have worked a lot with the food waste issue, I also work with how to increase organic and KRAV-sales, and work with waste management. "How can we reduce waste disposal?" Yes, those are the goals that the chains have that I help with. And I work quite a lot with extracting reports and following up our work, following up on food waste and analyzing and, like, finding organic food, follow up and see. "How are we doing?" "Were we big, were we small?" "What can we improve?" "Why is there so little here, and bad here?" and like that, I work quite a lot with analysis and reports actually myself, and think it's quite fun to do so. I think you get a lot of information that you wouldn't have discovered otherwise. You can be like "but why does it look like this?"	S1, A1	Follow up, extract reports, find explanations	detect - store
3	**Yes, but what does this production of reports look like? Is there a lot of information and such that you need to put together yourself, or does a lot come pre-processed?**			

4	So, it depends, everything is relative, but we have something called POS-data, Point Of Sale, so everything that all our customers buy is registered in our checkouts and then it goes into a large database. So we can follow our customers there, for example, and see so that we can do such analysis. We can go in and look. I've been involved in making one of these and it was when working with a global range and then we did that. So we took everyone who had bought frozen halal meat and then we check like this: "What does their shopping basket look like? What are their 100 most common goods?" And then we could see that compared to the average customer's 100 most common goods and then we could see that they have bought a lot more lemons. They bought a lot of tomato paste and then we could say, these are customers who come who are Muslims, probably, and see what they buy a lot of. Yes, and so you could kind of, so it was a little interesting, and are they profitable, nonprofitable, bought a lot of BRAND, here we got some information. I'm working on that a lot. Then you have to make specific runs and there's a guy at CHAIN, someone at CHAIN and doing these. I don't look at them very often. However, there is a system called microstrategy. There we produce sales reports that not only look at customers, but it is more like, that then I can go into and BRAND and see how much they have sold in 2021 compared to 2020, or choose the month, choose stores and I can get, for example, the food waste. I will follow up on it and see; "How much does food waste decrease?" "What does it look like on main groups, how much food waste do we have on bread, fish, poultry, and so on?" Here you can go into detail in the store, so that's where I decide. There I have a number of reports that are pre-ordered that I can work with. But I work quite a lot on that and there are also pre-ordered reports, such as eco-sales. It's a report that runs every month and it's sent out to a bunch, so there are a lot of different reports that are there and are sent to certain people every month. And there are sales managers and sales leaders and CEOs or everyone who has an interest in it, while I produce specific reports that I follow up with the goals that I find interesting. We might have a workshop, like we had at CHAIN last autumn, when I will present; this is what it looks like at CHAIN. These are the 20 most common goods. I think you can see this here, so. For that I work with microstrategy. And then we have a team called, then I think you should talk to them, but we have an analysis department that works with reports, produces reports. This basic, and then when I say so I would like to have this, then I send it to them and then they create it because I am so bad at creating them. Yes, no, but then they are in a library, I can use them several times. So many reports are created and that I can use, just change like what chain or what period or like that, so now I don't have to bother them so much because I have built up a number of reports.	BI1, BI1, S1, S5, A1	find explanations, follow up, reuse reports, scalable (?), spread infromation	food wastage, sustainability reporting, collected historical data, comparability - organization

5	**Yes, that's good.**			
6	No, I work and I think I find out very interesting things, a lot, and there are a lot of decisions to be made. Take, for example. We had a decision. "Should we remove disposable grills from our sales?" a few years ago and then it is very difficult for decision makers if it is not obvious things. It's so much better if those of us who work on sustainability say this. "Yes, but we sold this many grills for this much money and we made this much." Then it's easier for them to make this decision "should we remove them or not remove them" and that's where I work very much substantiating with. We shall have numbers, we should not be allowed to come like this, "remove the disposable grills". And then she asks, "yes, but what? What is the impact there?", "We don't know". I work very much to develop, NAME who is my boss, she often asks me to produce figures for basis so that we can feel businesslike when we try to lobby for our, yes, ideas about how we should work more sustainably.	BI1, A1	decision supported by data, make arguments based on data, make decisions based on proof of impact, lobby ideas with data as a basis	decision making
7	**If you look at these reports, you use a lot of analysis tools and so on, but in general, how do you think that technology and then in specific BI, and these analysis have contributed to improvements in your sustainability work? And I can add that I mainly mean what is environmentally friendly because that is our focus.**			
8	Yes, most of it is environmentally, but if I understand the question like how, how much have they added to our work, is it?			
9	**Yeah**			
10	It's hard to answer if you're going to count it on a scale of 5-10. But I would say, to take the food waste issue and then you can, surely it is also an environmental issue? It's really dumb to throw away food, because then we have to grow a lot of food that has been sprayed and it comes out into the fields that we then throw away so it's really a sustainability issue that is super important. It would be very difficult to work on that issue if we could not estimate how much waste we had and be able to see that the job we do is like paying off. So I would say very important if I get to decide on such a scale from "not important" to "important" to "very important" I will say very important. Yes, is that an answer or?	S1, BI1, A1	Estimate/measure	food wastage, detect - store
11	**Yes and yes, I think so. And if you think about where you stand today, how far have you come and what is your status today on using BI and Analytics in a sustainability work would you say?**			

12	Yes, and have I understood correctly that BI and Analytics is what I'm talking about that I'm getting numbers from microstrategy which is our database and reports and analyzing so, so is it like so then I have understood it correctly, then how far we have come you said?	BI1		
13	**Yeah**			
14	I think we have not come very far. I think we would need to work more on it actually, from a sustainability perspective. Absolutely, to deliver more reports. Then it is so difficult also what kind, because it cannot be too much either, because this should be received, analyzed, so it takes time. How often, take, for example, food waste and because I work a lot with it. We actually had a meeting a couple of weeks ago when I talked to CHAIN and CHAIN because we said, we want it delivered a bit more often, not just once a year. In the past, we have taken it out once a year and you order it maybe six months so that we would like to follow up on food waste every quarter. So that's what we look up to. And yes, but then there's a lot of interventions. But let's say there was one more, I am going to have time to do this while we're going to do everything else. If there was someone who was just responsible for this, that person would be able to create amazing reports and deliver and work on it. And it's a little spread out too, we can say so. With the complaint section where you return your goods to fruit and vegetables. It's on someone so it's analytical here and so you have to order and then I work a little on it. I guess I'd say. We can do this much better. Yes, if we were to go with it.	S1, A1	oppertunity to progess/improve, get information/reports out, more people analyzing needed, technology is able to do a lot of things but needs to be internalized by the org as well to assure affordances	oppertunity to progress or improve, general stance
15	I think, and then here it's also about getting people to read and understand reports. People are actually pretty bad at analyzing, I think, to be honest. And working in Excel maybe or like this; I'm surprised that there are a lot of newly graduated students who hardly know how to work with Excel I know. Just like this, hey. This is kind of CRAZY. Too often when you get a report, I think if you hadn't made those reports very specific and like many times you get interesting information. But then there is the next question like this, but God how exciting. But there are often several questions raised when you get interesting information so you go deeper and plunge into it like that.	A1	Improve understanding/make use of information,	General stance
16	And then there's the problem. How much time should you spend on this? So well that's yes, but it's an interesting question. I became like I get mine, I like to have them as a file, raw file, and work myself because I usually become like, but how does it work like that? It's hard to order, for me to order a standard report, because I always want to delve deeper and click through and see. What's the reason for that? But as I said, it's... I am very interested in numbers and am analytical		Prioritize	general stance

	so in that I am special I guess you can say. It's about that it shouldn't take too much time away.			
17	**Exactly. It's a trade-off between utility and yes, the time it takes time, of course. But if you feel like that you have had the opportunity to explain the big picture a bit, we can go into a little more detail. We can look into some aspects which we have identified. Does that sound good?**			
18	Mm			
19	**Because then we have these aspects and you have already been talking about some of them. And the ones we have identified are reduction of food waste and loss, resource consumption and reduction of it, to govern suppliers and retailers, and then customer awareness, and last we have sustainability reporting. So first. I know you've talked about it, so you don't have to repeat yourself too much, but then the first question on the food waste topic is whether you measure the food waste or food loss you have?**			
20	Yes, every store gets reports every week that they get, so they frequently go through, they run their morning meetings and every week they go, and many, and I think many do, go through the waste with their staff. So every week every store and I follow up on it, and now and we will start following it up quarterly. And if it had been to just deliver a simple report, we could easily have done it every month. But there are some interventions and stuff like that for different things that don't really work but... For clearance sales of fruit and vegetables, but we absolutely follow up on it on both store level and at chain level and at ORGANIZATION level.	S1, BI1, A1	Possibility to follow up, on different levels	sustainability reporting, comparability - organization, detect - store
21	**How do you use business intelligence and analytics to reduce this food waste?**			
22	So, it sets a little eh, I mean, we work a little like this, we set a goal that we should have half of our food waste. We have such a goal and then we follow up these figures every year on concern management and see and then you can see that CHAIN is not on track, they have started to lag behind CHAIN or vice versa. Then a little fighting spirit lights up. "Wait, wait. Now we have to see here. What are we doing that they don't?" We have to like, so it's an instrument to engage people. You set a goal if you want to get there.	BI1, S1, A1	measure and follow up, able to use data as a basis, focus motivation, engagement and understanding	general stance, food wastage, comparability - organization, detect - motivation

23	Absolutely, "or why isn't anything happening here?" Then you can discover; "God, you're not working enough. You have to focus. You have to prioritize this issue because you don't seem to be able to do this properly," so that's one way. Food waste is a good example actually. When we've said we're going to kind of halve it and now 6 years have passed and every year we have like a little curve; "we're going to go from there to there" and then we measure, send out to every CHAIN and CHAIN and see how they are doing. So far, they're pretty much on the curve like that. So that's a way to follow up and see. Like this; "Have they done their homework?" If they don't, go back. Do it right, "You have to focus". Or, like applause, "God, how good you are." So I want it to be a little competition there, and between the CEOs there.	BI1, S1, A1	Possibility to follow up, prioritize, instrument to engage, monitor, discover findings related to performance	food wastage, comparability - organization
24	**Yes, and these measurements, the follow-ups, is that something you can do through these reports you mentioned before, that that's what we have as a basis for doing this?**			
25	Yes		data generated reports for monitor/follow up	
26	**Would you say that you notice the difference that it significantly improves your work to reduce food waste that you use business intelligence and analytics?**			
27	Yes, absolutely absolutely. A lot of difference. And also the stores. We get every store and see and see. So here we have a store that has a lot of food waste, "what's the reason?" Yes, but they have problems because they have gotten a competitor and they kind of have to downsize. They may have too much space, no, but.	BI1, S1, A1	find explanation, alert when something is not going accordingly to goal/plan	general data collection and integration, detect - store
28	What's the problem with this store? Then the regional manager gets to go there and talk to them, saying, "Why is it that you have so much food waste? Do you have disengaged staff?" So then you kind of have to work on it, or the store manager discovers it. So this is a prerequisite for us to actually be able to work on it. I think so, otherwise we would just grope in if we're doing a good job or not. So absolutely, really, super important. And then when we present this, we have sustainability goals that we go out with externally in our annual report. Then we have to say, "This is how it is today, we're going to get down to this." And "This is how it goes." So we go out and publish this on our websites, how it is going. You can look at our sustainability report online if you haven't done so already.	S1, S5, A1	find explanation, having data related to sustainbility a prerequisite to improve sustainability efforts, incentivizes actions being taken by seeing a store struggles through the data,	sustainability reporting, general data collection and integration, detect - store

			reporting as improve-ment tool	
29	**We've looked at that, so there you can see a lot of these metrics and so on. Yes, and with that, to end the topic of food waste, I interpret it as you find it very useful?**			
30	Yes, absolutely.	S1, A1		
31	**From your description, very useful. But then we can go into the next one which is resource consumption. And by that, we mean things like electricity and water that are consumed. Do you measure resource consumption? And how.**			
32	Not water, but electricity. Yes, and there we have a goal that we should reduce electricity use as well. And I don't know exactly, I'm not working on that area so I'm not so up to date. But I think we're less good at following up, absolutely. We don't really have anyone to deal with it, to be honest. If I had been responsible for it, I would have taken care of it because I am very much in favor of following things up, but we don't really have those resources. So it's kind of like it needs to be taken care of a little more. We have those goals and I don't even know if it says in the annual report where we end up, but I think we have it.	S2, BI1, S5, A1	Follow up (less), more people ana-lyzing needed, pri-oritizing, po-tential	resource consump-tion, detect - resource
33	**Yes, we've been able to find some information about it, but... mm.**			
34	We have a girl named NAME who works on consolidated fi-nancial statements who is responsible for sustainability, she is responsible for sustainability reporting. That's right, any-way. She works with these numbers and follows up on OR-GANIZATION level. But she has the, yes, I'm more into eco, KRAV, food waste and garbage disposal that has to do with it. But I'm not following up on these other parts.	BI1, S2		resource consump-tion, detect - resource
35	**If, with the limited knowledge you have, you were to say something, would you say that you use business intelli-gence and Analytics for this?**			
36	Yes, we do, absolutely.			
37	**But to a lesser extent than with food waste?**			

38	I think so. I don't think there's a lot of focus on that to be honest, but it also probably depends on how much you prioritize. I think it's a little more difficult, but sure yes, we kind of change fridges and freezers and put doors and stuff like that. So no, I would say: we use it, we absolutely use it.	S2, A2	Prioritize	resource consumption, general data collection and integration
39	**What do you think is the hard part, that is, with implementing it. Is it prioritization, resources, difficult to measure, or what could be the basis?**			
40	What, to reduce electricity use or what?			
41	**Yes, or precisely that the same follow-up may not really be have been done, or done, on electricity such as food waste, for example.**			
42	I don't really know much about electricity use.			
43	**No, no, I understand. Would you still say that you think it's useful to use business intelligence and analytics to reduce resource consumption?**			
44	Yes, I think so.			
45	**Yes. Then think that we can move on to the next one that deals with with suppliers and retailers, and how to influence by making demands, or encourage reporting or certifications or similar things on those you co-operate on. So, in short, what kind of supplier relationships do you have? What does it look like with you at ORGANIZATION? Very briefly.**			
46	Yes, wow, I don't know what to answer. What kind of suppliers do we have? Yes, but we buy from lots of suppliers and we set requirements for them. We put codes of conducts where they have to sign that they meet our requirements and that's everything from like: They must not have child labor, and they should work as well as sustainably and based on our requirements. There are such rules that they can sign. We will work more to demand, in the future it will be discussed that we will kind of work more with the suppliers and demand that they set climate goals and things like that. We have come out with a new tool for the suppliers that is completely new that was presented this week to me, so it is still not done really, where we will come out with a site that they can go on and get help with figure out their own climate impact and as well as simple rules. So they can work on it. So we will help the suppliers to map their sustainability efforts and their climate impact and such things. So that we try to influence our suppliers to work in a more climate friendly	BI1, S3, S1, S4	requirements, demand climate goals, monitor, helping suppliers, help/educate rather than govern/push	governing suppliers, customer awareness

	way. And that's one of the biggest things we can really do because emissions occurs in agriculture and in production and that's where we need to lower it, and then we have to work on stopping throwing away food, and then trying to guide customers to buy a more climate-friendly assortment. And it is both more nice proteins, more plant-based diets, and also more organic. We're trying to work with that. Like I said, make an impact. And that's why we're working with them to try to help them. If that was the answer to the question?			
47	**Absolutely, that it was. How do you work to follow up and then measure the requirements you place on the suppliers?**			
48	Not really mine, but there is a department that works with this. But they follow it up and there is more of, Excel-files and that kind of thing. So we can't integrate with their reports that easily. So we're not great at follow up, instead we put up demands, and we help them. And we try to do that, but you can't say that we integrate lots of numbers so we can follow up. But, there is a different department that works with those kind of stuff. We make, for example, audits, when we buy from risk countries, China, ehm, yes but these countries far away where there could be poor working conditions. Then we do a lot of tests and such. We go there, visit and such, and we have a reporting system in which we fill in; these are controlled. And then "ah, these are controlled, but they don't fulfill, they are red, they are green, they are yellow". So there are people who work with our suppliers, that they should work sustainably and mark them as red and then they recieve warnings. Like "you have to improve this, otherwise we will stop selling, or buying" but we don't stop buying immediately because we'd rather affect them and change, instead of us stopping to buy, because then they'll just go to someone else. Do you get it?	BI1, S3, A2	not integrating numbers, help/educate rather than govern/push	governing suppliers, general data collection and integration, external sources
49	**Mmm.**			
50	So that it's like... yes.			
51	**Mm. Exactly. And it has been mentioned a little, but to what extent and how do you use Business Intelligence and Analytics to do such governing of suppliers' sustainability work?**			
52	I don't think we do that very much. Certainly not in the same way as when we measure our own business as we CAN, where we have like everything in, because it is difficult to	BI1, A2	difficult to get data, so not used that much	general data collection and integration

	get their numbers as well, into ours. I don't think it's that big. No.			
53	**No, and maybe there's something that comes with this system you mentioned that's being introduced this week, that it's increasing?**			
54	We have chosen not to follow it up. We decided to that we will help them and they are able to do it. The only thing we're going to follow up on is to see how many people have been on and looked at the page and how many might have done it. But not then send their numbers so far, because then we have to have an employee who will sort of take care of the numbers - and then what are we going to do with it?	BI1, A2	not follow up, needing people to analyze, prioritize	governing suppliers, external sources
55	**So that there will be something useful about it?**			
56	Yes, because it's so easy to get numbers, but you should also be able to use it and you should be able to do something with it and there's no reason just to have one person collecting numbers if you can't do anything with it and have someone... and we have a hard time in this case, maybe we don't have any, but this is like a first step.	BI2, S3, A2	needing people to analyze	
57	**Yes. We understand. So finally, how useful would you say you find Business Intelligence and Analytics to be for monitoring vendors?**			
58	It's hard to answer because I don't work with governance, but probably it's important too. Depending on what you mean. Which, yes, but for instance we work together with BCI, which is an organization that is out doing these checks so that working conditions are okay in these risk countries. And there we are a super-serious and there is probably a lot of information in something. I don't know, I don't think we own it. We're a member of this organization, and then how they work, so it's hard to say either yes or no on that question. I think that in some areas, yes, I can't answer how much it is possible to develop and like, but there it is important to keep track of. But it is mostly a system with the green reds or yellows as well as you should be able to go in and look at it.	S3, A1	Important, use external organization, keep track	governing suppliers, external sources
59	**I see.**			
60	So that is a little difficult, your questions almost need to be addressed to so many different people in the company who work with different things			

61	**Yes, absolutely. But it helps a lot with that answer and it's going great.**			
62	Yes, that's good.			
63	**So let's move on to customer awareness.**			
64	**Pause, talk about remaining time**			
65	**How do you work to increase customer awareness regarding environmentally sustainable habits and products?**			
66	Yes, it is difficult, but we work with customer magazines and write a lot about sustainability in our customer magazines and now you can see at CHAIN who have gone out in all stores and put up signs about sustainable proteins for example or "choose this", i.e. they have gone out and put up lots of messages in the stores. And then, for example, organic sales, they are green ones, the labels that are green like that. That's pretty much what we do and can do. And then we can work more in, CHAIN works with food waste in TV advertising and pillars, and works a lot. You can go to their website and see what they are doing.	S4	A lot of focus on efforts that are not related to technology	less affordance, customer awareness
67	**Yes. Would you say that you use business intelligence and Analytics in some way to increase this customer awareness? And examples if so.**			
68	No, I can't say right away that we do, no.	A2	Not using BI for customer awareness	less affordance, customer awareness
69	**Do you get any measurements out of them in some way? as well as what to say the actions you do, the effects of them. Is that anything you are measuring?**			
70	No. It's hard.	A2	not measuring	
71	**No. Do you see an opportunity?**			
72	Besides, we can tell if organic sales increase or decrease, but you don't know if it's due to information, so it's really difficult to draw conclusions.	A2	unclear to draw conclusions that it has an effect	detect - customer

73	**So if we're going to take it there again to how useful you then think business Intelligence and Analytics can be to increase customer awareness. Then what do you say?**			
74	That is a difficult question, then. The numbers themselves do not increase the awareness of the customers, but, but we get to do campaigns and try to get the messages out. Then you get, yes, but take organic sales, for example. Organic Sweden has done a lot of campaigns and eco September and everything, and they go out big and pillars and everything, so you have to see this then after September is over: does organic sales increase after this campaign? That's a way you can check.	S4, BI1, A2	unclear motivation, follow up	detect - customer
75	**Mm. Yes. Do you have any kind of visualization of personal... so the customers themselves get to follow up on something they have bought or their habits? Do you have such a function?**			
76	We have now sold mat.se. But STORE we owned and there they could go in and see how big the climate impact their purchase had. COMPETITOR has something like that as well. And they also have an organic share and so on. We are discussing it and it is just, so there will probably be more to come, that customers will be able to go on their side to follow up on the type of share of organic, share of climate emissions, and such. So it's probably coming along, I think. And it is discussed within the whole industry now, to have a common climate database, so that we have the same numbers and work on it, so we can work on being able to find out theirs, and how much climate emissions it is if I buy this and that. So that there's probably something going on. But it'll probably take a few more years, I think.	BI4, BI1, Bi2, S3, S4	visualizing impact, common database, oppertunity to cooperate through data collection and integration	governing suppliers, comparability - shareability, external sources, dashboard, dashboard - understand
77	**Yes, it's usually so yes. Are we ready to move on to sustainability reporting?**			
78	**Pause, talk about remaining time**			
79	**Regarding sustainability reporting, i.e. the official reporting in the annual reports, but also only the reports that are produced, how would you say that you get access to the data or information needed to carry out that reporting?**			
80	How do we get access?			
81	**Mmm.**			

82	Yes, it is in this Microstrategy and gets up food waste and organic shares and so on. As for waste, we have a special reporting system there, with some special database. And electricity consumption is, I don't know. I really don't know how they get it like these... But COMPANY, who does transporting, they get to report. How many cars do they drive with? Biogas or something. So exactly, some numbers we get from microstrategy, some from other systems and so on.	S5, S2, BI1		
83	**Mm. Would, or this information that you get from business intelligence and analytics tools: is it useful for sustainability reports and all that? And in what ways would you say it is?**			
84	Yes, but it is, otherwise we can't follow it up, so it's really important. Yes.	S5, BI1, A1	follow up	detect - store
85	**Yes. Yes, but if we then look at sustainability reporting and perhaps the annual sustainability report: Would you say that it has increased the importance of sustainability information and initiatives within the organization and in what ways?**			
86	Increased weight, yes, but yes. All sustainability work has become more and more important with each passing year and that includes following it up.	S5, A1	follow up, increased importance	detect
87	**Interview will be interrupted and resumed a few hours later**			
88	**Then we can bring it up in the sustainability report again. But you already answered it a little, but regarding how you get access to your data and the information needed to carry out sustainability reporting. Was there anything you wanted to add?**			
89	No, but we do it in different ways, some are from microstrategy. Some are other systems, so I answered that, right? So it's a little different yes.	BI1		
90	**But then we were probably done with it.**			
91	Sometimes we work with excel sheets, like that.			
92	**And then if that information comes from business intelligence and analytics, is it useful for the sustainability reports that you need to create?**			

93	That's the kind of thing we'll put out later. That, now it takes more and more and more. That all companies have sustainability efforts and goals and formulate and follow up and are transparent with their goals and their figures. They demand more and more, our investors demand that we report a lot of figures.	S5, A1	data is needed to follow up goals,able to use data as a basis, focus, motivation, engagement and understanding	general stance, sustainability reporting
94	**That's right, because we know that there are many external requirements. They want you to show numbers and things like that due to that reason. But if you look at it internally, do you experience that sustainability reporting of various kinds increases the importance of information within the company and also how initiatives are conducted in the organization, i.e. that you have the opportunity to get this information?**			
95	No, but it's like everything. Yes, it is very important, whether a training athlete and never measures how high jumps are or how fast you run. How much fun is it then to exercise and get a better result? It's like everything else. We have to look at it. We have to see what we are and where we want to and then set goals and then analyze what the way there is. But it's super important in every way. Everything from analyzing which stores are doing well and what they are doing. What is it that they sell that makes them have such high eco-shares compared to others? No, but now we have brought in this organic-cream; It's in plastic cans, but it sells worse than... yes Arla's organic in Tetra while our Tetra may sell better. Now I just take as an example, so maybe we should switch to a Tetra because they opt out of it. It's really important to look at all that stuff then and what goods you should remove because otherwise they just stand in the shelf and maybe create waste and so on. No, but I mean. It's really important. It's like 10 out of 10.	BI1, A1	measurement/monitoring, follow up, find explanations	General stance, food wastage, comparability - organization, detect - store
96	**And just that technology becomes a big part to help to be able to do that work then as well.**			
97	Yes, but it must not be too difficult to produce it and here we can do a lot. Here we can grow. I think the majority are. No, but there is a lot of potential here I think in companies. To sort of structure everything in a good way and see what, what is needed and how should it be developed in what form and how should it be distributed in different ways and who wants it accordingly. It is a huge job, a future to do in companies as big as us, maybe small ones too. But that I don't know. A lot of people say, "Yes, but I was such a bad math. I hate math at school" and so you think that math is the same as analytical ability and maybe it is. I don't know, but	A1	possibility to progress/improve, analyze more, structure, go deeper	General stance

	sometimes I think... No, but people should learn more about this. And use it more than we do, like. There is a lot and... Yes and I mean not only standard, but that you can go, deeper and analyze even more.			
98	**If you think about these particular requirements and the desire to produce more sustainability reports and annual reports and so on, do you think it has increased the possibility and clarity regarding what responsibility who has for what initiatives and for what areas within the company?**			
99	Actually a little bit, I think so. When you start demanding numbers, not only set goals but also demand to follow up on them. Yes, but then who's going to follow them up? And so that yes, there will be even more targeted then. There is a risk otherwise that you set up goals and then no one really copes with them and then you push it in front of you and you have not really talked about who should be responsible. And if you put someone who should follow it up, I almost think that you might go through it a little more to clarify who is responsible for things. So yes absolutely. Good question.	BI1, S5	follow up, data is needed,responsibility,	sustainability reporting
100	**Yes and then, we can take that holistic approach again then, about how useful you think business Intelligence and Analytics are then for your sustainability reporting?**			
101	Business intelligence sounds like... it has been around for many years. Okay, but if you kind of put it in relation to analyzing to get the right numbers and analyze it on your company's business. If, that's what we're talking about, which I guess we do. That is extremely important. Yes, absolutely, it's not possible. You have to, and I think that both we and many, many companies can get much, much better at it.	A1	able to use data as a basis, oppertunity to progress and improve	General stance
102	**Yes, good. Then it was probably that aspect also debunked so just as a conclusion, if there is something you feel is something we have not asked about or specifically addressed, or that you have not got to mention either - then is there something you want to add about how you use Business Intelligence and Analytics to increase sustainability?**			
103	No, yes, yes. If you say so, it's like an organizational topic, too. We are an incredibly large company indeed. There are a lot of employees and different companies and departments and so on. So it takes an organization as well, so that who works with this and who does what then and who follows up; so it really requires thinking, who will do what and why just that, everything you asked about. No, but that's actually	A1	organizing, having clear focus and agenda, organizational topic	general stance

	some interesting thoughts. I think you're on an interesting track, actually.			
104	**Yes, but that was pretty much the last part and now only as a reciprocating reflection. If you would like to revisit the question that we asked at the beginning about what role do you think technology and these then BI and analytics tools will be able to contribute to your current work and what improvements you can make in your sustainability work?**			
105	No, but that's what I said. So I think we use it a lot. It's not possible, so we're definitely using a lot today, but we can definitely do it much, much better. And go further, but we have numbers today. It's more about the numbers there are, it's more about kind of organizing it, what are we going to measure and how and who and who's going to get to take part of it and what are we going to do with it? Because it's for everyone. Many people need different numbers, the one who sits with purchases, as inventory manager and makes purchases. They need to have numbers in their own way then and everyone needs to. There are slightly different numbers in different companies that people need and then you kind of have to find that form and it can't not be too much and because we get little and it should be easy to get. And how much should you do yourself in Excel sheets and how much should you just follow reports and what should they look like? I think so, the sellers who decide the assortment at CHAIN and CHAIN. They kind of get ready-made reports every month that are designed so they get it in such ways every month. And what exactly that is? I don't really know, since our analysis department sends those out. But as I said there is certainly evolving and wanting to kind of go, deeper and so on. I don't know if you have the answer to that question.	BI1, BI2, A1	possibility to progress/improve, organizational topic, potential	General stance, strategy
106	**It absolutely was.**			

Appendix C: Transcription of Interview with INF2

Row	Text	Element	Iteration 1	Iteration 2
1	**Great, then we take the first question which is that we want to hear a little more about what you do at your company.**			
2	I've been at ORGANIZATION for just over a year and a half and work at DEPARTMENT as a data analyst. And since last summer, you could say, I've been working with CR so corporate responsibility, which is an area that is quite simply responsible for our sustainability efforts, but I don't have any special education to be working with sustainability really, but I come from a technical background. But, they were screaming for resources and then I was the one who got to jump in and work with them. So that's my role and I work mainly in Tableau, which is our visualization tool. But also building like, yes, the underlying tables that we use now, and we have our analysis and reporting.	BI4		dashboard
3	**Yes, so if we then speak of it broadly before we go into the details specifically: In what way do you think technology, and more specifically BI and Analytics, have contributed to improvements in your sustainability work?**			
4	I'd say it was a big, sort of game changer for us when we could visualize the data so that people understood what kind of volumes it's about. You can put it in relation to things and kind of make it visible, I work with food waste, but to make food waste visible in absolute numbers and tons and it was an eye-opener for many. So that it's made a huge difference, I'd say.	BI4, S1, A1	visualizing makes sustainability info more understandable	dashboard
5	**Is it both external and internal then or is it mostly internal?**			
6	It's both. We have to report our food waste in our quarterly reports. Now, ORGANIZATION is no longer a listed company, but before that we had to simply communicate it to the market and then we communicate what percentage of our sales are wasted.	S5		
7	**If you think about the improvements in practice? Do you have any examples of these improvements that you have been able to make with using BI&A in your sustainability work?**			

8	Yes, there are lots, so the first one that we track food waste in all our stores. ORGANIZATION which I work at, can't affect the stores very much, but we have to help them in their work and then we have a role at ORGANIZATION called sustainability coach and they are out in the stores and simply show them these reports. And then, for example, "your store performs much worse in this product category compared to the rest of the reference stores. What are the causes of that? Maybe you should change the strategy concerning your work with waste, or your work over all." So that's kind of a concrete thing. Also, we can see that we have a problem with our supply to... yes but, fruit and vegetables, and how can we improve that? In that case, banana controllers were hired who kind of go through bananas because we found that there were a lot in that area that was wasted. So there are many such concrete examples of how it has helped us, but above all that it has made things visible in a different way. Before, waste was, you didn't know how much you wasted basically. There was kind of no structure around it.	BI1, S5, S1, A1	making comparisons, communicate information better, discover important information, structure	food wastage, sustainability reporting, comparability - organization, comparability - shareability, detect - store
9	**I see. Yes, great. And over all, what are your thoughts on your status with using business intelligence and analytics? Or perhaps technology, in general, for these sustainability initiatives at the company?**			
10	So, really, we haven't come that far. When I came in last year, that's really when we started speeding up this work. There was a lot of demand, but we didn't have a report package as needed and that we could sort of, send out to the store, so, well it is... Yes, but we've been working on it for a little over six months, or we've reported our numbers longer like that, but now we have reports in place. So, our challenge at the moment is to get the stores to use these and spread them internally I would say.	S5	lot of demand, resource spent, challenge	progress, general stance
11	**Great, then we'll go into the specific areas if you feel like we are done with the big picture, which is Data warehousing, predictive analytics and corporate performance management. It is the larger grouping so that the first aspect itself is data collection and integration. So, you can tell us a little about how you use data warehousing in your processes for sustainability work?**			
12	Yes, data warehousing is kind of just what we store the data really, so it's kind of like a must to have it in place for us to be able to use the data in a structured and good way to... It's difficult to say how I use it for it [sustainability]? It just has to be there, but we are just in the process of migrating all our data to Google Cloud. So, it's a huge job and after that there will probably be quite a lot of processes changing related to how we work with data today, it is very spread out on several different data warehouses within ORGANIZATION but... Was there an answer to your question, was there anything else besides data warehousing?	BI1, A1	enables use of data in structured and good way, key element	
13	**Well, Data warehousing is central to being able to work with data from different sources and such, so how do you**			

	collect data for your data warehouses? If it's something you do as you need it or if you rather collect all the data that you possibly can access?			
14	I'd say we kind of have input from all of our source systems really. Then there are different layers in data warehouses, so we just raise it to the consumption layer, as it is called, that we actually use and do analysis on. But we have, above all, it's [food] waste data and then it's sales data which you can put in relation to something, and it's pretty much like that. It's always there and it is something we have to have, and then we also buy data linked to sustainability. There is a company called Rise that has a database on different food products, what carbon dioxide emissions they have, so we map our products and then we buy that data that way.	BI1, A1	being able to integrate data from internal and external sources to get more sustainability information about products	external sources
15	**Yes, would you say you have a large central storage or that you have a large central storage that is then broken down into smaller data marts for specific functions or what does the infrastructure itself look like?**			
16	Yes, now I can only speak for what I do. It varies, but I myself get to create data marts if I need it as well and put together my own tables and views with the variables that I need to make a report. So it's not something that's provided by our IT department or anything, it's something that we analysts get to create according to the business needs.	BI2		strategy
17	**How many would you say, on average, data sources might need to be required to deliver a sustainability function?**			
18	It will be completely reliant on what you want. Really difficult question, it depends, I would say but really, sustainability functions, I can only talk about food waste that I work with mainly then. And then it doesn't have to be so complex, actually, because it's mainly all of our items and how much of each product we've wasted and broken down to store level really, is and then we also have all... We have waste at our warehouse, we have waste in our transportation. There are kind of several different parts of it and it comes from... the transport waste coming from one system and then we all store waste come from one system and stuff like that, so yes, but we have 3, 4 different insourcing to our data warehouse to be able to do, specifically, the waste reporting.	BI1, S1, A1	able to do waste reporting by integrating data	
19	**And then we have also seen that an advantage of data warehouse is that you should be able to store historical data without overwriting or losing information. And then we would have liked to hear a little bit about how you use it, and if you get the use of it, when you are going to produce reports and such?**			
20	So, I've kind of never been to a company that doesn't have data warehouse, so I don't know what the alternative is. But it's such a big organization, you have to have structure on your data. There's no option really. We have several 100's of people working on it, so that's it.	BI1, A1	structured data	

21	**Is there anything in particular related to sustainability functions where this particular historical data is highly necessary to be able to have access to?**			
22	Yes, it depends, as I said, on what the area of use is, but I think that, it's always good to put things in relation to each other. At COMPANY, there are huge numbers and it is difficult to absorb a figure. But then it's good to put it in relation to, aa but always like this "last year we were on this, how big is the change and improvement?" or that you put relation to other stores. In any case, I feel that I percieve information easier then, and it feels like a lot of people agree with it, so it's probably such a thing, than such a clear KPI, but more like this how to put the data in relation to other things that you can relate to it.	S1, BI1, A1	Historical data enables seeing trends in the long run, see specific seasons in relation to food wastage	food wastage, collected historical data
23	**I see. So just as a conclusion, in what ways and how much would you say that data warehousing is contributing to your work on sustainability progress?**			
24	No, but super important to have good data at the right time and the quality of it. Otherwise, you also don't get trust in the data within the business, if you don't know that it's accurate so that it's really important.	A1	get right data in right time, data quality, trust in data, accurate data	decsion making
25	**Yes, then we have the next section that revolves a little more what approach you have to a data warehouse, which are that you can have a data-driven or analysis-driven approach, where the data-driven focuses the more on gathering all available data in a central place and then creating data marts with specific functions based on that, while you have an analysis approach which is a bit the opposite, that you start from needs and then collect data for the specific need into a data mart that is then integrated into a larger warehouse. Based on the two descriptions, which approach would you say mimics Ica's best?**			
26	Do I understand correctly if it was the case that the analysis approach was that you kind of get to create something that there is nothing ready for really?			
27	**Precicely, as you get to retrieve data from data sources based on needs instead of accumulating as much as possible so that everything is available, and that the need for a function comes later on.**			
28	I'd say that's how we work, specifically in sustainability as well. I guess it's this area that has kind of gotten the most recent analytics resources. They want to look at our area in store and sales for example so it looks different. There's kind of a more elaborate way and there's more people looking at that data, so there's data marts in a different way. But that's what is very much that you get, yes, but we get a need and then you have to go down kind of in the data warehouse and look for what you need and then build it yourself.	BI2		strategy

29	**Is it usually you need to bring in new information, then get new sources?**			
30	No.	BI2		
31	**It's still to be found there then once the need arises?**			
32	Yes, like this. Food waste does, then there will be new needs ahead and that may not be linked to it, if you want to check how much plastic there is in our packaging. So, then maybe we don't have it today but then maybe they also look over; How do we get it and is that data something we can get. But I'm just kind of checking food waste right now, so then we have all the data we need.	BI2, A1	have the needed data, some data is not available	
33	**How do you see this strategy that you have as contributing to the work you have in with sustainability? We've gone into that, but is there anything you'd like to add?**			
34	yes no, I don't think I have anything.		unsure of affordance	
35	**Well then we can move on to the next point which is about predictive analytics. So more or less, if you use Analytics to make predictions?**			
36	Yes yes, we do. It's not me doing them then, but it's more like they having to do it in their forecasting work as well. These sustainability coaches. And then you look at yes... but historical data to try to see some trend ahead that it will kind of hold up and if you see changes. So that yes, the short answer is that, yes, we're trying to projectize in the future, what we think food waste will look like in 2 and 3 and 5 years and so.	BI3, S1	enable seeing future trends for food wastage	predictive - comparability, predictive - demand
37	**Is it something more specific than just food waste? Just what you mentioned that, any other example of area?**			
38	I've also looked at carbon emissions linked to our sales. Then we kind of have sales forecasts and stuff like that, which are AI models. But if we talk about sustainability, it's really those pieces that we've looked at, just food waste and CO2 emissions.	BI3, S1		
39	**Is it about adapting purchases to needs when you talk about food waste or in what way does food waste relate to predictions like that?**			
40	Yes, but it's kind of like we have goals to reduce food waste by a certain percentage and then this is how we will find out if we'll reach it if we continue at this pace. I guess that's what you want to see. And otherwise, what adjustments are needed to reach the goal.	BI3, S1, A1	enables follow up on reaching a goal, identify whether changes are needed to reach goal	food wastage, detect, predictive - comparability
41	**Yes and then as a whole, how do you think how does the use of this contribute to your work and the ability to deliver sustainability-related functions?**			

42	Yes, but again, it kind of becomes visible in a different way than if you don't kind of visualize the data through dashboards and stuff like that, so then it becomes difficult for the business to act on the data if you don't show them clearly that "now the trend looks like this and we're going to continue like this unless we do something drastic." What specific efforts do we make to sort of remedy these problems that exist. So that again that yes, but lift up and show the data to the people, so they understand.	BI4, BI3, A1	becomes visible, combining predictive analytics and presenting it with dashboards, alerts if changes are needed, gain understanding through data	general stance, predictive - demand
43	**Great, then we'll continue with the last point, and it's about dashboards. So, you've been speaking about that already, but adding onto that, what do you have to say about how you use dashboards, or visualizations in general, just for sustainability?**			
44	Mm. But as I said, we use Tableau a lot and we have reports, so for everything, I was about to say, that is related to especially food waste, because that's how far we've gotten currently. Then we kind of continue to build on this, but then we have store-level and profile-level, ie if you look at PROFILES as they are called. There you can compare stores with each other. Which ones are performing well, which are performing less well, and so you can kind of actively contact these stores to see if they have special problems, do you get help with anything from the central side? And then that the work process looks like I'm building the report together with a few clients, and then their job is to kind of market and demo this for anyone who might be interested. Oh, and it has been greatful, as I said, it becomes more interesting and graspable when you can see the numbers for your individual store and stuff like that, and compare with others in terms of how you perform.	BI4, BI1, A1	comparable, gain understanding through data	comparability - organization, dashboard, dashboard - understand, dashboard - comparability
45	**Do you notice any kind of clear, or measurable, differences in once you've used visualizations versus some more non-visual way of presentation if you understand what I mean?**			
46	Yes no so I unfortunately can't answer because it was like before my... I've only seen that particular visualization part.			
47	**That's right, yes.**			
48	Yes, but at least I feel that there has been much greater commitment. You get like, people ping you in different places at COMPANY and just "But now I see this thing, it looks weird in this report" and then you realize that there are quite a few who still check these numbers all over Sweden as well. And it's super fun. So that I only notice a difference in the USE of the reports, the fact that it has increased very much.	BI4, S5, A1	greater commitment through better and more understandable reporting,	dashboard - motivation

			increase use of reports	
49	**Yes, fun! Now you've mentioned the internal parts if I've understood it, that it's at different levels of the company. Do you also do the visualization to the customer or consumer and how if so?**			
50	No, or no... Not visualizations as such, but we have other... We try to engage our customers in that they should think more sustainably when they shop and stuff, but it's kind of driven by the market in a different way as well. So that I don't really know. But there is a lot of initiative about eating 500 grams of fruit and vegetables and yes, COMPANIES work a lot with such parts, too.	S4, BI4	Engage customers, initatives	customer awareness, dashboard - understand
51	**But it's kind of not related to Business Intelligence and Analytics, right, how do you see it?**			
52	So what you can say was that we saw that it... if people didn't eat enough fruit and vegetables to... we would not reach our CO2 targets as well. If you then have to place that on the customers. So that's the kind of thing that you still, you saw that you're not tackling that goal. Yes, but then you have to make changes. So that, yes, everything is connected in a way.	S4, A1	Discover what is needed in terms of customer awareness	detect - customer, external sources
53	**Yes, exactly, mm. What information do you think of as most important to include in a dashboard or visualization related to sustainability? Do you have anything to add about that? Any measuring point?**			
54	Yes, it depends, as I said, on what the area of use is, but I think that, it's always good to put things in relation to each other. At COMPANY, there are huge numbers and it is difficult to absorb a figure. But then it's good to put it in relation to, aa but always like this "last year we were on this, how big is the change and improvement?" or that you put relation to other stores. In any case, I feel that I percieve information easier then, and it feels like a lot of people agree with it, so it's probably such a thing, than such a clear KPI, but more like this how to put the data in relation to other things that you can relate to it.	BI1, A1	comparable, more understanding by putting data in relation to eachother, follow up	comparability - organization
55	**Yes, mm. And then: in what way do you see that dashboards and visualizations are useful to the organization for the sustainability work?**			
56	Yes, but again to make the work visible. So it motivates people too, to see improvements or if you have made some kind of targeted effort. It's hard if you don't kind of get it that way on print or what to say. So that, yes but it's really important to engage people in this issue I would say. Really.	BI4, A1	Visibility lead to motivation, see improvements, more engagement	general stance, dashboard - motivation

57	**Mmm, perfect. We have some sustainability points as well, which are specifically: reduction of food waste, reduction of resource consumption and it can be more about electricity and water and such, and then we have to monitor or at least make demands and so on suppliers, and then there is also customer awareness and the last one is sustainability reporting. Is it in any of these areas that you see Business Intelligence and Analytics being particularly useful? Or, on the contrary, may not be so useful?**			
58	Yes, but we've been into the food waste topic a lot and it's... Yes, but we use a lot of Analytics for that. And then when I get to suppliers, I was unsure about that, so I sent a question to my colleague. And apparently COMPANY have a lot of demands on their suppliers, the short answer as well. But I can't really go into them, but it...	S3	Unsure, demands a lot	Governing suppliers
59	**yes, just fine.**			
60	So I don't know what the follow-up looks like, but you work very closely when we look at, for example, food waste and then for example if we have wasted a ton of sugar this month because, on that, registered on broken packaging, for example. Then maybe you should review the packaging sugar and contact the supplier then and just: "We have a lot of waste on this product because, the packaging can not handle our transports, for example". So that and it has a lot connected to our range and purchasing organization and it is those who have contact with the suppliers. So that it's the kind of findings that you can see and look at in our reports that we've produced, the sustainability organization then. So in that way, you want them to kind of work together with assortment and purchasing then, to find cases like this where you can make improvements.	S3, S1, A1	reports display findings that can improve supplier - food wastage reduction, gathered from analytics	food wastage, governing suppliers, detect - store
61	**Exciting because it links food waste with supplier-relationship impact.**			
62	Exactly			
63	**Great. Then we connect back a little bit again if you say so, to the grander thing. So is there anything you'd like to add in general about these particular topics we've been talking about? Ehm, or do you feel like we've been captured some sort of overall picture of it?**			
64	yes but I feel like I'm just repeating myself kind of *laughs*.			
65	**Then you don't really need to continue, it's only if there's something you feel we should have pinpointed as well.**			
66	Hmm. No, I can only say, like, a so-called here, it's not really connected to this, but a success factor when it comes to analysis and things like that in these matters is that it comes from management. Because it wouldn't matter how much reports we sit and make in our chamber, if there's not a demand in the business, and that preferably then from like the management simply, that this is something we have to improve and it kind of has to be put resources into it, because otherwise our		analysis needs management support and goals to adhere to	general stance

	sustainability station wouldn't have gotten like a full-time analysis resource if it wasn't for what they saw. that there was a need for it. So that it's just a co-sent, ehm, ja, analysis itself not only creates value, but there has to be like a... Yes but a goal of it.			
67	**Mm, yes. Do you think, like, it's evident that more resources can always help, but thought there's a LOT more to get out of it by putting EVEN more resources into it? Or do you have some kind of saturation of the use related to sustainability?**			
68	No, so I think there's a lot to do. Just in food waste, it feels like, like, now we don't really need more reports, but we just have to spread this and get the stores first, because they are the ones who account for the largest share of the food waste, to understand that this, ehm, yes, but partly it will be a very big cost for them to waste as much food as you do... Ehm, so our sustainability coaches have a big job of kind of communicating to the store what it looks like for yes, the different areas and stuff like that. So that... Yes, I think that, so saturation is well... no, there's a lot to do, which I talked about in packaging and stuff like that, it's really interesting. And how to look at the CO2 data, how to get customers to shop in a different way and so on, so that there's a lot to do, but you also has to let the business catch up a little bit. You can't push too much initiative at the same time either. So that now the focus for yes, but almost a year, has been food waste just and kind of really get to the finish line with it.	S1, S4. A1, A3	organizational move as well to get affordances? See potential of using more data for sustainability, maturity of organization	General stance, food wastage
69	**Do you see any clear sign of what the next focus could be? Or someone like this, what you're going to be working on in the near future of it?**			
70	Yes or what we have looked at, which I was a bit into, we looked at CO2 data linked to sales, but nu we have also checked on CO2 data linked to our food waste. It's not something that we've looked at before, but now you want to see what our waste actually is, like, if you translate it into CO2 emissions, what is it? Who are they? And how can you, well, put it in relation to our competitors and stuff like that? So I guess that's the kind of stuff that we're going to start looking at now.	BI1, S1, A1	integrate more data for new ways to work with sustainability, slow shift from only economic to a sustainable focus in the organization	comparability - data, external source
71	**Yes, exciting. Well, then, it feels like we've in many ways answered this one already, the last question really that is just: In what way do you think technology, and more specifically Business Intelligence and Analytics, has contributed to improvements in your sustainability efforts?**			
72	Yes, no but I believe that it has created a greater engagement, creating reports that are very easy for users to understand and to relate to, has created a yes, a greater interest in this issue.	BI4, A1	understanding, interest,	

	It's easy to do your own analysis in Tableau as a user, so that everyone can adapt these reports to their own specific needs. So that, it's become like, the analysis around sustainability has become very scalable and I think that's really been a success factor.		adapt information to needs, scalable	
73	**Mm, great! Yes, very exciting to hear. It was probably all questions anyway. Yes, so is there anything you'd like to add?**			
74	No, but I don't think so. If it's something else, you'll have to come back, if there's anything didn't talk about.			

Appendix D: Transcription of Interview with INF3a and INF3b

Row	Text	Element	Iteration 1	Iteration 2
1	**Yes, so. Now we want to start by hearing more about what you do at your companies and who you are.**			
2	I can start maybe then. So I'm responsible for AI and business intelligence at ORGANIZATION. What does that mean? No, but that means, partly about creating the conditions for the entire ORGANIZATION to become more data-driven and be able to get the information they need to make more data-driven decisions. Do more of better analytics, so build data platform and things like that. Then also have a team with, data scientists, engineers and analysts. Was maybe a little brief start.			
3	*INF3b is me then, I am a sustainability analyst at ORGANIZATION, on sustainable development then. I work a lot with analysis, linked to sustainability and maybe especially right now when extra much with the sustainability declaration and we have received quite a lot of data from there. And how are we going to kind of work with that data going forward to steer our assortment and sales in a more sustainable direction. So I work a lot with that and then, as well, we have set science based targets, on climate goals and we will start to meet them now, so we will also work a lot on that in the future.*			
4	**An overview then, if we start on the broad before we go into specific aspects, in what ways do you think technology, and more specifically BI and Analytics, has contributed to improvements in your sustainability work?**			
5	So, basically, it's about being able to, 1, clearly measure how good or bad we are [laughter]. How good we are and also be able when we take action to be able to measure that action, what effect it has. We should say that, where you have an internal variant so have it as well as towards the customer now have well internal so as INF3b says so we can, we can get confirmation of how we perform and how we change and that we move towards a certain direction, we can get good steering instruments. Then, we also want to influence the customer and help the customer make better choices as well, so those are	S4, A1	measure, take action, see effects/results, confirmation on performance, steering instrument, influence customers	customer awareness

	probably the 2 aspects I would say. INF3b is welcome to add on.			
6	*But I certainly agree with that. That's it and then it is also, if you think about sustainability reporting and so it really is, if you compare with financial reporting, financial reporting is standardized and everyone does, it's like obvious. But sustainability reporting, it's kind of still, you're kind of at the beginning of it. It's a bit immature and nobody really knows; "why are we doing this? What are the benefits?" It's a little... There is one who was a sustainability manager at ORGANIZATION before called NAME. They have started that company, called Sustainlab, which works with sustainability reporting. And they always say like sustainability reporting is where financial reporting was in like this sixteenth century [laughter] but the thing about doing it, I somehow highlight, is that you see what the problems are. I think it's pretty important there, to be able to develop; "but what is it that we actually need to know? How are we going to standardize it? ", and so on.*		Sustainability reporting needs to be further developed and standardized	General stance
7	**Interesting. What do you think is your status today when it comes to using business intelligence and analytics for the entirity of your sustainability initiatives?**			
8	Yes, but it's kind of in it's infancy. Now I can reply and you INF3b can agree or disagree with how you perceive it. And maybe that's because we... Partly as... So we have made a huge investment in the sustainability declaration as well as the science targets. I guess that's what has to go out as well and then so that we start acting on it. Then it's about like, yes, but how many, much analysis resources have we spent on the sustainability issue. On the other hand, you could say that we've come a hell of a long way considering we have this sustainability declaration launched, which is kind of pretty revolutionary. Having follow-up and big parts of ORGANIZATION follows it up as well. Getting there we is very much in it's infancy, perhaps?	A1	investment made, good progress, following up, infancy	General stance
9	*Yes, it really is. I certainly agree and for this we should have been doing a lot with the processes. Like, "How are we going to work on this?" Because one thing is kind of presenting the data; "this is how we are now with the water use within dairy" for example, and we have a lot of data there. But the question is sort of; "how do you, like, transfer it? And what should those processes look like? Who should be responsible for collecting information about a particular supplier's water program?" to see that*	S2, S3, A1	BI cause improvement, get organization involved, importance of having data	General stance, decision making

	here is actually now an improvement and a substantial shift in our assortment as well. And then we will also then, especially with the climate work. It's a bit challenging, because there we have to reduce our climate footprint by 25% per kilo of product, which means that we probably have to move away from meat a bit. It's a challenge, it's just like, how, we have to get the whole organization involved. "How are we going to do this?" And then it's super important to have this information, that it's right, that it exists, and that you get it when you need it as well. So this is super important with these business intelligence tools.			
10	**Interesting! Perfect, yes, if you feel done with the overview. Yes, we can go into these aspects. So the first one that is under the data warehousing category, one might say. It's data collection and integration. So do you want to tell us something about how you use collection and integration of data in your sustainability processes?**			
11	Yes... We have, like many others, not just one single system. But that's where we're aiming so our strategy is kind of sourcing all the data into a data lake and building up a data lakehouse. You write a little bit about warehouses and marts and stuff like that. If one's going to answer that question, I think we're maybe a mix between a data lake and a data warehouse, which is a lakehouse. And maybe that's more on the part of gather all the data in one place. The purpose of this is to be able to ask more questions later if you have all the data gathered. So maybe you want to say this, yes, but "how does category Blah blah perform? How do we do that on sustainability?" But then maybe want to ask another question that's like this "okay, but how do customers choose that? ". So you have another question and then it is important that all the data is gathered in one place, at least that you do not have to stretch too far to be able to get answers to these follow-up questions that such an analysis is leading to. But, but that's kind of the vision; collect everything in one place. Then we are not really there, but we have data in some different places. Then just specifically around, you [INF3b] might be able to talk about how we succeed in this work, to actually collect data from all the suppliers. That's a lot, that's probably the biggest challenge.	BI1, BI2, A1	Able to get more information straight away by having it in one place, easy accessed answers to follow up questions	General stance, strategy
12	**Yes, is it a certain type of data that ends up in other systems that it is more difficult to integrate in any way?**			

13	Basically looks like this; in order for us to know how sustainable products are, we need to know exactly what they contain, where they are produced, how they are produced, all the ingredients... yeah, what country they come from. Yes, and to just get that data on a hundred thousand products is a bit of a challenging thing then, but [laughter].	BI1, S3, A2		Governing suppliers, external sources
14	*Really and especially when it's like that... Sometimes we also end up in some kind of competitive situation, and suppliers, and you have your purchasing countries. You want to get this information and so, it's been a pretty big challenge actually to get the suppliers to share the information, but it's still been possible because, now we at ORGANIZATION have said "We're going to do this. All suppliers must submit it because it is a quality-factor for being able to be at ORGANIZATION" and at the same time work in the industry as a whole. And working with others who are also taking the leap on this, COMPETITOR can be on it, that COMPETITOR can be on it, that everyone can use the sustainability declaration, that is why we have done it openly as well, just because it should be an increased acceptance to do this in the industry because all the suppliers have not committed to it yet, most of them have, but not all of them. So more actors need to go into this as well.*	S3, A1, A2	everyone can use and access information, increase acceptance by having access	Governing suppliers, external sources
15	**Now that you say that you are happy to share it with competitors as well, if I understood it correctly, is there is any... Or is it so open for you to share, or how do you look at the competition? With the efforts you do?**			
16	*Yes but the sustainability declaration it is... It is left completely open. It's open source, completely. So it is on the website that you can download, it is described exactly how we have calculated everything. And then you can also as a COMPETITOR connect these suppliers that we have as well as for the supplier portal and as well as parts of the sustainability declaration. You can also do that and get the same type of access. In fact, it's a completely open strategy there on the part of ORGANIZATION.*	BI1, A1	Connect more actors, through integration more sustainability information is shared	governing suppliers, external sources
17	**Nice, really nice.**			
18	Yes, but then, and I guess the point is that it should become a standard. So here, if it becomes a standard that customers demand, it is better if it becomes standard for the whole of Sweden than just for ORGANIZATION.	A1	Standardizing the industry when working	governing suppliers, external sources

			with sustainability	
19	*Exactly.*			
20	**Precisely.**			
21	*We are still kind of at the forefront there as we have now finished this purely internally. "How are we going to deal with this with the data? How are we going to sort of move our range with the help of it?" There's quite a lot of time spent on getting that, and maybe that's something, we're keeping as internal then, of course. We are doing this movement then.*			
22	**Right. One advantage we have been able to identify with data warehouses is that you should be able to store historical data in a good way without it being overwritten or losing information. And then we wonder how you use it at ORGANIZATION and if it's something you get the use out of, having the data in a historical perspective for sustainability initiatives?**			
23	Yes, but the history is good to be able to see, if we start there, why it is interesting with history? It is to be able to see movements, i.e. so that we actually make a difference in the efforts we make. If you just look at following up. Then if we're talking then predictive analytics, it is good with a lot of data to be able to train a predictive model. There is a very big advantage to have a lot of historical data.	BI3, BI1, A1	Historical data beneficial to see difference in efforts, following up enhanced, predictive analytics important to have historical data	collected historical data
24	**Nothing to add to the sustainability side?**			
25	*No.*			
26	**No, great. By large, how do you see data warehousing, and integrating and collecting data, how and in what ways does it contribute to your work on sustainability? Anything you want to end with there?**			

27	Yes, but increased transparency, I guess that's the key as well, it becomes clear to us and all the important parts of ORGANIZATION as well. How we perform and what we need to change in order to perform better. So transparency is kind of the whole key, and then we have to bring that transparency to the customer as well. So that the customer can make active decisions. Because I mean, I don't think we can do everything. We can do a certain part, but in the end it is the customers who decides what they buy. And we can help them, but they decide. So that, I guess that's what I'm thinking is the big thing. It becomes very transparent and we can highlight clearly how we perform and how we want to perform and how initiatives affect that path.	S4, A1	Transparency, see/measure performance, effects	customer awareness, general data collection and integration, detect - customer
28	*Yes, indeed. I think about the shareability within the organization and be able to, kind of, say work on the same data, much like we do with financial data. You have all the different business units there. They're sitting with financial data, they kind of speak the same language. With sustainability, we're not quite there yet and if we can get there and have this common platform where we kind of speak the same language and we can kind of make moves on the same line, both yes, on online and digital. They can make moves with the help of analyses in their own place and so can the business areas purchasing and assortment, they can buy the right products and set an assortment, campaign, those who campaign for products. You can, on the line that there is financial data, you can then kind of do the same with sustainability data, it is an opportunity now then, with this common platform.*	BI1, A1	Shareability, work on the same data, having common language, work with data in a more standardized way	general data collection and integration, comparability - shareability
29	**Yes, exciting. Great, then we can move on a little bit to this data driven or analytics driven part. So there are 2 approaches to this and then you can either focus on gathering all the data that is available, generally, into one place or by creating smaller data warehouses, data marts, based on needs that are integrated into a data warehouse. So can you somehow see which of them most reminds of your approach?**			
30	Yes, but I would say like this gathering everything in one place is the most similar to our approach.	BI2		
31	**And if the sustainability department comes to you and wants a new function or something for a report. How do you go about producing the information needed to do this?**			

32	Well, yes, we can say we're there now [laughter]. No, but somewhere there is here that shows data analysis, there is, we strive for democratization of data. That being said, I don't want there to be a small unit that can do everything that people go to and ask for things, but we should create the conditions so that the sustainability department can do sustainability analysis. But then of course there is, you don't democratize everything. Bring in new data sources, structure data, there are certain parts that we manage centrally and then it's pretty much exactly as you describe. You come up with a wish, a story about why you want to do something and then it is prioritized against other initiatives.	BI2, A1	data to be shared to more people	comparability - shareability, strategy
33	*I thought about this for us [Sustainability department]. We are a support function to the rest of ORGANIZATION, so we need to kind of go out and so to speak to assortment and purchasing. "Yes, but this is how you could use the data, this is how you could do analysis" and that we need to do together then with AI and INF3a's group who have the knowledge of how to retrieve data in the best way, how to analyze it. It's really important sounding board for us there. So it's really such an incredibly cross-functional work with sustainability and analysis here that I think may not be very common otherwise, not that I've seen anyway, but that is very fun.*	BI2, A1	Collaborate cross-functionally, discuss new options of using data and analysis	comparability - shareability, strategy
34	**Mmm. Then we get into a little bit of the next track, which is predictive analytics then. And then we would like to hear more about how you use analytics to make predictions, preferably linked to sustainability?**			
35	You could say that the most important thing we do is to reduce waste together, and it's really about understanding the need. If you understand the need, if we start there. "How many milk packages are sold at STORE in 3 days?" if we know it as well as possible, then we can make sure that we fill up the stores with as much as needed. And then we manage to make sure that we have good sales. But we can also make sure that we minimize waste. Then there's a hell of a lot of stuff you could do that hasn't been started with yet, we have some stuff around... If products get old, you can sell them at a lower price so that we do not have to throw them away and then you can do it in differently sophisticated ways. So, if you're going to lower the price, how much should you lower it to maximize the benefit between waste and revenue? Yes but I think like this, the core of what we've done so far is about understanding what demand there is, and to know what the demand is, you can use predictive	BI3, S1, A1	Answers to needs, optimizes assortment, minimize waste, easier to make correct choices and reduce waste, balance of sustainability and revenue	food wastage, predictive - demand, predictive - price

	algorithms. If we know that, it will be easier to buy in correctly and then there will be less waste.			
36	**Good. Want to add any INF3b? Is there any need you've seen just to predict more on your part?**			
37	*Yes, but needs are really, first of all, I think like maybe what comes out most recently now that we've set the climate goals that we're going to kind of make a move. There's kind of a predictive model, just to be able to see where you can make moves and what effects does it have overall. And because in our goals that are also set, that we should reduce within climate but it should not be at the expense of anything else. It shouldn't be at the expense of animal welfare, biodiversity, social conditions, and it's also kind of an optimization problem there that's not easy when you have 10 other parameters to relate to. Plus then there will be food waste, packaging, that is not included in the sustainability declaration. So that there's a lot, a lot of information there that's going to... There you definitely see the need.*	BI3, A1	see opper-tunities and effects, not make choices that infringes on other parameters	predictive - educate
38	**How would you broadly say that the use of predictive analytics contributes to the work and ability to deliver sustainability-related functions?**			
39	I'd say we're pretty much, in terms of sustainability, well the weight is in descriptive analysis rather than predictive analytics. So going forward, there's a lot more predictive to do. I don't know exactly that our question was here, I lost my way, but...	BI3, A2, A1	Potential to use more predictive	predictive analytics
40	**No, but exactly. But precisely, about how the use of predictive analytics and such contributes. But you really gave an answer, that you see the greater the potential in the future. But that maybe at the moment it's something else?**			
41	More descriptive than predictive anyway. And that being said, the descriptive is also damn important. To be able to show and see what you can make a difference. But there's potential in lots of predictive projects as well.	A1, B3	Recognized potential for BI3	predictive analytics
42	**Yes. Do you have any examples of these potentials you see? If it's in any certain areas?**			

43	No, yes, but like this, if you think like this, what I talked about a little earlier: replenish the stores in a way that... we can get better at, very much at, to reduce waste. Remove goods, keep track of goods and remove goods that are approaching their expiration date to reduce waste there. There's a lot we can do with the help of, maybe also so... It's about several things, partly knowing which goods are expiring. Know how we get them out to the customer, which customers want them. So, yes but around replenishment and waste, I would say that there is a whole lot.	S1, A1	Using BI3 to replenishment and waste	food wastage, predictive - demand
44	**Yes, exciting. Great, shall we take the next little aspect then? Yes, then it's dashboards, which differ a bit because that's how to visualize the data. So, how do you use dashboards and visualizations for sustainability? And do you have any examples of that?**			
45	*Should I go for it INF3a maybe, or?*			
46	*Yes, go, go, go.*			
47	*It's in its infancy really. We've kind of started to do dashboards, and it's specific to the sustainability declaration in order to see, well, how are we doing like, which... What share of our sales have sustainability declarations and what share of suppliers do have it? And that's because our buying department should be able to increase that share, so that's a part then that dashboard can show, and kind of information over time. The other thing is that on top of this sustainability information, we also build our own model where you can find: What is like a good performing product within equivalent products? And just the same way: What is a less good performing product? As seen then in these 10, collected these 10 different sustainability aspects together then for this whole product. And, and that's something where you can get kind of a picture of: Okay, where, how are we kind of in percentage terms, with kind of good products and how we are in percentage terms with less good products in different segments. And that's kind of a basis then that you can use then to be able to create movements and then you can kind of also in the dashboard go in and look at what products drive this, percentage sales, and what areas are it on those products that make it worse than the others? Is there any chocolate that stands out on animal welfare because it has milk from..? So like this, then you can break it down quite detailed and work with it in a way that is... Yes but becomes very impactful and kind of becomes very... You can only get a lot of information and*	BI4, S3, BI4, BI1, A1	Dashboards displaying performance, compare products and discover good/bad performance, visualizing this, increase level of detail, more impactful,	food wastage, dashboard - understand, dashboard - comparability

	you get it pretty specifically with like now we're going to look at this and it causes this effect.			
48	**Mmm. Yes, exciting! Do you want to add any INF3a or was it captured?**			
49	No, go.			
50	**Yes, if you were to say, what information do you think it is most important to include in a dashboard, or visualization, related to sustainability? Any thoughts on that?**			
51	Yes, that is... What I think we are most important is, but it contradicts the question a little, but it is well not to lose aspects, so that you only think about CO2 so there are lots of other sustainability aspects that are... Going the other way. Without it being important to try to include all aspects of sustainability. But I don't know. I think maybe INF3b, you're much better gifted to answer that question.	A1, BI4	Gain a holistic view	
52	*Yes but I thought was a good point there, just that you have to be able to see the big picture and to be able to see the movements. What is it, "Who's doing it well?" and kind of rewarding those who do it well, that you're now kind of going down specifically at a store that's been working a lot with animal welfare and that you see like there it's actually improved, or reduced food waste or whatever it may be. So that that kind of... Information, I think, is important to be able to kind of actually create pure movements and see that you actually do it as well. Now we can see that we have reduced this one by x number of points.*	A1, BI4	gain a holistic view, see results, see detailed information, see actual impact, create actual movement	dashboard - motivation
53	**So the opportunity to see it both big and then follow up to detail, I interpret that as?**			
54	*Exactly, exactly, then as well as you can also create motivation for the individual store. If they kind of have their own overview here.*	A1, BI4	Creates motivation, individual views	general stance, dashboard - motivation

55	Yes, exactly, that's the point overall, as to why you're doing analysis, is kind of changing things. It's not, otherwise it's completely pointless if we don't change anything. And there comes the motivation. Also, perhaps the connection to the financial, is well not entirely irrelevant, which can be the contributing motivator to a store or those who, yes... That, actually, do you reduce waste? Yes, it is also economically beneficial. Or if you're going to talk like this... Logistics flow, you get it more tight, well, then you save both on money and the environment, because it's quite connected.	S1, A1, A3	incentivises changes, motivation, economically beneficial to be sustainable	Food wastage
56	*That's actually a great point, in regards to linking it with financial flows, because sustainability kind of often becomes its own little thing here on the side. But you want it on the same line with the management when they sit and go through their... numbers for the last week, you kind of have yes, but you have financial figures, but then you kind of have sustainability figures from last year's sustainability report, it doesn't work. It needs to be more up-to-date and on time and that you can kind of sit and look at this, here and now on the same line with financial figures.*	BI1, A1, BI2	Factor in sustainability data for management, compare to other departments figures to make impact	comparability - data, comparability - shareability, decision making, strategy
57	**That's right, yes just as a way to tie the question and the area together a little bit then, so: How do you see the potential and in what ways do you see dashboards and then visualizations being useful for the organization's sustainability work?**			
58	Sorry, can you repeat that?			
59	**Well, in what ways and what kind of potential might, or importance, do you see that dashboards and visualizations have for sustainability work?**			
60	Yes, but I think like this... After all, step one is to measure things. And show it. So if you want to be data-driven, if you want to steer it toward something, it's hard to control without knowing where you are. So it's super important. It must somehow be the start. Then it can lead to you doing... Find lots of initiatives where we can use other types of analysis to sort of solve a problem, or make it easier for the customer, or make us better. But would I, would we rank or what did you say that?	A1	Measurement, being able to display, provides overview, able to find initiatives, able to solve problem, able to improve	
61	**No, but just express the perceived importance of it.**			

62	Ehm... But again, it's about this... If we don't make a changes, we haven't accomplished anything. But... Ehm... It's really hard to make changes if you don't know where you stand and how you develop. So that, well, it's well... Critically important, perhaps very important.	A1	Basis for changes	dashboard, dashboard - understand
63	**Yes, just that this visual will be a good basis then to be able to see these points we are talking about perhaps?**			
64	Mmm.			
65	*And it's like, when we show this dashboard now as well as internally for the sustainability declaration, it's... A lot of people get this motivated and happy and like this just: "yes shit, now we can see like the sustainability topic in a way that we haven't done before like, we can see our obligations and we can kind of set what goals, set in a completely different way". So that need to have this information, it's there, but when it kind of never really, there haven't been conditions for like having it in this, as well as uniform, structured way that we're now starting to get. At least with the sustainability declaration. Then we kind of have a little bit of a way to go with other data then like food waste and all that, but it's an incredibly important, I think, kind of step in as well as the sustainability work to be able to kind of visualize and see actually how it's going, that you're doing it well.*	BI4, S1, A1	motivation, able to visualize goals, information presented in structured, uniformed way, visualize progress	food wastage, dashboard, dashboard - motivation
66	**I see. *Conversation about the remaining time.***			
67	**Yes, but it's really about going into these sustainability aspects we've looked at and even though we've talked about them now, we have some questions directly towards the aspects themselves. So, if we start with food waste reduction that we've talked a little bit about, how useful do you find that Business Intelligence and Analytics are in reducing food waste? And all the sides of Business Intelligence and Analytics we're talking about now, nothing specific like dashboards or so.**			
68	Yes, but I think like this. After all, there is no way that we should reduce food waste, there are quite a few. But it, it's kind of like understanding the causality between different initiatives and its effect on food waste. That's where a dashboard fills a function. So that like, well, ehm, I don't know what you have to say about it.	BI4, A1	Understanding through visualizing	dashboard-understand

69	*Yes, I really agree and we kind of have some challenges in how we might measure food waste today and that you need to... Get a better, better measurement method for it to get it right, for you to measure the right thing, and that you can see like the movement you're making and means that you're actually reducing food waste and not something else. So yes, no but it's important, yes.*	S1, A1	Follow up	food wastage
70	**Yes, what would you say that measurement methods are missing, or what would you have wanted to improve?**			
71	*yes, that's kind of to see... Yes, but what is it that actually becomes food waste? Because it's often like that, it can be sort of that you measure something, but it's kind of something you put a short date on and then it still gets sold, or it becomes like... Maybe it gets sent back to a supplier because it was crushed and then it gets donated, it's kind of like that... In the system today, it's not easy to get an accurate picture of the amount of food waste there is, and we need to have that for it to... That is, there are goals set on it, so that mm.*	S1, BI1. A2		food wastage, detect
72	**Yes, great. If we instead turn our attention to resource consumption such as water, electricity and likewise, how do you see the usefulness of business intelligence analytics to reduce that type of resource consumption?**			
73	I don't really have a real insight there.			
74	*yes no but... I don't know if I have either. More than like... You kind of talk a lot about but like this, AI, and like... New electrification, that it may be needed... Because it kind of optimizes certain flows and stuff, to make it more energy efficient. Maybe it's something there. I, I don't know what else Business Intelligence, it's about again that thing about being able to kind of follow up. Like now, like now, we have replaced all our refrigerants in the stores and it should then kind of give a lower energy consumption because it is more energy efficient, and then it is important to be able to kind of follow up: Has it actually become that? What's kind of the result of that? So that's where it's important then to... And then that's it. Yes, but you can see like this kind of waste, i.e. as plastic packaging and so on. We have also taken positions and set goals on that all our EDN plastic packaging should in any case be kind of recyclable to... I don't know if it's 2025 I think it is. And how, how do we know that? So like this, we don't really know that today. It's also kind of a thing like this that we have to work on getting*	S2, A1	Opportunity to optimize, follow up on actual impact, potential	resource consumption, detect - resource

	into business intelligence, as well as that kind of information.			
75	**Mmm. Then we get more into governing suppliers and suppliers' sustainability work and then we wonder if you use Business Intelligence and Analytics to govern the suppliers in that way? And the experienced usefulness in doing so.**			
76	What do you mean by govern then, then? Would it be that we would go to their factories and check how the situation is there right?			
77	**More maybe collecting data, being able to govern what figues they present through technology. Or, to help. Actually, make demands and be able to implement something, with it.**			
78	*I think it sounds like I'm thinking about this question now... I was thinking about, so the sustainability declaration sounds a bit like such a thing because it's us getting information from the suppliers regarding countries of origin, certifications, but also like you can have company-specific programs, so if you have information that goes beyond the information that is the basic information then in the sustainability declaration, you can submit it. "We have our own water program that ensures that our almonds don't kind of use more water than necessary for the cultivation in California," for example. So in that way you can kind of follow up the suppliers with it, I can say, but I don't know if we do it any other way really. Not that I know of.*	BI1, S3, A1	Able to get more detailed information to improve governance, by following up	Governing suppliers
79	*INF3a needs to leave, finishing conversation. INF3b stays.*			
80	*Yes, but it's, like we have certain specific things like, all our EDM, coffee and cocoa for example, it's supposed to be 100% Fairtrade where you include forest Alliance. It's such an example of a thing that, as we measure as well and follow up in different ways, so that it's also... It's also one of those things, so there could certainly be more examples, just that I don't know about it simply.*	S3, A1	example of above	governing suppliers

81	**Yes, is that something you see as potential areas you could have used the technology to govern suppliers better, in terms of sustainability?**			
82	*Yes, quite a lot, but it would require quite a lot of information from the suppliers. One thing I've been thinking about, it's that we have countries of origin, which kind of... Yes, but how much does it tell you if you have China or like Russia? It's a big country. Brazil. It's really different depending on the mass, but we kind of grow soy in like an old rainforest area or in serradon, or whatever it may be. yes, but kind of being told... It's my dream to know, like this, but where is it actually grown? Better, as well. Where is the geographical location? Because then you can kind of say a lot more about the risk of deforestation, you can say the risk of overfertilization hazards, you can kind of have a completely different control there then, so I think that's what I'm thinking like the traceability of value chains in a completely, completely different way there. But given that the country of origin, just that, wasn't easy, I can... Imagine that information, then we are a few years in the future.*	BI1, S3, A1	Potential, more specific information, be able to estimate risks accurately and specifically, more control, more traceability by integrating more data	governing suppliers, general data collection and integration, external sources
83	**But it's a desire for more data for increased precision for improved yes, analysis and information?**			
84	*Exactly, exactly.*			
85	**Mmm, great. Now if we go into the customer awareness that we also already talked a little bit about, but to educate and encourage and so on to sustainable consumer behavior simply. How useful do you think Business Intelligence and Analytics are in raising your customer's awareness of sustainability issues really? And how you use it, too, is part of it.**			
86	*Exactly, because I kind of think that's the sustainability declaration is the clearest example of what we're doing it really. And it's very, very, important for the consumer's awareness of: What kind of food does the impact on different ecological and social, or environmental and social parameters? And it can kind of developed even further. For example, that you could see your consumption, what you bought at the ORGANIZATION. What does it look like and such? It's also important but there's also like, I'm working more towards this internal bit towards assortment and purchasing, like: How are we going to... One thing is that the consumer should kind of choose the right things, sustainable food, but it's not possible to put all the pressure on the consumer only, but we kind of need to do ours. We also have a responsibility as a chain as well, to buy in and market, place, campaign, make*	S4, A1	customer can see impact, see consumption, help consumer choose sustainably, measure progress, more streamlined provess, opperunity	customer awareness,

	offers on things that are sustainable, because we are also kind of involved in controlling consumption in that way. But it's kind of a collaboration there, and I kind of think it's... I see it as very difficult to... Had you not had this type of business intelligence, you would not have been able to see: Are we making this move now in the right direction? Or like, we're just out there groping for like...? We're doing a little bit here, we're doing a little bit there, it's kind of like it's kind of a whole different, a whole different opportunity to do it in a systematic way than it's been in the past, I would say.		to be more systematic	
87	**That's right. If you think about these... Yes, the customer awareness initiatives that you have taken on, yes, including this sustainability declaration is a very good example. Do you somehow do any measurements or have you gotten any clear results, that the customers who have used this have improved their behavior, or something like that? Do you have any way to follow up on that?**			
88	*Good question. Not that I know of yet, so we kind of haven't... We haven't quite gotten there yet. So now we've kind of been working on and getting in... The sustainability information data to this data platform that, data warehouse, lake, whatever you call it as INF3a said so, so that we can fetch it and kind of be able to analyze the data in different parts of the organization in the way that you're talking about now, and then you would kind of yes, but these... the customer analysts as well as on e-commerce would kind of just be able to fetch that data and plug it in and do things like this, it's called A/B testing, they could do it using that sustainability data right on the same line as we do with sales data. But we're not quite like that yet, haven't done as far as I know anyway. It's mostly anecdotes or stuff like that. Someone who emailed and wrote like, "Yes, now I've seen that you started on the sustainability declaration, it's amazing, I won't shop anywhere else anymore." Kind of like that, but no measured behavior.*	BI1, S4, BI2, A1, A2	customer analysts can include sustainability data when it's shared within org as potential, no available data about customer effect	customer awareness, comparability - data, strategy
89	**That's right. But it's great to hear it anyway, it's probably some indication that you are not working in vain. *laughter* Yes, but nice, then we come to the last one really about sustainability reporting. And yes, do you use business intelligence in your sustainability reporting and in what ways is it important?**			

90	*Yes but exactly, that is, it's probably mostly for, well, like, we do. Yes, as an answer to that question, we use a reporting tool that our stores and associations, our controllers go into and provide information that is then used in our sustainability reporting. Now, a bit of a problem with sustainability reports is that they may not be read to the extent that you as a sustainability person would have liked. And the question is how much of an impact does it have? And there is, so I mentioned them before, NAME then who started this Sustainlabs, she often talks about this, that "Well but sustainability reporting it's kind of in its infancy still, and you haven't found like all the exact standards how to measure different things, maybe you measure in different ways and some sources were like: Why are we doing this?" But it's also kind of part of our journey to learn because: How we're going find a good way and know that we're doing something sustainable, it's still kind of necessary. But I kind of think what you'd have to work on more is knowing how do you use this data, as well as not just report it. But how can you actually act on the data that's there? I think, yes, so we use, but I think we use it but, certainly, could use it more.*	BI1, S5, A1	Potential to make use of the data and act on it, potential to use it more	general stance
91	**Mmm. Great. Those were really all questions, so if you feel like, do you have anything to add about how you see the potential to use Business Intelligence for sustainability work or something?**			
92	*So, I think like this yes, but I think most of it has been said. I also think that you should be open about... ie dangers, because I think that can also be, that is, good to keep in mind. And it's kind of when you start putting numbers on things, that you should always be kind of aware that it can get... depending on how you incentivize, you can kind of get, it can have different effects. That you're aware of this, that there can kind of be some setbacks sometimes. I was at a lecture a while back when someone gave an example, and it was something, it was the NHS in the UK then that is kind of theirs... Health care and health organization then, they had kind of started measuring on, it was like an example that this is something that could go wrong then, as well as if they only measured on one thing. And it was the hospitals then, they would put a limit on like patients couldn't wait any longer like, yes, but if the ambulance comes and hands in an emergency patient, the patient wouldn't have to wait longer than 2 hours or whatever it was. And it kind of became empty eventually because you wound down that time, but the way it had happened, it was kind of like instead it became like a queue of ambulances outside. They didn't let the ambulances in because they were going to kind of keep these times down and it was like people who died in the ambulances. The point of it is,*	A1	Maintain a holistic view, ensure important aspects are included	General stance

	like, you don't want you to improve anything and so it kind of looks good, but then it kind of worsen something else which you kind of miss. And I think that's so damn important to keep in mind in all of this. And you can't kind of take it all with you all the time, but you can still be aware that this thing, something, "Have we kind of thought about everything now?" and like, "Or maybe we've missed some part that's an area that can get affected", but it's called reverse incentive I think is called in English, that you give incentive to do something and then they kind of get an effect you didn't intend from the beginning then. So I think that's really important that you kind of always see: there are a lot of benefits to it, but you also need to be aware of which... Negative effects it can bring as well.			
93	**Super interesting. Yes indeed, great addition. Yes, that's a lot to think about. After all, this is the case when there is a lot of data and there is also far TOO much data.**			
94	*Yes but exactly, you shouldn't drown in it either and not know what to make of it.*			
95	**Yes. But thanks for that. I think we can round off.**			

Appendix E: Transcription of Interview with INF4

Row	Text	Element	Iteration 1	Iteration 2
1	**Yes, then we take the first question. It's simply about who you are and what you do at your company?**			
2	Yes, my name is NAME and I am then ROLE [in IT] as it is called, and you can say then that IT is a group function within ORGANIZATION? And ORGANISATION is a group where Sweden is part of the company and... IT then a group function and I am then responsible for the IT department and we are then about 12 employees who are trying to ensure that our IT environment here is up and spinning and that we can implement new projects in a good way. So it's both project and operation you may say. I guess that's the short explanation of where I'm doing.			
3	**Mm. Great. So on to ORGANIZATION then. In what ways do you think technology, and more specifically and especially BI and analytics tools, has contributed to improvements in your sustainability efforts?**			
4	Yes, well you can, if you consider what we work with or what we do, then you can say, in IT is that we provide tools for our business, so that we can streamline all our business functions. Then exactly how we use it in our sustainability work, it is rather something that COLLEAGUE can answer, or someone else within the business. So there I have a some lacking knowledge of it, but you can say in general, so we have a BI strategy where we work with standardized tools then, to be able to download and read data. And there we work a lot with Microsoft products where we extract data from our business system and from our surrounding systems. What we are working on is extracting data from data sources into data cubes where the users, with support from IT, can work to analyze the data then. And we are working with Microsoft Report Services and Microsoft Power BI.	BI1	infrastructure of DW	strategy
5	*pause because of phone call*			
6	**Do you have any examples of when it has been used for some sustainability purpose, in any project or so that you have undergone, or where the user has been to improve sustainability.**			

7	Yes, so it depends a little bit on what we do, what we think about with sustainability. But if you now think about what we use Business Intelligence, it's a lot about production and production efficiency and it may be that we want to ensure that we have a good yield on our products, that we reduce waste in our production, so that, for example, we follow up how much if you now think about one, we work with meat production. We have input of goods in the form of animals and then we have products that come out, and there we follow up all the time how efficient our production is, how much waste we have in production, so that we have the opportunity to check the parts of the process where we lose material. And it will be the case that it will be sustainable because it is both about money, the economy for the company, but at the same time it will be to ensure that we become better at our sustainability and it can be materials, but it can also be about how energy efficient we are, that we ensure that we, well, that we use our resources properly then. So I guess that's part that has to do with sustainability.	S2, S1, A1	Detecting, identifying, alerting and discovering by follow up efficiency, wastage, oppertunity to find step in process where material is lost. ensure that they become better, in terms of material, energy efficiency, proper use of resources	General stance, food wastage, detect - resource
8	**Yes, what are your thoughts on your status today around using business intelligence or general technology perhaps for your sustainability initiatives?**			
9	No, but you can say from an IT perspective, it is that we should provide the tools and solutions then for our various business functions when you want to follow up on something. It's not that we in IT are pushing for "Now we're going to look at this sustainability part, how we can be more efficient and better" but it's very much about having standardized tools, standardizing processes, so when we get asked that "We want to be able to investigate this area in a better way." then we have both the tools and the processes ready and ready then. So there you can say that it is IT's role then, not that we should drive sustainability development within the company.	BI2	Organization influences, IT prepared to deliver the services people come and ask for to use for sustainability efforts	General stance
10	**Mm. Then we thought we'd go into some specific aspects of BI, which we've defined. They will be: Data warehousing, Predictive Analytics and Corporate Management, and then we have special aspects within them. So the first one is about data collection and integration of data. So, you want to tell us a little more, you've already been into it a bit, but a little bit more about how you use data collection and integration into your sustainability initiative processes specifically?**			

11	Yes, if you think about our system map, we have our ERP system, which is kind of the core where all of the, most of, our transactions end up. There we have financial systems there and we have sales, and we have manufacturing, production, and then around those we have a number of related systems. We have more systems for our production, and then we have a warehouse system, we also have systems for our distribution. And we want us, when we're going to download or run reports or use business intelligence on them, we don't want our users to connect directly to our systems because it can have an impact on performance and there may be some security issues as well. So that in those cases, we then discuss together with, what now the business function can now be, whether it is quality or sales, or market, about their need to be able to get reports and we discuss and we then help with our knowledge of our systems, how to extract data from our systems so that it is possible to get reports then. And so what those [data] cubes should look like. So we then make the data available, but then the report itself or what those reports should look like... There we usually rely on external resources if we do not have your own expertise then. We want to educate within ORGANIZATION so that the various business functions will have the opportunity to create the reports themselves and twist and turn the data as they find it to be necessary then. So you could say that we are more enablers than we are a report factory or so that creates reports, in IT. In a secure way, extract data and make data available, but then, so to speak, visualize it, it has to be done by business functions themselves then as part of their own process then.	BI1, A1, BI2	Infrastructure, mitigating security risks by having a certain approach to infrastructure, users able to access data to create reports whilst minimizing security risks	General stance
12	**Yes, so you could say that the user or the person who will design the report has a place to go to, while you work more with putting together information from the different systems, or extracting information.**			
13	Yes, yes, that is, if you sit as a user on market or on quality, then you may know which system you work in, but you may not know; "How am I going to put the question forward to this system to get the information I need", and then we at IT help and to understand where this information should be retrieved from and then also extract it to a place where they can then freely run their reports. And is it that they also need help with the actual report creation and then we can also help with... with external consultants and who can help with the actual report creation.	BI1		structure
14	**No, but we see that an advantage of collecting and integrating data and data warehouses, is that you can then store historical data without overwriting or losing information and is it something you use then and if so? How do you get the use out of it? Specifically for sustainability, then?**			

15	That, yes, I don't really know if I understood that, but depending on whether there is a need to retrieve a certain type of data, for example, how much have we produced and how much waste we have? So we extract that data and then it is in this data layer that we have where you can set reports and then you agree on as well; "Yes, how old data should we have in this? The system is one year 2 years, 3 years, depending on what the need is then?" And it really applies to all our systems that after discussion you agree on how much historical data should be there. And then there are large amounts of data, so you may have to have a shorter history if it's just a small amount of data then. But now capacity and disk and so on, it becomes cheaper and cheaper so that there is less cost than it might have been before. But there is no need to lag on old data that is not relevant or current then.	BI1, S1	Historical data, able to follow up and see how much waste there is, discussions on how long data should be stored for, No need to store irrelevant data	collected historical data
16	**In these sustainability features, you'll see that older data is often requested than you might have or so? This particular historical aspect is particularly important in sustainability.**			
17	No... it's not something I've gotten that impression of.		No particular use of storing historical data for sustainability	collected historical data
18	**And then we just conclude with in what ways do you see integration and the collection of data as contributing to your work with sustainability work?**			
19	Yes, but of course it is important, as it is well to be able to act upon or you want to be able to see the effect as well. To be able to see there, you need to measure them and measure them, you do that via collecting and looking at the data that we have then so that it is of course important to be able to improve in the work.	BI1, A1	Able to act upon, see effects, measure, collection important as a step to improve work	general data collection and integration
20	**Yes great, then we will move on if you feel satisfied with this particular one. We have found that there are 2 recognized approaches when designing data warehouses and then you can either focus on gathering all the data available in one location or by creating smaller data warehouses, data mart then, based on needs that are then integrated into a warehouse. And which of these 2 would you say following a similar approach of your own?**			
21	Yes, no, but we want to gather all the data in one place because often it is the case that you have a type of data that you want to analyze, but then you come to the conclusion... Yes, but how is this related to the second type of	BI1, BI2, A1	Gather in one place, when wanting to	strategy

	data and then you often need... combine these different data sources to get the information you need then so that we try to centralize all the information and that's why we're building these cubes instead of asking these questions directly against separate systems. So that we try to collect them in one place.		integrate data for need everything in one place, centralizing	
22	**But then what way do you see this strategy or your chosen way of collecting and producing data as contributing to the work on sustainability?**			
23	I don't know if I understood the question, but it's we wanted to centralize our data to be able to ask questions if it was an answer to the question.	BI2, A1	Centralization to get answers to questions more easily	
24	**Then we move on. And then we get into the area of predictive analytics and then the question of whether you use analytics to make predictions, and in what ways related to sustainability then?**			
25	yes, I probably can't answer that, unfortunately that. I don't know, but it gets it's the different functions that need to answer it then, then they have to answer really then.			predictive analytics
26	**Do you think there is a potential in using predictive analytics that makes predictions for sustainability work?**			
27	And yes, but then. But now if you look at one of the reasons for analyzing the data. It's that you have to understand what has happened, but that's it. Also at the same time understand where you're going then so I mean that's it... I think so, even if I don't know exactly what that concept consists of then, but you also use it to make forecasts if forecasts are the same thing as predictive analytics, so can you answer yes to that question then?	BI3, A1	Understand where you are going by analytics	predictive analytics
28	**Yes yes, but surely that could sum it up as being, does it change anything of what your knowledge of it looks like or is it something you want to add to it?**			
29	No, but if you do as I said, we do not work with analyzing the reports themselves in IT, but it does the respective function. But, do you see that it is a trend that the exchange is decreases? That the curve points like this [gesticulates upwards], then you can conclude that they are not making any change here, then it will... And the same way in the other direction [gesticulating downwards] if we see a trend in our sustainability work, that it's improving. Yes, but then I think it can also be that way, so it's more of an analysis of the information itself and then, as I tried to say earlier, it's not something that we in IT are doing, so to speak. We don't have a sustainability expert in IT, but we work more with the tools and data then.	BI3, A1	Detect trends, able to see improvements	detect, predictive analytics
30	**As I understand it, you are not currently working on providing any feature that does pattern analysis just to do this?**			

31	No, no.	A2		
32	**because it is the technical parts that later can be used. But that's not something you do?**			
33	Yes exactly, we are more for the tool and systems you could say rather than analysis function. We don't have that in IT then.			predictive analytics
34	**No fine, the next point is the dashboards and the visualization then. It's mainly the users of it, but you who work on the IT side, have you seen how you use dashboards so visualizations for sustainability or have any examples?**			
35	No, I haven't.			
36	**Then the next question is whether you somehow see it useful to visualize the data and, if so, how?**			
37	Yes, but that's why we work hard with training internally on these tools. The need is within ORGANIZATION to be able to visualize and analyze data and given that we are such a small IT organization in the company, we do not have the time and power to service the business with it or sort with it with that knowledge so therefore we need to train the users to make it possible for themselves to analyze their data. So that is where the need is.	BI4, A1, A2	Size of IT limit what resources could be spent on, important to train employees to enable visualizations and analysis	dashboard
38	**Absolutely. What benefit do you see from the fact that departments in the organization outside of IT can do analysis through these visualizations?**			
39	Yes, the way it is, it is, so to speak, the only way forward so that it's critical that they can.	BI4, A1		dashboard
40	**Yes, great. Then we are done with the main aspects of the IT part and BI analysis specifically. But we have also identified some sustainability aspects. So we can go through them a little quickly as well to see if what you, yes how you look at how you use business intelligence analytics just to reduce food waste or loss. You have talked a bit about it before, but if you have anything more to add about it?**			
41	The short answer is, I mean food waste and everything it goes hand in hand with how profitable we are as a company. So if we have waste in our production or we have products that has passed their expiry date and we have to discard. That is very costly for us. So what we do then with our different systems, it is partly that each function follows it on a daily basis, but also follows up weeks and months. And like, it ends up in our financial statements in the end, so that information we do on a daily basis. That we keep track of it and that's partly in the systems	S1, BI1, A1, A3	Important to work with following up on waste, as it is a cost for org. Included in	food wastage, comparability - data

	themselves but also then report follow-up then by business intelligence tools like that. It is a very important part of our work at ORGANIZATION.		follow up reports	
42	**If we then look more towards resource consumption, such as electricity and water, are you also using business intelligence and analytics to reduce that?**			
43	Yes, we do. Maybe it's a small area where we need to get even better then. But absolutely, that's how we follow it up. But I myself haven't seen those kinds of reports, but if you look at it. It is also what do you mean by business intelligence, but if you look at all the functions and systems that we have, they have some kind of follow-up in them then, then it may not be certain that we extract all the data to central data sources. What we run reports against. But much of that feature might be within their respective systems then. So, a little uncertain, but it's an area that we're definitely working on. I myself have not seen the reports that we use there.	S2, BI1, BI2, A1, A2	resource consumption as an area of improvement in terms of follow up, not all data extracted and centralized, see potential	resource consumption, general data collection and integration, strategy
44	**No, I understands, but then it's still a usefulness that you see from it?**			
45	Yes yes yes absolutely. Yes, that's what it is.			
46	**If we instead move to suppliers now, and maybe even for you then retailers can be included in this. What kind of suppliers and resellers do you have and do you set any requirements on them that you use BI to follow up on?**			
47	Yes, our suppliers are the farmers who deliver their animals to us then and exactly what information... I don't really know what we have, how we use BI, I don't know I must say then. And will you look at our customers then who are RETAILER, RETAILER and our big wholesalers. So of course we follow up on how our customers, how our sales go on possibly, what scrap we have and so on so that we have that kind of information. But not so that we have any demands on them, that they should provide any type of data. We don't have that.	S3, A2	collect data, follow up on customers, no demands on them	governing suppliers, external sources
48	**When it comes to farmers then as your suppliers, we can say, do you collect any data at all about their sustainability work or mesurements?**			
49	Yes yes yes. We do. We are working on projects where we will, so to speak, in our climate work that we will become carbon neutral. Can't remember exactly what date, but there we collect information to be able to get our entire value chain to keep track of it. So we do.	BI1, S3, A1	Collecting and integrating data to improve value chain	governing suppliers, external sources
50	**And then business intelligence and analytics are used in it, you can also say.**			
51	Yes, I guess one can say so.			

52	**Yes, but it's not something you do to just follow up, how the retailers then, you don't set any requirements or collect any data from retailers' sustainability work or?**			
53	No, I'd say we don't, it's the suppliers that look down[stream].	A2	Do not collect data from vendors	governing suppliers, external sources
54	**How useful do you see business intelligence would be in just monitoring or following up then?**			
55	No but it... Will be like a, it's really important and it's... Yes, but you look at how we are measured and what demands our owners put on us and also our customers then they want us to be climate friendly. And constantly improving our sustainability work and then it is very important that we can measure what we do and how we get better then so that... I guess it's a very important factor to be able to demonstrate that.	A1, S5	Being able to demonstrate measure what is done and how they improve, show to owners and customers. Not mentioned, but leads to sustainability reporting?	sustainability reporting
56	**Exactly. next point where actually the customer awareness and simply if you are somehow using business intelligence to influence customer awareness and maybe increase environmentally sustainable habits or products?**			
57	Yes, but it is good to follow up our own business, and show how good we are in our sustainability work and then there needs to be some kind of facts behind these figures. And the facts, we get that from them by measuring what we're doing then. And when we measure, we analyze the data through business intelligence, so it's an important tool.	A1, S5	show sustainability work - figures - facts - measuring - analyzing data, influence customer likability by showing reports rather than influencing behavior	sustainability reporting
58	**Is it something you are working on, to make customers more sustainable in their choices, from your side?**			

59	Yes but if you look at which... It is rather what products we sell then, that we try to broaden our range and that we start with yes... Not only the pig and beef and lamb that we have, but we've also started selling more and more plant-based products, starting with fish as well, so that... Then in the end. Whichever product the customer chooses, it's not that we're saying meat is bad and now we're going to start eating only plant-based products, but rather that we're trying to broaden our portfolio. And if the customer in turn chooses to buy plant-based products, then we should be there and be able to provide and sell those products as well, so that we can continue to survive as a company. But then exactly how the development is going is a little bit out of our control. But we try to be a modern company that provides the products that customers want.	A2, S4	Not possible to influence customer, but offer sustainable options	customer awareness
60	**But then business intelligence analytics isn't used in a direct way to increase customer awareness or change choices in that way, is it?**			
61	No, someone else should probably answer that. But I don't think so.	A2	No BI affordance	customer awareness
62	**No, the last point is sustainability reporting and just if you briefly then use business intelligence for it and if you see it as useful?**			
63	Yes, but we do, because we produce statistics and reports and such. That's how we do it.			
64	**Do you think it increases your internal sustainability work that you work for it?**			
65	That's what I tried to say before, in order for us to be better, we need to be able to measure and measure it, we do it through business intelligence, so that we create reports and statistics on our data then so that it is a key factor for us to be better.	BI1, A1	Working with analyzing data is a key factor to improve	detect
66	**Yes, that's good. Well those were all the questions, is there anything you want to add in the area or so?**			
67	No, not really, but that more than you have a bright future [laughter], continue to engage in, the need seems to be infinite so that... It was, but what you can say is, something that you can take with you, is really to create reports and so on, it's often the bread and butter, and there are very many who can do, but the tricky and the difficult thing is what data to handle and use then. So that's probably the challenge, being able to find the right data to be able to create the right report. Making a report is something many people can do, but that what does the data come from and how should it be used, and how should it be interpreted then? That's what's usually the challenge and what takes time in this type of project. I mean, users have a need to see something. So it's kind of where are we going to get the data, and what does the data consist of, and what does	A1, A2	Great need of BI&A for sustainability, however, working properly with the data is a challenge, to find the right data and create the right reports	general stance, detect

	it come from? It's like evaluation of sources when reading news really. And that's the challenge with business intelligence often, and there the knowledge is often very difficult to get, or low and then. So the source of data is the key to success, to finding the right data to analyze.			
68	**Yes, interesting, really good addition. Then we were well satisfied there if you don't have anything more there to add, huge thanks for your participation!**			

Appendix F: Transcription of Interview with INF5a and INF5b

Row	Text	Element	Iteration 1	Iteration 2
1	**Then we simply want to start by hearing a little more about you and your roles at the company.**			
2	*But we can take business perspective first, INF5b.*			
3	And I represent business perspectives. [DESCRIPTION ABOUT ORGANIZATION AND ROLE]. I am probably the one who works the most with data in our team in sustainable development and closest to BI and IT then. Yes, I have worked for 10 years with pretty much the same issues regarding transport and energy use here at ORGANIZATION.	S2		
4	**In what way would you say you work with technology in your role?**			
5	It is mainly data collection, from energy use, and data collection from suppliers to estimate our footprint, our Co2 footprint. Yes, I work with technology in energy efficiency and yes, energy-conversion projects.	BI1, S2	collect external data for sustainability	
6	*Yes I've been 10 plus years at ORGANIZATION. Worked with data for a long time at all the companies I've worked at, have been at, big and small. And so we can say central IT function here in this context then where we have a relatively large central organization but also then but. Towards a central platform for collecting data from different data sources that we will get into. And it's kind of important to have a person like INF5b, who drives both strategic issues and hands on who directs us simply.*	BI1, BI2	central platform	
7	**Yes, perfect. And how would you say in what way and more specifically about business intelligence and analytics, has it contributed to improvements in your sustainability work?**			
8	Yes, but it has added credibility to our sustainability work. Yes, to approach the accepted way of working in all major companies. Being KPI-driven and yes, data collection from a business perspective then; to measure is to know and we have tried to embrace that and you get a completely different response when it is... Yes red, yellow or green like that, based on some number and year then. So in	BI1, A1	Data adds credibility. BI for sustainability makes the issue relevant in the	General stance, decision making

	that way, it's made sure that we get more space, I think, because that's the language that's being spoken.		whole organization	
9	*Can I take it a step further INF5b? Because we've actually been working together for a number of years on and off. That is where it starts, with key figures and showing facts. But I think it's also taken a step forward… to the next step. It's one thing that we found data we happen to have, and can demonstrate that, but strategically, like INF5b said... I'm thinking about several different aspects where you and others have been pushing strategic issues, that if we could have this data or if we were to apply this kind of mass balance calculations, then we can produce new data. And say that rather we can produce a data-driven factual picture, that this is what it looks like. To the best of our knowledge, so there's a strategic element here too I think. Except for this where we've started. And that's where I hope we can take more steps forward.*	BI1, A1	produce new data with current data as next step beyond demonstrating	detect, decision making
10	**And what would you say is the status today when it comes to using business intelligence and analytics for your sustainability initiatives?**			
11	Do you have any selection options of statuses? No, but I... I'd say we're in the start-up phase, I mean if we look at how? On the one hand, you can see the potential that exists for other than sustainability-related issues in business intelligence and analytics, if you get things in order, you can get like... Yes, you can, from my judgement, you can get a hell of an exchange and as well as decision support and know, like that. There is a potential, and then you can also kind of think about where are we in the sustainability work? This applies to follow-up, key figures management, and even reporting, then we are... on a fraction of what the whole company does then, from an ecologic perspective and a production or efficiency perspective then. So we have enormous potential and there are winds blowing now within sustainability reporting with upcoming legislative changes that will mean that we will have to report on a completely different level and there are those who say that the sustainability report will be much larger than the financial or business description as well.	S5, A1	see potential for progress, exchange and decision support, ability to measure, follow up, fraction of what is done overall	general stance, sustainability reporting
12	**Yes, that report, is it externally directed then, that you must report to others, not for the sake of your own business?**			
13	Yes, but it is. I think, what's going to increase, that's the external reporting.	S5		

14	**Which, of course, drives it together, but that it is still externally that you see an increase that the information must come?**			
15	Yes, yes, that's it.			
16	*Yes, can I split that image a bit and I can develop it maybe? You talk about the legal requirements and EU and such primarily, I think, but what I see from my data-technical horizon is data sharing. Pay it forward I call it, maybe. There's a lot, I think, in commercializing our information and sending information forward in the supply chain. Where, as I mentioned, we have a mass balance is a way to commercialize our data, charge for the sustainability work we do. But above all, I see that there will be a great deal of pressure further ahead in our flow of goods. And I don't know how much you face it yet INF5b. But do we have requirements from our customers to deliver sustainability data to them as well?*	BI1, S3, A3	BI makes it possible to commercialize data and make money, data sharing, send information forward in supply chain, pressure and requirements ahead	comparability - shareability
17	Yes, and it increases exponentially almost. It's some kind of trend now, or what to call it with... Yes where those close to us at least, especially RETAILER then, but similar players have… You go into science based targets, you embrace it, and then you say that "We have an eye on our scope. So what we do inside our walls. And now you have to keep track of your scope." Like you kind of push this out. It's a way to get approved through this science-based target then. So that's clear trend, INF5a.	S3	retailers govern more, get approved through targets	Governing suppliers
18	*Yes, though the wind hasn't come to me yet.*			
19	No			
20	*So I think you do some yourselves maybe unfortunately, but we're going to have to automate that more and more I imagine. And then I think, I'm saying pay it forward, but I mean pay it backwards, that is, we get paid for the efforts we do.*	S3, BI1, A1	Automate data sharing	governing suppliers
21	Yes, that's exactly it's part. Yes, it's partly some kind of carbon disclosure, there is standardized as well so...			
22	**Interesting! Then I think we've got a great overview of what you're doing and that we can then go into more about our specific BI elements that we're investigating. And first up is data collection and integration and then we would have liked to hear a little more about how**			

	you use the collection and integration of data in your processes for your sustainability work?			
23	*Technical or? Should we start with your overview INF5b? Maybe you don't want a technical system map?*			
24	**Not quite at that level perhaps, but a brief summary of the technical aspects that are important and included in it I would say.**			
25	But let's start at... yes, just at the most basic level, we collect like a survey yes, but systematized survey work on sustainability-related issues. We follow up on our code of conduct. We centrally on DEPARTMENT follow up against the code of conduct so that the whole organization and the sites deliver on it. We do this with a survey tool, maybe it's not business intelligence, but at least it's a bit IT. And we have a working one, but we've got it to work well. Well, this is then once a year, so it's not particularly... Yes, varying over time. It's hard to kind of say something, analyze something from this in the short term. But in the long run, can you see trends then. And then we have… If we start then with yes, it has been economic fueling when we talk about energy efficiency, it has been... economic driving forces, it is called! And to streamline and then we've put a hell of a lot of meters out at our facility and then it's been a little bit like this... Yes, depending on where you sit in the organization, it has been in a way and so. We have tried to standardize this and then we have collected this data so that it is available to the entire organization. And it's heading towards BI.	BI1, S2, S*, A1, A2, A3	Economic reasons to improve, collecting external data with survey, compare to code of conduct, done once a year, short term not visible but long-term	food wastage, collected historical data
26	*Yes but yes, god, it is foundation for a lot of it, so that it's just at the bottom lies a UT [Ultrasonic Testing] device, a IOR [Importer of Record]. And so we gather it together, and package it, just briefly, we have a traditional kimball data warehouse structure at the bottom for the data layer if you say so, and then at the top it's some type of consumption. Via some, one or another type of cube handler. Right now, it's Power BI we use the most. So it's definitely a lot of BI that you're [INF5b] involved in building a lot of.*	BI1, BI4	Gather data from devices and integrate in traditional DW, bottom layer, top layer consumption	
27	And it's impressive that from such basic information packages you can kind of get structure and large scale on it, and some order on it.	BI1, A1	collecting and integrating data provide structure, scale and order	detect

28	**If one can just list a little quickly. What sustainability aspects are included in this Code of Conduct? Food waste, energy supply…?**			
29	Yes, all of them. No, but… all the ones you've brought up here. Yes and I think the code of conduct is available and it is a solid document. Yes, which we try to work to comply with then. We aim to do so.	S*		
30	**Yes, it was a bit in the area of seeing trends in the long term, and one advantage we have seen with data warehouses is being able to store historical data, without having to overwrite or lose information. So we would like to hear a little about how you use it and if you get any use of historical data for your sustainability initiatives?**			
31	*We can take that solution first INF5b, because it's a bit fun in the way that it's hour-level data, on device, so that's the whole point is kind of following the story that I said a little bit briefly, Kimbal as a signal word really, i.e. a traditional data warehouse structure where we restack the information so that it can be more easily consumed from different perspectives and filtered and so on. But more in the future, we see that we will also do simulations with what if analyses, so that you can also make strategic decisions and extrapolate things like that. I don't know if I should go that far and say that, right now we're looking at a newer, more modern Kafka-oriented event streaming platform, we're working on. Where we can work more with so published... Can you say? I will argue strongly that anyone who builds a system or a source or something has an obligation to first talk about "what do I want to publish, what kind of information am I prepared to share with some kind of, square?" because that's what I call it [square], someone else calls it stream, and this we haven't talked much about INF5b, but it's basically about regular message broker, but with a little more modern technology and more offline states where each one does what that application is best and good at. But you have an obligation to go to the square with the daily news, as I call it, so that you or someone else can subscribe to that information in your way. With our data lake in the cloud then, in the new recipient, the new subscriber, of the data that we can subscribe to. But it's kind of like a little bit beside the point because whoever publishes the information shouldn't have to care who is consuming it, right. So basically it's just good old fashioned integration, but we have a big project around this right now that's extremely exciting.*	BI1, BI2, BI3, A1	Decision support, more easiliy consumed and filtered data, Sharing information, question what information to share, offline state project	strategy, predictive analytics
32	Which I'm not involved in. *laugh*			

33	*No but if we build something new, INF5b? Then I will definitely say, "Okay. what do you choose to go to the square with, what kind of information?" like you, if you say: "I own this domain, I own our PIM [Product Information Management] system" or whatever, then I'm going to ask like: "Okay, what do you want to take responsibility for notifying others about, what you think you're good at?"*	BI1, BI2, A1	Cross-functional when developing new things	strategy
34	Right.			
35	**So it's really a communication...**			
36	*It's a means for future BI where we can, I imagine, be a little more relevant in the moment. When things happen, we can also give feedback back: "Okay if that happens, then you could do that."*	BI1	Timely and more relevant data Decision support	detect
37	The first step is communication and then it should be easy to connect to this data which is yes...	BI1	easy access	
38	*And I happen to be sitting in the data layer that I call the company's memory then, right? But you should be able to with the same signal to be able to react with a different signal, and the whole point is, as I say, that you should be able to bomb the internet, that you should be able to be like in offline state. You should be able to do your thing out on your device if you don't have an internet connection right now, then you'll be sending up data whenever you can. Yes, and me on my other edge, I receive the data when I can and the only thing I know about the world, it's how many newspapers I've read. So we're building a more data mesh, that's another keyword, we're building a more impact-resistant system going forward.*	BI2, BI1	offline state, data is uploaded or fetched once connection is established, leads to more robust system	Data or analysis driven approach
39	Exciting.			
40	*Yes, it is and so we stop there in terms of technology, if you don't have any more questions.*			
41	**We have as a small summary then about data collection and integration. How do you see it contributing to a work with sustainability and how useful it is?**			
42	Ehm no, but it's currently the case, or as I said before, it's been a way of 'talking corporate'. And has been yes more annually reported, "This is how it is from a sustainability perspective", but it will in the future... be crucial for us to be able to do something… If we are to continue to be ORGANIZATION and have producing operations, we must have access to the data to be able to make these difficult	BI1, S5	Decision support, a way to cope with the increasing transparency and	sustainability reporting, general data collection and integration, detect,

	decisions that will be required. And then there will also be great demands on us, or requirements for reporting and transparency, that we can't really deliver on today, but it will be statutory.		reporting demands, access to data for important decisions, ability to follow up	decision making
43	**So you think this data collection and integration will make that possible?**			
44	Yes, exactly, we can deliver on these requirements going forward then, but then we have to develop as well.	BI1, S5	Automate to cope with requirements	General stance, governing suppliers
45	*I'll say now that, INF5b, you won't be able to staff up as many people as you want, you won't have time.*	A2	lack of resource	General stance
46	No, that's... yes, that's a good point because it hasn't been... It's been hard to say that the sustainability department is going to grow.	A2	lack of resource	General stance
47	**Yes, a matter of resources and time simply?**			
48	*Yes and human limitation. It is not possible to scale the manual work anymore.*	A1	Automate to cope with requirements	General stance
49	No, that's... It's physically impossible to do it manually, yes exactly.	A1	Automate to cope with requirements	General stance
50	**Okay. Yes, then we have the next bit that goes into data strategy. And it is then that there are 2 recognized approaches when designing data warehouses, which focus either on gathering all the data that is generally available in one central location, or that you then create smaller data warehouses, data marts then, based on needs that are then integrated into a warehouse. And of these 2, what would you say resembles your own approach the most?**			
51	Yes, I have no idea. INF5a?			
52	*Yes, but this good old fashioned Kimbal, as I say then, and the idea of centralization has always been there and it will always be there in finance, trickle-up reporting will always be a backbone unfortunately. But having said that, we see*	BI2, A2		strategy

	that it is not sustainable in the long term to have central control on everything. It also has to, so I'm not saying we're going to choose one or the other. I think we have to live with both. Must also have lived and let die.			
53	**What is the advantage of moving from the traditional way?**			
54	*Mobility, presence, contact related and also the possibility of dying also so... Feed-fertilize-kill, I say, like, that you have to be able to build something which can also be shut down.*	A1, BI2	abilities related to adapting strategy	strategy
55	**Is there any particular sustainability aspect that benefits from one or the other? To be able to relate it to sustainability work.**			
56	Yes, but if I listen to what INF5a says, I think it's sustainable to be mobile.	BI2	benefit of local	
57	*At the same time, it also has evidence on the other edge. You will never be able to escape the legal and other requirements that will require a structured collection as well. Unfortunately, I think we're stuck in having central and local. We won't be able to do one or the other, especially not one as an organization like ours. In an ordinary organization you can manage it top-down. Or do the opposite, not having a core but only have franchises. We're kind of caught in the middle. We'll have to do both then.*	S5, BI2	mobile vs structure, legal requirement factor in	strategy
58	But it is an important aspect of our organization that affects our responses as well, that we are not strictly top-down, but this is like a composition of companies along the [PRODUCT DETAILS] chain.			
59	*And Gartner a number of years ago talked about bi-model. I'm very much there that you have to be able to, so to speak, chew gum and run at the same time. Must have both parts. We have to be able to move more easily, I think. We have to be a lot more agile, that's the part we have to develop more.*	BI2		strategy
60	**Yes, so on that note: if the sustainability department then comes to you and wants a new function or new information. So how do you go about getting the information they need to do this?**			

61	But it's quite recently that we've established that connection in a good way, I would say, between the sustainability department and BI. So the way we go about it, right now it's just... So the sustainability department comes up with a good idea and then we say: "Do we want to do this? Can it be done?" We don't know, we can talk to the BI department and then we have standing meetings where we bring up these new ideas. Or it's BI that has come up with something damn smart and brings it up the other way. That's the way it is today. Then it becomes an increasing, it has been in at least, budget. We started a few years ago with nothing. And now we're at the point where we can have developers working on issues.	A1	Organizational: It is not only sustainability making new ideas, but also BI-department seeing a potential to develop. Possibilities from data can drive improvement, increased interest and resources, cross-functionality	General stance
62	**Yes, neat, and as a little rounding off on this part then. How would you say this strategy of collecting and producing data contributes to sustainability efforts?**			
63	Yes, that's a big part, but it's far from everything I think... And I don't really know what's most important or what the other parts are? But yes, it's a long-term strategy and then that it somehow translates into action, and yes, and then data collection is an important part of that. Yes.	BI2, A1	long term stategy, important with data collection	General stance
64	**INF5a do you have any comment, or?**			
65	*No, as INF5b puts it, it's not all, but it's what we can do in our… And it is important that we break different perspectives and ideas and that we are also good at taking care of new talents' expectations. Ie new people, new perspectives, can come into the room and be like: "But why doesn't it work like this?"*	A1,	Understanding, learning, capture insights by being open, cross functional work give perspective	
66	Now I just raised my hand when you said new talents, that wasn't the point [laughter] but I had one thing I was going to say. [laughter] But me and INF5a are sitting on common functions and now it's starting to bubble out in the business that is... There are different ways of looking at it and INF5a probably sees me as the business, but I also have like many lines, and now the customer requirements and the legal requirements are strengthened, and then it has an	S5	common functions, lots of requirements, effect on organization	sustainability reporting

	effect in the line organization. So now it's coming from that direction as well. It's very exciting.			
67	**Yes, so are the demands of sharing information and all that, lead to improvements internally? That you work more with sustainability and control how you do it, or what would you say?**			
68	Do you want me to say that [laughter]			
69	**No, [laughter] but I wonder if that's what you mean it works?**			
70	But I hope so. But it's hard to say at the moment, but I hope so. I think we're heading in that direction.	S5	difficulties	sustainability reporting
71	**Yeah, I mean because that is why they have stipulated by law, they want to have certain demands but also improve and push that work?**			
72	Just yes. And I hope it gives the effect that they want, but sometimes when you're sitting with a understaffed group and then demand, after demand, after demand comes along. Then you start to think. And then they come from different directions, and you kind of can't put them on top of each other, we kind of haven't had time to do that and that's what we have to do so that we can kind of answer in our own way for everyone who asks the question. It's challenging to get to, but right now we don't have time. Or now we feel like these all these questions are coming from... Yes, customers, from... Suppliers, from... legal standards as we say... We say "Yes, but now we're going to be in the forefront" and then we've done that, and we've been ahead for a few years with some other players, and said: "This is how we're going to report" and then we kind of continue to report that way at the same time as… Yes, like that. It's a bit tricky to navigate.	S5, S3	Understaffed, demand, different directions, difficult	General stance, governing suppliers, sustainability reporting
73	**Really interesting.**			
74	I hope it gives effect.	S5		
75	**Yes, we all do [laughter]. But then we can take the next BI part then which is predictive Analytics and forecasting. We simply wonder if you use analytics or Analytics to be able to make predictions?**			
76	No, not, I can't say.	BI3, A2	not using	

77	*I wish, I wish... Yes, but in that line you could say that we've had a number... If we go into that box: machine learning projects. I'm getting pretty used to seeing how they fail. [laughter] It feels good at first and then you get to a plateau and then it's not commercially useful... Yet. And the day we happen to get it right, we'll face a new challenge. How to mechanize and industrialize it… How do we get that little golden edge that we have gotten to work. But, there will be more and more, again it builds on that we build skills.*	BI3, A1, A2	It's difficult, but there is an af-fordance, will not be problem free	predictive analytics
78	**Are there any specific sustainability purposes then or do you look at it more generally?**			
79	It's always around sustainability, because it's always about saving resources, and indirect money. So in all aspects, we're doing really exciting projects. But with machine learning, there are a lot of balls rolling and some will roll into the goal. Yes, and then under that, then I'll say regular advanced Analytics, it has never really been taking off. I don't think we have, we don't have any focus at the central level around any area, like the sales. Well, a little. But I'll say it is relatively undeveloped, advanced analytics.	S*, BI3, A2, A3	Not taking off, organi-zational barriers	food wast-age, pre-dictive ana-lytics
80	**Do you see any potential areas in sustainability where predictions and foretelling would have been useful?**			
81	It's like the whole area of [production], it's a big biological machinery. Like just the weather is difficult. So to get closer to the ground, simply, in all aspects. Within the company, i'd say that analytics isn't advanced, considering the data growth, INF5b, [ORGANIZATIONAL DE-TAILS]. [In precision production], we just have to get even further.	S*	Potential to do analyt-ics overall	predictive analytics, predictive - educate
82	*talk about switching location*			
83	**And then we have our last business intelligence point which is then dashboards and visualizations. And then we would like to hear about how you use dashboards and visualizations in your sustainability work? And any examples of that?**			
84	Yes, we have something called mininum responsibility re-quirements that is linked to the code of conduct. And I guess there'll be some kind of dashboard of that, with maybe 10 to 15 points... Yes where sustainability is broken down then. And that's something that we take with the OR-GANIZATION management, once a quarter no, once in the tertiary we have yes, three-part year... Yes, then it says that it is red, green or yellow and some kind of metric in	BI4, S5		dashboard - under-stand

	relation to goal setting. Yes, that's how we work with the dashboard concretely together with the business.			
85	**How do you think the use of it has improved the work itself? If it has.**			
86	Yes, no but and it is based on data collection that is done then via surveys once a year or once per tertiary then. And it's not really improved its form or like the data collection very much in quite a long time, but it's that it's used so that it's looked at and, yes, taken seriously in the business. That is, it gets a reaction that something is red or that something is missing. In this way, it has improved. But yes, it would be nice if you could get them there a little more automated and that they are generated more often than once a year or tertiary.	BI1, BI4, S5, A1	Visualization creates reactions and issues are taken more seriously. Potential to be more frequent and automated. doesn't affect the backend process	dashboard
87	**Why aren't they, then?**			
88	This is because we do not have the connection to the systems where the data may be located. If you take... Yes, and then there is also that it can be... Yes, no, but that's the way it is... So the example is then if we have a climate goal, we have to have this collection of energy consumption on our sites. Now I'm talking scope 1, and that information can kind of be collected with pen and paper at the facility, or that someone on the site has to go up to the electricity or heat supplier and kind of say, "How much have we consumed this year?" and then they get it, and register it in a system and send it off to us when they get asked to do so. So that it… It's a bunch of steps, or gaps, that should be overlapped.	BI1, S2,	Simplify the data collection at sites by improved collection methods	resource consumption
89	**And a fairly manual work then that you were talking about before that is required for it, as I interpret it?**			
90	Definitely. And then we've been looking for alternatives to this manual, because this specific example then with energy measurement, that it's kind of adding a logger in the right place, and then that it's automated. But it's, well, you have to stay focused on it and think it's important enough for it to survive and stuff.	BI1, S2,	Potential, but it is about prioritizing	General stance, resource consumption, detect - resource

91	*But I think INF5b we did a good thing once, because this is the manual work that... We did 'one' good thing [laughs]. Yes, but we had that challenge then that manual work sometimes becomes an accounting issue, with adjustments and "What is it we don't know?" Because we can never automate 100% and so on. But I did a good thing once I think, you know exactly what solution I'm thinking of. We have a base, a deaful value, in response, and all the information we put on top of that default value is an improved quality in the data product. I don't know how far that been carried out, but I thought it was a good approach where we kept away from saying "We're not satisfied until we reach 100% of the truth", but we... it starts with 0% of the truth, a starting point, a guessing, or default value, and then to the extent that we can qualify certain bits to get them right… That's a good thing. That is an approach where you accept that we will never have all the data.*	BI1	comparing to default value, critical thinking about having 100 % of data/truth, default value increase quality, can never have all the daa	General stance, comparability - data
92	And that's yes, but it's good in one way but tricky in another way, when you're going to... yes, but when it changes, like the quality changes over time, then you kind of have to be... Yes very clear about that, with those you communicate with and yes... So it's somehow, the people I've talked to want to have poor data continuously rather than better data that varies in quality. And it's boring, but it's reactions…	BI1	Demand don't always require data quality	detect
93	*Well then I think another thing that came from you guys actually, that was what working with base lines. Not trying to say that "this is the exact truth", but instead "this is the change of truth from last year". I think that was a good approach for you, and it made my life easier to... Whether we are so much off, we have changed something.*	BI1, A1	Comparing changes to default values, not always correct but improvements are shown	detect
94	**Mm. But if we're going to round off our last BI element here, we just want to hear a little bit about; In what way do you see dashboards and visualizations being useful to the organization when it comes to sustainability?**			
95	Yes in the same way that they have been used within the organization, financial or productivity follow-up, is one answer. Then you would wish you could give more information to everyone, as well as open... To enable yes, what is one enabling when giving more information to everyone, perhaps innovation or... yes, I don't think that's going to happen. Not within ORGANIZATION. It won't happen. What are you thinking INF5a?	BI4, A1, A2	See affordance, it could be used to increase knoweldge. But impossible. following up, more open, innovation	General stance

			as a recognized opportunity but not realized	
96	*No, but that's just how I... I have noticed the fact that you're a little run down, so to speak, with all these requirements and automating won't solve the issue either. Because what I see is that you are not promoting your information, any more than I had expected. Because you don't have time to cope with it.*	S5, A2	No point to improve (automate) technology if the business priorities does not follow	General stance
97	No, that's the way it is.		Confirming	General stance
98	*No, I think I you would have something to gain from it. That's what you can't bear, and neither do I, for that matter.*	A1	recognized that marketing information is positive, but no time for it	General stance
99	**No, it requires some.**			
100	It's proactivity, but there's something in marketing.	A1	market information is positive	general stance
101	*talk about remaining time*			
102	**We've been into it a little bit before, but we have an aspect that is that you govern suppliers. And also then for you, it's also about you being governed by retailers, i.e. stores, and such. Do you monitor your suppliers? Are you monitoring anything? Do you influence anything of what the stores do, or is it one-sided from there?**			
103	I have no insight into it.	S3		
104	**You collect data from [primary producers] and such, and sometimes during the year' ... What is sometimes done to compile these reports or is it done more on an ongoing basis?**			
105	Yes, no, but the data we collect from the [primary producers] is probably for us as well, but the idea is that we will sort of provide a service for the [primary producers] then. Through data growth. But it also gives us a lot of	BI1, S3, A1, A2	Help suppliers, get data for themselfs	Governing suppliers

	information that we can possibly use. But if we monitor our retailers, stores and stuff like that, we certainly do that, but not from a sustainability aspect. Within risk screening, we have some kind of connection to systems to know about it... Yes, probably if the company is in a tangle or if they are resident in a country that is problematic and so. In that way we screen a little.		that can help. No monitoring, only helping.	
106	*Yes, but it happens as well as within the framework of the procurement's normal routines, it is not something that… more than maybe guides. But of course they follow blacklist and stuff like that.*	S3	suppliers are governed in different ways	
107	Yes exactly and we have yes...			
108	*They're doing their job. Yes.*			
109	**As one of the concluding questions then. It's really more if you feel that there's something you haven't gotten that's important to mention, maybe about one of these aspects that we've talked a little bit about: Sustainability reporting, customer awareness, supplier monitoring, resource consumption or food waste. If there's anything that you feel like "this is what we use business intelligence" or maybe think it's very useful for in the future. Is that something you've been thinking about?**			
110	Yes, but what I reacted to was food waste. Which we work with, the internal food waste is part of our production apparatus, where we minimize to the best of our ability to find streams that are profitable and… Yes. So that was something I thought about when I saw that it was food waste. But otherwise, I don't have anything that should be added. I am very curious and I, I also want to say that... I am curious about the result and then this is an opportunity for me and INF5a to hear each other. That's nice. We thank you for that. [laughter]	S1	internal food wastage, minimize	food wastage
111	*Should we throw in a question here, one last thing. That we don't own the [primary producers], they own us. This means that we... But also can help [primary producers] in their sustainability work. I think quite a lot about these carbon footprints, which you've been working on. That we want to be able to support [primary producers] in their sustainability work - I think we have a lot to do there.*	S3, A1	supporting suppliers	
112	**And you think BI can help in those efforts?**			

113	*With our perspective [ORGANIZATIONAL DETAILS]. I think we have a unique ability, that's actually the case, and be able to go a little bit ahead and help and yet ultimately make both money and gain the environment. Then it is locally on the [sites] that things happen that we can be involved in supporting.*	S3, A3, A1	Financial benefit as well	governing suppliers
114	**Really interesting really, it's 2 a.m. too, so it's time to round up, but a huge thank you!**			

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