Data for Sustainable Development in Logistics and Supply Chains – A Systematic Literature Review

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Abstract

The pressure on companies to contribute to sustainable development has increased drastically due to new regulations and political and social demands. The logistics and supply chain industry is directly influenced by this pressure as it has a considerable impact on society, is accountable for a large amount of emissions, and is a major contributor to the economy. The amount of information available is multiplying, and data is an asset that has become the essence of this century's economy. This study investigates the implications of data in sustainable development by identifying data objects and attributes for logistics in a systematic literature review. The findings highlight the importance of data to sustainable development, contributing to the UN SDGs, promoting informed decision-making, and focusing on operational optimization.

Keywords: Sustainability, Data, Logistics, SCM

1. Introduction

Logistics companies play a crucial role in globally delivering finished goods, such as the latest tech gadgets and medical products, to the market within a specific timeframe (Ceniga & Sukalova, 2015). The logistics business is also known for significantly impacting society and the environment through its multiple processes (Lukman et al., 2021). Indeed, today's transportation systems are obliged to provide sustainable, secure, and on-time delivery of goods (Fanti et al., 2016). However, logistics activities such as transportation and packaging are responsible for a significant amount of carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions (Davydenko et al., 2022; Mageto, 2022). According to Dai et al. (2023), The CO_2 emissions from transportation have increased by around 80% from 1990 to 2019 and although there was a 12% drop due to the COVID-19 outbreak in 2020, transport CO_2 emissions are expected to rise again as business resumes. As a result, logistics companies must develop sustainable supply chains not only due to the climate change pressure but also to the increase in energy prices, the rigid regulations, and the fluctuations in consumer behaviors (Ansari & Kant, 2017; Bové & Swartz, 2016; Rajeev et al., 2017; Zampou et al., 2022).

In the last decade, research in the field of sustainability has expanded significantly. This is due to the increasing pressure from customers and authorities when it comes to complying with sustainability regulations (Caiado et al., 2018; Disli et al., 2022; Ikram et al., 2021; Martins et al., 2022; Xu et al., 2015). One of the principal strict regulations is the Corporate Social Responsibility Directive (CSRD), introduced by the European Commission, which mandates that companies report on sustainability starting in 2023 (Ulrich & Metzger, 2022). Another one is the 17 Sustainable Development Goals (SDGs) set up in 2015 by the United Nations (UN), which are a call for action to protect the planet and achieve a sustainable future by 2030 (United Nations, 2015). Consequently, the relevance of sustainability and sustainability reporting is increasing. Creating such reports requires a large amount of environmental, economic, and social data. This is one of the main reasons we decided to investigate data objects and attributes that can be used not only to implement strategies that reduce environmental impact and promote economic efficiency and social responsibility but also to ensure regulatory compliance. Logistics companies can use data to improve internal processes and create novel business models (Möller et al., 2022). Monitoring products, optimizing routes, and tracking shipment status along trade lanes are typical applications (Gómez-Marin et al., 2020; Matsuda & Tanaka, 2022; Tang et al., 2022; Yachen Tang et al., 2020). Since companies have to report their sustainability, data is getting more significant. In other words, to produce a sustainability report, the organization must identify the

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data objects and attributes needed to report information, such as GHG emissions or child labor. Data objects in this context are any collection of multiple data points or a storage region containing multiple values, such as emissions data or employee data while data attributes are any single value that describes a data point or stores a single value, such as the type of emissions.

Although some work has been done to demonstrate how data can be used to achieve a sustainable future, as far as we are aware, no study has explicitly investigated data for sustainability in logistics and supply chains. Moreover, no available study has clustered the relevant sustainability reporting data within the logistics and supply chain industry regarding data objects and attributes while mapping it to the TBL dimensions and SDG(s). As a result, this paper investigates the use of data to drive sustainability in logistics and supply chains. Thus, we formulate the following research questions (RQs):

RQ1: *What data objects can be used for sustainability in logistics and supply chain, and how do they support TBL and the SDGs?*

RQ2: *What are possible use cases of data for logistics and a sustainable supply chain?*

Our goals are to (a) identify relevant data objects and attributes for sustainability reporting and sustainable development, (b) broaden the available research to include the social and economic dimensions as well, and (c) present the results of the findings comprehensively. To achieve this, we perform a systematic literature review to comprehensively understand the existing knowledge on data-driven sustainability and identify research gaps.

First, we introduce the background on sustainability, sustainability reporting, and data-driven sustainability. Second, we explain the research methodology and present the findings. Finally, we discuss the results, highlight potential future research possibilities, and outline the limitations of our work.

2. Key Concepts

2.1. Sustainability (Reporting)

The end of the last Millenium marks the turning point where sustainability became a fundamental concept for mankind's development (Keiner, 2005). Humanity's issues, such as extensive use of resources (e.g., timber or natural gas) and irresponsible economic development, call for immediate action. Indeed, the excessive use of timber triggered Carlowitz to introduce the term *sustainability* or sustainable development in 1713, which was then redefined later by the WCED in 1987 (Keiner, 2005). The frequently quoted definition of sustainable development is the Brundtland-Definition which considers it to be a "[…] development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland et al., 1987, p. 43). Sustainable practices support the social, environmental, and economic aspects of the community (Elkington, 1999). It assumes that resources are not infinite and, hence, should be utilized wisely. As mentioned previously, sustainability can be understood better based on TBL (Cetindamar et al., 2020; Gibson, 2006; Pope et al., 2004; Schroder et al., 2021; Zimek & Baumgartner, 2020). Elkington (1998, p. 397) says that "[s]ustainable development involves the simultaneous pursuit of economic prosperity, environmental quality, and social equity". The environmental dimension of TBL includes all the aspects related to the environment, such as GHG emissions, waste management, and energy efficiency. The social dimension covers all that is related to the well-being of the employees, such as labor conditions, diversity, and health & safety, whereas the economic dimension focuses on sustainable economic growth.

To proclaim the importance of sustainability, the UN introduced 17 SDGs with 169 targets to be achieved by 2030 (United Nations, 2015). The SDGs can be seen as a blueprint to achieve a sustainable future. They are also an opportunity for companies to impact human development positively. Besides, there is currently prominent attention towards the implementation of initiatives in companies such as Corporate Social Responsibility (CSR), the Environment, Social, and Governance (ESG), Circular Economy (CE), and Diversity, Equity, and Inclusion (DEI) (Langley, 2022). According to Schoormann et al., (2020) we currently use what equals 1.6 earths to meet our needs, prompting society to contribute to act sustainably.

The first separately published environmental report was issued in 1989 (Kolk, 2004). Since then, many companies and organizations have started publishing reports on their environmental and social responsibility instead of the classic economic reports only (Kolk, 2004). The motivation for a company to report on those aspects or not was summarized through a study conducted by SustainAbility/UNEP in 1998, where they interviewed a group of reporting and non-reporting organizations. Some reasons for reporting were the competitive advantage based on reputational benefits, the possibility to track progress based on specific targets, and the ability to communicate the corporate strategy for internals and externals (Kolk, 2004). Examples of reasons for not reporting were the costs involved, the difficulty in collecting accurate data from operations and choosing the right reporting indicators, and following the footprints of their competitors who are not reporting (Kolk, 2004).

2.2. Data-Driven Sustainability

The amount of data available has increased exponentially (Baesens et al., 2016; Hasan & Legner, 2022). This brisk increase has made companies understand the importance of data and its potential to support strategy (Fadler et al., 2021). In fact, data has become the essence of the economy of the 21st century and is recognized as an essential enterprise asset (Brackett & Early, 2009). "Organizations that do not understand the overwhelming importance of managing data and information as tangible assets in the new economy will not survive" (Brackett & Early, 2009, p. 1). While "Data has value only when it is actually used, or can be useful in the future" (Brackett & Early, 2009, p. 27), companies still only use a small snippet of the total data they collect.

Based on the assumption that data has the potential to drive sustainability, some studies have already explored it, especially in terms of the environmental dimension. For example, Metzger et al. (2012) analyze how using operational data for predictive monitoring can increase sustainability in business networks in the transport and logistics industry. Appelhanz (2013) investigated if the data collected from Tracking&Tracing systems can support environmental sustainability and argues that this data can help overcome forest management challenges in the wood supply chain by fulfilling the legislative requirements and providing information such as the wood origin certification. Gómez-Marin et al. (2020) discuss how large amounts of data can help future decision-making. Due to the traffic congestion and the high amount of emissions produced through freight loading and unloading, they propose a collaboration model for operational decision-making in urban freight. Additionally, Mrazovic et al. (2018) present a routing optimization based on data analytics to make the use of parking spaces and the circulation of vehicles smoother. They developed a tool for urban freight in Barcelona that tracks the deliveries and evaluates possible routes for optimization purposes, which is believed to contribute to sustainable urban freight transport. Zampou et al. (2016) demonstrate an Energy and Carbon Management System (ECMS) artifact within the retail supply chain and identify data challenges such as poor data quality or multiple data granularity levels. They also highlight the importance of gathering data from the different available systems (e.g., energy sensors or warehouse management systems) to support ECMS. Zampou et al. (2016) also stress the lack of environmental data availability. They state that "[…] the existing systems don't typically store non-traditional supply chain information, such as energy consumption and fuel consumption" (Zampou et al., 2016, p. 10).

3. Research Design

To disclose research on data for sustainability, we follow a Systematic Literature Review (SLR) based on Webster and Watson (2002) and Bandara et al. (2015). This type of literature review ensures systematicity, reproducibility, transparency, and traceability (Cram et al., 2020) and enhances credibility (Paré et al., 2016). This is important as we expect data's role in sustainability to advance in the upcoming years. We apply three knowledge-building activities based on Schryen et al. (2020):

(1) synthesizing, where we summarize the available sustainability data in the scientific papers' sample to provide a foundation for our literature review, (2) identifying research gaps to highlight the mismatch between knowledge, namely through mapping the identified data objects and attributes to the related TBL dimension and SDG(s), and (3) developing a research agenda for future research possibilities. We adopt the extraction and literature analysis guideline of Bandara et al. (2015) to answer the RQs. To extract literature, we use several databases. We first consider the search string, which is based on a combination of the terms "sustainability" or "sustainable" and "data" and "logistics" or "supply chain". We chose these search terms since they best reflect our understanding of the field. Given that this study is explorative in nature, we first took a focused approach to searching the literature data bases to optimize the search engine results and generate the most relevant sample. As a result, in subsequent studies, the search string can be extended to incorporate a broader set of keywords (e.g., circular economy or ecology). The resulting search strings were used to search the databases *AISeL* and *IEEE Xplore* to include Information Systems (IS) and engineering literature to ensure relevance in these specific fields. We excluded broader databases at this point, such as *EBSCO* and *JSTOR*, to maintain accuracy while avoiding extraneous content, though this could overlook potential interdisciplinary insights. We did not limit the publication date to obtain substantial literature since the available research papers on data and sustainability for logistics or supply chains are scarce.

The search was carried out in September 2022, resulting in a total sample of 190 articles. Based on the guideline of Bandara et al. (2015), we first eliminate duplicates and any non-accessible articles, which results in a sample of 162 papers. Then, we screened the title, abstract, and keywords and followed it with a full-text review of the research-relevant articles, which amounts to 59. During the screening process, we consider relevant: (a) any article that mentions data objects or attributes used to contribute to or report on sustainability measures, (b) any article that links data to the TBL or SDGs, and (c) any article that describes a use case of how data can be used to achieve sustainability. We structure our full-text analysis in a concept matrix listing all the relevant articles, the industry, the sustainability-related data, and the use case. Next, we filter our concept matrix based on the industry to include only logistics and supply chains. As a result, we compiled a final sample of 38 publications that are relevant to our study. We use a coding scheme to simplify the analysis results by giving each final paper a reference ID (#) (**see Appendix attached as supplementary file**). To present the results of our literature review, we propose a classification of sustainability reporting data in terms of data objects and attributes. We map it to the relevant TBL dimension and SDG(s) (see Table 1). In some instances, we could not map the data object to a single TBL or SDG because particular data objects can affect more than one TBL dimension and contribute to multiple SDGs. The mapping is not mutually exclusive and based on our interpretations.

4. Results: Data for Sustainability

4.1. Overview of the Literature Sample

To begin with, we look at the distribution of our literature corpus over the years. We notice the recency of the topic. Indeed, most of the papers (22 out of 38) were published between 2018 and 2022 (see Figure 1). This reveals that it has been considered a hot topic in the last five years and demonstrates the shift in attention towards sustainable development in the last decade.

Figure 1. The distribution of the literature based on the year of publication.

Next, we conduct a paper count based on TBL dimensions and observe that most articles mention environmental-related data (33 out of 38). In contrast, some articles report economic-related data (18 out of 38) and social-related data (11 out of 38). This can be interpreted by the current focus on saving the environment and climate change, especially since the logistics industry accounts for an elevated amount of GHG emissions (Davydenko et al., 2022; Kahn Ribeiro et al., 2007; Mageto, 2022) Nevertheless, we expected that we would come across more economic-related data for sustainability due to its importance for business growth and more social-related data due to its significance for customers and building a good reputation.

4.2. Data for Sustainable Development

Our analysis considers a data object as any collection of multiple data points or a storage region containing multiple values, such as vehicle data or employee data. In addition, we define a data attribute as any single value that describes a data point or stores a single value. It can be a naming attribute such as ID, a descriptive attribute such as type or conditions, or even a numerical attribute containing a value such as a salary.

Based on the final literature corpus of 38 articles, we extract the frequently mentioned data objects (e.g., emission data, shipment data, payroll data, etc.). Next, we screen the literature to identify exemplary data attributes for the corresponding data object. For instance, shipment data mentioned in articles (#7), (#11), (#22), and (#36) has attributes such as tracking number and shipping status (#7), volume and frequency (#22), and cost (#11). In the following step, we map the data object to the TBL dimension it affects. In this case, shipment data can affect the economic dimension directly (cost of shipment (#11)) and the environmental dimension indirectly (e.g., the distance traveled affects the amount of CO_2 emissions produced). Finally, we map the data object to the SDGs it contributes to. Shipment data maps to SDG 13 (climate change) and SDG 14 (life below water) because being aware of shipment data can help logistics companies minimize their transportation CO_2 emissions and protect the ocean under the assumption that they have business in land, air, and ocean freight. Similarly, we map all the remaining data objects (see Table 1).

Table 1. Sustainability data - data objects, exemplary attributes, and mapping to TBL dimensions and SDG(s).

Data Object (exemplary reference ID)	Exemplary Data Attributes (exemplary reference ID)	Related TBL Dimension(s)			Mapping to SDG(s)
		Economic	Social	Environmental	
Emissions (#1, #2, #3, #6, #9, #18, #19, #22, #24, #26, #28)	Type: CO_2, NO_x, etc., Emission control technology (#22); Factor, Unit of measurement (#1)			X	SDG13
Energy consumption/efficiency/ conservation (#1, #5, #10, #17, #32, #33, #35)	Rate (#35)	X		X	SDG 7
Global warming Weighting factors (#1)	Unit: per day, per route (#1)			X	SDG 7,13
Fuel consumption (#1, #22, #27, #32)	Type (#22); Cost (#28, #37); Unit: per vehicle (#1)	X		X	SDG 7
Waste (#10, #11, #17, #18)	Type: solid, liquid etc. (#10); Volume (#33); Components: wood, glass, etc. (#33)			X	SDG 14,15
Shipment (#7, #11, #22, #36)	Tracking number, Creation time, Shipping status, Last update time (#7); Estimated arrival time (#7, #36); Volume, Frequency, Time-window (#22); Cost (#11); Distance traveled (e.g., in Km) (#26)	X		X	SDG 13,14
Delivery (#3, #36)	Delivery areas, shortest paths between loading areas, travel time, delivery vehicle, route, delivery location list, initial position of vehicle, delivery start time, estimated duration of delivery, waiting time, arrival time, departure time (#31)	X		X	SDG 13,14
Road network/Route planning (#26, #37)	Geographical location, daily operating time, consolidated origin-destination distance (#26); Road works, Optimal paths (#37)	X		X	SDG 11,13
Vehicle/Fleet configuration (#22, #27, #31, #37)	Vehicle fill rates (#1); End life of vehicle (#10); Number of vehicles (#22); Speed (#22, #27); Position (#27); Transport (#22, #37); Load/Capacity (#27, #37); Type of vehicle or mode of fleet sharing (#37)	X		X	SDG 7,11,13, 14
Traffic & Weather conditions (#26, #37)	Congestion, Freight loading/unloading, Movement of vehicles in the city, and their interaction with traffic (#26); Traffic conditions (#37); Weather conditions and related delays (#37)	X		X	SDG 11
Material (#5, #8, #11, #19, #33)	Type:e.g., hazardous, harmful, toxic, raw, restricted, banned, recycled etc. (#5, #8, #1, #19)			X	SDG 6,13,14, 15
Finished Product (#34, #38)	Mass, cost (#34); Creation date (#38)	X		X	SDG 12
Equipment (#7)	Type, technical parameters of each type of power equipment (#7)	X		X	SDG 9
Building (#7, #11)	ID (#7); Capacity (#11); Type: factory (#7, #11), warehouse (#7, #30), etc.	X		X	SDG 9
Cost (#4, #5, #9, #11, #18, #21, #26, #28, #32, #33, #34, #35)	Type: Fixed costs (#11); Operational costs (#28) (e.g. product cost (#9), labor cost (#9, #11), transport cost (#18, #26, #32, #34), hardware, software, & consultancy costs (#21), fuel cost (#28, #37)), material processing and re-processing cost (#33, #35), Inventory cost (#35) …etc.); Procurement costs (e.g., purchase price, related taxes) (#32)	X			SDG 8
Profit (#3, #5, #14, #32)	-	X			SDG 8
Transactional Data (#1, #8)	Sales volume (#8); Shipping documents (#7)	X			SDG 8
Business partner Data (customer & supplier) (#26, #32)	Customer data (e.g., number and location, demand in terms of quantities, type of products required, time windows, average loading and unloading times required to serve them) (#26); Supplier data (e.g., number and location, product offerings, loading service times, load capacity of vehicle fleet) (#26); Supplier selection criteria (#32)	X	X	X	SDG 8,10
Contract (#32)	Type: e.g., stakeholder contract, labor relations record, etc. (#32)		X		SDG 5,8,10
Payroll (#5, #12, #28)	Wages or salaries (#5, #12, #28); Male vs. female salaries (#5); Benefit standards (#12)		X		SDG 5,8,10
Employee (#5, #9, #10, #12, #16, #32, #35)	Male vs. female time employment, employment benefits, gender discrimination, inequality (#5); Labour rights and integration (#5, #9); Diversity and equal opportunities, Workers' and employees’ condition (#12); Child labour (#10, #12, #16); Cost of employee health & safety (#35)		X		SDG 5,8,10
Training (#5, #25)	Improvement in employee training and education, personal skills (#5); Type: (e.g. compliance with safety & security regulations (#25))		X		SDG 3,4

Table 1 demonstrates that data impacts economic, social, and environmental sustainable development. We can use the identified data objects and their attributes for sustainability reporting, development of optimization and efficiency solutions, deriving and calculating sustainability key performance indicators, or identifying a company's current sustainability status quo. The results will be further discussed in Section 5.1.

4.3. Illustrative Use Cases

To better explain the role of data in achieving sustainable development, we demonstrate two illustrative use cases based on our corpus of literature. These use cases provide a focused and tangible illustration that makes the concept of data for sustainability more understandable and relatable. We choose to use two cases from the literature that clearly showcase sustainability data's applications, thus demonstrating applicability across multiple contexts. Based on Bailey et al. (2011), we unravel how vehicle and/or fleet data is essential for economic and environmental sustainability. Then, we shed light on how data can be used to drive social sustainability, as reported by Cetindamar et al. (2020) and Sudusinghe et al. (2018).

4.3.1. Data for economic & environmental sustainability (#37). In their attempt to contribute to sustainable development, Bailey et al. (2011) present "Efficient and Reliable Transportation of Consignments (ERTOC)", which is a standardized data hub that tracks carbon costs. This hub is bringing many benefits, such as (a) optimization of transport, (b) reduction of emissions and energy consumption, and (c) better visibility throughout the supply chain (Bailey et al., 2011). These benefits are achieved by capturing real-time data, allowing CO_2 emissions to be allocated to exact consignments. They argue that sharing load capacity and improving the behavior of drivers, for instance, can reduce emissions produced throughout the supply chain. They give the example of comparing a parcel shipped in a standard way on a full transportation mode (low carbon shipping cost) vs. one shipped on an empty one the next day (high carbon shipping cost). According to Bailey et al. (2011), this statement is supported by the European Federation for Transport and the Environments (EFTE), which concluded that a heavy truck has more CO_2 emissions than a fully packed small lorry if it is loaded at a capacity, which is less or equal to 77%. Having access to data such as vehicle type helps select in a smart way the right vehicle for lower emissions, thus contributing to environmental sustainability. In addition, EFTE also states that for transporting light goods on large trucks, the costs per ton/km can be reduced up to 20-25%. With ERTOC's access to telemetry data, such as vehicle and consignment tracking, ERTOC can lead to cost-efficient transport and minimize carbon emissions. As a result, tracking and managing this data is indirectly contributing to many UN sustainable goals such as SDG 7 (affordable and clean energy) by employing vehicles that use clean energy (e.g., electric trucks); SDG 11 (sustainable cities and communities) by monitoring the drivers' behavior we can make our cities safer and sustainable; SDG 13 (climate change) by optimizing transportation through data hubs such as ERTOC to reduce carbon emissions; and SDG 14 (life below water) by using our ocean freight in a smarter way to avoid fuel spillage and keep our oceans and their resources safe and sustainable.

4.3.2. Data for social sustainability (#5, #12). Cetindamar et al. (2020) discuss the capability of big data analytics to impact sustainability performance. They argue that the strategic use of big data analytics can improve the response of supply chains to economic, social, and environmental changes. They highlight that the social dimension is the hardest to assess because the impacts that need to be considered are not clear, and quantifying those is hard. They also classify social performance into seven subdivisions: health and safety, employment benefits, labor rights, etc. Sudusinghe et al. (2018) discuss social sustainability in supply chains under the guidance of SDGs. They categorize 33 identified "key business themes" into 11 sub-categories among which are: "educational benefits", "gender-related equity improvement", "health and safety improvement", "improved labor conditions", and "improved wage condition". They argue that to ensure gender-related equity in the supply chain, we must promote gender equality and leadership opportunities for women. Having access to employee data (such as male vs. female time employment, employment benefits, gender discrimination, and inequality (#5)) is important to be able to identify the status quo of the organization and thus be able to promote gender-related equity. Another example they discuss is improving wage conditions by negotiating the wage and benefit standards and providing adequate benefits to all employees. Access to payroll data helps understand the wage condition in the organization for potential improvement. Consequently, we interpret that data objects such as employee or payroll data influence social sustainability by highlighting the existing gaps and helping develop actionable solutions.

5. Discussion

5.1. Interpretation of Results and Directions for Future Research

Table 1. highlights the relationships between different data objects, their attributes, and how they map to SDGs. The listed data objects can be used to derive key performance indicators for sustainability reporting. Moreover, each data object is associated with specific data attributes that provide detailed information. For example, we can learn many details about the data object "shipment" through its associated data attributes "tracking number", "shipping status", and "creation date". It is also important to note that the results encompass many types of data. We can differentiate between static data, such as "global warming weighting factors", which are likely predefined values used in calculations related to global warming; and dynamic data, such as "shipping status", where the value varies based on real-time events. The table also shows the interdisciplinary nature of the listed data objects as they map to different TBL dimensions and SDGs. The analysis of data objects in the context of SDGs underscores the importance of data-informed decision-making, which helps organizations to make targeted interventions to meet their sustainable development goals.

In addition, based on our corpus of literature, we noticed that most papers (33 out of 38) address environmental sustainability, particularly emissions. Additionally, most papers discuss a specific use case. For example, Bailey et al. (2011) presented ERTOC, Appelhanz (2013) investigated the data collected from Tracking & Tracing systems, and Gómez-Marin et al. (2020) proposed a collaboration model for operational decision-making in the context of urban freight. This draws attention to the complexity of the processes within the logistics and supply chain industry. Indeed, there is an unlimited number of sustainability scenarios to investigate. Exploring the possible scenarios and how to cluster them as a next step can establish a holistic view of data-driven sustainability. Second, fewer articles discussed economic and social sustainability or only addressed these dimensions on a high level. Furthermore, Cetindamar et al. (2020) highlighted that the social dimension is the hardest to assess because the impacts that need to be considered are unclear, and quantifying those is hard. This finding might motivate IS researchers to investigate these two dimensions and share the findings with the research community. Third, we noticed that SDG 8 (decent work & economic growth) and SDG 13 (climate change) were mapped to seven data objects each (see Figure 2 below). This emphasizes again the current hype on environmental sustainability and the importance of achieving economic growth simultaneously. In contrast, we could not map some of the SDGs, such as SDG 1 (no poverty), SDG 2 (zero hunger), and SDG 16 (peace, justice, and strong institutions), to any data object (see Figure 6 below). We interpret this as a result of the scarcity of research papers related to the social dimension in the logistics and supply chain industry and the possible missing linkage between our research industry and those SDGs. Indeed, they are relevant to our world and governmental organizations, but a specific link to the logistics and supply chain industry could not be made. Based on the various SDG-data object combinations in Table 1, we can deduce many implications, which help organizations use the data objects to derive key performance indicators to make informed decisions aligned with the respective SDGs. Moreover, matching the data objects to SDGs can assist in better resource allocation and making targeted interventions. For example, if an organization would like to address climate change (SDG 13), one of the main data objects they should monitor and derive interventions upon would be emissions.

Nevertheless, as mentioned previously in the research design, the mapping to the SDG(s) conducted

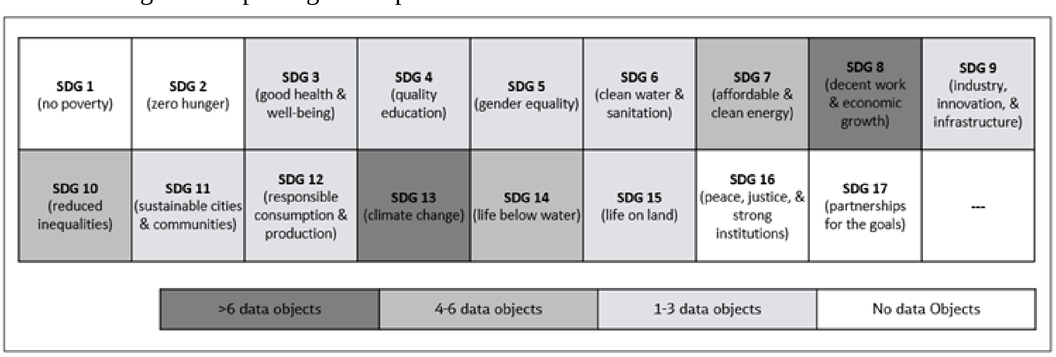

Figure 2. A heat map of data objects per SDG.

in this paper is not mutually exclusive and is based on the writers' own interpretations and experiences.

As a result, further research with industry experts can validate the findings, prove or deny them, and give real-life business examples. Finally, this paper identifies some of the data objects and attributes but does not investigate the source of the data. We conclude this discussion by bringing attention to the importance of data sources, which are mandatory for accurate data collection. To sum up, we suggest the following research agenda for future investigations:

- Enlarge the research scope by collaborating with industry experts to validate, refute, or enrich the current findings through real-life business examples, thus enhancing both the credibility and applicability of our findings.
- Enlarge the research scope by using additional databases that include management literature to incorporate interdisciplinary insights, and include additional keywords to the search string, such as "circular economy".
- Investigate the data sources for the identified data objects and the corresponding data attributes to explore the complete data life cycle.
- Examine how the identified data objects and attributes are used in sustainability reporting to unravel their practical applications and implications.

5.2. Limitations

In this research paper, we are providing a comprehensive overview of IS research. However, this study still has its limitations, which also open the discussion for further investigation and development. This study investigates two interdisciplinary areas, sustainability and data. The systematic literature review is based on specific keywords, and the selection of those is based on our own decisions. Furthermore, the decision to exclude management literature might result in failing to spot additional potential interdisciplinary insights. Therefore, using additional databases such as JSTOR or EBSCO could enhance the findings in upcoming research. From another perspective, the interpretation is based on our own experiences and can be reinforced by expert knowledge through interviews. Finally, this work is the starting point in investigating the role and importance of data for sustainability, which can be built upon.

6. Conclusion

Companies are adopting more and more data-driven strategies as they start understanding the impact and importance of data (Fadler et al., 2021). One of the highly impacted areas is sustainability or sustainable development. Based on our systematic research, we acknowledge the potential role that data can play in advancing our society in topics such as monitoring climate change through informed decision-making (environmental dimension), ensuring diversity and equal opportunities (social dimension), and promoting profitability and economic growth by enhancing operational efficiency (economic dimension). With this paper, we aim to contribute in creating a sustainable future through datafication. To unfold the potential of IS in this field, we conduct a systematic literature review based on AISEL and IEEE. We obtain a sample of 59 articles that we drill down to 38 papers only to include logistics/transportation and supply chain industries. We deduce exemplary data objects and attributes that contribute to sustainable development and map them to relevant TBL dimension(s) and SDG(s). The resulting overview exposes blind spots and unfolds future investigation possibilities. All in all, our study revealed the potential of data in achieving sustainable development.

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