The Role of Information Systems in Balancing Environmental, Social and Economic Organizational Decision-Making

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ABSTRACT,

This study explores the role of information systems in supporting organizations to enhance their decision-making by balancing environmental, social and economic factors. This research has its theoretical foundations in environmental frameworks such as the Triple Bottom Line, Environmental, Social and Governance (ESG) and Stakeholder Theory that explores how organizations can balance their sustainability decision-making outcomes. Information systems are investigated from a Resource-Based View perspective, as a key strategic tool leveraged by organizations to enhance their sustainability performance.

This study takes a mixed-methods approach. The first approach consists of analyzing environmental and economic performance data of Amazon and Tesla. The second approach investigates the information systems Tesla and Amazon use for leveraging their sustainable outcomes. The case studies on Tesla and Amazon highlight the role of Monitoring and Control, Business Intelligence, and ERP systems in enhancing sustainability performance.

The findings indicate that Tesla's more diversified information systems architecture, which integrates these systems effectively, outperforms Amazon's less advanced information systems architecture in balancing environmental and economic outcomes. By leveraging its comprehensive IS infrastructure, Tesla has gained a significant competitive advantage in driving sustainable outcomes.

This study concludes that Monitoring and Control Systems, Business Intelligence, and ERP systems play a critical role in supporting organizations to achieve sustainable outcomes by enabling efficient data monitoring, informed decision-making, and integration of operations across environmental, social, and economic dimensions.

Graduation Committee members: Patricia Rogetzer & Wouter van Heeswijk

Keywords

Environmental transformations, organizations, sustainability performance, environmental , economic, social, information systems, decision-making, Tesla, Amazon, Monitoring and Control Systems, Business Intelligence Systems, Enterprise Resource Planning Systems

1. INTRODUCTION

In today's world, organizations need to shift their attention on the environmental and societal impacts of environmental transformations, such as large-scale construction projects, urbanization, climate change and air pollution. Sustainability impacts our society by disrupting and influencing trends in technological developments, societal structures, economic practices and legislation. Therefore, organizations have to engage in sustainable practices, defined as "those practices aimed at minimizing emissions, waste and water, improving efficiency and minimizing the total environment footprint of enterprise operations." (Bokolo et al., 2019).

This study starts with the premise that organizational performance is reflected into the efficient alignment of environmental, social and economic considerations within organizational decision-making processes. Environmental and normative frameworks such as Triple Bottom Line, Corporate Social Responsibility and Environmental, Social and Governance (ESG) support organizations to understand the importance of sustainability in a business context and to integrate all three considerations in a way that neither economic performance nor environmental sustainability are compromised.

Information systems are defined by Laudon et al. (2021) as "a set of interrelated components that collect, process, store and distribute information to support decision-making and control in an organization". According to Butler (2011), Elliot (2011) and Melville (2010), "Information systems have become a key resource to assist organisations in their efforts of becoming environmentally more sustainable", and "IS can support environmental sustainability transformations – a type of organisational change projects aiming at the reduction of resource consumption and environmentally harmful outputs – by enabling organisations to make sense of the situation and, in turn, implement more sustainable practices" (Butler, 2011; Degirmenci & Recker, 2016; Seidel, Recker, & vom Brocke, 2013).

This study aims to bring into discussion Tesla and Amazon, two companies recognized worldwide for both their economic performance and sustainability commitment, mentioned by Buchholz (2023).

2. PROBLEM STATEMENT

The main research questions this study intends to focus are: the primary research question is "How can information systems be effectively leveraged by organizations for attaining sustainable decision-making outcomes" and the subquestion is "How do organizations balance environmental, social and economic considerations within their decision-making processes?."

This study focuses on Amazon and Tesla, two organizations that are recognized as having high financial and sustainability performances. The scope of this study is to examine (1) how these companies successfully balanced and integrated environmental, social and economic considerations within their decision-making processes, (2) what types of information systems these companies use to enhance their sustainable and financial performance, what are the main functionalities and capabilities of these information systems and (3) how information systems enhance organizations to attain sustainable and financial performance

Before starting to investigate these research goals, a comprehensive literature review extracted from various academic sources was pursued to consolidate the theoretical basis of understanding the main concepts and frameworks related to sustainability integration in organizational decision-making processes and leveraging information systems for the purpose of enhancing sustainable and financial performance of companies.

3. LITERATURE REVIEW

The literature review of this study aims to serve a consistent theoretical foundation of this study. Before conducting the methodology, this study intends to reflect upon the theoretical frameworks and concepts related to environmental sustainability, social responsibility and information systems as a competitive and intangible resource. The main environmental sustainability frameworks addressed are the Triple Bottom Line, Stakeholder Theory and ESG. The Resource Based View Theory is used to explore the advantages provided by the information systems' functionalities in leveraging sustainable outcomes within organizations.

3.1 Environmental sustainability frameworks

A comprehensive literature review is conducted to build a strong theoretical foundation over the main aspects that cover the integration of social responsibility and environmental sustainability into organizational decision-making. In this manner, Triple Bottom Line, Stakeholder Theory and Environmental, Social and Governance (ESG) frameworks are examined to describe sustainability performance as the result of the efficient balance of environmental, social, and economic factors.

The Triple Bottom Line Theory, stated by Elkington (1999), defines sustainability as being composed of three main components: economic, social and environmental considerations (Crane & Matten 2016). Another version of this theory is defined as people, planet, profit (3Ps). This theory suggests that organizations, to adapt environmental transformations and implement sustainability, need to simultaneously focus on societal and environmental values created and at the same time on the economic one. Arowoshegbe et al. (2018) in their study argue that the Triple Bottom Line framework aims to support organizations to achieve long-term viability by aligning their operations with global sustainability goals and balancing financial performance with environmental stewardship and social responsibility. Goel (2010) analyzed in his study the practicability of Triple Bottom Line reporting among Indian companies, stating that "over 65% are already publishing a sustainability report […] of the 250 largest companies" and "More than 3,000 companies across the world report on how they minimize their environmental footprint, engage with stakeholders, adopt fair social practices, or embed sustainability into their day-to-day business, R&D or marketing practices." (Goel et al., 2010).

The Stakeholder Theory, according to Freeman & Clarkson (1995), states that "a company's real success lies in satisfying all its stakeholders, not just those who might profit from its stock (shareholders)" (Freeman 1984). Stakeholders are defined as "'those groups without whose support the organization would cease to exist" (Stanford memo 1963 & Freeman 1984) who 'have, or claim, ownership, rights, or interests in a corporation and its activities' (Clarkson 1995). (Crane & Matten 2016, p. 59). Stakeholder Theory focuses on the "social line" of the Triple Bottom Line and aims to enhance the social aspect of an organizations by integrating stakeholders' interests into organizational decision-making. According to Donaldson & Preston (1995) and Talan (2024)., stakeholder theory is "a managerial concept instrumental in examining how effectively a company manages its stakeholders to achieve its corporate performance goals" (Talan et al., 2024). Organizations can use this framework to make decisions that value stakeholders' interests and increase their social impact, by "actively interact with workers, local communities, and other stakeholders to ensure their well-being, […] improve labor conditions, foster community development, and improve corporate transparency." (Grewatsch & Kleindienst, 2017). Such actions and decisions can lead organizations to fulfill their ethical and philanthropical responsibilities from Caroll's Four–Part Model of Corporate Social Responsibility (CSR). Stakeholder Theory is an important CSR framework that aims to integrate social sustainability within decision-making processes, by considering the engagement of different stakeholders' groups that are directly implied in the organization's strategy, values and goals, such as employees, managers, and customers. Grewatsch & Kleindienst (2017) argued that the efficient implementation of stakeholder's management and active collaboration with environmental and regulatory agencies can lead to enhanced resource efficiency and decreased emissions (Talan et al., 2024).

ESG, is a CSR framework which helps organizations to implement sustainability. The ESG framework is a key tool to evaluate the sustainability impact, by integrating environmental, social and governance (including economic) factors within investment and decision-making processes. According to Li et al. (2021), companies and investors increasingly use the ESG data of companies to evaluate corporate performance, including sustainable and ethical responsibilities beyond financial performance. The ESG framework provides a comprehensive method to evaluate organizational performance across environmental, social, and economic (governance) dimensions. Moreover, this framework translates environmental, social, and economic (governance) outcomes into concrete data, which can be reflected by the ESG reports.

ESG and sustainability impact reports are documents that reflect upon environmental sustainability and social responsibility efforts and outcomes pursued by organizations. These type of reports can be found under other names, such as CSR reports or Global Reporting Initiative (GRI) reports. Environmental and social performances is reflected by quantitative and qualitative data in the form of key performance indicators (KPIs), indices or metrics. ESG and sustainability reporting is important because it enables organizations to measure their efforts of integrating sustainability considerations into their decision-making processes, to measure their environmental and social impact against economic performance and to provide transparency and accountability for important stakeholder groups, such as customers, local communities, investors and institutions. As Gray et al. (1995) stated in their publication, "companies do not operate in isolation from the political, social and institutional framework within which economic activity takes place".

This comprehensive literature review significantly contribute to this study because it argues the importance of sustainability integration within organizational decision-making processes. The environmental frameworks discussed above, Triple Bottom Line and ESG framework, constitute a strong theoretical basis that contribute to the idea that organizational sustainability is composed by three important pillars, namely environmental stewardship, social responsibility and economic performance. Yongvanich & Guthrie (2006) argued in their publication that "it is important for the company to achieve superior economic, environmental and social performance". Nevertheless, ESG and sustainability reporting is an important method which enables organizations to reflect upon their sustainability efforts.

3.2 Information Systems from a Resource-Based View Theory perspective

The Resource-Based View (RBV) Theory, described by Penrose (1959), Barney (1991), and Peteraf (1993), states that organizations can achieve superior performance by possessing and making use of valuable, rare, inimitable, and non-substitutable resources such as physical assets, human capital, and organization competencies. According to Williamson (1985) organizations enhance long-term competitive advantage if their resources are immobile, meaning that they cannot be easily replicated or transferred by the competitors (Cousins et al., 2008, p. 34)

The RBV is relevant for our study because this theory helps to investigate the importance and the usefulness of specific resources, in this case information systems, into supporting organizations to achieve sustainability performance. This study aims to investigate how organizations can use the unique capabilities of information systems of gathering, collecting, analyzing and reporting data to balance economic, social and environmental factors in achieving sustainable decision-making outcomes. Bokolo et al. (2019) studied the integration of information systems in organizations from a natural RBV point for achieving environmental performance. They stated that the implementation of information systems increases the organizations' reputation concerning environmental sustainability. Jnr et al. (2018) argued that information systems' usage support organizations to lower the costs, save energy and conserve the materials associated with their operations and processes and generate low and non-polluting waste. Bokolo (2019) argued that information systems can support organizations in lowering their production costs, optimizing their operations and processes, reporting and tracking of environmental metrics, such as the ecological footprint and CO_2 emissions (Bokolo et al., 2019).

According to Loeser et al. (2017), "green IS practice in organization entails investments in IS and its use", and "it further involves the management and deployment of IS to reduce the negative environmental effects of IT usage" (Ryoo and Koo, 2013; Dubey et al., 2017). That means, from a RBV perspective, information systems highly depend on the financial situation and human capital organizations possess. In other words, organizations need to have a budget associated with covering the implementation and maintenance costs of information systems and have the knowledge capacities associated with the implementation, maintenance and operationalization of information systems for sustainable purposes. In other words, information systems, seen from a RBV perspective, can represent a competitive tool that organizations can enhance to improve their sustainability and financial outcomes, however, as information systems require financial and human capital resources, it is very important for organizations to make trade-off decisions in order to ensure the implementation of such systems does not affect but improve the current environmental, social and economic outcomes.

4. METHODOLOGY

The first part of the methodology focuses on the research question "How do organizations balance environmental, social and economic considerations within their decision-making processes?". The research goal is to explore how Tesla and Amazon balance their environmental and social performance against economic performance and what are the decision-making processes that led to environmental, social and economic outcomes. The methodology used for it is the Triple Bottom Line theory, ESG framework and Stakeholder Theory (explained in Chapter 3) that explain the integration of sustainability for the purpose of balancing environmental, social and economic considerations.

Data sources consist of sustainability impact and financial reports for Tesla and Amazon from the years 2020, 2021, 2022 and 2023. Data collection consists of extracting the main metrics and KPIs from these reports that reflect upon environmental, social and economic performances in a database. The first step of data analysis is to calculate growth rates or decreasing rates, on a year-over-year basis, by using these formulas:

Growth Rate = (x (2) - x (1)) / x (1)

Decrease Rate = (x (1) – x (2)) / x (1)

The second step of data analysis is to calculate environmental and economic performances of the organizations, by aggregating each of the metrics into an overall score.

*Environmental performance = 1/n * x (1) +1/n * x (2) + … + 1/n * x(n)*

where "n" represents the total number of environmental metrics and "x" represents each of the environmental metrics.

*Economic performance = 1/n * y (1) +1/n * y (2) + … + 1/n * y(n)*

where "n" represents the total number of environmental metrics and "y" represents each of the economic metrics.

The data analyzed is represented in the form of visualizations that offer insights into and patterns over environmental and financial increases or decreases, by using bar charts and trend lines.

The second part of the methodology focuses on the research question "How can information systems be effectively leveraged by organizations for attaining sustainable decision-making outcomes?". The methodology starts from the theoretical aspects reflected by RBV perspective over the information systems' supporting capabilities of enhancing sustainable performance and balancing environmental, social and economic considerations within organizational decision-making processes.

The hypothesis of this study states that information systems capabilities of collecting, analyzing and reporting environmental, social and economic data support organizations to transform insights into concrete decision-making plans that are useful into integrating sustainability into the core business strategy. Data sources consist of case studies, articles and publications and data collection consists of gathering qualitative data that offer insights over (1) what information systems Amazon and Tesla use, for what purposes, what are the main functionalities of these information systems and (2) what functionalities of that information systems help organizations to enhance their sustainable outcomes and integrate environmental, social and economic considerations within organizational decision-making processes.

5. RESULTS

A brief introduction into the chapter (one small paragraph that gives an overview about what is dealt with in this chapter) – guide the reader with it.

5.1 Tesla

Tesla is recognized at global level as the biggest manufacturer of electric cars. Tesla was ranked as the 18th sustainable company in the world (Buchholz, 2023).

Based on Tesla's sustainability reports from 2020, 2021, 2022 and 2023, the following environmental data (see Table 1) was collected and analyzed (see Figure 1):

Year/ KPIs	CO_2 Emissions Avoided (tons)	CO_2 reduction Growth Rate	Energy Storage Deployed (kWh)	Energy Storage Growth rate
2020	5000000	0%	3000000	0%

2021	8400000	68%	4000000	33%
2022	13400000	60%	6500000	63%
2023	20000000	49%	14700000	126%

Table 1 Table with Tesla's environmental metrics and growth rates from 2020, 2021, 2022 and 2023 Tesla sustainability impact reports

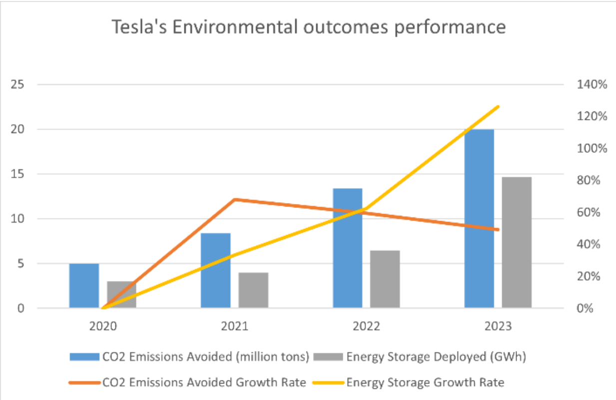

Figure 1. Tesla's environmental outcomes performance over 2020, 2021, 2022 and 2023

The environmental metrics that reflect Tesla's environmental performance are CO_2 Emissions Avoided and Energy Storage Deployed. Based on the 2020 – 2023 sustainability reports, Tesla's main decision-making outcomes that lead to the positive year-over-year increases of these metrics are: increasing the manufacturing and delivery of electric vehicles from 500.000 in 2020 to over 1.2 million model Y vehicles in 2023, expanded globally energy storage and solar deployment and the renewable-powered supercharger network and improved grid-efficiency.

Based on Tesla's sustainability reports from 2020, 2021, 2022 and 2023, social responsibility is represented by KPIs such as "Diversity in Workforce", "Workplace Safety" and "Employee Engagement". Tesla's decision-making outcomes that lead to attaining these KPIs were focused on underrepresented groups in leadership, safety improvements, reduced injuries and professional development initiatives.

Based on Tesla's financial reports, the following financial data (see Table 2) was collected and analyzed (see Figure 2):

Year	Revenue Growth (Billion $)	Revenue Growth Rate	Net Income (Billion $)	Net Income Growth Rate	Automotive Gross Margin (%)	Automotive Margin Growth Rate
2020	$31.50	0%	$0.72	0%	25.6	0%
2021	$53.80	71%	$5.50	664%	29.3	14%
2022	$81.50	51%	$12.60	129%	28.5	-3%
2023	$96.80	19%	$15	19%	25.9	-9%

Table 2. Table with Tesla's financial metrics and growth rates from 2020, 2021, 2022 and 2023 Tesla financial reports

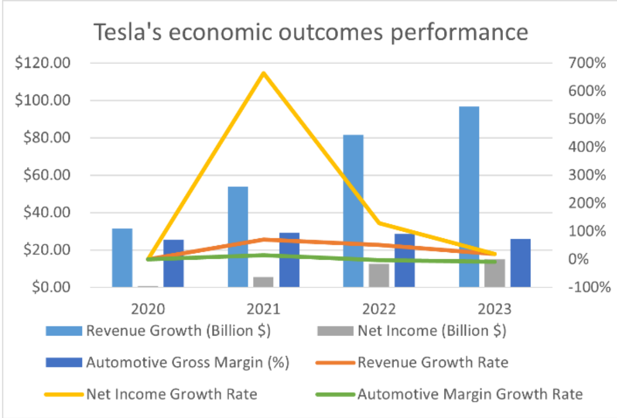

Figure 2. Tesla's economic outcomes performance over 2020, 2021, 2022 and 2023

The main decision-making outcomes that lead to the performances of revenue growth, net income and automotive gross margin were expansion of the manufacturing of Model 3 and Model Y vehicles in key locations such as Fremont and Shanghai during 2020 and 2021 and in Texas and Belin during 2022 and 2023, expanded energy storage and renewable energy businesses and delivering over 1.2 million Model Y vehicles in 2023, making it the bestselling vehicle globally.

Based on environmental and economic data from Tables 1 and 2, the following analysis (Figures 3 and 4) was made to compare the environmental against the economic performance:

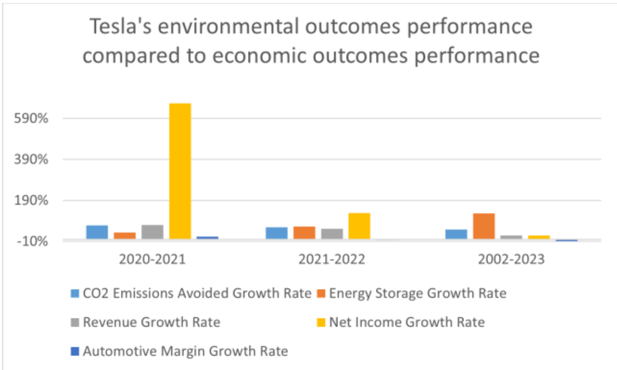

Figure 3. Tesla's environmental outcomes performance compared to economic outcomes performance over 2020-2021, 2021-2022 and 2022-2023

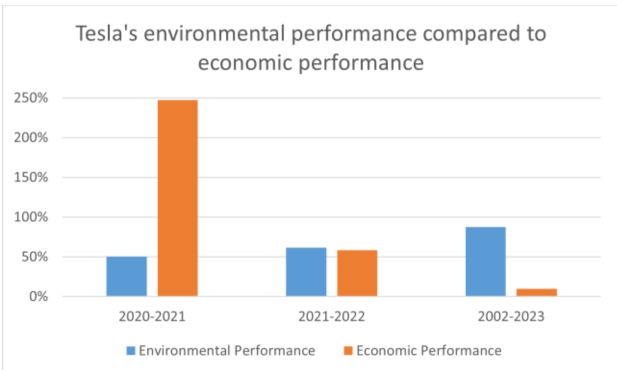

Figure 4. Tesla's environmental performance compared to economic performance over 2020-2021, 2021-2022 and 2022-2023

Based on Figures 3 and 4, we see Tesla's efforts of delivering a high number of electric vehicles, expanding production capabilities especially in Shanghai and operational efficiencies resulted in growth of its economic performance, but over time, the company began balancing these efforts between 2021 and 2022 by increasing its environmental impact. During 2022 and 2023, environmental performance outpaced economic performance, indicating a strategic shift towards long-term sustainability goals.

Tesla uses WARP Drive Enterprise Resource Planning (ERP) system to integrate operations across financial, production, and staff functions (*ERP Research* n.d.) and several energy-focused information systems for managing and optimizing its energy products, including Autobidder, Powerhub, Microgrid Controller, and Opticaster (*Tesla Energy Software | Tesla Support*, n.d.), see Table 3 for details.

IS name	IS Type	IS functionality
WARP Drive	ERP	supports real-time, collaborative, and integrated operations across finance, production, and staff functions (*ERP Research* n.d.)
Autobidder	Energy Management and Trading System	real-time market bidding for energy assets (*Autobidder | Tesla Support*, n.d.)
Powerhub	Monitoring and Control System	managing in real-time distributed energy resources, renewable power plants and microgrids (*PowerHub | Tesla Support*, n.d.)
Microgrid Controller	Monitoring and Control System	managing microgrid stability, optimizing energy resources, balances energy supply and demand by integrating battery storage, solar, and generators (*Microgrid Controller | Tesla Support*, n.d.)
Opticaster	Business Intelligence System	maximize economic benefits and sustainability objectives for distributed energy resources (*Opticaster | Tesla Support*, n.d.)

Table 3 Table with information systems names, types and functionalities used by Tesla

Tesla's ERP system, WARP Drive, plays a significant role in integrating all business processes and operations to achieve superior business goals alongside sustainability and social responsibility ones (*ERP Research n.d.)*. The other systems emphasize integrating sustainability within economic performance, operations, management and control. Tesla used Autobidder and Opticaster functionalities to make profitable and sustainable investment decisions in renewable energy solutions, energy storage and deployment and electric vehicles manufacturing businesses, due to their functionalities of evaluating sustainable resources from both economic and environmental perspectives. Tesla used Powerhub and Microgrid Controller to evaluate the efficiency of energy and renewable resources usage, this supports Tesla to reduce CO_2 emissions, water usage and to replace the traditional resources such as fossil fuel with energy and renewable resources.

5.2 Amazon

Amazon is recognized globally as one of the biggest technology companies, being considered one of the Big Five American technology companies, engaged in e-commerce, cloud computing and artificial intelligence. Amazon was ranked as the 11th sustainable company in the world. (Buchholz, 2023,).

Based on Telsa's sustainability reports from 2020, 2021, 2022 and 2023, the following environmental data (see Table 4) was collected and analyzed (see Figure 5):

Year	**Carbon Emissions (Million/ 100 MT CO2e)**	**Carbon Emissions reduction rate**	**Renewable Energy (%)**	**Renewable Energy Growth rate**
2020	0.6064	0%	65%	0%
2021	0.7154	-18%	85%	31%
2022	0.7074	1%	85%	0%
2023	0.6882	3%	100%	18%

Table 4. Table with Amazon's environmental metrics and growth rates from 2020, 2021, 2022 and 2023 Amazon sustainability impact reports

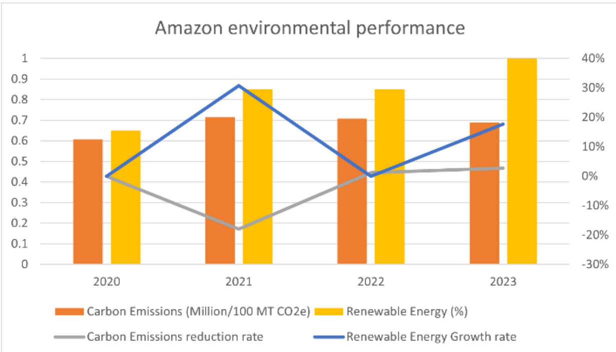

Figure 5. Amazon's environmental outcomes performance over 2020, 2021, 2022 and 2023

The environmental metrics that reflect Amazon's environmental performance are CO_2 Emissions and Renewable Energy Rate. Based on the 2020 – 2023 sustainability reports, Amazon's main decision-making outcomes that lead to the year-over-year increases and decreases of these metrics are: expansion in logistics and data centers to support e-commerce demand, made improvements in its supply chain, made investments in wind and solar projects across the globe, launched its Climate Pledge Fund and moving towards Amazon's Climate Pledge goal of achieving net-zero carbon by 2040.

Based on Amazon's sustainability reports from 2020, 2021, 2022 and 2023, social responsibility is represented by KPIs such as "Diversity in Workforce" and "Safety Initiatives". Amazon's decision-making outcomes that lead to attaining these KPIs were appointing more than 70% Black directors/VPs in 2021, launched and pursuing DEI trainings, expanding and developing health and safety measures.

Based on Amazon's financial reports, the following financial data (see Table 5) was collected and analyzed (Figure 6):

Year	Net Revenue (Billion $)	Net Income Growth Rate	Operating Income (Billion $)	Operating Income Growth Rate
2020	$386.10	0%	$22.90	0%
2021	$469.80	22%	$24.90	9%
2022	$513.90	9%	$12.20	-51%
2023	$575	12%	$36.90	202%

Table 5. Table with Amazon's financial metrics and growth rates from 2020, 2021, 2022 and 2023 Amazon financial reports

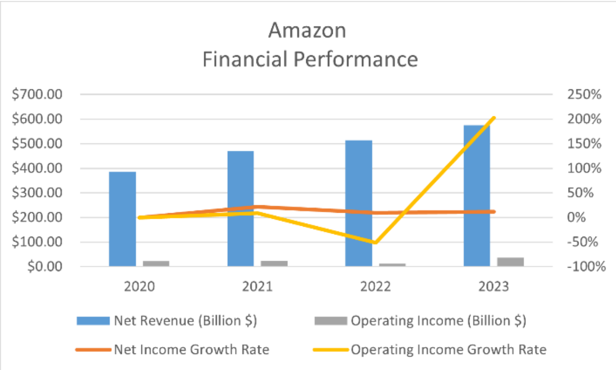

Figure 6. Amazon's economic outcomes performance over 2020, 2021, 2022 and 2023

The main decision-making outcomes that led to the performances of net revenue and operating income were focused on the e-commerce demand during pandemics, expansion of Amazon Web Services (AWS), investments made in logistics and improvements in cost management. However, pandemic-related costs, increased wages, inflations, and supply chain disruptions led to a drastic drop in operating income between 2021 and 2022.

Based on the environmental and economic data from Tables 4 and 5, the following analysis (Figures 7 and 8) was made to compare the environmental metrics performance against economic metric performance and environmental performance against economic performance:

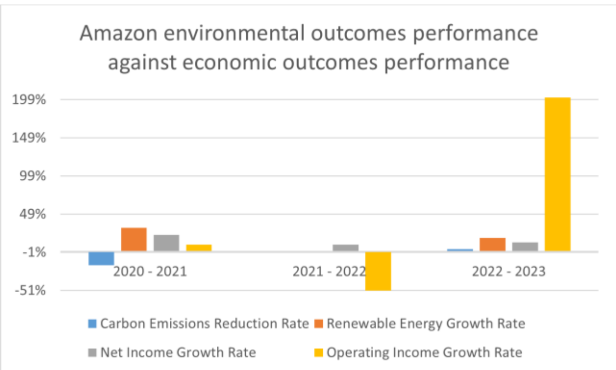

Figure 7. Amazon's environmental outcomes performance compared to economic outcomes performance over 2020-2021, 2021-2022 and 2022-2023

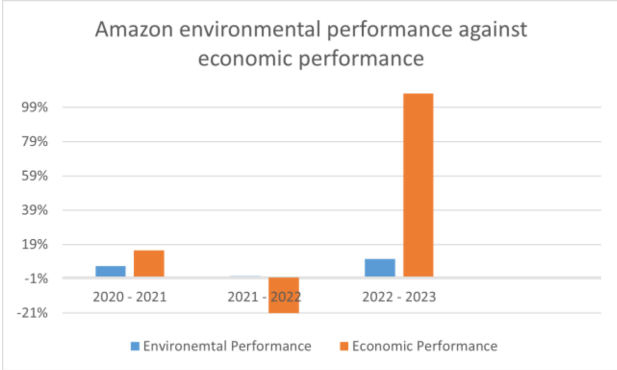

Figure 8. Amazon's environmental performance compared to economic performance over 2020-2021, 2021-2022 and 2022-2023

Based on this graph, it can be seen that Amazon attained its best balance between environmental and economic performances between 2020 and 2021, when Amazon set the environmental goal to to power its operations with 100% renewable energy by 2025, invested in manufacturing of electric vehicles, expanded its renewable energy projects and achieved significant revenue growth due to pandemic. However, the pandemic safety costs and the rapid scale of operations led to an increase in CO_2 emissions of 18% and a drastic decrease in operating income, leading to low environmental and economic performances. During 2022 and 2023, Amazon optimized the efficiency of its operations, attained 100% renewable energy within operations target and improved its economic measures. However, there can be observed that Amazon focused more on attaining economic stability and improving its profitability after attaining its environmental goal, leaving environmental progress to a modest level.

Amazon uses SAP as its ERP system to integrate operations across order management, financials, HR, purchasing, and receiving/inventory control (*ERP Research* n.d.) and Amazon Cloud Services (AWS) as a cloud-based information system that contains multiple packages and functionalities. (*Amazon Web Services*, n.d.)

IS name	IS Type	IS functionality
SAP	ERP	integrate operations across order management, financials, HR, purchasing, and receiving/inventory control *ERP Research* n.d.)
AWS	cloud-based integrative system	cloud computing and storage, data analytics and AI, environmental tracking and supply chain and inventory management applications (*Amazon Web Services*, n.d.)

Table 6 Table with information systems names, types and functionalities used by Amazon

Amazon uses the SAP ERP system to integrate all operations and processes to attain superior business goals alongside sustainability and social responsibility ones (*ERP Research* n.d.). AWS functionalities of high-performance computing for large datasets and real-time monitoring support Amazon to track environmental impact data, such as renewable energy and water usage, across its facilities and supply chain, manage CO_2

emissions and improve operational efficiency by analyzing usage and waste patterns (*Amazon Web Services*, n.d.). AWS functionalities of data analytics and AI support Amazon to monitor the delivery of electric vehicles, optimize route efficiency and reduce the carbon intensity for achieving net-zero emissions by 2040. AWS functionalities of environmental tracking and inventory management support Amazon to track renewable energy investments and commitments, manage its portfolio of wind and solar projects and the broader Amazon Climate Pledge initiative.

5.3 Monitoring and Control Systems' role in tracking environmental, social and economic outcomes

Table 7 summarizes the key findings and insights that describe how Monitoring and Control Systems (MCS) support monitoring of environmental, social and economic considerations across organizational decision-making performance:

Study	What Was Measured	Key Findings
Wang, L., Abbou, R., & Da Cunha, C. (2022)	Impact of production planning and control systems on sustainability indicators in closed-loop production systems.	Closed-loop production systems using integrated planning and control enhanced resource efficiency and reduced energy consumption, directly supporting sustainability outcomes.
Management control for sustainability (2021b)	Integration of Management Control Systems (MCS) with Sustainability Control Systems (SCS) and their alignment with sustainability strategy.	The integration of MCS and SCS facilitated collaboration across management levels, aligning operational controls with sustainability strategy and leading to reductions in waste and emissions.
Wijesinghe, D., Jayakumar, V., Gunarathne, N., & Samudrage, D. (2023)	Effects of health and safety-focused MCS on sustainability in the mining sector, specifically accident reduction and compliance improvement.	MCS implementation significantly reduced workplace accidents and improved regulatory compliance, enhancing social sustainability outcomes by supporting employee welfare and safety.
Dharmayanti, N., Ismail, T., Hanifah, I. A., & Taqi, M. (2023a)	Influence of Sustainability Management Control Systems (SMCS) on eco-innovation and financial sustainability in supply chains.	SMCS enabled better alignment of eco-innovation with resource efficiency and cost-effectiveness in supply chains, demonstrating positive effects on environmental and economic sustainability.
Jutidharabongse, J., Imjai, N., Pantaruk, S., Surbakti, L. P., & Aujirapongpan, S. (2024)	Relationship between MCS, dynamic capabilities, and sustainable performance during crisis (COVID-19).	MCS, combined with dynamic capabilities, increased resilience and sustained performance during crises, showing MCS's role in supporting both environmental stability and economic continuity.

Table 7. Table with summarized literature review of the main articles, measurements used and key findings of how MCS tools enhance the monitoring, controlling and optimizations of environmental considerations.

These articles investigate and explain the roles, functionalities and the strategic impact MCS pursue in enhancing sustainable outcomes within organizations.

The implementation of monitoring and control systems support organizations to better align environmental, social, and economic indicators within decision-making processes and organizations can address the challenges concerning the alignment of financial and non-financial goals better (Beusch et al., 2021, Wang et al., 2022). Moreover, studies indicate that MCS are not only used to monitor outcomes but are also instrumental in making strategic decisions that enhance sustainable outcomes. MCS optimize resource utilization, ensuring that organizations minimize waste and energy consumption and high-impact sectors like mining and manufacturing use MCS to implement safety and environmental strategies, showcasing their role in reducing waste and improving safety standards, which ultimately contributes to sustainability. (Beusch et al., 2021, Wang et al., 2022, Dharmayanti et al., 2023)

5.4 Business Intelligence Systems' role in reporting environmental, social and economic performances

Table 8 summarizes the key findings and insights that describe how Business Intelligence systems support balancing and reporting of environmental, social and economic considerations across organizational decision-making performance:

Source	What was measured	Key Findings
Petrini and Pozzebon (2009b)	Integration of socio-environmental indicators	BI helps incorporate socio-environmental indicators into organizational strategies, enhancing transparency and aligning reporting with sustainability goals. This integration supports long-term environmental, social, and economic planning.
Abu-AlSondos (2023)	Data Quality, Visualization, BI Management	Emphasizes that BI improves data quality and visualization, crucial for accurate strategic decision-making. High-quality, visually clear data enhances environmental and social reporting, ensuring stakeholders receive reliable insights.
Seddigh et al. (2022)	BI in Sustainable Supply Chains	BI systems positively impact sustainable supply chains by enhancing transparency and real-time monitoring of economic, social, and environmental indicators, crucial in complex sectors like pharmaceuticals.
Hodinka et al. (2014)	BI in Environmental Reporting	BI, powered by XBRL (eXtensible Business Reporting Language), optimizes environmental data reporting by standardizing data extraction and processing, leading to improved accuracy and efficiency in environmental outcome reporting.

Table 8. Table with summarized literature review of the main articles, measurements used, and key findings of how BI tools enhance environmental, social and economic reporting

These articles explain the capabilities of business intelligence (BI) tools that can be leveraged by organizations in analysis and reporting. BI systems significantly contribute to integrating socio-environmental indicators within organizational strategies, particularly through data structuring and visualization, by consolidating and managing large datasets and improving data accuracy, completeness, and accessibility (Petrini & Pozzebon, 2009, Abu-AlSondos, 2023).

Seddigh et al. (2022) mentioned in their study on supply chains that BI systems play a role in ensuring compliance with international sustainability standards (e.g., United Nations Sustainable Development Goals). BI tools can be leveraged by organizations to address sustainability challenges related to supply chain (functional department involved in operational decision-making), to track environmental and social data across to improve transparency and address sustainability challenges promptly. Hodinka et al. (2014) discuss the use of BI in environmental reporting, especially through XBRL (extensible Business Reporting Language), which enhances the Extract, Transform, Load (ETL) process, reduces errors associated with data collection and analysis and increases the efficiency of environmental, social and economic data reporting.

5.5 Enterprise Resource Planning (ERP) systems' role in integrating environmental, social and economic decision-making outcomes within operational processes

Table 9 summarizes the key findings and insights that describe how ERP systems support the integration of environmental, social and economic considerations within organizational decision-making processes:

Source	Measurement Focus	Key Findings
Barna (2022)	ERP's role in digitalization for sustainability	ERP systems help organizations reduce resource wastage and align operations with sustainability standards, supporting environmental and economic integration.
Anaya and Qutaishat (2022)	Activities aligned with sustainability principles in ERP implementation	ERP systems enable integration of sustainability in operations, enhancing both economic growth and compliance with environmental principles, demonstrating ERP's strategic benefits.
Tarigan et al. (2021)	ERP impact on Green Supply Chain Management (GSCM) and internal integration	Enhanced ERP supports green supply chain initiatives by promoting efficient resource use and reducing environmental impact through internal and supplier integration.
Estébanez (2024)	Satisfaction in sustainable ERP (S-ERP) implementations in SMEs	S-ERP implementations facilitate eco-friendly practices and resource optimization, contributing to environmental sustainability in SMEs through lifecycle assessments.
Agarwal (2024)	ERP integration with CRM for sustainable practices	ERP and CRM systems collectively enhance sustainability by optimizing resource use, supporting data-driven decision-making, and aligning business processes with environmental and social goals.

Table 9. Table with summarized literature review of the main articles, measurements used and key findings of how ERP systems enhance the environmental, social and economic factors within organizational processes.

These articles explain the roles of ERP systems in the digitalization of business processes, helping organizations to comply with sustainability standards and to align economic and environmental performance with organizational goals. The main findings suggest that implementation of ERP systems either by large-size organizations or small and medium enterprises (SMEs) lead to improvement of sustainable outcomes.

Anaya & Qutaishat (2022) find that ERP systems can drive business growth and sustainability by incorporating sustainability principles throughout the ERP lifecycle. Organizations use the ERP systems functionalities to pursue data-driven decisions that reflect into environmental, social and economic outcomes. Environmental benefits are associated with waste reduction, resource usage optimization and streamlining the business processes, especially in the supply chain industry (Tarigan et al., 2021). Economic benefits are associated with reduction of costs associated with materials procurement, production and operations (Barna, 2022). Social responsibility benefits are associated with the capabilities of ERP and customer relationship management (CRM) systems to enhance communication and collaboration between organizations and their stakeholders, such as communities, suppliers, customers and environmental partners (Anaya & Qutaishat, 2022).

6. CONCLUSIONS

Based on the findings resulted from investigating "How do organizations balance environmental, social and economic considerations within their decision-making processes?.", we can see that both Tesla's and Amazon's environmental, social and economic outcomes are aligned to the principles of Triple Bottom Line, ESG and Stakeholder Theory. These theoretical frameworks provide guidelines that describe sustainability integration into decision-making processes. The findings also indicate that Amazon and Tesla, through strategic deployment of information systems as a competitive tool for attaining sustainable performance, succeeded in successfully balancing environmental, social and economic considerations.

Moreover, we can observe that Tesla balanced more efficient environmental and economic performances compared to Amazon, and Tesla has better information systems architecture than Amazon. Both organizations possess ERP systems, however Tesla possesses a more diversified information systems architecture compared to Amazon, which relies only on the different modules and packages of the cloud-based systems AWS. These insights indicate that information systems' deployment is related to fostering better sustainable outcomes.

The qualitative analysis pursued to investigate "How can information systems be effectively leveraged by organizations for attaining sustainable decision-making outcomes" started from the assumption that information systems, from a RBV perspective, are powerful tools that can be leveraged by organizations to enhance sustainable performance. The main findings indicated the importance of MCS in tracking sustainability metrics performance, business intelligence (BI) systems in reporting of environmental, social and economic data and ERP systems in integrating operations to achieve an efficient balance of environmental, social and economic outcomes.

The implication of further research can leave space for investigating the sustainability performance of organizations improvement before and after integrating the sustainability framework concepts into the core strategy and leveraging information systems for sustainability purposes.

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