

SUSTAINABILITY EVALUATION OF THE SUPPLY CHAIN UNDER THE GREENPACT: A FRAMEWORK PROPOSAL FOR THE TEXTILE SECTOR

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Abstract Sustainable development is a very broad and rich concept that refers to a global development model that presupposes the satisfaction of humanity's current needs without compromising its future. With the growing globalization, there has been a greater concern with promoting sustainable economic activities internally and in supply chains. Aligned with these concerns, this research study proposes to develop a framework for the analysis and classification of the companies' socio-environmental impacts to be integrated in the GreenPact. This is a digital sustainable supply-chain-as-a-service platform that promotes the creation and availability of sustainable products through the relationship between brands and manufacturers, thus fostering the development of more sustainable value chains. The project supporting this study is the result of a research partnership with Zenithwings, a high-tech company focused on providing services related to Research & Innovation in the areas of Precision Agriculture and Industry 4.0. It is intended that this research contributes to a greater awareness of the considerable socio-environmental impacts of the supply chains in the textile sector. It is also expected to highlight the importance of using performance indicators as key tools to verify whether companies adopt good practices for mitigating socio-environmental impacts.

Keywords:

sustainable development, sustainability, textile, supply chains, socio-environmental impacts, business assessment and classification

JEL:

L67, Q55, Q56

1 Introduction

The concept of sustainable development (SD) has distinct interpretations according to the researchers' adopted approaches. In this research it is considered that SD refers to a global development model, characterized by the use of scarce natural resources to satisfy people's current needs without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). Hák et al. (2016) have argued that transforming global society, environment and economy to a sustainable one is one of the most uphill tasks confronting humanity today. Since supply chains (SCs) are networks of companies and people, directing efforts towards the common good is extremely important (Egels-Zandén & Hansson, 2016). The management of material, information, and capital flow as well as cooperation among companies throughout the supply chain (SC), considering the Triple Bottom Line (TBL), is crucial (Seuring & Muller, 2008). TBL addresses the required balance between the economic, social, and environmental dimensions of Sustainability (Seuring & Muller, 2008). Organizations have sought to integrate sustainability goals into their internal operations and SCs to respond to pressure from various stakeholders, to ensure compliance with legal requirements established by government and/or to improve their performance and/or gaining competitive advantage (Khan et al., 2021).

The globalization of the textile industry has leveraged the complexity of SCs. The SCs of textile companies are globally dispersed and characterized by a strong social and environmental impact. This has put these companies under the spotlight when it comes to their involvement in social and environmental issues (Fraise & Seuring, 2015; Oelze, 2017). Many companies have made efforts to make their activities more sustainable. However, as pointed out by Oelze (2017), due to the characteristics of this sector "enhancing sustainability along the supply chain is often difficult". Although there is a lot of research on sustainability in the textile sector, the focus has been on the environmental dimension. Furthermore, there seems to be a lack of research focusing on the whole SC and sustainability (Gbolarumi et al., 2021; Li & Leonas, 2022). Studies addressing the performance assessment have been also privileged the environmental dimension and focused on some parts of the SC (Gbolarumi et al., 2021). Therefore, a research question is defined: what are the main indicators to evaluating the sustainability of companies in the textile sector in a SC perspective?

This research study proposes an experimental framework to evaluate the sustainability of companies' SCs in the textile sector, using performance indicators, allowing to verify if companies adopt good practices for minimizing socio-environmental impacts. This framework emerges as an output of part of project with Zenithwings, a Portuguese company that focuses on developing solutions for the Precision Agriculture and Industry 4.0 sector, to develop a digital sustainable supply-chain-as-a-service platform to the textile industry: the GreenPact. Information sharing facilitated by the use of information and communication technologies is an important enabler for the sustainability of SCs. These technologies play an important role in addressing supply and demand and in decision-making to configure and plan the SCs (Oelze, 2017). GreenPact mixes technology with sustainability, to improve the sustainability of production processes, which can be through the exchange of information in a SC, such as the assessment of socio-environmental factors of companies, to support decision-making.

The reminder of this study is organized as follows: after an introducing, section 2 presents a literature review. In section 3 it is presented the methodology. Following, section 4 describes the proposed framework for the assessment of organizations' socio-environmental impacts. Finally, the paper ends with a brief discussion and the mains conclusions.

2 Literature Review

Worldwide, countries are expected to promote an economic growth, by respecting the social and environmental concerns defended in the UN approach of SD. This concept is already an integral part of many businesses in different economic sectors and is involved in all stages of the manufacturing process, from the raw material supplier to the customer (Hassan et al., 2023).

The textile industry has become an extremely important sector, valued at three trillion dollars, and employing, directly or indirectly, one in six people in the world. It is estimated that the textile and fashion sector represent around 8% of global emissions of CO₂ (Accenture, 2022). The process of globalization of the textile sector affected SCs in different ways. Firstly, the relocation of manufacturing sites entailed a heavy environmental burden due to the great distances covered by transport to deliver products that respond to the new consumption behavior:

demand for greater variety and affordability of products. Secondly, many of the suppliers are in developing countries that have not only environmental regulations, but also less strict social ones (Köksal et al., 2017). On the other hand, textile firms offer products that have a significant social and environmental impact during their lifecycle (Oelze, 2017). Each stage of the SC is linked to specific considerations regarding sustainability. Clancy et al. (2015) highlight the impact of activities that take place in the upstream SC such as raw material sourcing, yarn or fabric production, or the manufacturing of the final product. For example, in the production processes, particularly in the dyeing, drying, and finishing phases, chemical products and non-renewable natural resources are intensively used, which harm the environment (De Brito et al., 2008). In addition, the use of some raw materials (e.g., fibres such as cotton, wool, or synthetic fibres) have a very significant environmental impact since they require a lot of water, pesticides, or energy in their transformation (Caniato et al., 2012). Therefore, it is essential to consider sustainability not only internally but from a SC perspective. Incorporating sustainability into the SC is becoming a key priority to many textile companies (Shen et al., 2017). In this line, Pichlak and Szromek (2022) argue that it is crucial that companies develop efforts to implement a sustainable system between production and the consumers, which requires the creation of eco-innovative products. However, the sector that lacks innovation to increase the efficiency of the SC, and solutions for end-of-life products.

Several instruments have emerged to guide organizations in the sustainability integration process (e.g., GRI Guidelines, Dow Jones Sustainability Index, ESG criteria, ISO 14001) with different approaches varying, among other aspects, in their purpose (reporting, monitoring, rating, management or performance assessment) (Neri et al., 2021)- For example, the “environmental, social and governance” (ESG) Criteria represent three relevant areas in companies throughout the production processes, and, as such, they feel the need to communicate the efforts they have made to minimize the socio-environmental impacts of their activity. The sustainability of a SC depends on the commitment of all those involved in a social and environmental responsibility strategy (Klimkiewicz, 2017). Several studies have sought to analyze how sustainability can be assessed in the textile sector, focusing on indicators, but without a perspective of the entire SC (Gbolarumi et al., 2021).

3 Methodology

The methodology used is Design Science Research (DSR), which is a six-phase approach that aims at devising a relevant solution (called an artefact) for a real-life field problem, bridging theory and practice (Naik et al., 2023). In Figure 1, a schematic view of the DSR process is shown duly adapted to this project. The project is currently entering phase 4. Thus, the focus of this paper are the first three phases.

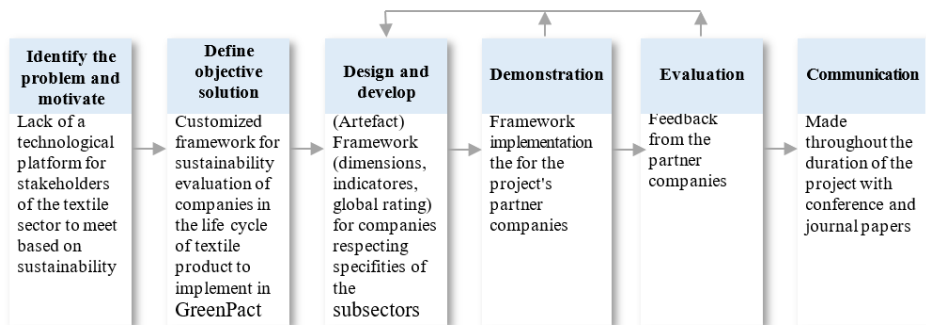


Figure 1: Project's customized DSR process

Source: Adapted from Naik et al. (2023).

Regarding the first phase, it is recognizable in the literature review. The second phase also incorporated the requirements: collect, segment and organize social-environmental indicators applicable to organizations in the textile sector, so that an assessment of related good practices can be produced and ranked based on gathered information.

For the third phase, inspiration was drawn from literature review and rating agencies, such as MSCI Inc., S&P Global Inc., FTSE Russell, Refinitiv, ISSInc., and ECPI S.r.l. These agencies are specialized in collecting and processing data, with the aim of providing relevant information to stakeholders, whether investors, managers or the final consumer. For this purpose, they develop systems for evaluating and classifying companies, in part based on non-financial information, like the one linked to sustainability. In this context, the framework was designed in three stages: i) the first was the unfolding of ESG criteria; ii) the second was the selection of the

performance indicators; and iii) the third was subsequent integration into the textile product SC.

4 Results: Framework Proposal

The proposed framework for this project has the final goal of structuring Zenithwing’s GreenPact technological platform regarding the textile sector.

| Criteria | Sub-criteria | Indicators | Textile Supply Chain Stages* | | | | | | | | |
|----------------------|-------------------------------------|--|------------------------------|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| Environment | Climate Change | Amount invested in research and development projects for environmental protection, % net sales | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Climate Change | Operation in sensitive areas of fauna and flora | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Water Consumption | Volume of water consumption, m ³ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Water Consumption | Proportion of recycled or reused water, % | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Water Consumption | Amount of toxic waste, mg/m ³ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Pollution & Waste | Atmospheric, water and soil pollution, mg/m ³ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Pollution & Waste | Proportion of recycled waste, % | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Pollution & Waste | Number of toxic, carcinogenic and non-carcinogenic molecules released, mg/m ³ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Pollution & Waste | Use of land for agriculture, livestock and landfills, m ² | ✓ | | | | | | | | ✓ |
| | Pollution & Waste | Prospecting for minerals and fossil resources | ✓ | | | | | | | | |
| | Pollution & Waste | Correct treatment of end-of-life products | | | | | | | | | ✓ |
| | Emissions | Energy consumption, mw | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Emissions | Percentage of energy from renewable sources, % | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Emissions | Carbon offset | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Social | Product Liability | Failures in the application of the general data regulation | | | | | | | | | ✓ |
| | Product Liability | Accidents caused by the product | | | | | | | | | ✓ |
| | Health & Safety | Accidents at work in one year | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Health & Safety | Total expenditure on product safety, % net sales | | | | | | | | | ✓ |
| | Human Capital | Discrimination occurrences | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Human Capital | Fulfilment of employment contracts | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Human Capital | Percentage of employed women, % | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Human Capital | Risk assessment for employees | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Human Capital | Fulfilment of universal basic rights | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Human Rights | Freedom to unionize | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Governance | Human Rights | Using child labour or forced labour | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Transparency & Reporting | Communication of sustainability reports | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Transparency & Reporting | Hiring external and independent audits | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Transparency & Reporting | Supplier sustainability control | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Transparency & Reporting | Apply anti-corruption measures | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Corporate Governance | Communication of financial reports | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Corporate Governance | Timely payments to suppliers and employees | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Corporate Governance | Collaboration with local communities | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Corporate Governance | Ambition in sustainable development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

Note *: Textile supply chain stages: 1: Raw material; 2: Raw material to fibre; 3: Yarn preparation; 4: Grey fabric; 5: Finishes fabric; 6: Apparel; 7: Use phase; 8: End-of-life

Figure 2: Framework to Sustainability Evaluation of the Supply Chain in the Textile Sector

Source: Authors’ research

The unfolding of ESG criteria is the theoretical cornerstone of the framework (see Figure 2). It provides structure, transparency and simplicity to the system. It was the result of a detailed analysis of the sub-criteria used by the rating agencies listed above. For the “Environment” criterion, the rating agencies under study tend to present a sub-criterion related to energy consumption, including CO₂ emissions; another sub-criterion is related to water consumption; a third criterion is related to pollution and

waste; and another broader topic is considered which be related to companies' investment in the environment, environmental opportunities, actions to combat climate change or even biodiversity. For the "Social" criterion, rating agencies commonly distinguish respect for human rights, human capital, occupational health and safety, and product liability. This criterion also highlights the relationships with the companies' surroundings, whether suppliers, stakeholders or the community. As for the "Governance" criterion, the two sub-criteria stand out, namely corporate governance and fiscal and ethical transparency. Figure 2 presents the proposed framework.

5 Discussion and Conclusion

SCs as organizational ecosystems must be managed with conscience to reduce socio-environmental impacts. In the specific case of the textile sector, the wide range of agents in the SCs make it difficult to objectively assess all the productive processes and companies involved and exacerbates the difficulty of specifying indicators for this sector. The GreenPact platform aims to facilitate communication between companies and contemplate the possibility of their rating. Considering the diversity of existing assessment instruments, the proposed framework, grounded on ESG criteria, summarizes the main indicators to assess the impacts on the different stages of the textile SC. This framework intends to be comprehensive enough to integrate the most important evaluation criteria, requirements of the GreenPact project. One of the main challenges in expanding the platform is approaching in detail the indicators to evaluate the companies. This may constitute a limitation of our study, as the framework may ignore some important indicators for these companies. Future research should validate this proposal with companies in the textile sector.

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