



UNIVERSIDADE ESTADUAL DE CAMPINAS
Faculdade de Engenharia Mecânica

TESE DE DOUTORADO

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Roadmap to enhance the insertion of social
sustainability in logistics systems considering
the Brazilian context

Roteiro para potencializar a inserção da
sustentabilidade social em sistemas logísticos
considerando o contexto brasileiro

CAMPINAS
2022

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PhD Thesis presented to the School of Mechanical Engineering of the University of Campinas in partial fulfillment of the requirements for the degree of Doctor, in the area of Materials and Manufacturing Processes.

Tese apresentada à Faculdade de Engenharia Mecânica da Universidade Estadual de Campinas como parte dos requisitos exigidos para a obtenção do título de Doutor em Engenharia Mecânica, na Área de Materiais e Processos de Fabricação.

Supervisor/Orientador: Prof. Dr. Rosley Anholon

ESTE TRABALHO CORRESPONDE A VERSÃO FINAL DA TESE DEFENDIDA PELO ALUNO VITOR WILLIAM BATISTA MARTINS, E ORIENTADA PELO PROF. DR. ROSLEY ANHOLON.

CAMPINAS
2022

Ficha catalográfica
Universidade Estadual de Campinas
Biblioteca da Área de Engenharia e Arquitetura
Rose Meire da Silva - CRB 8/5974

M366r Martins, Vitor William Batista, 1986-
Roadmap to enhance the insertion of social sustainability in logistics systems considering the Brazilian context / Vitor William Batista Martins. – Campinas, SP : [s.n.], 2022.

Orientador: Rosley Anholon.
Tese (doutorado) – Universidade Estadual de Campinas, Faculdade de Engenharia Mecânica.

1. Logística. 2. Sustentabilidade. 3. Modelos logísticos. 4. Desenvolvimento sustentável. 5. Objetivos de Desenvolvimento sustentável. I. Anholon, Rosley, 1979-. II. Universidade Estadual de Campinas. Faculdade de Engenharia Mecânica. III. Título.

Informações para Biblioteca Digital

Título em outro idioma: Roteiro para potencializar a inserção da sustentabilidade social em sistemas logísticos considerando o contexto brasileiro

Palavras-chave em inglês:

Logistics

Sustainability

Logistic models

Sustainable development

Sustainable development goals

Área de concentração: Materiais e Processos de Fabricação

Títuloção: Doutor em Engenharia Mecânica

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Robisom Damasceno Calado

Data de defesa: 10-02-2022

Programa de Pós-Graduação: Engenharia Mecânica

Identificação e informações acadêmicas do(a) aluno(a)

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- Currículo Lattes do autor: <http://lattes.cnpq.br/1169104147868277>

**UNIVERSIDADE ESTADUAL DE CAMPINAS
FACULDADE DE ENGENHARIA MECÂNICA**

TESE DE DOUTORADO ACADÊMICO

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sustainability in logistics systems considering
the Brazilian context**

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sustentabilidade social em sistemas logísticos
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A Ata da defesa com as respectivas assinaturas dos membros encontra-se no SIGA/Sistema de Fluxo de Dissertação/Tese e na Secretaria do Programa de Pós-Graduação em Engenharia Mecânica.

Campinas, 10 de fevereiro de 2022.

Acknowledgements

First of all, I would like to thank God for completing this thesis, I am sure that without faith nothing would be possible.

To my advisor, Professor Dr. Rosley Anholon, for his attention, guidance and dedication in the development of this work. Patient and tireless with guidelines aimed at the continuous improvement of research.

To the professors of this doctoral period. Especially to Professors Dr. Dirceu da Silva and Dr. Robert Eduardo Cooper Ordóñez who contributed a lot to my training process.

To Professors Dr. Renato Martins das Neves, Dr. André Cristiano Silva Melo and Denilson Ricardo Lucena de Nunes for their support and encouragement in this journey.

To all the friends of UNICAMP's Engineering and Management Teaching Research Laboratory for the partnership, support and learning. Especially the great friend Izabela Simon Rampasso for friendship and all shared knowledge.

To all respondents of the surveys, that enabled this research.

To my wife Renata Brabo Barra Martins and my son Joaquim Barra Martins who accompanied me, supported and gave me strength in moments of uncertainty.

To my family and friends. In particular, my mother Ana Maria Batista Martins for her conversations, advice, affection and confidence throughout my life.

To the Universidade do Estado do Pará - UEPA for the financial support that enabled the development of this thesis.

To everyone who directly or indirectly contributed in any way to this doctoral period, my sincere thanks.

Resumo

Esta tese teve como principal objetivo propor e validar um roteiro para potencializar a inserção de práticas de sustentabilidade social em sistemas logísticos considerando o contexto de empresas atuantes no Brasil. Para atingir este objetivo, quatro fases foram conduzidas. Na primeira fase, buscou-se compreender os métodos de transporte sustentáveis que têm sido utilizados, seu tipo, os benefícios e as dificuldades a partir de uma revisão sistemática da literatura. Nesta fase foi possível constatar as principais ações e métodos que vem sendo desenvolvidos para a promoção de atividades de transporte mais sustentáveis. Na segunda fase, identificou-se as práticas sustentáveis que vêm sendo desenvolvidas em sistemas logísticos por empresas brasileiras por meio da análise de conteúdo de 30 relatórios de sustentabilidade. Nesta fase identificou-se 22 diferentes práticas sustentáveis que vem sendo desenvolvida por empresas brasileiras. Na terceira fase, foi identificada a importância atribuída pelos profissionais brasileiros da área de logística em relação aos indicadores de desempenho para avaliação de sistemas logísticos sustentáveis, considerando os aspectos ambientais, econômicos e sociais. Para tal, uma *survey* foi conduzida junto a 50 profissionais atuantes no Brasil. Os resultados desta fase, apontam que profissionais atuantes na área logística no Brasil relegam a um segundo plano os aspectos sociais frente aos aspectos ambientais e econômicos. Portanto, a quarta fase consistiu na estruturação e validação de um roteiro para potencializar a inserção de práticas de sustentabilidade social em sistemas logísticos por meio do desenvolvimento de um DELPHI junto a profissionais da área de logística e sustentabilidade atuantes no Brasil. Como principais resultados desta fase, destaca-se que o roteiro validado contempla ações desde o atendimento e adequação das questões jurídicas relacionadas a sustentabilidade, passando pelo diagnóstico inicial da empresa, motivação e conscientização da importância da sustentabilidade social, seguida pelo incentivo da inserção de práticas de sustentabilidade social em atividades logísticas, e por fim, a identificação de oportunidades de melhorias e estabelecimento planos de execução dentro da organização. O roteiro validado converge para uma reestruturação e redefinição da cultura organizacional orientada para o atendimento das diretrizes sustentáveis, e também, contempla a dinâmica de busca pela melhoria contínua ao longo de todos os níveis e setores pertencentes a uma determinada organização. Analisando do ponto de vista prático, os resultados desta tese podem ser utilizados por profissionais que atuam na área de logística que visam potencializar a inserção da sustentabilidade social em atividades e operações nas quais estão inseridos, garantindo um melhor desempenho ambiental, econômico e social de suas organizações. Do ponto de vista teórico, pesquisadores também podem utilizar os resultados aqui apresentados como ponto de partida para pesquisas futuras, com o objetivo de validar os resultados em outros contextos e realidades, promovendo ainda mais a ampliação dos debates na área de logística sustentável, e ainda, consolidando em outros contextos um roteiro que potencializa a inserção da sustentabilidade social em sistemas logísticos. Quanto a originalidade e relevância é possível destacar a falta de pesquisas propondo meios para potencializar a inserção de práticas de sustentabilidade em sistemas logísticos, principalmente quando considerado os aspectos sociais. Além disso, para o desenvolvimento desta tese vale destacar a utilização de um conjunto de estratégias e métodos científicos tanto qualitativos quanto quantitativos.

Palavras-chave: Logística; Sustentabilidade; Sustentabilidade Social; Roteiro; Sistemas Logísticos; Brasil.

Abstract

This thesis had as main objective to propose and validate a script to enhance the insertion of social sustainability practices in logistic systems considering the context of companies operating in Brazil. To achieve this goal, four phases were conducted. In the first phase, we sought to understand the sustainable transport methods that have been used, their type, benefits and difficulties, based on a systematic literature review. At this stage, it was possible to see the main actions and methods that have been developed to promote more sustainable transport activities. In the second phase, the sustainable practices that have been developed in logistics systems by Brazilian companies were identified through the content analysis of 30 sustainability reports. In this phase, 22 different sustainable practices that have been developed by Brazilian companies were identified. In the third phase, the importance attributed by Brazilian professionals in the field of logistics about performance indicators for the assessment of sustainable logistics systems was identified, considering environmental, economic and social aspects. To this end, a survey was conducted with 50 professionals working in Brazil. The results of this phase show that professionals working in the logistics area in Brazil relegate social aspects to the background compared to environmental and economic aspects. Therefore, the fourth phase consisted of structuring and validating a roadmap to enhance the insertion of social sustainability practices in logistics systems through the development of a DELPHI with professionals in the field of logistics and sustainability working in Brazil. As the main results of this phase, it is highlighted that the validated script includes actions ranging from the service and adequacy of legal issues related to sustainability, through the initial diagnosis of the company, motivation and awareness of the importance of social sustainability, followed by the encouragement of the insertion of practices of social sustainability in logistic activities, and finally, the identification of improvement opportunities and establishment of execution plans within the organization. The validated script converges to restructuring and redefinition of the organizational culture oriented towards meeting sustainable guidelines and also contemplates the dynamics of seeking continuous improvement throughout all levels and sectors belonging to a given organization. Analyzing from a practical point of view, the results of this thesis can be used by professionals working in the logistics area who aim to enhance the insertion of social sustainability in activities and operations in which they are inserted, ensuring a better environmental, economic and social performance of their organizations. From a theoretical point of view, researchers can also use the results presented here as a starting point for future research, to validate the results in other contexts and realities, further promoting the expansion of debates in the area of sustainable logistics and consolidating in other contexts a roadmap that enhances the insertion of social sustainability in logistic systems. In relation the originality and relevance, it is possible to highlight the lack of research proposing ways to enhance the insertion of sustainability practices in logistics systems, especially when considering the social aspects. Furthermore, for the development of this thesis, it is worth highlighting the use of a set of strategies and scientific methods, both qualitative and quantitative.

Keywords: Logistics; Sustainability; Social Sustainability; Roadmap; Logistics Systems; Brazil.

Summary

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1 INTRODUCTION

1.1 Context of this research

Nowadays, the market is characterized by its high competitiveness, where the search for differentiation from competitors becomes a key factor in the process of performance and maintenance in the market Mennens et al. (2018) and Pacheco et al. (2019). With this, new demands of consumers come to the fore, resulting in new forms of management by companies, with a focus on increasing customer satisfaction Calabrese et al. (2018) and Tseng; Lim; et al. (2018). Therefore, to guarantee a solid base of performance and execution of its activities, it is important to develop strategies that guide companies to meet these new requirements.

Organizations are under pressure to adopt sustainable practices in the management of their activities that make up the supply chain since the logistics sector is considered one of the ones that contribute most to negative environmental impacts such as air pollution, global warming and the depletion of resources Limoubpratum et al. (2015) and Philipp; Militaru (2011). This scenario increases the need for logistics service providers to accelerate the insertion of sustainable guidelines in the development of their logistics functions Jazairy; Von Haartman (2019).

In view of this, the insertion of sustainability aspects in business processes appears as a strategic differential in the development of products and the provision of services Calabrese et al. (2018) and Tseng; Lim; et al. (2018). Research shows that customers are demanding increasingly sustainable products and services, and it is possible to perceive in recent years an increase in the amount of research discussing the insertion of sustainability guidelines in services as a strategy to direct the company to meet the needs of its customers. However, there is a scarcity of research that directly focuses on the inclusion of sustainability in logistics systems Calabrese et al. (2018). More specifically, the activities that make up the logistics systems are in evidence at the business level, simplified, according to Ballou (2004) as logistic systems formed by a set of activities that aim at the efficient management of the processes of planning, implantation and control of the flow of goods and provision of services.

In this context, the concept of sustainable logistics emerges in line with the concept of the Triple Bottom-Line (TBL), defined by Elkington (1998), which consists

of considering sustainability through the fulfillment of environmental, economic and social aspects. For Chhabra et al. (2018) the provision of services and products in accordance with sustainable aspects represents the organizational capacity in promoting environmentally, economically and socially sustainable logistics. Aldakhil et al. (2018) and Tseng et. al (2018) agree with this point of view and emphasize that the guarantee of a more sustainable future involves the development of logistical activities in a sustainable manner. Nilsson (2019) claim that the management of logistical activities is complex, as it is characterized by a large number of variables, parameters and restrictions, which makes it more challenging to achieve a balance between the three dimensions of TBL Lee; Wu (2014), Schaltegger; Burritt (2014) and Zaman; Shamsuddin (2017).

The importance of sustainable logistics is evident. However, Frayret et al. (2017) ponder that most organizations do not develop all TBL guidelines in their logistical operations correctly. For the authors, even with a comprehensive literature in the area, none of them presents a simple and objective way to correctly assess sustainable logistics systems. Lee and Farzipoor Saen (2012), Lee and Wu (2014) and Schaltegger and Burritt (2014) emphasize that the integration of traditional performance indicators with sustainability guidelines is an important step forward in the objective of more sustainable logistics. Therefore, companies must be trained about the TBL guidelines. Additionally, and in line with the TBL concept, the importance of the concept of sustainability governance arises, which refers to the guidelines for organizational decision-making processes, aiming to develop processes and activities in accordance with sustainable initiatives Ghabri (2022), Jallali; Zoghلامي (2022), Elsayed; Ammar (2020) and Stuebs; Sun (2015). Another important concept in this context is the circular economy, which consists of promoting a circular flow of resources, adding value and contributing to developmentally sustainable through an economic system. Kwarteng et al. (2021), Maldonado-Guzmán et al. (2020) and Del Vecchio et al. (2021).

According to the context presented, it is possible to perceive the importance of the development of means that enhance the insertion of sustainability in logistics systems.

1.2 Research Questions

Considering the importance of defining research questions to guide its conduct,

four main questions were defined that guided the development of this study:

- a) What are the overview of the utilization of sustainable transportation methods, the types of methods used and the benefits and difficulties in their use?
- b) What are the sustainable practices that have been developed in logistics systems by Brazilian companies?
- c) What is the importance attributed by Brazilian professionals in the field of logistics to analyzing a set of performance indicators to assess sustainable logistics systems considering environmental, economic and social aspects?
- d) What should a roadmap look like to design a path that enhances the insertion of social sustainability practices in the logistics activities of companies that develop operations in Brazil?

This thesis is presented according to the alternative format, according to INFORMATION CCPG N° 002/2018¹, Art. 2nd. Therefore, it is composed of a book chapter and three articles, related to each other. The book chapter was published in an encyclopedia organized by Springer, two articles are already published in international journals and the third will also be submitted to an international journal in the area. The publications detail are presented below:

- 1) Sustainable Transportation Methods, (2019). In: Encyclopedia of Sustainability in Higher Education. Springer. https://doi.org/10.1007/978-3-319-63951-2_192-1 (Book chapter);
- 2) Sustainability (ISSN 2071-1050): Journal Impact Factor: 3.251 (2020); 5-Year Impact Factor: 3.473 (2020). <https://doi.org/10.3390/su11154140> (First article);
- 3) International Journal of Logistics Management (ISSN: 0957-4093): Journal Impact Factor: 5.661 (2020); 5-Year Impact Factor: 5.286² (2020). <https://doi.org/10.1108/IJLM-02-2020-0091> (Second article).

¹ http://www.prpg.unicamp.br/argpdfnormas/old_20181011_INFORMACAO_CCPG_002_2018.pdf

² The information regarding journals' impact factors were take from InCites Journal Citation Report (<https://jcr.clarivate.com/JCRLandingPageAction.action?Init=Yes&SrcApp=IC2LS&SID=J5-i9KCs2F6Gilx2BmXr4zh8yGWWuk3i6yvtx2B-18x2dXnP4n6TGSKsPrQKQ8eH2vwx3Dx3DM5XzscJCLex2Fx2FvO4AfFXIPwx3Dx3D-03Ff2gF3hTJGBPDScD1wSwx3Dx3D-cLUx2FoETAVeN3rTSMreq46gx3Dx3D#>). Accessed in November 3, 2021.

1.3 Objectives

1.3.1 General Objective

This thesis aimed to propose and validate a roadmap to enhance the insertion of social sustainability practices in logistics activities considering the scenario of companies operating in Brazil.

1.3.2 Specific Objectives

Since this research was based on four macro phases, the specific objectives will be presented independently.

- 1) To initially understand the sustainable transport methods that have been used. Their type, the benefits and difficulties. For this, the following steps were taken:
 - a. Definition of a literature review protocol;
 - b. Execution of the literature review protocol and generation of associated debates.

- 2) To identify the sustainable practices that have been developed in logistics systems by Brazilian companies. This macro phase was conducted via the following steps:
 - a. Review of the literature on logistics systems and sustainability in logistics activities, to create a theoretical basis;
 - b. Collection of sustainability reports published by companies that perform logistic operations and that are recognized in Brazil;
 - c. Content analysis of the reports collected;
 - d. Discussion of results with the literature and establishment of conclusions.

- 3) To identify the importance attributed by Brazilian professionals in the field of logistics about performance indicators to assess sustainable logistics systems considering the environmental, economic and social aspects.
 - a. Systematic review of literature on sustainable logistics and

- performance indicators used in the context of sustainability;
 - b. Definition of the indicators used to construct the research instrument;
 - c. A survey carried out with professionals who act with logistics systems activities;
 - d. Cronbach's alpha run to identify the reliability of the research instrument; respondents grouping via cluster hierarchical analysis and data analysis using TOPSIS technique;
 - e. Establishment of conclusions about the findings.
- 4) Propose and validate a roadmap to enhance the insertion of social sustainability practices in logistics activities considering the context of companies operating in Brazil, using the steps below:
- a. Conduct a literature review;
 - b. Elaboration of the proposed roadmap;
 - c. Roadmap validation through a Delphi process developed with logistics and sustainability professionals;
 - d. Analysis of the results achieved and their implications for theory and practice;
 - e. Establishment of conclusions.

1.4 Originality and relevance

The management of organizational operations demands constant attention from the managers involved, who need to optimize their service flows, giving agility to the processes to avoid waste (Santos et al. 2020). Specifically, when it comes to the Brazilian context, companies are faced with limitations inherent to the operational capacity of the logistics sector, such as: failure in information management, dependence on road transport, lack of quality of port services, constant change in prices of fuels, lack of development of reverse logistics and the high cost of air transport. In line with this, it is still possible to highlight the pressure from society and customers in relation to the inclusion of sustainability in the development of logistics activities Camioto et al. (2017) and Martins et al. (2020).

Considering the context presented, the literature review developed and the initial

results achieved, it was identified the lack of research proposing ways to enhance the insertion of sustainability in logistic systems, especially those that considered social sustainability practices. Therefore, the objective of this thesis was established.

Another important point is the use of a set of scientific methods to validate the results of this thesis. The use of content analysis techniques in conjunction with statistical techniques also contributes to the originality of this research. There is little research in the literature that uses decision support techniques (for example, TOPSIS - Technique for Order of Preference for Similarity to the Ideal Solution) for studies related to the management area and these are pointed out as an important means for researchers to carry out exploratory studies on little-explored topics. It is important to emphasize that the results of this research are original since no other research has carried out the methodological procedures used for this purpose.

Analyzing from a practical point of view, the results of this thesis can be used by professionals working in the logistics area who aim to enhance the insertion of social sustainability into activities and operations, guaranteeing better performance in your companies. From a theoretical point of view, researchers can also use the results presented here as a starting point for future research, aiming to validate the results in other contexts and realities, further promoting the expansion of debates in the area of sustainable logistics, and in addition, consolidating a roadmap that enhances the insertion of social sustainability in logistics systems.

1.5 Thesis development strategies and structure

In addition to this introductory chapter, this thesis comprises three more chapters. In chapter 2, the book chapter and the three articles developed in this study are presented. Initially, the text corresponding to the chapter of the published book was developed, which corresponded to the identification of the panorama of sustainable transport methods through the use of a literature review protocol, this publication served as the basis for the first understandings in the area of sustainable logistics. Then, continuing the development of the thesis, the strategy adopted was the identification of sustainable practices that have been developed by logistics companies operating in Brazil, this was done through the analysis of the content of sustainability reports published by such companies. The main result showed that logistics organizations

operating in Brazil still relegate social aspects to environmental and economic aspects (first article). Then, in view of the results achieved, it was adopted as a research strategy to identify the perception of professionals working in the area of logistics regarding the importance that such professionals attribute to sustainability issues in logistics activities, this was done through the analysis of a set of performance indicators in the area of sustainable logistics. The results indicate that professionals in the area also still relegate social issues to the background of environmental and economic issues (second article).

Considering the results achieved, the objective for the third and final article that composes this thesis was defined as the proposition and validation of a roadmap to enhance the insertion of social sustainability practices in logistics systems of companies operating in Brazil. This was done through the elaboration of the script based on the literature and its validation with professionals in the area using the procedures of the DELPHI technique. As a result, it was possible to propose and validate a script aligned with sustainable social objectives and that permeates a restructuring of the organizational culture and has the ability to promote the continuous improvement of the organizational processes of companies in the logistics area operating in Brazil according to the professionals participating in the study.

The chapter 3 presents the discussions of the results achieved, relating the findings in each phase of the study. Finally, in chapter 4, the conclusions of this research and proposals for future research are presented. The references used, authorizations from the Research Ethics Committee and authorizations from the publishers for the use of published works are listed at the end.

2 BOOK CHAPTER AND ARTICLES

This section presents the book chapter and articles that compose this thesis.

The book chapter is entitled “Sustainable Transportation Methods”. It was published in the Encyclopedia of Sustainability in Higher Education by Springer Nature, Switzerland, AG 2019. The main objective of this chapter was to understand the sustainable transport methods that have been used, their type, the benefits and the difficulties in using them.

The first article is entitled “Sustainable Practices in Logistics Systems: An Overview of Companies in Brazil”. It was published in Sustainability Journal from MDPI. This article aimed to elaborate an overview of sustainable practices developed in logistics systems by companies in Brazil.

The second article, “Brazilian logistics practitioners’ perceptions on sustainability: an exploratory study”, was published in the International Journal of Logistics Management. The research presented in this article aims to identify the comparative importance attached to Brazilian professionals when considering 33 performance indicators to assess sustainable logistic systems.

The third article, “Roadmap to enhance the insertion of social sustainability in logistics systems considering the Brazilian context”, will also be submitted to an international journal in the area. The research presented in this article proposes and validates a roadmap to enhance the insertion of social sustainability practices in logistics activities considering the scenario of companies operating in Brazil.

In the next chapter, the connections between them will be explored.

S

Sustainable Transportation Methods



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Definition

Sustainable transportation methods may be defined as the means by which transportation takes place in line with the principles of sustainability, which, for instance, entails as little CO₂ emission as possible in urban mobility and process management in organizations.

Introduction

Nowadays, the use of the concept of sustainability is discussed in much research around the world, a fact that has resulted in the dissemination of divergent conceptual interpretations according to the objective of each piece of research, resulting in a

considerable increase in its importance. In this chapter, we look at how concepts of sustainability serve current demands without compromising the ability of future generations to meet their own necessities, providing an improvement in the quality of life for society.

To ensure a sustainable way of life, it is necessary to integrate three specific areas, known as the triple bottom line, being economic equity, the environment, and social development. Regarding the economic aspects, the interconnected global systems are highlighted that demand integrated actions to promote solid growth for long periods and at the same time ensure that no community will be left behind. In reference to the environment, it is necessary to concentrate the efforts in the adequate use of natural resources by solutions that are economically viable, aiming to reduce the resources consumption, pollution, and maintain natural habitats. Social development is related to securing employment, food, energy, health services, education, water and sanitation, and beyond this, to secure cultural and social diversity and labor rights and train all members of the society to participate in determining their future.

According to Jha et al. (2013), sustainability in transportation usually refers to the contribution to the sustainable development of a community that has and uses a certain system. Traditionally, the development of transportation infrastructure is based on guidelines that minimized the initial operation costs and emphasized traffic mobility considering social and environmental necessities.

Recently, global concerns about climate changes, environmental impacts, and limited financial resources illustrate the necessity of a different approach in the selection of transportation solutions. Hence, there is a growing desire to provide environmental sustainability in the transportation infrastructure system. A sustainable transportation system must be safe, healthy, available, and renewable, working in a fair way and limiting the emission of polluting gases and the use of non-renewable resources.

This discussion is justified by the fact that the transportation sector is a booster of global economic development. It is emphasized that this theme is important to the public and private sectors that together must constantly concentrate efforts for the development and continuous improvement of the triple bottom line.

Against this background, this chapter proposes to present an overview of research about sustainable transportation methods, highlighting the principal practices that are being used in the world and evidencing their advantages, obstacles in the practice of using them, and the research methods and strategies used. Methods used to optimize urban mobility are considered, along with reductions of pollutants (CO₂) and improvements in transportation management in the organizations considering their supply chain.

In this chapter a systematic literature review was adopted as the research strategy, since it considers the peculiarities and parameters of sustainable transportation methods. The stages corresponded to the definition of the publication periods considered, the keywords, the database, and the criteria of inclusion and exclusion of the articles. After this, relevant information was extracted, the information synthesized, and, finally, the creation of this chapter. The details can be seen in the Appendix A.

Sustainable Transportation Methods

The utilization of sustainable transportation methods is defended throughout the world, aiming in a general way to reduce energy consumption and the emission of polluting gases.

Below is presented an overview of the methods that are being used for the improvement of urban mobility, the reduction of pollutants, and the management of industrial processes (supply chain). It is highlighted that the activities and operations of transportation are important for economic development, allowing goods and services to flow between the zones of production and demand, besides the mobility and accessibility of the population. Sustainable transportation methods aim to reduce the social and environmental impacts during the execution of transportation activities.

Urban Mobility

Sustainable transportation methods focus on the improvement of urban mobility aiming to ensure access and the fast movement of the population in big urban centers. Urban transfers usually involve many means of transportation, and transit can occur using different transportation modals.

Hsu and Wang (2015) defend the promotion of sustainable transportation ensuring accessibility and mobility. The authors discuss the idea of the use of different ways of transport to secure a reduction in environmental impacts. The utilization of electric buses combined with vehicles of rapid transit is more efficient alternatives in terms of energy instead of the use of conventional private cars. However, users still prefer to use private vehicles due to the speed of travel. The focus of the discussion is in the means of transition from the use of conventional private cars to the use of different ways of transportation by integrating terminals aiming to reduce the time of travel from origin to the destination. Another point to be analyzed is the low rate of occupation of collective transportation, because this scenario aggravates the environmental impacts.

In relation to the rate of collective transportation occupation, Guimarães and Junior (2016) say that the evaluation of the performance of the urban transport of passengers is relevant, because it has economic, environmental, and social impacts. The authors used in their research the concept of eco-efficiency for the evaluation of the performance of the transportation system in the State of Rio de Janeiro, in Brazil. The route analyzed was Rio-Niterói. The big ferries had the best

performance compared to the conventional ferries, and according to the authors, this can be explained by the fact that, although the ferries have the biggest capacity between the evaluated alternatives, they also have a low rate of occupation (32%). Analyzing the conventional bus, a performance level very like the ethanol-powered cars was identified that also can be explained by the occupation rates (96% for the bus, against 23% for those cars powered by ethanol). Beyond this, the cars that use gasoline had the worst performance, being the most used alternative. Analyzing the actions that could increase the occupation of the means of transportation; the necessity of the integration of the modals, fares, attendance pattern; and quality of the available infrastructure was identified. Such integration of the aforementioned criteria is important to enable the use of means of transport.

Analyzing the impacts and the effects of the economic crisis in relation to the promotion of the usability of sustainable transportation, Galanis et al. (2017) did research in the city of Volos in Greece (of about 130,000 residents) where a survey was applied with 605 random participants in 2013. It aimed to identify, firstly, the demographic data, the purchasing power, the possession of bicycles, and the private vehicle and driver license ownership. Then the respondents presented their possibilities to change their means of transportation in routine and recreational transit, comparing the time before and during the economic crisis. Moreover, they answered about the personal and road safety and security when using bicycles as transportation. The results show that citizens changed their habits of transportation during the years of economic crisis in Greece in favor of ways of sustainable transportation, and according to the authors, this position is justified by the increase of unemployment and decreasing personal income, with people choosing public transportation, bicycle, or walking instead of the use of private vehicles. The conclusion is that an economic crisis has a positive impact on sustainable mobility favoring the ways of transportations which are economic, environmental, and sociable.

Bachok et al. (2015) did research centered on the applicability of indicators of international

sustainable transportation in an important region of Malaysia, known as Klang Valley. The research strategy used was a case study by an electronic survey applied to the relevant professionals in the transportation field (transportation planners, traffic engineers, public operators and transportation managers, transportation economists, environmentalists, academics and researchers, as well as urban and regional planners). The research focused on the level of the public transportation service. The sustainability of the public transportation in Klang Valley could be achieved by the implementation of a consistent and coherent evaluation of the performance indicators of transportation.

Still, analyzing the development of the public transportation system, Patlins (2017) made a study aiming to define sustainability in this scenario. The research consisted of a bibliographic review where it was verified that the analysis and comparison of the transportation systems in different cities and countries, as well the analysis of the future requirements of the transportation system is the theme of much research in many European countries. It was identified that there is still no definition in the literature of principles of sustainable development for public transportation systems. What is noticed is that much discussed in the literature are the aspects related to development of the urban transportation systems, but not from the point of view of sustainable development. The author sought to improve the definition of sustainability, aiming at the development of the transportation system. These systems cannot be sustainable without understanding environmental sustainability. The sustainable development of the public transportation system is an aspect of global sustainability and must be measured quantitatively by indicators.

In reference to mensuration, Jha et al. (2013) made a quantitative analysis of the sustainability and green transportation by considering a project of a roadway and its maintenance planning. The results pointed out that, when the maintenance cost is considered in the planning, a different result is obtained being slightly cheaper when the cost of the roadway maintenance is not considered. This means that if all the factors are the

same, it can allow a solution of a sustainable roadway if the cost of maintenance during its cycle life is incorporated in the planning stages of the roadway.

Reduction of CO2 Emission

Buwana et al. (2016) did research in Kasongan City, capital of the Katingan district. The increase of the use of roads instead of the Katingan River, considered initially the principal means of transport in the region, is justified by the fact of the increase of motorcycles, which reached 91.9% in 2013. The transportation sector contributed around 53.33% of the total emission of CO₂ produced per year. The research discussed important criteria regarding the choice of the most appropriated alternative to develop sustainable transportation systems using the analytic hierarchy process (AHP). The results showed that the best alternative is to optimize the integrated systems of roadway – water transportation using terminals integrated at strategic points in the region. Social acceptance becomes the principal aspect that must be met to increase economic activity. The authors believe that this strategy can increase the use of public transportation and consequently reduce CO₂ emissions.

Mehar et al. (2014) produced research about sustainable transportation systems that aim to reduce pollution and the emissions of greenhouse effect gases. The focus of the research was electric vehicles, where they described the components of sustainable means of transportation and their solutions, projects, and standardization. For the authors, a transportation system is composed of three principal categories: fleet management, schedule planning, and energy usage. These categories if managed and well planned provide a reduction of CO₂ emission in transportation activities.

The negative effects of transportation for the environment have led researchers to focus on green transportation programming in the last few years. According to Salehi et al. (2017), transportation activity has harmful environmental effects. This sector emits a considerable amount of

greenhouse gases. The authors believe that the efficient transportation scheduling/planning can decrease the harmful environmental effects and consequently improve supply chain operations. The trade-off between the transportation cost of a truck and the total emission of carbon as an index of environmental sustainability was analyzed. The model proposed by the authors allows for manufacturers and transportation companies to trade-off between the total costs of transportation and the total carbon emission. These practices of processes management and supply chain are detailed in the next section.

Process Management in Organizations

Lin et al. (2013) said that sustainable development in industry requires a transportation scheme more embracing of the operations of logistics services. Green logistics (GL) has increased as a tendency in the management of the distribution of goods and the collection of products at the end of their life cycle. The focus is on maximizing the economic and environmental value by recycling and emission control. The research focused on the practice of the delivery and collection of water bottles, proposing an optimization model based on generic algorithms to design an efficient ecological transportation scheme in terms of economic and environmental costs in direct and reverse logistics.

Khan et al. (2017) affirm that the sustainable supply chain performs an important role in the environmental and financial questions of an organization. In the last few decades, companies were showing a greater tendency to implement favorable practices for the environment in their business. There is no doubt that some motivating factors exist in relation to sustainable development, as financial gains cost reduction in terms of recycling, reutilization, and remanufacturing. On the other hand, the pressure from customers and strict governmental laws in relation to the environment also pushes the companies to adopt ecological practices. The results prove that green practices have a significant and positive association with company performance.

Conclusions

It is possible to produce an overview of the research already undertaken about sustainable transportation methods, highlighting the principal practices that are being used, pointing out their advantages, obstacles to the use in practice, and the methods and strategies of the research adopted. Considering the methods identified and used in urban optimization, reduction of pollutants (CO₂), and improvements in the transportation management in organizations, it is perceived that there is a quantitative divergence in the research done, when studied deeply, which highlights the large amount of research involving urban mobility by the analysis of the level of public transportation service in different regions in the world. It is important to point out there is a lack of research to analyze and propose sustainable transportation methods in organizations, more precisely methods to optimize the transportation activities of supply chains.

In relation to the research methods and strategies utilized, it is possible to highlight the case study, survey, bibliographic review, and the Monte Carlo simulation. In reference to the analysis tools, the following were identified: the usage of the AHP method, cost management techniques, definition and analysis of the usage of the performance indicators, the concept and definition of eco-efficiency, the usage of the concept of trade-off, and the development of an ecological transportation model by the generic algorithm.

Analyzing the advantages of the use of sustainable transportation methods, it was perceived that there is unanimous agreement in the research analysis about the approach given to the reduction of the pollutant gases as CO₂ in the atmosphere. Beyond this, it is possible to perceive the improvement of the conditions of urban mobility and the benefits generated in the companies' performance that cherish the use of sustainable practices. However, the high cost in the usability of sustainable transportation methods is highlighted and the population culture in relation to the non-utilization and identification of the importance in the use of those methods, a fact that has improved considerably over the years. Finally, it is believed that a greater amount of research must be undertaken, aiming at the development and improvement of sustainable transportation methods, analyzing their definition, importance, new practices, and the awareness of all involved, considering the social, environmental and economic benefits, to ensure the meeting of the current demand without compromising future necessities.

Cross-References

- ▶ [Sustainability Evaluation](#)
- ▶ [Transportation Impacts on Sustainability](#)
- ▶ [Transportation Optimization Measures for Sustainable Development](#)

Appendix A Parameters of the Review Protocol for Sustainable Transportation Methods

| LITERATURE SYSTEMATIC REVIEW | | | | | | |
|---|------------------------------|--|----------------|------------------------------|----------------------------------|----|
| Research Question: "What is the overview of the utilization of the sustainable transportation methods considering articles published between the years 2013 and 2017, the types of used methods, the benefits and difficulties in their use?" | | | | | | |
| Keywords | Period | Inclusion Criteria | Databases | Total of downloaded articles | Total of articles after criteria | |
| Sustainable transportation methods Green Transportation | January 2013 - November 2017 | Publications with proposition of the use of sustainable transportation methods Publications with comparisons between the sustainable transportation methods | Web of Science | 2 | 11 | |
| | | | PROQUEST | 1 | | |
| | | | SCOPUS | 31 | | |
| | | Exclusion Criteria | | ScienceDirect | | 11 |
| | | Publications where the keywords are not in the title, abstract or in the keywords Articles in non-English language | | | | |

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Article

Sustainable Practices in Logistics Systems: An Overview of Companies in Brazil

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Received: 12 June 2019; Accepted: 26 July 2019; Published: 31 July 2019



Abstract: The main purpose of this article is to present an overview of the applications of sustainable practices in logistic operations performed by Brazilian companies. To reach this objective, the following steps were carried out: (1) a review of the literature on logistics systems and sustainability in logistics activities; (2) the collection of sustainability reports published by companies that perform logistics operations, which are recognized in Brazil; (3) a content analysis of the reports collected and (4) a discussion of the results, cross-checked with the literature and the extrapolation of conclusions. It was possible to identify 22 sustainable practices, and these practices were grouped into five macro areas. The authors of this paper believe that the findings presented here can be useful for professionals and researchers in the implementation of sustainability practices in logistics systems.

Keywords: sustainability; logistics systems; sustainability reports

1. Introduction

Since the publication of the 17 sustainable development goals proposed by the United Nations (UN) [1–5], sustainability has become an important aspect of business management. The definition of sustainability proposed by the World Commission on Environment and Development (WCEED) is the most accepted in both academia and business. According to this report, “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [6], p. 41. Liu et al. [7] and Yun et al. [8] argue that this new context of business management requires organizations to critically evaluate their activities in relation to environmental, social and economic aspects.

Focusing on the industrial environment, Le et al. [9] argues that sustainability has become an important factor in competitive advantage for companies. Increasingly, society requires industries to develop sustainable practices throughout their manufacturing, supply and distribution operations [10,11]. Bask et al., Björklund and Forslund [12,13] corroborate this point of view which reinforces the need to better understand the role of sustainability in the development of logistics activities. Specifically, it can be seen in Brazil that the logistics sector has been evolving and consolidating rapidly in recent years to achieve a greater operational performance.

The inclusion of sustainable guidelines in the management of logistics activities is a topic of growing interest among researchers. Additionally, Bandeira et al. [14] and Stindt [15] argue that the

measurement of the sustainability of logistics activities can greatly contribute towards achieving the goals proposed by the UN. This is true specifically in relation to objective number 12, which is to ensure responsible production and consumption standards, as changes in production and distribution patterns are characterized as indispensable activities to reduce environmental impacts. However, according to Filho et al. [16], the requirement and importance of sustainable development goals are clear, yet there is a need for further research to clarify how these objectives can help to meet present and future sustainability challenges. According to Hong et al. [17], there is much to be researched in relation to the use of sustainability in logistics operations. These authors cite, for example, the need to better explore social aspects in these activities. Kim et al. [18] argues that there is still a lack of robust methods to analyze the social and environmental impacts of logistic activities in productive systems.

In recent years, sustainable logistics has been focused by academics, organizations and governments. This context can be defined as the analysis and promotion of sustainable procurement, sustainable transportation, sustainable packaging, sustainable distribution, reverse logistics, design and control of sustainable supply chain activities. It is important to highlight that most research carried out in this area focuses on the reduction of environmental impacts of logistics operations [19]. Therefore, it is important to mention that this research, besides analyzing sustainable practices in logistics operations related to environmental aspects, also presents discussions regarding social aspects.

Reefke and Lo [20] emphasize that the evaluation of overviews related to sustainable logistics can contribute to academic debates. Analyzing the literature, research presenting an overview of sustainable practices developed by Brazilian companies in logistic systems was absent. Considering this, the main objective of this research was defined: to create an overview of the sustainable practices developed in logistics systems by companies in Brazil. To reach this objective, 30 sustainability reports published by Brazilian companies were analyzed through content analysis.

In addition to the introduction section, this article has four more sections. Section 2 is dedicated to the presentation of theoretical reference in logistics systems and sustainability in logistics activities. Section 3 highlights the methodological procedures utilized, in order to enable replications. Section 4 presents the results of this study. Finally, Section 5 presents the conclusions and final considerations. The acknowledgments and references used are listed at the end.

2. Theoretical Background

This section is divided into two parts. The first part presents concepts, definitions and discusses the importance of logistics systems for business success. The second part presents the current research in sustainability in logistics activities.

2.1. Logistics Systems

Logistics refers to the managerial aspects pertaining to the acquisition, maintenance and transportation of materials, people and facilities. Corresponding to the process of planning, implementing and controlling the optimized flow of commodities, services and information from origin to destination, in order to meet customer demand [21], p. 540, [22,23]. According to Ballou [23], a logistics system is composed of several components which can be divided into key activities (management of the levels of services offered to customers, transportation, inventory and information flow management and order processing) and support activities (storage, materials handling, purchasing management, packaging design and maintenance of information). Logistics activities are strategic for companies and are critical for business success. Logistic planning is integral for a business's competitiveness and, for this, it is necessary to improve the performance of operations, integrate sectors of the company and provide logistics service with quality [23]. Companies should also consider the impact of logistics activities in sustainability [24,25].

One of the main aspects of a logistics system to be considered is the selection and definition of transportation modal [26,27]. According to Hauger et al. [28], this strategy is critical to company success. Moreover, the correct choice of transport modes enables better environmental and economic

results [29]. Zhou et al. [30] also reinforces this argument, and states that this aspect is essential for a more green logistics system.

Another interesting element of logistics is the strategy behind the programming and routing of vehicles. This requires the analysis of cargo capacity and the definition and the number of routes to be calculated. The planning of these activities can lead to additional problems and costs [31–34]. The definition and pricing of freight is an important activity for logistics systems. There are many variables to consider in this pricing and, according to Gavriilidis et al. [35] and Sánchez-Díaz [36], sustainability aspects must be considered in this analysis.

It is also important to analyze the service level offered to the clients of the logistics system. Boyacı et al. [37] argue that the optimized use of resources in order to satisfactorily meet the demands should be considered as part of the level of service offered to customers. According to Melović et al. [38], the need to meet customer's demands has gained attention in logistic strategies of companies in recent years.

Efficient warehouse management can also provide interesting gains to the whole logistics system. It is fundamental to the achievement of strategic operations that the planning of operational configuration of a warehouse takes into consideration the strategies of operations [39–41].

Aspects related to the definition, evaluation and relationship with suppliers, as well as strategies to define the period and quantity of purchases, are a routine part of a logistics system. According to Karuna et al. [41] and Miranda et al. [42], the correct choice of suppliers substantially increases the chances of success and improvement of business competitiveness. This is corroborated by Shi and Fung [43] and Andreasen and Gammelgaard [44].

In many companies recently there has also been a focus on packaging projects. The correct structuring of packaging optimizes the handling of a commodity, enables multiple configurations of storage, reduces losses by faults and allows greater security, among others. Efficient packaging design ensures the reduction of operational logistics costs, generates greater productivity and ensures competitive advantages [45,46].

Considering the aforementioned, the complexity of managing a logistics system is considerable. However, well-directed efforts in this context can improve productivity and business competitiveness.

2.2. Sustainability in Logistics Systems

This section aims to present the most up to date research related to sustainability in logistics activities. Through the synthesis of the studies presented, it is possible to note the importance of social, environmental and economic guidelines in these activities.

Aiming to highlight the importance of sustainability in logistics systems for business competitiveness, Eroglu et al. [25] conducted a study to evaluate the reaction of the stock market to the achievements of sustainability awards in logistics by some companies. The findings indicated that the stock market reacts positively to the presentation of these types of awards. Additionally, it was identified that this positive reaction was more significant than the reaction to other similar situations. This demonstrates that even shareholders recognize the importance of sustainability as a strategic factor for companies' survival.

Lu et al. [47] analyzed the insertion of sustainability in logistics operations of container terminals. The effects of internal practices (related to communication) and the collaboration of external practices (regarding suppliers, customers and subcontractors) on sustainable performance of operations was analyzed empirically. The findings demonstrated that both internal practices and external collaboration positively affects the sustainable performance of operations. In addition, Lu et al. [48] analyzed the effects of sustainable management in logistics operations in the port context. The results reinforced the fact that external collaboration is positively associated with internal management, and that this positively influences the sustainable performance of port operations.

Rai et al. [49] proposed an extensive list of indicators relating to the transportation of cargo with an operational goal (in support of urban policies and planning) to improve the service of sustainability.

In the same theme, Andersson et al. [50] also developed a framework of indicators. However, the focus was to measure sustainable logistics innovation in retail operations.

Cherrafi et al. [51] analyzed the relationship between green innovation practices and the performance of logistics chains. The findings showed synergistic effects between the adoption of practices and performance. The study showed that the practices that most positively affected the performance of logistics chains were eco-design, life cycle assessment, green manufacturing, reverse logistics and waste management.

Morgan et al. [52] performed a study which looked at the factors that influence the success of implantation of sustainable practices in logistics chains. Among other factors, they highlighted the commitment of resources as a fundamental aspect in order to obtain good results.

Bask et al. [12] examined the function of environmental sustainability in transport operations of companies providing logistics services. The findings showed that carrier companies, which operate globally, are the most interested in environmental subjects. This is due in part to external pressures, and partly because they see transport sustainability as a potential source of competitive advantage. However, due to the lack of widely accepted methods to measure the environmental impact of transport, companies cannot easily share costs and benefits of initiatives taken among supply chain members, nor can they use initiatives as marketing arguments to differentiate their offers [12].

The study by Watanabe et al. [53] suggests that for good performance of logistics systems it is necessary to consider the efficient use of technological resources of transformation, information processing and operations of handling and transport. However, there are no standard criteria or rules to evaluate such activities in the context of sustainability, which makes it difficult for companies to understand.

Finally, it is worth highlighting other studies that have addressed sustainable logistics practices in different contexts. Firstly, Murphy and Poist [54] aimed, through an empirical study, to provide an overview of the social responsibility in logistics, identifying key factors, strategies and functional impacts. González-Benito and González-Benito [55] identified essential factors for the adoption of management practices in logistics that impact on the environmental performance of the company through the analysis of two variables (the environmental pressure of stakeholders and the beliefs of its managers). Kim and Lee [56] also considered in their study the pressure of interested parties; however, they analyzed the eco-oriented culture in the company. Additionally, Colicchia et al. [57] evaluated the adoption of environmental initiatives in the contract logistics sector. They identified facilities and difficulties in the adoption of such initiatives, presenting new insights in theory and opening opportunities for new research on these topics.

Analyzing the research mentioned above on sustainable logistics, it is possible to verify the variety of objectives they present. This shows the efforts in literature to enlarge the debate on this topic. It is possible to highlight these efforts in the following themes: proposal of indicators to evaluate logistics operations; evaluation of the sustainable logistics impacts in a company's performance; identification of the factors that influence sustainable practices in logistics systems; analysis of the environmental aspects in the transportation sector and lack of criteria to evaluate the sustainability in logistics operations. Only one study had as main objective to give a general overview of social aspects in logistics; however, it had a different focus from our research.

According to the research presented, there is no article presenting an overview about the insertion of sustainability in logistics operations in Brazil. This research aims to fill this gap.

3. Methodology

For the development of this research, the following steps were carried out: (1) review of the literature on logistics systems and sustainability in logistics activities, to create a theoretical basis; (2) collection of sustainability reports published by companies that perform logistic operations and that are recognized in Brazil; (3) content analysis of the reports collected following the recommendations presented by Elo and Kyngeäs [58]; and (4) discussion of results with the literature and establishment of conclusions. Figure 1 summarizes the steps of research.

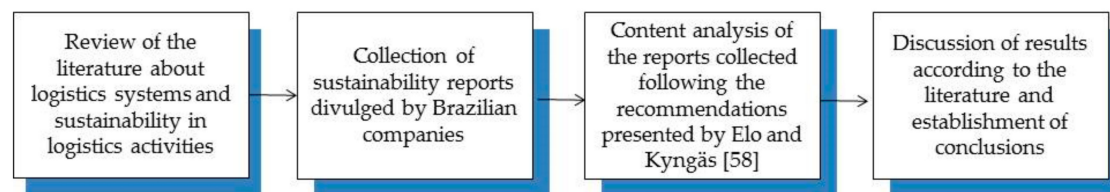


Figure 1. Steps of the research. (Source: Authors).

The literature review was conducted in the following scientific bases: Science Direct, Taylor and Francis, Springer, Emerald Insight and Wiley. Initially, to understand the concepts associated with logistics systems, the following terms were used: “logistics operations”, “logistics systems”, “warehouse management”, “purchasing management” and “supplier management”. Subsequently, in order to hone the search, the following terms were used: “sustainability in logistics systems” and “sustainability in logistics operations”. Several articles were analyzed in detail. The synthesis of the articles most related to this research was presented in Section 2.

The collection of sustainability reports was done through companies’ websites and published documents. There are some companies in Brazil that do not publish their sustainability reports annually, therefore, we considered the newest documents (between 2015 and 2018). In total, 30 reports were collected which comprise the sample considered in this study. According to the Global Reporting Initiative (GRI) [59], the reports enable organizations to publish their economic, environmental and social results. Additionally, they are able to present their strategies for contributing to sustainable development. Corporate sustainability reports have been used over the years by many researchers around the world, as they consolidate a large amount of relevant information regarding sustainability to be discussed and analyzed [60,61]. It should be noted that no studies were found that analyzed sustainable practices in logistics systems through information in sustainability reports published by companies.

Firstly, we did the sample characterization. After this, the reports were analyzed using the guidelines proposed by Elo and Kyngäs [58] in order to carry out the analysis of the content. According to these authors, a content analysis can be carried out in three phases: (a) preparation phase; (b) organizing phase; and (c) reporting the analyzing process and results.

In the preparation phase, the researchers must define the unit of analysis. Polit and Beck (2004), cited by Elo and Kyngäs [58], p. 109, argue that the unit of analysis may be a word or a theme. In our research, the unit of analysis was defined by the following theme: “Sustainable practices developed by Brazilian companies in logistics systems”. In terms of sample size, Duncan (1989), cited by Elo and Kyngäs [58], p. 109, argue that it should be representative. For this article, we selected 30 companies that were representative of the Brazilian economy and that had published sustainability reports between 2015 and 2018. Still in the preparation phase, the authors of this study read the sustainability reports to become familiar with the subject. Polit and Beck (2004), cited by Elo and Kyngäs [58], p. 109, recommend this familiarization, and highlight that no detailed analysis should be done without the researchers becoming familiar with the information.

After the preparation phase, there is the data organization phase. Elo and Kyngäs [58] mention that in this phase the study may assume deductive or inductive characteristics. Deductive analysis is performed when researchers aim to evaluate data using theories and models. Inductive analysis is recommended when there are no previous studies about the phenomenon, or the knowledge is fragmented. As previously mentioned, the study of sustainable practices applied to logistics activities developed by Brazilian companies is original and the current studies are focused on specific points and cases. Thus, we understand that the inductive analysis proposed by Elo and Kyngäs [58] is more adequate for our analysis.

For inductive analysis, Elo and Kyngäs [58] recommends performing the following steps: open coding, category creation and abstraction. Firstly, in the open coding phase, all material is analyzed and categories are freely created. Burnard (1991), cited by Elo and Kyngäs [58], p. 111, and Cavanagh

(1997), cited by Elo and Kyngäs [58], p. 111, argue that category creation increases the understanding of the phenomenon studied. In this research, during the coding phase, all sustainability reports were read and categories related to the information mentioned were created. Examples of these categories are: “practices associated with storage”, “practices associated with vehicle routing”, among others.

Following the recommendations of McCain (1988) and Burnard (1991), cited by Elo and Kyngäs [58], p. 111, the next step performed was to group the categories in “higher order headings”, known as “macro areas”. This was performed because many of the generated categories presented similar information, or they were close to each other in terms of themes. For example, practices related to modal choice, vehicle use and routing are close to each other in terms of themes, therefore, they were grouped together. Dey (1993), cited by Elo and Kyngäs [58], p. 111, points out that grouping categories into “higher order headings” requires comparisons among the data collected and this was done in this research. As a result of the grouping process, it was possible to obtain five macro areas; namely: 1: practices related to modal choice, vehicle use and routing; 2: warehouse practices; 3: practices related to suppliers and purchasing processes; 4: practices related to packaging management; and 5: expansive management practices and social programs.

The third phase of the inductive analysis is “abstraction”. According to Polit and Beck (2004), cited by Elo and Kyngäs [58], p. 111, in the abstraction phase the researcher tries to create a general formulation. In this research, during this phase, we aimed to establish an overview of the application of sustainable practices developed by Brazilian companies in logistic activities. According to Polit and Beck (2004), cited by Elo and Kyngäs [58], p. 112, when the authors show a link between data and results, the reliability of the study is increased; additionally, the authors must describe the results in detail and tables and attachments are helpful in this way to increase the reliability.

It is important to remember that Elo and Kyngäs [58] argue that content analysis is characterized by a great challenge and it must be very flexible. The same authors point out that there is no one correct way to perform the analysis of the content. Because of this, it is very important to describe all the steps taken and highlight the research limitations. The detailed description of this work in this section met this objective. We describe in detail the procedures performed, allowing other researchers to understand the steps done and increase the research reliability. The authors of this paper checked the results carefully and obtained a consensus that the findings are reliable.

The last stage of this research was characterized by the comparison between the results obtained in this research and information presented in the literature, the establishment of conclusions and writing of a final report. This phase corresponds to the stage “reporting the analyzing process and the results,” mentioned by Elo and Kyngäs [58].

4. Findings and Associate Discussion

The sustainability reports that were analyzed were published by companies operating in Brazil. These companies belong to 13 different economic segments, with emphasis on transportation (23%), food and beverages (17%) and e-commerce (13%). Figure 2 shows more details. It is worth mentioning that most of the reports analyzed follow the structure proposed by the GRI (83% of the reports), which facilitated the analysis. The authors of this paper believe that the fact that most of the companies use the GRI standard provides greater credibility to the information presented.

Table 1 presents the sustainable practices developed by companies grouped into five macro areas. The procedure used to group the practices was described in Section 3. It is important to emphasize that the five macro areas listed are found in logistic system components presented by Ballou [23]. We did not identify sustainable practices in some components presented by the mentioned author, thus, some components present by Ballou [23] were not listed in Table 1. Macro area 5 contemplates expansive management, sustainable practices and social programs. Figure 3 presents the percentage of companies that developed each sustainable practice identified in the macro area logistics considered.

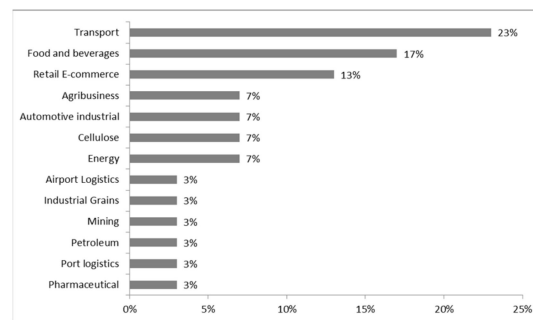


Figure 2. Distribution of companies analyzed according to segment of performance. (Source: Authors).

Table 1. Detail of the sustainable practices identified in each macro area. (Source: Authors).

| Macro Area 1: Practices Related to Modal Choice, Vehicle Use and Routing | |
|---|---|
| (1) | Use of electric vehicles. |
| (2) | Use of strategies to define the modal of transport to be used considering its transport capacity and the reduction of environmental impact. |
| (3) | Mapping the energy and/or fuel consumption of the vehicle used. |
| (4) | Planning of delivery routes contemplating the optimization and reduction of emissions of polluting gases. |
| Macro Area 2: Warehouse Practices | |
| (1) | Ergonomics and operational safety of the warehouse to improve working conditions. |
| (2) | Rainwater collection for use in warehouse operations. |
| (3) | Use of photovoltaic panels for power generation in warehouses. |
| (4) | Use of electric trolleys in warehouses. |
| (5) | Use of less polluting fuels in forklifts. |
| (6) | Mapping of waste in order picking operations. |
| Macro Area 3: Practices Related to Suppliers and Purchasing Processes | |
| (1) | Selection of suppliers considering their environmental practices, compliance with labor rules, code of conduct, anti-corruption program and sustainable certifications. |
| (2) | Programs for the development of suppliers with sustainable aspects. |
| (3) | Inclusion of social criteria and human rights in purchases processes. |
| (4) | Prioritization of purchase of inputs available in the local community. |
| Macro Area 4: Practices Related to Packaging Management | |
| (1) | Reuse, recycling and reverse logistics of packaging. |
| (2) | Reduction of the use of supplies in production of packaging. |
| (3) | Use of recycled material in the production of packaging. |
| (4) | Development of campaigns to encourage the use of more sustainable packaging. |
| (5) | Packaging design focused on the optimization of handling. |
| Macro Area 5: Expansive Management Practices and Social Programs | |
| (1) | Free transport for social projects. |
| (2) | Management actions focused on transparency and anticorruption. |
| (3) | Adoption of environmental and social rules such as ISO 14001 and Labor rules. |

Analyzing macro area 1 of logistics (practices related to modal choice, vehicle use and routing), it is possible to see that there are four different sustainable practices being developed by the analyzed companies. Among these, two stand out: (a) use of strategies to define the modal of transport to be used considering its capacity as transport and reduction of environmental impact, and (b) planning of delivery routes considering the optimization and reduction of emissions polluting gases. Both practices have been developed by only 27% of the companies analyzed. The other two practices identified in this macro area have an even lower percentage, with only 7% of companies using electric vehicles, and 10% of them performing mapping of the energy and/or fuel consumption of the vehicle used. Thus, based on the data reported, it is possible to see a small number of Brazilian companies

that have been developing sustainable practices related to modal choice, vehicle use and routing. This finding is worrying. According to Breunig et al. [31], scheduling and routing of vehicles can contribute significantly to a more sustainable development. This is corroborated by Hauger et al. [28], Zhou et al. [30] and Laghaei et al. [62].

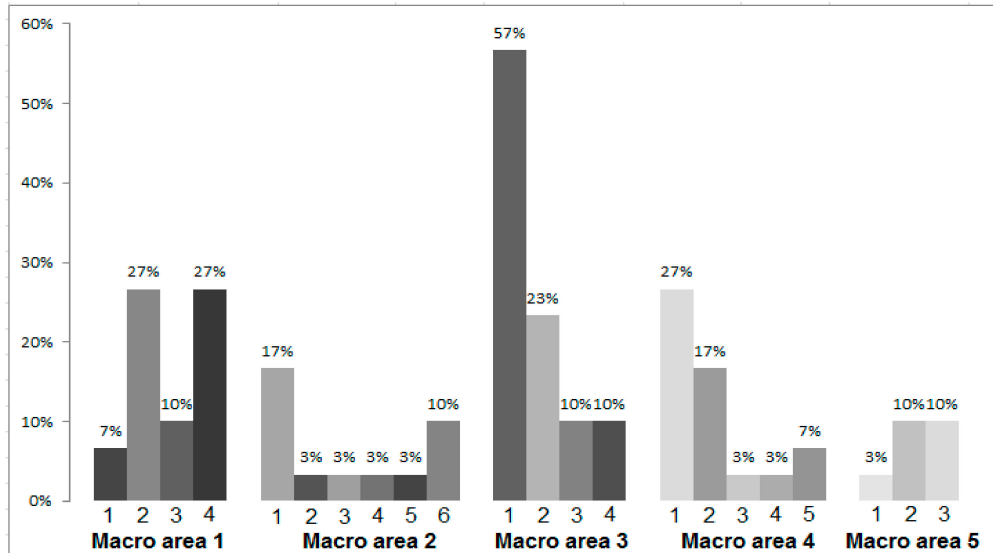


Figure 3. Percentage of companies that develop each practice identified in function of the logistic macro area (Source: Authors).

Considering macro area 2 (warehouse practices), it can be seen that it presents the greatest diversity in terms of sustainable practices identified (6 in total). Two of which should be highlighted: (a) ergonomics and operational safety of the warehouse to improve working conditions (with 17% of companies developing this practice) and (b) mapping of waste in picking operations (with 10% of companies developing this practice). The other practices are punctual, since the index of 3% corresponds to only 1 company. These practices are: rainwater collection for use in warehouse operations; use of photovoltaic panels for power generation; use of electric carts; and, use of less polluting fuels in forklifts. Similar to the previous macro area, it is noted that for the practices related to storage, the number of companies that have developed sustainable practices is still low. According to Makaci et al. [40], there is great potential for the development of sustainable practices in storage operations which can contribute towards a more sustainable future. Kang [63] argues that sustainable operations in warehouse activities improve productivity, safety and reduce adverse environmental impacts.

Macro area 3 (practices related to suppliers and purchasing processes) presents four different sustainable practices being developed by the analyzed companies. The practice regarding the selection of suppliers considering their environmental practices, compliance with labor rules, code of conduct, anti-corruption program and sustainable certifications stood out as the most developed practice by companies, with 57% occurrence. The practice of providing programs for the development of suppliers with sustainable elements, in turn, is developed by only 23% of the companies. The other practices in this macro area were identified in only 10% of the companies. According to Miranda et al. [42], the system of evaluation and careful selection of suppliers provides the observance of sustainable requirements and, in addition, positions the supplier as a strategic partner in the logistics operation. It can be seen, mainly through practice 1 of this macro area, that a good portion of the companies studied have been following the recommendations of Miranda et al. [42] and carefully selecting their suppliers. Despite the good results identified in practice 1, it is possible to observe many opportunities for improvement from a sustainable point of view. Large [64] argues that the achievement of sustainable goals requires joint actions between companies and their suppliers. Given the percentage reported in practice 2, it is still infrequent in Brazilian reality.

Considering macro area 4 (practices related to packaging management), it is possible to see that this area presents the second largest diversity of sustainable practices identified (5 in total). The most commonly used practices in this macro area are: (a) reuse, recycling and reverse logistics of packaging (being developed by 27% of companies) and (b) reduction of the use of inputs in the production of packaging (being developed by 17% of the companies). In a much smaller percentage of applications by the companies in the sample studied, there are practical packaging projects focused on the optimization of movement (7%); use of recycled material in the production of packaging (3%) and the development of campaigns to encourage the use of more sustainable packaging (3%). The authors of this article consider these numbers unsettling, as few companies develop activities that are integral for sustainable development. Crainic et al. [65] argues that packaging management allows a proactive integration of efficiency and attendance of sustainability aspects in logistics operations.

Analyzing macro area 5 (expansive management practices and social programs), it can be seen that this is the logistics area that presents the lowest diversity of sustainable practices (three in total). Practices regarding management actions aimed at transparency and anti-corruption, and the adoption of environmental and social norms are developed only by 10% of the companies. The practice of providing free transportation for social projects has an even smaller percentage, being developed by only 3% of the organizations. It can be seen that for the practices related to broad management systems and social programs, the number of Brazilian companies that are developing activities is still very low. Melović et al. [38] emphasize the importance of management systems for the continuous and sustainable growth of companies.

Finally, comparing the literature with the results obtained, we did not identify evidence of sustainable practices related to the following logistic activities: definition and pricing of freight; levels of services offered to customers and; execution of procedures for the operationalization of production and order separation. Therefore, it can be verified that there are many possibilities to develop and apply sustainable practices in these activities. The importance of points mentioned are corroborated by Sánchez-Díaz [36] and Lam et al. [66].

5. Conclusions

Based on the results presented, it is concluded that the main objective proposed for this research was achieved, as it was possible to develop an overview of sustainable practices performed by Brazilian companies in logistics operations. It was possible to identify a variety of sustainable practices developed within the five macro areas, but with a low degree of use by most of the companies analyzed. The practice that stood out was “supplier selection considering its environmental practices, compliance with labor standards, code of conduct, anti-corruption program and sustainable certifications”. This practice is developed by 57% of companies of the sample.

It is important to emphasize the role of the logistic system in the pursuit of sustainable development goal number 12, proposed by the UN. The mentioned goal consists of ensuring responsible production and consumption, with a focus on supply chain operations; adequate logistics management can contribute to the improvement of every supply chain agent, from producer to final consumer.

Regarding the limitations of this study, it should be noted that the results and conclusions obtained were drawn by the information provided by 30 Brazilian companies in their sustainability reports. Other samples composed by different companies can provide other results and conclusions. Also, the analyses were performed using information from these reports, therefore the conclusions were based exclusively on them. Another limitation of this study is related to the content analysis. Remembering Elo and Kyngäs [58], this kind of analysis can be very flexible and the definition of the free categories and groups depends on the researchers.

Regarding the theoretical and practical contributions, the findings presented in this article have implications for theory and practice. The results provide an overview of the application of sustainable practices performed by companies in Brazil regarding their logistic activities, and highlight areas with improvement opportunities. Academics and professionals that work with logistic systems can use the

results presented here. Academics can use the results in classes or future research and professionals, in turn, can use the findings to enhance the sustainability in their companies.

Finally, we present some future research opportunities: (a) development of sustainable practices and tools to improve the insertion of sustainability in logistics activities; (b) developing roadmaps to help companies in Brazil with the transition to sustainable logistics; (c) proposal of models to assess the maturity of logistics systems in terms of sustainability; and (d) conducting sector studies, to present specific characteristics.

Author Contributions: All the authors contributed equally to this paper. They performed the collection of sustainability reports, analyzed the data, and wrote the paper together.

Funding: This research was funded by Conselho Nacional de Desenvolvimento Científico e Tecnológico—CNPq—Brazil, grant number 307536/2018-1 and 305442/2018-0. Universidade do Estado do Pará—UEPA—Brazil, grant number 626/18.

Conflicts of Interest: The authors declare no conflict of interest.

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Brazilian logistics practitioners' perceptions on sustainability: an exploratory study

Perceptions on
sustainability

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Received 12 February 2020

Revised 19 April 2020

23 June 2020

Accepted 20 July 2020

Abstract

Purpose – Confronting globalization, logistics systems need to achieve greater efficiency in processes to be competitive. Competitiveness is not related only to economic aspects; companies need to perform their activities aligned to the triple bottom line concept. In this context, the main objective of this research is to analyze how Brazilian professionals think about sustainable logistics through an exploratory study.

Design/methodology/approach – A set of 33 indicators, compiled from a literature review, was used to develop a research instrument applied in a survey of 50 professionals working with logistics processes in Brazilian companies. First, the Cronbach's alpha was run to verify the questionnaire reliability. Respondents were grouped through cluster hierarchical analysis, and their answers were analyzed through TOPSIS technique.

Findings – The results from the sample analysis showed that Brazilian professionals think in the three dimensions of TBL when considering sustainable logistics systems; however, social aspects are relegated to a second level of importance when compared with environmental and economic indicators. In addition, it is possible to highlight that most important environmental aspects are directly related to economic objectives.

Originality/value – There are few studies examining sustainable logistics system in Brazilian companies that consider the purpose mentioned by evidencing originality in the same way as this current study. The results presented here can contribute to amplifying debates in the theme.

Keywords Sustainable logistics, Sustainability, Sustainable performance indicators, Brazilian logistics practitioners

Paper type Research paper

1. Introduction

Globalization has directly impacted logistics systems in pursuit of efficiency in processes. To be competitive, companies need to integrate sustainable concepts in logistics activities because environmental regulations and consumer pressure are increasing for more sustainable services and products (Chu *et al.*, 2019). In the academic literature, it is possible to find studies regarding sustainable logistics systems, showing the interest of



academia and market professionals within the mentioned theme (Bebbington and Thomson, 2013; Chandra and Kumar, 2019; Jozef *et al.*, 2019; Lee and Kim, 2011; Lee and Wu, 2014; Velasco *et al.*, 2018).

The logistics system is a set of activities considered strategic for the success of organizations. The activities are divided into key activities and support activities. Management of service levels offered to customers, transportation, inventory management, information flow and order processing are considered key activities. Storage, material handling, purchasing management, packaging design and information maintenance are considered support activities (Ballou, 2004; Dang and Yeo, 2018; Martins *et al.*, 2019). The efficient management of logistics activities is essential to companies reaching competitiveness. It is necessary to improve processes continuously, think in a systematic way and provide better services to customers. (Ballou, 2004; El-Berishy *et al.*, 2013; Irfani *et al.*, 2019a; Kuo *et al.*, 2019; Martins *et al.*, 2019). Additionally, Chen and Bibanda (2019) and Eroglu *et al.* (2016) argue that to be competitive, companies need to consider sustainability in logistical activities.

The concept of sustainability most used in the academic and business environment is proposed by UN World Commission on Environment and Development (Brundtland, 1987). According to this concept, sustainability is “*meeting the needs of the present without compromising the meeting of future demands*” (Brundtland, 1987, p. 16). More specifically, Liu *et al.* (2018), Yun *et al.* (2019) and Sirilertsuwan *et al.* (2018) show the concept of sustainability using *Triple Bottom Line (TBL)* definition. According to this concept (TBL), companies should consider environmental, economic and social aspects in their activities. Logistic systems should create value to companies and positive results to all stakeholders, such as job creation, poverty reduction and community development (Abbasi and Nilsson, 2016).

The concept of sustainable logistics consists in organizational ability to supply products and services aligned to sustainability guidelines, balancing environmental, social and economic aspects (Chhabra *et al.*, 2018). Aldakhil *et al.* (2018), Calabrese *et al.* (2018) and Tseng *et al.* (2018) agree with this point of view and argue that sustainable logistics contribute to the global agenda toward a better future. The management of logistics systems is a complex activity (Nilsson, 2019) because it involves consideration of a large number of variables, parameters and restrictions. The main challenge for managers in adopting sustainable practices in logistics processes is to define the correct balance among the three dimensions of TBL (Lee and Wu, 2014; Schaltegger and Burritt, 2014; Zaman and Shamsuddin, 2017).

The importance of sustainable logistics to companies' future is evident, as mentioned above; however, Furtado and Frayret (2015) highlight many companies do not correctly consider all TBL guidelines in their operations. The same authors argue that, although there are several propositions in the literature, none of them preset key performance indicators in a simple way to assess sustainable logistics systems correctly (Furtado and Frayret, 2015). Lee and Farzipoor Saen (2012), Lee and Wu (2014) and Schaltegger and Burritt (2014) agree with the statement, emphasizing that is necessary to integrate traditional performance indicators with sustainability guidelines.

In this sense, it is worth highlighting the efforts present in recent literature, in which it is possible to perceive a growing number of studies analyzing sustainability aspects in logistics systems (Hong *et al.*, 2018). However, it is possible to note that most of studies in this context do not carry out a comparative analysis among environmental, economic and social aspects. Thus, more debates are required about the importance of considering environmental and social aspects with economic issues (Lee and Wu, 2014; Martins *et al.*, 2019; Seuring and Müller, 2008). Stindt (2017) argue that there is lack of guidelines to support comprehensive analysis, especially regarding assessment of environmental and social performance, which hinders advances in corporate sustainability. The authors also argue that questions arise about how to measure and balance the respective indicators with traditional economic objectives. The increase in the number of researches in this context can be seen in studies of

Agrawal and Singh (2019), Davis-Sramek *et al.* (2020), Hojnik *et al.* (2020), Le *et al.* (2013), Liu *et al.* (2018), Torabizadeh *et al.* (2020) and Watanabe *et al.* (2018).

Focusing on the Brazilian context, it is possible to note that there are several studies related to sustainable logistics systems; however, few of them analyze environmental and social aspects in detail. Regarding the application of sustainable practices in logistics activities, few companies perform these. The explanation for this situation can lie with business focus, lack of strict legislation and low customer pressure (Alves and Nascimento, 2014; Hisano Barbosa and Andreotti Musetti, 2010; Martins *et al.*, 2019; Penteado Pinto Martins *et al.*, 2012).

In this scenario, the hypothesis is raised that Brazilian professionals of logistics system give less attention to social aspects when considering sustainable activities. In addition, environmental aspects are directly related to economic goals when considered. This hypothesis is corroborated by studies in other regions (Chhabra *et al.*, 2018; Khan *et al.*, 2019; Lee and Wu, 2014; Narayana *et al.*, 2019; Nikolaou *et al.*, 2013). In order to verify the hypothesis mentioned, the research presented in this article aims to identify the comparative importance attached to Brazilian professionals when considering 33 performance indicators to assess sustainable logistic systems.

Further to the introduction section, this paper presents four subsequent sections. Section 2 is dedicated to the theoretical background, highlighting the importance of sustainable logistics systems and the state of the art about the theme. Section 3 shows the methodological procedures used, allowing other researchers to replicate the study. Section 4 presents the findings and debates considering academic literature. Finally, Section 5 presents the conclusions and final considerations, as well as future research proposals. The references used are listed at the end of the paper.

2. Theoretical background

The logistics sector plays a significant role in global business environment and, in this context, it can make an important contribution to sustainable development goals. The sector mentioned, besides the economic contribution, can provide benefits to society regarding environmental and social aspects (Aldakhil *et al.*, 2018). Abbasi and Nilsson (2016) argue that sustainable logistics systems can generate value for companies at the same time as not harming the environment and contribute to people's better quality of life. Faced with this context, the theme has been attracting attention as an interesting topic for researchers, companies and society (Agrawal and Singh, 2019).

Despite the aforementioned importance, the current logistics sector is still responsible for the consumption of a considerable amount of energy resources and influences greenhouse gases emission (Dahmann and Röhrich, 2019; Rashidi and Cullinane, 2019). Aldakhil *et al.* (2018) argue with the point of view and highlight the consumption of fossil fuels, nonrenewable natural resources and air pollution.

Promoting a sustainable logistics system in companies is not an easy task because there are many variables to be considered simultaneously in a context of costs, organizational cultural issues, uncertainties, restrictions and different stakeholders' goals (Chakraborty *et al.*, 2020; Jamali and Rasti-Barzoki, 2019; Lan and Zhong, 2018). Furthermore, when present in companies, sustainable practices are more related to economic and environmental issues, leaving social aspects in the background (Chhabra *et al.*, 2018; Khan *et al.*, 2019; Lee and Wu, 2014; Narayana *et al.*, 2019; Nikolaou *et al.*, 2013).

According to Micale *et al.* (2019), most of the sustainable practices implemented for companies in logistics systems aims to reduce operational costs. They also highlight that environmental and social aspects of sustainability should be considered when designing and reengineering logistics operations. Kumar and Anbanandam (2020) corroborate this

statement and highlight that political aspects should also be considered in the insertion of sustainable practices in logistical system.

Melkonyan *et al.* (2020) state that sustainability needs to be integrated into logistics strategies of organizations, and in doing so, organizations must consider all aspects of value-adding and agile services delivered to clients, including fast delivery, price and sustainability, among others. Moreover, the authors argue that the demand for environmental-friendly products and services is increasing, which drive logistics systems to be redefined to accommodate such a mega trend, including aligning the organization strategy with the operation of the logistics component of supply chains, as Gruchmann *et al.* (2019) emphasize.

Martins *et al.* (2019) and Furtado and Frayret (2015) highlight the lack of evaluation models that consider the three pillars of TBL in logistics systems and can help companies in this way. Confronting this statement, the analysis of sustainable indicators to logistics system is very important and becomes a central issue for organizations (Chandra and Kumar, 2019; Irfani *et al.*, 2019b).

The literature presents different sustainable indicators and, to better understand them, the authors of this paper synthesized the information in a table (Table 1). It is important to observe two considerations about Table 1. First, the following table presents the indicators already segregated in TBL guidelines and shows the nomenclatures that will be used in the next section. Second, five of 33 indicators were classified as “general” because they incorporate more than one dimension of TBL.

It is worth highlighting some recent studies of literature review and bibliometric analysis carried out in the same context but with different objectives. Zhao *et al.* (2020) conducted a literature review to identify the most important topics, explore gaps in knowledge and recommend future directions in the context of sustainable logistics, specifically regarding sustainable transport. Their findings showed nine research topics, with emphasis on indicators of sustainable transport and performance models, corroborating the importance of indicators analysis developed here. Lan and Tseng (2018) developed a study to develop a set of indicators through the literature review for logistics in metropolitan regions to improve economic development of operations. This context is also related to the study developed here.

Another important review in this context was developed by Ahmad *et al.* (2019). The authors aimed to review indicators for the three aspects of TBL to be used in manufacturing operations. The authors found that the economic evaluation was mainly limited to cost-based indicators and that, from a social point of view, it considered aspects of the community as priority, leaving customers’ needs in the background. Abedini *et al.* (2020) also analyzed indicators considering the TBL concepts and identified that there is no holistic model considering the three pillars of TBL in the development of production operations. Therefore, comparatively analyzing the perception of logistics practitioners regarding the three pillars of TBL, it becomes important to deepen the debates in this context.

Hojnik *et al.* (2020) carried out a systematic review of the literature on sustainability indicators and validated through expert analysis, validated applying it in 18 different companies. Finally, the authors categorized the set of indicators proposed through TBL guidelines. Thus, it is possible to note the use of environmental, economic and social aspects of TBL in different contexts, in this case in the yachting industry. In addition to the study related to performance indicators for sustainable logistical systems, the authors of this article also analyzed the “state of the art” to the theme. Relevant studies were analyzed, and a synthesis of them is presented below.

Morana and Gonzalez-Feliu (2015) present in their study a proposal of indicators to assess sustainable performance of the urban delivery systems. During the research, indicators were chosen by managers individually and, subsequently, in small groups. It was possible to note different points of view, highlighting that professionals do not have a consensus about the theme. Still in the context of urban logistics, Rai *et al.* (2018) developed a research to define indicators to assess sustainable logistics of cities. The authors proposed a comprehensive set of indicators

| | Authors |
|--|---|
| <i>Environmental indicators</i> | |
| En_1 – Fuel consumption monitoring | Zaman and Shamsuddin, 2017 |
| En_2 – Analysis of adequacy regarding environmental policies | Buldeo Rai <i>et al.</i> , 2018; Chen <i>et al.</i> , 2018; Govindan <i>et al.</i> , 2016; Seguí <i>et al.</i> , 2016 |
| En_3 – Transport environmental impact assessment | Björklund <i>et al.</i> , 2016 |
| En_4 – Control of energy consumption | Asmone <i>et al.</i> , 2019; Björklund <i>et al.</i> , 2016; Bloemhof <i>et al.</i> , 2015a; Rai <i>et al.</i> , 2018; Chen <i>et al.</i> , 2018; Govindan <i>et al.</i> , 2016; Kalenoja <i>et al.</i> , 2011; Pilouk and Koottatep, 2017; Zaman and Shamsuddin, 2017 |
| En_5 – Measurement of total water consumption spent on logistics operations | Asmone <i>et al.</i> , 2019; Björklund <i>et al.</i> , 2016; Chen <i>et al.</i> , 2018; Pilouk and Koottatep, 2017 |
| En_6 – Amount of waste correctly destined | Govindan <i>et al.</i> , 2016 |
| En_7 – Measurement of the amount of use of sustainable materials in logistics operations | Govindan <i>et al.</i> , 2016 |
| En_8 – Monitoring of CO2 emission by developed logistics operation | Björklund <i>et al.</i> , 2016; Bloemhof <i>et al.</i> , 2015b; Rai <i>et al.</i> , 2018; Chen <i>et al.</i> , 2018; Govindan <i>et al.</i> , 2016; Kalenoja <i>et al.</i> , 2011; Morana and Gonzalez-Feliu, 2015; Sarraj <i>et al.</i> , 2014; Zaman and Shamsuddin, 2017 |
| En_9 – Elaboration and updating of environmental inventory | Chen <i>et al.</i> , 2018; Seguí <i>et al.</i> , 2016 |
| En_10 – Measurement of the amount of clean energy use | Asmone <i>et al.</i> , 2019; Routroy and Pradhan, 2014 |
| <i>Economic indicators</i> | |
| Ec_1 – Mapping of operational logistics costs | Govindan <i>et al.</i> , 2016; Kunadhamraks and Hanaoka, 2008; Pilouk and Koottatep, 2017; Routroy and Pradhan, 2014; Sarraj <i>et al.</i> , 2014 |
| Ec_2 – Measurement of the profitability of the logistics system | Irfani <i>et al.</i> , 2019a, b |
| Ec_3 – Quality assessment of after-care services | Govindan <i>et al.</i> , 2016 |
| Ec_4 – Average journey time per delivery | Sarraj <i>et al.</i> , 2014; Schulz and Heigh, 2009 |
| Ec_5 – Delivery reliability assessment | Govindan <i>et al.</i> , 2016; Kunadhamraks and Hanaoka, 2008 |
| Ec_6 – Total deliveries served per day | Schulz and Heigh, 2009 |
| Ec_7 – Distance traveled by total daily working time | Morana and Gonzalez-Feliu, 2015 |
| Ec_8 – Evaluation of order fulfillment time | Chae, 2009 |
| Ec_9 – Evaluation of the corporate image of the logistics system | Govindan <i>et al.</i> , 2016; Irfani <i>et al.</i> , 2019a, b |
| Ec_10 – Rate of filling capacity of means of transport | Sarraj <i>et al.</i> , 2014 |
| Ec_11 – Freight quantity fluctuation analysis | Lan and Tseng, 2018 |
| Ec_12 – Mapping of information sharing costs | Govindan <i>et al.</i> , 2016 |
| <i>Social indicators</i> | |
| So_1 – Measurement of employee satisfaction in the workplace | Irfani <i>et al.</i> , 2019a, b; Pilouk and Koottatep, 2017 |
| So_2 – Monitoring the impacts of operations on neighboring communities | Govindan <i>et al.</i> , 2016; Pilouk and Koottatep, 2017; Seguí <i>et al.</i> , 2016 |
| So_3 – Evaluation of occupational health and safety in the corporate environment | Govindan <i>et al.</i> , 2016 |
| So_4 – Social demands employability index | Govindan <i>et al.</i> , 2016 |
| So_5 – Participatory management index | Pilouk and Koottatep, 2017 |

Table 1.
Indicators listed from
the literature
(continued)

| IJLM | Authors |
|---|---|
| So_6 – Satisfaction rate of inhabitants of neighboring communities | Morana and Gonzalez-Feliu, 2015 |
| <i>General</i> | |
| Ge_1 – Assessment of long-term strategic objectives | Routroy and Pradhan, 2014 |
| Ge_2 – Assessment of the level of understanding of employees regarding sustainability | Seguí <i>et al.</i> , 2016 |
| Ge_3 – Number of suppliers that meet sustainability aspects | Björklund <i>et al.</i> , 2016; Routroy and Pradhan, 2014 |
| Ge_4 – Frequency of publishing sustainability reports | Seguí <i>et al.</i> , 2016 |
| Ge_5 – Analysis of the customer’s perception of the logistics process | Govindan <i>et al.</i> , 2016 |
| Table 1. | Source(s): See table |

related to freight transport aligned with urban policies. Using these indicators, local authorities can assess and improve urban logistical sustainability. Regarding this theme, the authors note a lack of understanding regarding the topic despite the negative impact provided on air pollution.

In the context of port logistics, [Chen and Pak \(2017\)](#) conducted a study to define a set of indicators to assess sustainable operations in three Chinese ports. The results present 21 indicators divided into six dimensions: liquid pollution management, air pollution management, noise control, low carbon regulations and energy savings, preservation of marine biology and management indicators. Still in the context of port logistics, [Carlucci *et al.* \(2018\)](#) conducted an analysis to define factors that affect the logistical and economic performance of 20 ports in Europe. The results of the mentioned study show that it is possible to increase economic value respecting standards of environmental quality.

Focusing logistical operations on vaccine distribution, [Chandra and Kumar \(2019\)](#) conducted a study to identify performance indicators to better control the Universal Immunization Program in India. The results provide contributions to management of the program, improve the performance of vaccine delivery and childhood immunization.

[Helo and Ala-Harja \(2018\)](#) analyzed the logistical activities of the food industry considering environmental aspects with the main traditional performance indicators. The analysis focused on aspects of order picking, transportation, storage and distribution. Through the indicators, it was possible to perceive the energy saving potential of logistical processes mentioned.

[Khan *et al.* \(2017\)](#) examined the relationship between environmental logistics performance indicators and specific growth factors in 15 different countries from 2007 to 2015. The results indicate that sustainable logistic systems improved the conscious consumption of energy, economic and sectoral growth of countries. Additionally, [Khan and Qianli \(2017\)](#) examined the association between economic and environmental indicators with the performance of sustainable logistics. It was possible to note foreign investments were attracted by environmental policies and practices in logistics operations, generating new opportunities.

In another study, [Khan *et al.* \(2019\)](#) analyzed sustainable logistics operations of countries belonging to South Asian Association for Regional Cooperation. The results showed that the consumption of fossil fuels is the center of logistics operations, and negative effects are generated on society and environment. There are many opportunities to improve environmental sustainability in terms of carbon emissions. The authors also point out the need for more studies that propose performance indicators for sustainable logistics systems.

Björklund and Forslund (2018) argue that more innovative organizational thinking is required to achieve the sustainability targets that logistics operations have currently. The authors also propose a set of logistic innovation indicators to identify the correlation between those indicators and the success of sustainable practices in the development and running of logistics systems. Golroudbary *et al.* (2019) emphasize that in order to better plan and undertaken the implementation of sustainability innovation, the negative environmental effects of logistics operations should be thoroughly evaluated. The authors claim that it is necessary to recognize, develop and promote sustainable practices and policies to ensure a fair balance among the economic and social elements of performance.

Analyzing the information mentioned above regarding sustainable logistics and performance indicators, it is possible to verify the relevance of the theme and their range. Many authors are developing studies in order to improve performance of sustainable logistics systems and enlarge debates about the indicators more adequate.

3. Methodological procedures

To develop this research, the following steps were performed: (1) literature review on sustainable logistics and performance indicators used in the context of sustainability; (2) definition of the indicators used to construct the research instrument; (3) survey carried out with 50 Brazilian professionals who act with “logistics systems” activities; (4) Cronbach’s alpha run to identify the reliability of the research instrument; respondents grouping via cluster hierarchical analysis and data analysis using TOPSIS technique; (5) establishment of conclusions about the findings.

The literature review was conducted on scientific bases Emerald Insight, ScienceDirect, Taylor & Francis, Springer and Wiley, aiming to find papers to establish the theoretical background and to list the set of indicators. The following terms were used in this process: “Sustainable logistics”, “Green logistics”, “Key indicators in logistics systems” and “Indicators in sustainable logistics”. In order to guarantee the robustness of the information and the possibility of replication in other researches, it should be noted that the procedures mentioned above were developed based on the systematic review of literature proposed by Xavier *et al.* (2017) and Denyer and Tranfield (2009). This approach consists of a protocol composed of the following steps: formulation of a research question; study location; selection and evaluation of studies; analysis and synthesis and reporting and use of research results. A summary of this protocol is shown in Figure 1.

The analysis of the literature allowed the construction of Table 1, and this content was used to structure the research instrument used in the survey. Using classifications presented in the literature, the indicators analyzed were grouped in triple bottom line dimensions. It is important to remember that five of them are classified in a general class because more than one dimension was contemplated.

In the research instrument (questionnaire), for each 33 indicators, the professionals consulted should indicate a note using a scale from 1 to 3. Note 1 referred to an indicator considered “not important” to assess sustainability in the context; note 2 to an indicator “important but not essential” to assess sustainability in the context and, finally, note 3 was associated with an indicator considered “essential” to assess sustainability in the context. The authors of this paper opted for a three-point scale because they believe that this choice allows respondents a more pragmatic direction of their perceptions.

The research instrument and other information related to this study were submitted to a research ethics committee and approved. It is important to remember that in Brazil research involving human beings, even as an opinion, needs to be appreciated by an ethics committee. This procedure is established by resolution 466/2012.

After approval, data collection with professionals began. An invitation was sent via email, and the questionnaire was available to respondents on the Google Forms platform for a

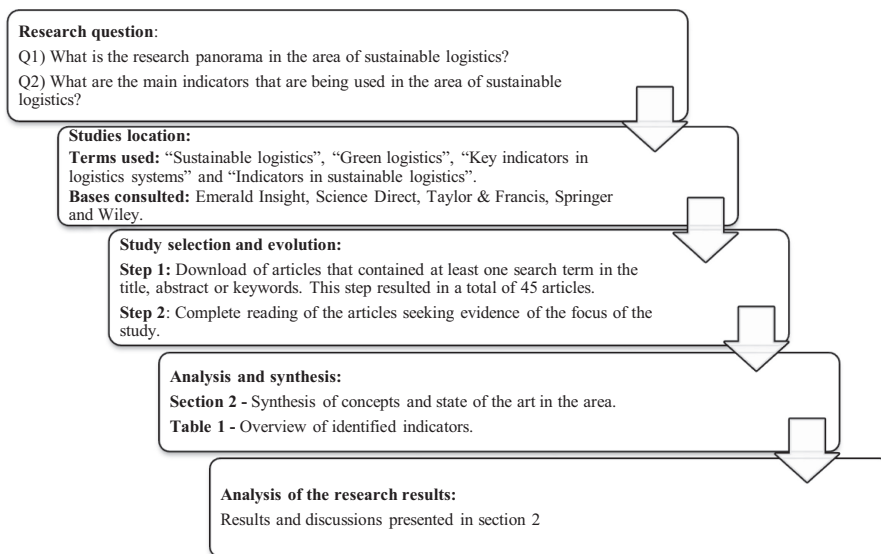


Figure 1.
Literature review
protocol

period of two months. The invitation via e-mail was sent to 206 professionals, and 50 of them accepted to participate (return rate of 24.27%). Regarding respondents' characterization, they are professionals who act in logistics Brazilian companies; 22% of them were directors, 14% coordinators, 36% managers, 10% supervisors and 18% analysts of logistics operations. Regarding experience, 32% have more than 20 years of experience, 28% have between 10 and 20 years of experience and 40% have less than 10 years of experience. In this sample, there are professionals from five Brazilian regions: 37% are from Southeast, 32% from North, 12% from Northeast, 11% from Northeast, 11% from South and 8% from Midwest. Therefore, it is possible to state that the sample represents the views of professionals from different regions. It was possible to weigh the opinion of each professional, considering the time of experience in logistics area and sustainability, scholar background and the job position they occupy in current company.

Once the database with the survey was obtained, the calculation of Cronbach's alpha was run to guarantee the research instrument reliability. This calculation followed the recommendations proposed by [Christmann and Van Aelst \(2006\)](#) and resulted in a coefficient value equal to 0.89, demonstrating the reliability of the research instrument used. Then, data analysis started through the hierarchical cluster analysis technique aiming to identify how the respondents are grouped in relation to their similarities in terms of experience in logistics area and sustainability, their scholar background and the job position they hold in the company. For each category mentioned, scores 1, 2 or 3 were assigned according to the details presented in [Table 2](#).

The hierarchical cluster analysis was developed based on the words undertaken by [Arbolino et al. \(2019\)](#) and [Malhotra \(2012\)](#). For the hierarchical cluster analysis, Ward method was used, in which the smallest variance increase between the groups is considered, being possible to verify the variance through the means of the variables of each group. Then, cluster analysis allowed the identification of the best segregation according to the number of groups considered most suitable for this analysis. The results of hierarchical cluster analysis can be presented in a graphical way using the dendrogram, in which it was possible to analyze the groups according to their hierarchy. This calculation was performed using the SPSS 24

software by using the following parameters: classification, hierarchical cluster, dendrogram, clustering method, Ward, Euclidean distance, Z score standardization, cluster analysis by cases and cut-off point for defining the groups the combined distance equal to 10. Five groups were generated, and their details are presented in the results section.

The data gathered from the survey were stratified into five groups according to hierarchical cluster analysis development. After that, to continue the analysis, the guidelines proposed by Singh *et al.* (2016) for the development of the TOPSIS technique were followed. According to the mentioned authors, TOPSIS allows the ranking of alternatives considering different analysis criteria. This method was used to allow the classification of alternatives considering different criteria (which can be weighted differently). This is precisely the case presented here because the authors of this article understand that professionals with greater experience in logistics activities, scholar background and the job position they occupy in the company interfere in their expertise and experience to evaluate the indicators considered in this study.

It is worth highlighting that the literature presents relevant studies that previously used TOPSIS method in the logistical context: Moon *et al.* (2015) analyzed the competitiveness of six transport routes between Korea and Europe evaluating criteria such as total transport distance, total transport time, total transport cost, service level and transport security; Pereira *et al.* (2020) analyzed lean warehousing practices performed in Brazilian companies context, in order to assess the most and the less adopted, in an exploratory character.

In this research, different weights were assigned to each of the five groups generated by the hierarchical cluster analysis as it can be seen in the results section. These weights were assigned based on the characteristics of each group considering the time of experience in the area, scholar background and the position in the company. Comparative ordering via TOPSIS can be achieved through seven steps (see Figure 2). In the first, a matrix D with elements (x_{ij}) must be structured, where (i) refer to alternatives and (j) refer to analysis criteria. In the case of this study, the alternatives corresponded to the 33 indicators presented in Table 1 and the criteria corresponded to the averages attributed by each group of respondents. The mathematical representation of matrix D is shown in equation (1). The second step refers to the normalization of matrix D through equation (2), resulting in a matrix called matrix R according to equation (3). Equations (1)–(3) can be seen in Figure 2.

The third step is the weighting of the values of matrix R using equation (4), obtaining matrix V. Then, the ideal positive (v_j^+) and negative (v_j^-) ideal solutions that characterize the fourth step are determined. Ideal positive (v_j^+) and negative (v_j^-) solutions are the maximum and minimum values respectively existing in matrix V for each of the analysis criteria. This procedure was necessary to perform the fifth step, in which the positive and negative Euclidean distances of each alternative were calculated. For this, equations (6) and (7) presented in Figure 2 were used. Finally, having the values of Euclidean distances, it was possible to calculate the C_i^* indicator and, through it, rank the 33 indicators that were

| Time of experience in the area | Scholar background | Position in company |
|--------------------------------|---|--|
| 1 = Up to 10 years | 1 = Graduation | 1 = Coordinators, supervisors and analysts |
| 2 = From 11–20 years | 2 = Postgraduate (MBA or master degree) | 2 = Managers |
| 3 = More than 20 years | 3 = Postgraduate (PhD) | 3 = Directors |

Source(s): Authors

Table 2.
Scores for each category considered

| Respondents | Time of experience | Scholar background | Position in company | Respondents | Time of experience | Scholar background | Position in company |
|-------------|--------------------|--------------------|---------------------|-------------|--------------------|--------------------|---------------------|
| R1 | 3 | 3 | 1 | R26 | 3 | 2 | 3 |
| R2 | 3 | 1 | 3 | R27 | 3 | 2 | 3 |
| R3 | 2 | 2 | 3 | R28 | 3 | 2 | 2 |
| R4 | 2 | 2 | 2 | R29 | 3 | 1 | 2 |
| R5 | 2 | 2 | 1 | R30 | 3 | 1 | 2 |
| R6 | 1 | 2 | 1 | R31 | 2 | 2 | 2 |
| R7 | 1 | 2 | 3 | R32 | 2 | 2 | 1 |
| R8 | 1 | 2 | 2 | R33 | 2 | 1 | 1 |
| R9 | 1 | 1 | 1 | R34 | 2 | 1 | 1 |
| R10 | 1 | 1 | 1 | R35 | 2 | 2 | 2 |
| R11 | 1 | 2 | 3 | R36 | 2 | 1 | 1 |
| R12 | 1 | 1 | 1 | R37 | 2 | 2 | 1 |
| R13 | 1 | 1 | 1 | R38 | 2 | 2 | 2 |
| R14 | 1 | 2 | 2 | R39 | 2 | 2 | 2 |
| R15 | 1 | 2 | 3 | R40 | 2 | 2 | 1 |
| R16 | 1 | 1 | 3 | R41 | 2 | 1 | 2 |
| R17 | 3 | 2 | 3 | R42 | 1 | 1 | 2 |
| R18 | 3 | 2 | 2 | R43 | 1 | 1 | 1 |
| R19 | 3 | 2 | 1 | R44 | 1 | 1 | 1 |
| R20 | 3 | 2 | 2 | R45 | 1 | 1 | 1 |
| R21 | 3 | 2 | 3 | R46 | 1 | 1 | 1 |
| R22 | 3 | 1 | 3 | R47 | 1 | 1 | 2 |
| R23 | 3 | 2 | 1 | R48 | 1 | 1 | 2 |
| R24 | 3 | 2 | 2 | R49 | 2 | 2 | 2 |
| R25 | 3 | 3 | 3 | R50 | 1 | 2 | 1 |

Source(s): Authors

Perceptions on sustainability

Table 3.
Scores attributed to respondents

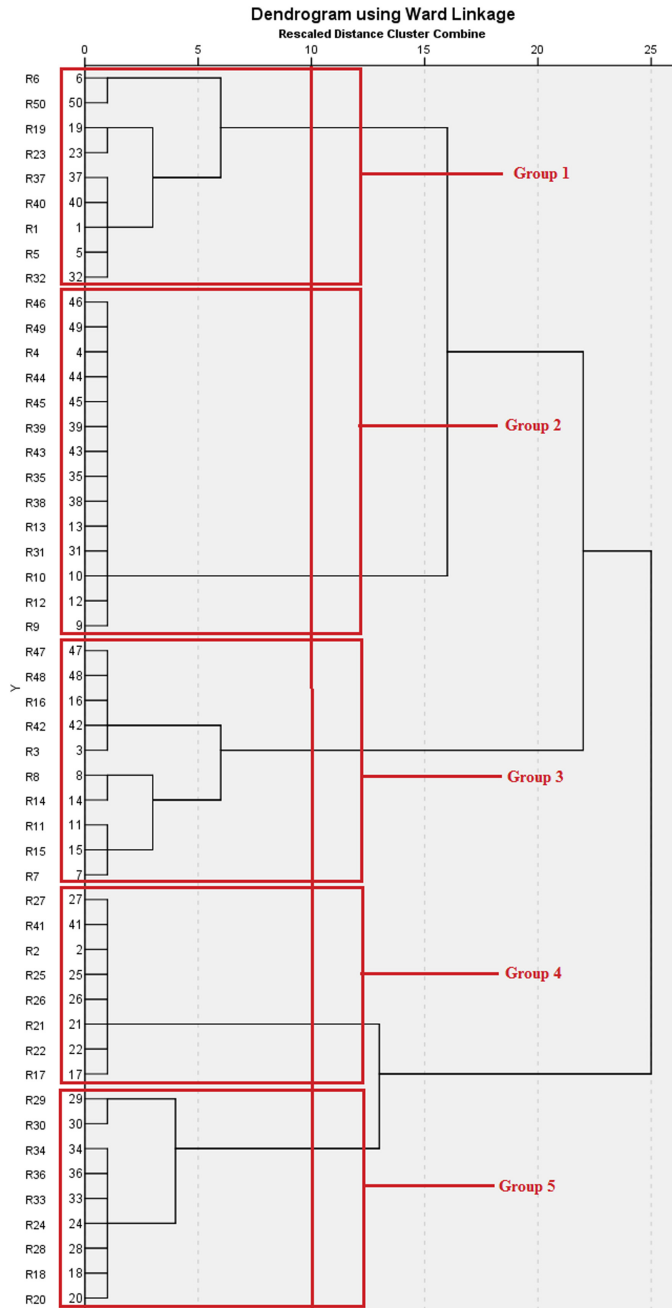


Figure 3.
Dendrogram of
similarity

Source(s): Authors based on research data

companies and 44% have specialization in the area (MBA or master degree). A weight of 0.25 was assigned for this group. The group with intermediate weight was group 3, in which 90% have up to 10 years of experience in the area, 50% occupy positions of directors and 60% have specialization in the area at the level of MBA or master's. A weight of 0.20 was assigned for this group. Both group 1 and Ggroup 2 received a weight of 0.10. These groups are characterized by their respondents having little experience in the area, the vast majority occupying initial positions in companies such as analysts, coordinators and supervisors and with a considerable number of professionals who have only college degree.

With the identification of groups and weights to the indicators, they were ranked through TOPSIS Technique. The results are presented in the following section.

4.2 Technique for order of preference by similarity to ideal solution (TOPSIS)

First, the averages assigned by each group of professionals for 33 indicators were calculated, as showing in [Table 4](#).

When analyzing the averages obtained in group 4 based on the scale adopted, it is possible to observe that the indicators that received the highest averages are: "Monitoring of fuel consumption", "Analysis of adaptations regarding environmental policies", "Control of energy consumption" and "Number of suppliers that meet sustainability aspects". All these

| Items | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 |
|-------|---------|---------|---------|---------|---------|
| En_1 | 2.89 | 2.79 | 2.70 | 2.88 | 2.67 |
| En_2 | 2.78 | 2.50 | 2.70 | 2.88 | 2.89 |
| En_3 | 2.67 | 2.36 | 2.40 | 2.75 | 2.56 |
| En_4 | 2.67 | 2.36 | 2.50 | 2.88 | 2.67 |
| En_5 | 2.56 | 2.14 | 2.70 | 2.63 | 2.67 |
| En_6 | 2.44 | 2.43 | 2.70 | 2.63 | 2.56 |
| En_7 | 2.44 | 2.29 | 2.40 | 2.75 | 2.44 |
| En_8 | 2.56 | 2.07 | 2.50 | 2.75 | 2.56 |
| En_9 | 2.67 | 2.36 | 2.60 | 2.63 | 2.67 |
| En_10 | 2.33 | 2.14 | 2.40 | 2.75 | 2.67 |
| Ec_1 | 3.00 | 2.93 | 2.60 | 2.75 | 2.67 |
| Ec_2 | 3.00 | 3.00 | 2.50 | 2.38 | 2.56 |
| Ec_3 | 3.00 | 2.57 | 2.60 | 2.38 | 2.56 |
| Ec_4 | 2.78 | 2.50 | 2.60 | 2.13 | 2.56 |
| Ec_5 | 3.00 | 2.86 | 2.50 | 2.00 | 2.67 |
| Ec_6 | 2.67 | 2.71 | 2.70 | 2.13 | 2.56 |
| Ec_7 | 2.00 | 2.50 | 2.30 | 2.38 | 2.22 |
| Ec_8 | 2.89 | 2.86 | 2.40 | 2.00 | 2.33 |
| Ec_9 | 2.67 | 2.43 | 2.30 | 1.63 | 2.22 |
| Ec_10 | 2.33 | 2.93 | 2.50 | 2.00 | 2.56 |
| Ec_11 | 2.22 | 2.57 | 2.30 | 1.63 | 1.89 |
| Ec_12 | 2.44 | 2.00 | 2.10 | 1.38 | 2.00 |
| So_1 | 2.89 | 2.93 | 2.30 | 2.38 | 2.56 |
| So_2 | 2.44 | 2.29 | 2.60 | 1.88 | 2.22 |
| So_3 | 2.89 | 3.00 | 2.40 | 2.25 | 2.67 |
| So_4 | 2.33 | 2.21 | 2.20 | 1.75 | 2.22 |
| So_5 | 2.56 | 2.43 | 2.50 | 2.00 | 2.11 |
| So_6 | 2.33 | 1.93 | 2.00 | 1.63 | 1.78 |
| Ge_1 | 3.00 | 3.00 | 2.50 | 1.75 | 2.22 |
| Ge_2 | 2.56 | 2.43 | 2.70 | 2.50 | 2.44 |
| Ge_3 | 2.22 | 2.50 | 2.30 | 2.88 | 2.56 |
| Ge_4 | 2.44 | 2.29 | 2.70 | 2.25 | 2.11 |
| Ge_5 | 2.78 | 2.50 | 2.30 | 2.13 | 2.44 |

Source(s): Authors

Table 4.
Average grade for each
group for each item

indicators presented an average of 2.88; 3 of them are related to environmental management aspects, and 1 is classified as general, but it has a strong impact on triple bottom line environmental issues. In contrast, the indicator that received the lowest average was: "Mapping of information sharing costs", presenting an average of 1.38, pertaining to the economic aspect of the triple bottom line. Analyzing in general the averages of the 33 indicators, it is clear that the perception of this group of professionals about sustainable aspects in logistics systems is characterized by the prioritization of environmental and economic aspects, leaving important social aspects in the background. In this sense, [Zaman and Shamsuddin \(2017\)](#) emphasize the importance of balancing sustainable performance through consideration of environmental, economic and social approaches in the context of the management of logistics systems.

Considering the averages obtained through the responses from professionals in group 5 (second highest weight attributed), the scenario is similar to that of group 4. The indicator that presented the highest average was "Analysis of adequacy regarding environmental policies" with an average of 2.89, being, therefore, considered the most relevant for this group of professionals. The indicator that received the lowest average was "Satisfaction rate of inhabitants of neighboring communities", related to the social aspect, with an average of 1.78. When analyzing the averages of the 33 indicators of this group, in general, it is possible to identify a scenario in which environmental and economic aspects stand out. This scenario is still worrying, because according to [Aldakhil et al. \(2018\)](#) sustainable logistics plays a fundamental role in achieving global sustainability, enhancing the organizational result not only of economic and environmental factors but also of social aspects. This understanding is supported by [Calabrese et al. \(2018\)](#) and [Tseng et al. \(2018\)](#).

In the analysis of the averages obtained through responses from professionals in group 3 (the third highest weight among the groups), it is noticed that seven indicators presented average of 2.70 (the highest average of the group); among them, four are related to environmental aspects, one is related to economic aspects and two are classified as general. In contrast, as in group 5, an indicator related to the social aspect presented the lowest average. Groups 1 and 2 (lowest weights assigned), in general, also presented similar results to the other groups, prioritizing environmental and economic aspects. Therefore, it is possible to perceive the coherence between the groups of respondents where, in general, all groups prioritized the economic and environmental aspects over the social aspects. [Furtado and Frayret \(2015\)](#) highlight the deficiency on the part of researchers and professionals in the context of sustainable logistics, mainly due to the divergent understanding of concepts in this context, generally not taking into account all the sustainable aspects relevant to the management of logistics systems.

TOPSIS technique was used to rank the indicators. Its use enabled the authors to attribute weights for participants groups according to their experience level. It is worth mentioning that the data collected in the research were divided into five different groups (see [Figure 3](#)). Based on the averages shown in [Table 4](#), the values were normalized using equation (2) shown in [Figure 2](#), resulting in matrix R, shown in [Table 5](#).

Then, the weights of each group of respondents were considered, according to the values presented in [Section 4.1](#). By using this procedure, it was possible to obtain matrix V, as shown in [Table 6](#).

Following the steps of the TOPSIS method, [Table 7](#) presents the ideal positive solution and the ideal negative solution. This information is necessary to calculate the values shown in [Table 8](#), which correspond to the Euclidean distances of the ideal positive and negative solutions. Using equation (8) presented in [Figure 2](#), it was possible to calculate the C_i^* coefficient through which the ordering of goals will be performed. This coefficient is also shown in [Table 8](#).

| Items | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | Perceptions on sustainability |
|-------|---------|---------|---------|---------|---------|-------------------------------|
| En_1 | 0.19 | 0.19 | 0.19 | 0.21 | 0.19 | |
| En_2 | 0.18 | 0.17 | 0.19 | 0.21 | 0.21 | |
| En_3 | 0.18 | 0.16 | 0.17 | 0.21 | 0.18 | |
| En_4 | 0.18 | 0.16 | 0.18 | 0.21 | 0.19 | |
| En_5 | 0.17 | 0.15 | 0.19 | 0.20 | 0.19 | |
| En_6 | 0.16 | 0.17 | 0.19 | 0.20 | 0.18 | |
| En_7 | 0.16 | 0.16 | 0.17 | 0.21 | 0.17 | |
| En_8 | 0.17 | 0.14 | 0.18 | 0.21 | 0.18 | |
| En_9 | 0.18 | 0.16 | 0.18 | 0.20 | 0.19 | |
| En_10 | 0.15 | 0.15 | 0.17 | 0.21 | 0.19 | |
| Ec_1 | 0.20 | 0.20 | 0.18 | 0.21 | 0.19 | |
| Ec_2 | 0.20 | 0.21 | 0.18 | 0.18 | 0.18 | |
| Ec_3 | 0.20 | 0.18 | 0.18 | 0.18 | 0.18 | |
| Ec_4 | 0.18 | 0.17 | 0.18 | 0.16 | 0.18 | |
| Ec_5 | 0.20 | 0.20 | 0.18 | 0.15 | 0.19 | |
| Ec_6 | 0.18 | 0.19 | 0.19 | 0.16 | 0.18 | |
| Ec_7 | 0.13 | 0.17 | 0.16 | 0.18 | 0.16 | |
| Ec_8 | 0.19 | 0.20 | 0.17 | 0.15 | 0.17 | |
| Ec_9 | 0.18 | 0.17 | 0.16 | 0.12 | 0.16 | |
| Ec_10 | 0.15 | 0.20 | 0.18 | 0.15 | 0.18 | |
| Ec_11 | 0.15 | 0.18 | 0.16 | 0.12 | 0.13 | |
| Ec_12 | 0.16 | 0.14 | 0.15 | 0.10 | 0.14 | |
| So_1 | 0.19 | 0.20 | 0.16 | 0.18 | 0.18 | |
| So_2 | 0.16 | 0.16 | 0.18 | 0.14 | 0.16 | |
| So_3 | 0.19 | 0.21 | 0.17 | 0.17 | 0.19 | |
| So_4 | 0.15 | 0.15 | 0.15 | 0.13 | 0.16 | |
| So_5 | 0.17 | 0.17 | 0.18 | 0.15 | 0.15 | |
| So_6 | 0.15 | 0.13 | 0.14 | 0.12 | 0.13 | |
| Ge_1 | 0.20 | 0.21 | 0.18 | 0.13 | 0.16 | |
| Ge_2 | 0.17 | 0.17 | 0.19 | 0.19 | 0.17 | |
| Ge_3 | 0.15 | 0.17 | 0.16 | 0.21 | 0.18 | |
| Ge_4 | 0.16 | 0.16 | 0.19 | 0.17 | 0.15 | |
| Ge_5 | 0.18 | 0.17 | 0.16 | 0.16 | 0.17 | |

Source(s): Authors

Table 5.
Matrix R with
normalized values

Finally, ranking the C_i^* coefficient values obtained, there is a comparative ranking of the indicators considered by the professionals in this sample to be the most relevant for the management and promotion of sustainable logistics systems. Table 9 presents the results of said ranking.

In order to guarantee the significance of results and achievement of the objective proposed in this study, a detailed analysis of the ranking generated by handling the survey data using the TOPSIS method was carried out in detail. Such analysis considered the positions of indicators in the ranking and their classification according to the area of TBL to which each belongs. In addition, the results are discussed in the light of literature.

When analyzing the first ten best ranked indicators, it is noticeable that none of them are inserted in the context of social aspects; eight of them are related to environmental aspects, one to economic aspects and one classified as general. Some indicators related to environmental aspects; however, they are also related to economic benefits. As an example, “monitoring fuel consumption” reduces environmental impacts, while providing cost savings. It is worth mentioning that the first indicator best classified in social aspects with regard to the “Measurement of employee satisfaction in the workplace” occupies the

| IJLM | Items | rijG1*0.10 | rijG2*0.10 | rijG3*0.20 | rijG4*0.35 | rijG5*0.25 |
|------|-------|------------|------------|------------|------------|------------|
| | En_1 | 0.02 | 0.02 | 0.04 | 0.08 | 0.05 |
| | En_2 | 0.02 | 0.02 | 0.04 | 0.08 | 0.05 |
| | En_3 | 0.02 | 0.02 | 0.03 | 0.07 | 0.05 |
| | En_4 | 0.02 | 0.02 | 0.04 | 0.08 | 0.05 |
| | En_5 | 0.02 | 0.01 | 0.04 | 0.07 | 0.05 |
| | En_6 | 0.02 | 0.02 | 0.04 | 0.07 | 0.05 |
| | En_7 | 0.02 | 0.02 | 0.03 | 0.07 | 0.04 |
| | En_8 | 0.02 | 0.01 | 0.04 | 0.07 | 0.05 |
| | En_9 | 0.02 | 0.02 | 0.04 | 0.07 | 0.05 |
| | En_10 | 0.02 | 0.01 | 0.03 | 0.07 | 0.05 |
| | Ec_1 | 0.02 | 0.02 | 0.04 | 0.07 | 0.05 |
| | Ec_2 | 0.02 | 0.02 | 0.04 | 0.06 | 0.05 |
| | Ec_3 | 0.02 | 0.02 | 0.04 | 0.06 | 0.05 |
| | Ec_4 | 0.02 | 0.02 | 0.04 | 0.06 | 0.05 |
| | Ec_5 | 0.02 | 0.02 | 0.04 | 0.05 | 0.05 |
| | Ec_6 | 0.02 | 0.02 | 0.04 | 0.06 | 0.05 |
| | Ec_7 | 0.01 | 0.02 | 0.03 | 0.06 | 0.04 |
| | Ec_8 | 0.02 | 0.02 | 0.03 | 0.05 | 0.04 |
| | Ec_9 | 0.02 | 0.02 | 0.03 | 0.04 | 0.04 |
| | Ec_10 | 0.02 | 0.02 | 0.04 | 0.05 | 0.05 |
| | Ec_11 | 0.01 | 0.02 | 0.03 | 0.04 | 0.03 |
| | Ec_12 | 0.02 | 0.01 | 0.03 | 0.04 | 0.04 |
| | So_1 | 0.02 | 0.02 | 0.03 | 0.06 | 0.05 |
| | So_2 | 0.02 | 0.02 | 0.04 | 0.05 | 0.04 |
| | So_3 | 0.02 | 0.02 | 0.03 | 0.06 | 0.05 |
| | So_4 | 0.02 | 0.02 | 0.03 | 0.05 | 0.04 |
| | So_5 | 0.02 | 0.02 | 0.04 | 0.05 | 0.04 |
| | So_6 | 0.02 | 0.01 | 0.03 | 0.04 | 0.03 |
| | Ge_1 | 0.02 | 0.02 | 0.04 | 0.05 | 0.04 |
| | Ge_2 | 0.02 | 0.02 | 0.04 | 0.07 | 0.04 |
| | Ge_3 | 0.01 | 0.02 | 0.03 | 0.08 | 0.05 |
| | Ge_4 | 0.02 | 0.02 | 0.04 | 0.06 | 0.04 |
| | Ge_5 | 0.02 | 0.02 | 0.03 | 0.06 | 0.04 |

Table 6.
Matrix V with weighted values
Source(s): Authors

| Solution criteria | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 |
|-------------------------------|---------|---------|---------|---------|---------|
| Positive ideal solution (vj+) | 0.02 | 0.02 | 0.04 | 0.08 | 0.05 |
| Negative ideal solution (vj-) | 0.01 | 0.01 | 0.03 | 0.04 | 0.03 |

Table 7.
Positive ideal solution and negative ideal solution for criteria access
Source(s): Authors

16th position. Furthermore, four of the six social indicators are among the ten worst ranked. This pattern reinforces the apparent issue related to the perception that social aspects are delegated to secondary hierarchy levels by Brazilian professionals when considering sustainability in logistics activities.

[Agrawal and Singh \(2019\)](#) emphasize that the logistics sector is not only a significant contributor to economic performance and international development but also plays a vital role in environmental and social aspects. The scenario identified in this study is worrying because, according to [Uyar et al. \(2020\)](#), the logistics sector plays an important role toward social aspects. [Agyabeng-Mensah et al. \(2020\)](#) highlight that the adoption of sustainable

| Items | Distances from the positive ideal solution (Si+) | Distances from the negative ideal solution (Si-) | Coefficients (Ci*) | Perceptions on sustainability |
|-------|--|--|--------------------|-------------------------------|
| En_1 | 0.00 | 0.04 | 0.91 | |
| En_2 | 0.00 | 0.05 | 0.92 | |
| En_3 | 0.01 | 0.04 | 0.81 | |
| En_4 | 0.01 | 0.04 | 0.86 | |
| En_5 | 0.01 | 0.04 | 0.79 | |
| En_6 | 0.01 | 0.04 | 0.78 | |
| En_7 | 0.01 | 0.04 | 0.77 | |
| En_8 | 0.01 | 0.04 | 0.79 | |
| En_9 | 0.01 | 0.04 | 0.80 | |
| En_10 | 0.01 | 0.04 | 0.80 | |
| Ec_1 | 0.01 | 0.04 | 0.89 | |
| Ec_2 | 0.01 | 0.03 | 0.69 | |
| Ec_3 | 0.01 | 0.03 | 0.68 | |
| Ec_4 | 0.02 | 0.03 | 0.56 | |
| Ec_5 | 0.02 | 0.03 | 0.52 | |
| Ec_6 | 0.02 | 0.03 | 0.56 | |
| Ec_7 | 0.02 | 0.03 | 0.58 | |
| Ec_8 | 0.03 | 0.02 | 0.46 | |
| Ec_9 | 0.04 | 0.01 | 0.26 | |
| Ec_10 | 0.02 | 0.02 | 0.49 | |
| Ec_11 | 0.04 | 0.01 | 0.20 | |
| Ec_12 | 0.04 | 0.01 | 0.11 | |
| So_1 | 0.02 | 0.03 | 0.67 | |
| So_2 | 0.03 | 0.02 | 0.38 | |
| So_3 | 0.02 | 0.03 | 0.63 | |
| So_4 | 0.03 | 0.01 | 0.28 | |
| So_5 | 0.03 | 0.02 | 0.42 | |
| So_6 | 0.04 | 0.01 | 0.15 | |
| Ge_1 | 0.03 | 0.02 | 0.35 | |
| Ge_2 | 0.01 | 0.03 | 0.71 | |
| Ge_3 | 0.01 | 0.04 | 0.80 | |
| Ge_4 | 0.02 | 0.03 | 0.54 | |
| Ge_5 | 0.02 | 0.02 | 0.52 | |

Source(s): Authors

Table 8.
Positive ideal solution distance, negative ideal solution distance, and coefficient Ci*

practices in the management of logistics systems still have little influence on improving social well-being, health of society and employees. This can be explained by the need to better understand the comprehensive sustainability perspectives in the context of logistics systems (Uyar *et al.*, 2020).

Considering economic aspects, Khan *et al.* (2019) present the importance of logistics sector to improve countries' economic performance. The authors highlight the improvement of global supply chain operations and industrialization operations. From environmental aspects perspective, Sim and Sim (2017) highlight the great negative environmental impact caused by logistical operations and argue about the importance of adopting management strategies that allow to minimize this negative impact generated by logistical systems. In this sense, some actions with practical managerial implications are presented, mainly to meet the needs of logistics managers in developing economies, such as Latin American countries. To improve this scenario, Martins *et al.* (2019) and Furtado and Frayret (2015) highlight the need to develop assessment models that consider the three pillars of sustainability (environmental, economic and social) in logistics systems.

| Position | (Ci*) | Items |
|----------|-------|--|
| 1° | 0.92 | En_2 – Analysis of adequacy regarding environmental policies |
| 2° | 0.91 | En_1 – Fuel consumption monitoring |
| 3° | 0.89 | Ec_1 – Mapping of operational logistics costs |
| 4° | 0.86 | En_4 – Control of energy consumption |
| 5° | 0.81 | En_3 – Transport environmental impact assessment |
| 6° | 0.80 | Ge_3 – Number of suppliers that meet sustainability aspects |
| 7° | 0.80 | En_9 – Elaboration and updating of environmental inventory |
| 8° | 0.80 | En_10 – Measurement of the amount of clean energy use |
| 9° | 0.79 | En_8 – Monitoring of CO2 emission by developed logistics operation |
| 10° | 0.79 | En_5 – Measurement of total water consumption spent on logistics operations |
| 11° | 0.78 | En_6 – Amount of waste correctly destined |
| 12° | 0.77 | En_7 – Measurement of the amount of use of sustainable materials in logistics operations |
| 13° | 0.71 | Ge_2 – Assessment of the level of understanding of employees regarding sustainability |
| 14° | 0.69 | Ec_2 – Measurement of the profitability of the logistics system |
| 15° | 0.68 | Ec_3 – Quality assessment of after care services |
| 16° | 0.67 | So_1 – Measurement of employee satisfaction in the workplace |
| 17° | 0.63 | So_3 – Evaluation of occupational health and safety in the corporate environment |
| 18° | 0.58 | Ec_7 – Distance traveled by total daily working time |
| 19° | 0.56 | Ec_6 – Total deliveries served per day |
| 20° | 0.56 | Ec_4 – Average journey time per delivery |
| 21° | 0.54 | Ge_4 – Frequency of publishing sustainability reports |
| 22° | 0.52 | Ec_5 – Delivery reliability assessment |
| 23° | 0.52 | Ge_5 – Analysis of the customer's perception of the logistics process |
| 24° | 0.49 | Ec_10 – Rate of filling capacity of means of transport |
| 25° | 0.46 | Ec_8 – Evaluation of order fulfillment time |
| 26° | 0.42 | So_5 – Participatory management index |
| 27° | 0.38 | So_2 – Monitoring the impacts of operations on neighboring communities |
| 28° | 0.35 | Ge_1 – Assessment of long-term strategic objectives |
| 29° | 0.28 | So_4 – Social demands employability index |
| 30° | 0.26 | Ec_9 – Evaluation of the corporate image of the logistics system |
| 31° | 0.20 | Ec_11 – Freight quantity fluctuation analysis |
| 32° | 0.15 | So_6 – Satisfaction rate of inhabitants of neighboring communities |
| 33° | 0.11 | Ec_12 – Mapping of information sharing costs |

Table 9.
Ranking of the items

Source(s): Authors

5. Conclusions

Based on the results presented, it is concluded that the main objective proposed in this study was achieved because it was possible to identify the comparative importance that Brazilian professionals who act with logistics activities attribute to different indicators regarding sustainability. A set of 33 indicators was used to develop a research instrument and used in a survey with 50 professionals.

The main conclusion obtained is that, despite considering social indicators for the management and promotion of sustainability in logistical systems, Brazilian professionals relegate them to a secondary level when compared with environmental indicators. This proves the hypothesis presented in the introductory section.

Regarding the limitations of this study, it is important to mention the sample size (50 respondents) and some considerations adopted; however, we highlight again the exploratory nature of this study. We intended, with this study, to amplify the debates about how sustainability is perceived and motivates other researchers. In addition to the theoretical contributions that allow the expansion of debates in the area, this study also have practical implications, especially as a guidance for policymakers. This paper has strong implications

for theory and practice because it links the principles of sustainable development with the field of logistics. The results obtained may be used to support teaching programs related to business courses and also can help to identify specific policies to support the competitiveness of local players, suggesting the development of specific sustainable capacities that can contribute to operational competitiveness, the company's reputation and the sustainable performance of companies operating in the logistics sector. We believe that these actions in logistics sector management can contribute considerably to the mentioned improvements, especially in emerging markets, as is the case in Latin America.

Finally, the results presented here can contribute to the development of new models and tools that enable better performance of the logistics systems in terms of meeting sustainability considering the three aspects of the TBL.

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Roadmap to enhance the insertion of social sustainability in logistics systems considering the Brazilian context

Purpose: This article aimed to propose and validate a roadmap to enhance the insertion of social sustainability practices in logistics activities considering the scenario of companies operating in Brazil.

Design/methodology/approach: The initial construction of the aforementioned roadmap was based on a detailed literature review and the fine-tuning as well as validation of it was carried out through a Delphi process developed with professionals specialized in the area of logistics and sustainability.

Findings: As main results, it is highlighted that the validated roadmap includes actions ranging from meeting and adapting legal issues related to sustainability, through the initial diagnosis of the company, motivation and awareness of the importance of social sustainability, followed by encouraging the inclusion of social sustainability practices in logistic activities, and finally, the identification of opportunities for improvement and establishment of execution plans within the organization. The phases and actions of the validated roadmap converge towards restructuring and redefinition of the organizational culture oriented towards meeting sustainable guidelines, and also contemplate the dynamics of seeking continuous improvement throughout all levels and sectors belonging to a given organization.

Practical implications: It is possible to highlight the importance of the roadmap validated as an ally of logistics system managers who aim to conduct their management processes in line with the insertion of sustainable practices, especially practices related to social aspects, transforming the company into an organizational culture guided by sustainable guidelines and consequently generating competitive advantages for the organization to which it operates.

Social implications: The results achieved can contribute to the development of an organizational culture more aligned with the guidelines regarding social sustainability practices in operations and logistics activities, consequently being able to promote greater social development in the region considered in this study.

Originality/value: The originality of this study lies in the fact that the roadmap focuses on the inclusion of social sustainability practices in logistic activities, since, according to the literature, social aspects are still relegated to the background when compared to environmental and economic aspects.

Keywords: Social sustainability; Logistics systems; Roadmap; Sustainability; Delphi process; Brazil.

Introduction

Nowadays, it is possible to notice that research in the area of sustainability has been gaining a lot of attention and expansion of debates by researchers around the world (Martins *et al.*, 2019). In the business environment, it is no different and this is due to the pressure from authorities, governments and customers regarding compliance with sustainability guidelines (Caiado *et al.*, 2018; Disli *et al.*, 2022; Xu *et al.*, 2015). It is also important to highlight that, in seeking

sustainability, companies not only meet requirements but also come to have sources of competitive advantage (Chu *et al.*, 2019; Eng *et al.*, 2021; Le *et al.*, 2013).

The concept of sustainability is still quite broad and is presented in different ways in the literature. A well-accepted approach is that associated with the concept of sustainable development proposed by the World Commission on Environment and Development (WCEED) “*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (Brundtland, 1987). Additionally, Elkington (1998) spreads the understanding of sustainability through the dynamic balance between the environmental, economic and social dimensions (Triple Bottom-Line - TBL), and this approach is also well presented in the literature, for example, as the study of (Singh and Srivastava, 2021).

Strengthening the importance of sustainability, in 2015, the United Nations - UN launches an agenda with a set of sustainable goals to be achieved by the year 2030, known as the 17 Sustainable Development Goals – SDG's. Each objective is made up of several goals that cover actions ranging from the eradication of poverty to the promotion of decent work and responsible consumption of energy-generating systems. It is worth highlighting the considerable number of goals related to social aspects, such as gender equality, access to food for all, promotion of a safe working environment, fostering local communities with the generation of jobs and income, among others (Martins *et al.*, 2019; Palmer, 2015). SG9, in particular, has a strong focus on industrial and innovation activities and SDG12, in turn, also addresses aspects of sustainable production, both being very close to the daily lives of companies (UN, 2020).

Considering the activities developed along the value chain of a company, the importance of the activities that make up the logistic systems to achieve good results in terms of sustainability is highlighted (Jozef *et al.*, 2019; Kumar and Anbanandam, 2020). Logistic systems are composed of key activities and support activities. Examples of key activities are management of service levels offered to customers, transportation, inventory management, information flow, and order processing. Examples of support activities are warehousing, material handling, purchasing management, packaging design, and information maintenance (Ballou, 2004; Martins *et al.*, 2020)

According to Chhabra *et al.*, (2018) sustainable logistics is understood as the ability to provide products and services in line with environmental, social and economic sustainability guidelines. However, in the logistics area, Martins *et al.*, (2020) draw attention to the low number of studies focused on social aspects when compared to environmental and economic ones in the literature. The evolution of corporate sustainability is impacted by the lack of guidelines and tools focused on the analysis of social performance (Stindt, 2017).

Specifically considering Brazil, the aforementioned scenario is no different, there are several studies in the literature on sustainable logistics systems, however, few analyze the social aspects in detail. The explanation for this situation may lie in the focus of the business, lack of strict legislation, low pressure from the customer and the non-identification of return in the short and medium-term by companies. Therefore, the importance of developing a study to facilitate the inclusion and consideration of social aspects in logistic systems is evident (Hojnik *et al.*, 2020; Martins *et al.*, 2020) and the insertion of such social aspects will become easier if they are

presented in the form of a roadmap. De Reuver et al., (2013) define a roadmap as a detailed plan to guide progress towards an expected result.

When analyzing the existing literature on the roadmap and social sustainability that has been developed by companies, it is possible to see that roadmaps aimed at achieving practical goals are agents that facilitate change towards meeting sustainable guidelines (Moretto *et al.*, 2018). However, it is notorious that such scripts usually focus on the environmental and economic aspects of sustainability, thus resulting in insufficient development of social aspects. Therefore, a roadmap focused on enhancing the inclusion of social practices in logistic activities becomes important for achieving the company's sustainable objectives and competitive advantages. Thus, a research gap is evidenced and it is exactly this point that will be explored by this study.

This paper aims to propose and validate a roadmap to enhance the insertion of social sustainability practices in logistics activities considering the context of companies operating in Brazil. In addition to this introductory section, this article is structured in 4 more sections. Section 2 presents the theoretical foundation, which presents the evolution of studies on roadmaps in general and on sustainable logistics (with emphasis on business social practices). Section 3 details the methodological procedures followed for the development of this study, from the literature review to the validation of the proposed roadmap. Section 4 presents the results achieved by carrying out a critical analysis in parallel with the literature. Section 5 presents the conclusions, theoretical and practical implications and proposals for future research. In the end, the list of references that served as the basis for this article is presented.

Theoretical foundation

The roadmap approach

The proposal and use of roadmaps are presented in the literature in different ways and objectives, therefore, it is characterized as a broad topic that has been developed in different approaches (Phaal *et al.*, 2004). Saritas & Aylene (2010) highlight in their study that, according to the former President of Motorola, Robert Galvin, the roadmap consists of a look into the future of a field of investigation composed by the collective knowledge and imagination of the agents driving change. These same authors emphasize that a roadmap must answer three basic questions: a) Where do we want to go? b) What are the ways to get there? c) What should be done from now on? For Caritte et al., (2015) roadmaps are essential models that aim to mobilize organizations to assess different options and develop action plans to meet strategic objectives.

As mentioned earlier, the literature presents different types of roadmaps. Sinha et al., (2013) highlight its importance for achieving practical results with the implementation of new processes that improve business models. According to Moretto et al., (2018) a practice-oriented roadmap is particularly suitable when the objective is to design a sustainable path within companies, identifying practices and steps to transform organizations towards following sustainability guidelines. For Abreu (2015) the organization needs to prioritize among the various possibilities to achieve results in the context of sustainability and develop an implementation plan with the most appropriate allocation of resources over time. Therefore, a well-developed and detailed roadmap allows companies to develop a plan on such an uncertain and evolving topic, such as

social sustainability, which is often approached in an unsystematic way. Considering the context of sustainability, Moretto et al., (2018) argue that programs aimed at achieving sustainable results are strongly affected by uncertainty, and that analyzing previous studies on sustainability, it is possible to see that the results of sustainable programs change over time, as can be seen in Lin & Tseng, (2016).

Scenarios and practices for social sustainability in logistics systems

Analyzing the literature, it is possible to see that the development of a roadmap for sustainability can promote the alignment between the activities developed by a particular company (Ageron *et al.*, 2012), however, according to Martins et al., (2019) e Martins et al., (2020) there are still few studies focused on the insertion of social sustainability in logistic systems. These authors developed studies in which they analyzed sustainability practices and indicators that have been developed and used by Brazilian companies and identified that social sustainability is relegated to the background of environmental and economic practices and indicators.

Considering the context of sustainability, it is possible to highlight more recent studies such as the one from León Bravo et al., (2021) which aimed to develop a roadmap of sustainability practices and mechanisms for evaluating the performance of the food supply chain. This study identified the sustainability practices and assessments in the companies considered and analyzed the different pressures on the part of stakeholders for the implementation and assessment of sustainability, it is noteworthy that the three dimensions of sustainability were considered together (environmental, economic and social). Bubicz et al., (2021) considered the analysis of the apparel industry's supply chain. The authors highlighted that the operations of such a chain are complex and sustainability issues are a constant concern, as satisfactory results have not yet been achieved, especially in social aspects.

Other studies highlight the sustainability practices related to social aspects that have been developed by companies. Considering the actions with employees, it is possible to identify in the literature a set of different practices, such as defining accident prevention strategies such as driving speed limit, night driving time restrictions, planning time off and rest (Amirmokhtar Radi and Shokouhyar, 2021; Bloemhof *et al.*, 2015; Kumar and Anbanandam, 2019; Singh *et al.*, 2020; Walker *et al.*, 2021); Ensure accessibility in the development of operations and activities (Chamseddine and Ait Boubkr, 2020); Assess the employee's health and well-being (Amirmokhtar Radi and Shokouhyar, 2021; Bubicz *et al.*, 2021; Chakroun *et al.*, 2019; Chamseddine and Ait Boubkr, 2020; Guo and Lu, 2021; Walker *et al.*, 2021); Conduct training for skills development (Chakroun *et al.*, 2019; Kelling *et al.*, 2020; Yadava and Sinha, 2016); Make employees aware of the importance of inclusion and gender differences (Bubicz *et al.*, 2021; Ryan, 2020; Schönborn *et al.*, 2019; Walker *et al.*, 2021; Yadava and Sinha, 2016); Ensuring means for career development with the provision of retirement benefit, pension fund and bonus (Bubicz *et al.*, 2021; Kumar and Anbanandam, 2019; Schönborn *et al.*, 2019); Set firm rules and regulations about not drinking and driving and also having health insurance for drivers (Kumar and Anbanandam, 2019); and, Ensure up to date and equal salaries at the same level (Kumar and Anbanandam, 2019; Schönborn *et al.*, 2019; Yadava and Sinha, 2016).

Considering the practices developed in which neighboring communities are the main stakeholders, the literature highlights that companies are prioritizing the employability of communities close to their operations and also fostering the social demands of the community, contributing to the development of the local economy (Govindan, Paam, *et al.*, 2016; Martins *et al.*, 2020; Schönborn *et al.*, 2019; Walker *et al.*, 2021), in addition, organizations must assess the impact of operations on neighboring communities in order to maintain their well-being (Govindan, Paam, *et al.*, 2016; Martins *et al.*, 2020; Pilouk and Koottatep, 2017; Walker *et al.*, 2021); another important practice present in the literature is the development of assistance projects for access to essential services (Example: access to drinking water and free assistance services) (Chakroun *et al.*, 2019; Fraser, 2018; Kumar and Anbanandam, 2019; Walker *et al.*, 2021); additionally, it is still possible to identify in the literature practices such as the development of educational, philanthropic and cultural activities (Amirmokhtar Radi and Shokouhyar, 2021; Chakroun *et al.*, 2019; Han and Lee, 2021; Kelling *et al.*, 2020; Walker *et al.*, 2021); and, the use of services from local community providers (Schönborn *et al.*, 2019).

Analyzing the literature focusing on sustainable social practices directly related to customers, it is possible to highlight the achievement of product development with the direct participation of customers, including giving them opportunities to participate in sustainable projects, demonstrating socially ethical behavior towards the customer and offering subsidy for low-income family accounts are some practices highlighted by (Walker *et al.*, 2021); additionally, Chakroun *et al.*, (2019) highlight the importance of providing a channel for customer service, support and conflict resolution.

Finally, considering the sustainable social practices present in the literature that are directly related to society, the need to respect national legislation can be highlighted (Han and Lee, 2021; Kumar and Anbanandam, 2019; Walker *et al.*, 2021); Create a protection system against child labor (Bradley and Botchway, 2018; Bubicz *et al.*, 2021); Make a public commitment and contribute to social sustainability initiatives (Walker *et al.*, 2021); Adopt an anti-corruption system (Bubicz *et al.*, 2021; Chakroun *et al.*, 2019; Schönborn *et al.*, 2019); Ensure animal welfare (Bubicz *et al.*, 2021); Prepare period reports of actions related to social sustainability (Rotondo *et al.*, 2019; Schönborn *et al.*, 2019; Svensson and Wagner, 2015); Ensure transparency of information (Bradley and Botchway, 2018; Han and Lee, 2021; Toussaint *et al.*, 2021; van der Watt and Marais, 2021); Have a social sustainability support committee (Schönborn *et al.*, 2019); and, Promote social responsibility throughout the value chain (Chakroun *et al.*, 2019).

Methodological procedures

The development of this research comprised the realization of the following steps: a) literature review; b) elaboration of the proposed roadmap; c) roadmap validation through a Delphi process developed with logistics and sustainability professionals; d) analysis of the results achieved and their implications for theory and practice; and, e) establishment of conclusions.

The initial stage included the development of a literature review demonstrating the evolution of roadmap studies in general and studies that focused on the theme of sustainable logistics, with emphasis on social practices that have been developed by companies. The scientific databases of

Emerald Insight, Science Direct, Scopus and Springer were consulted, and the following search terms were used individually and also in combination: “Roadmap in logistics”, “Roadmap business”, “Roadmap sustainability”, “Social sustainability in companies”, “Social sustainability in business”, “Corporate social responsibility”. This literature review, in addition to providing an understanding of the roadmap development, was also important to understand what is expected of a company in the context of social sustainability that is, identifying which practices to be developed. The result of this step is presented in section two of this article.

With the foundation resulting from the initial stage, it was possible to prepare and propose a roadmap that aims to enhance the insertion and development of social practices by companies that carry out logistic activities operating in Brazil (step 2). The proposed roadmap is presented in section 4.1 of this article. In addition to the starting point, it is composed of 4 more phases, highlighting in each one the strategies, objectives, goals and means to achieve results in each phase. It is noteworthy that it was prepared considering the research context and the understanding acquired in step 1 of this study (literature review).

Then, the roadmap proposed was validated with professionals in the field of logistics and sustainability working in Brazil, as this study considers the context and scenario of companies operating in this country (step 3). Therefore, a Delphi was structured where each professional, based on their knowledge and experience on the concepts of social sustainability and social practices expected by companies that develop logistics activities, were initially invited to analyze and express their opinion on the roadmap proposed considering its suitability with the Brazilian context of the logistics sector.

According to Ahmad & Wong (2019) the Delphi Method is considered a procedure used to collect expert opinions to support decision making. Through Delphi, it is possible to manage, structure and analyze expert comments and also validate literature analysis results (Gallego Carrera and Mack, 2010), the case of this study, since the proposed roadmap is the result of an analysis of the literature in the area. The Delphi method is usually performed remotely through sequential questionnaires or rounded according to the objective of each one, interspersed with researcher-expert feedback in a controlled manner (Ahmad and Wong, 2019; Bélanger *et al.*, 2012). The Delphi process must include at least two rounds and each one must be based on the responses from the previous round (Ahmad and Wong, 2019; Mahanty *et al.*, 2021; Rampasso *et al.*, 2021).

In the initial stage of this study, the professional could freely suggest changes, complements, exclusions and/or grouping of phases, evaluate the objectives of each one and the suggested means for the development of each phase. In this first round of Delphi, professionals received an invitation by email via the Google Forms platform to analyze and record their perception (response) in a discursive way, with a maximum limit of 400 words, the maximum period available for feedback was two weeks. In this first round, 27 invitations were sent and a return of 13 responses was obtained, consequently, totaling a return rate of 48.14%. It is noteworthy that this study, as it involves the opinion of human beings, was submitted to a research ethics committee and approved with the registration number CAAE: 48817821.4.0000.5404, such practice is required by Brazilian law.

Based on the result of the first round and performing a content analysis between the responses obtained, following the guidelines of Elo & Kyngäs (2008), it was possible to redefine the roadmap according to the professionals' notes. To this end, inductive analysis of the content of the responses was performed, one of the categories emerged with the analysis of information and then it was possible to define analysis categories to help identify the necessary improvements in the proposed roadmap. These categories were defined based on the full reading of the professionals' responses, which Elo & Kyngäs (2008) call it open coding. The defined categories were: a) regarding the adopted strategy; b) as to the objective; c) as to the goal; d) as to the means to achieve results; e) textual adjustments for better definition and understanding; and, f) general considerations.

With the results obtained from the first round of DELPHI and the analysis of the content of the responses, it was possible to adjust and redefine the roadmap and then place it in a new evaluation through another round with the responding professionals. In this second round of DELPHI, an online approach was also carried out through the Google Forms platform and email. This round 2 evaluation was sent to the 13 respondents from the first round and a 100% return rate was obtained. Respondents were given a summary of the responses obtained in the first round, the redefined roadmap (section 4.2) and the appendices cited throughout the roadmap (tables with the set of social indicators (Appendix C), social sustainability practices (Appendix A) and the competency development model (Appendix B). Then, they were asked to carry out an analysis and answer the following questions: 1) Based on the synthesis of responses from the first round of DELPHI and the redefined roadmap, do you consider that your suggestions were considered or, when not considered, were they satisfactorily justified?; and, 2) Knowing the view of all professionals participating in this research, presented in the synthesis of responses from the first round, would you like to compliment your point of view? If so, objectively present details to improve the proposed roadmap. The maximum period available for return was one week.

Still following the guidelines of Elo & Kyngäs (2008) for the treatment and analysis of the results obtained in the second round of DELPHI, it was also possible to carry out a new alignment according to the respondents' notes in this round. Then, another round of evaluation was carried out in search of a consensus on the validation of the roadmap proposed in this study.

In the third round, the respondents were provided with a summary of the responses from the previous round and the roadmap was realigned according to the results of round 2. The professionals were then asked to analyze them and answer the following question: "Based on a final version of the Roadmap presented in this round and obtained after adjustments made with the suggestions of round 2, do you consider that it enhances the inclusion of social sustainability practices in the logistics activities of companies operating in Brazil?". This round was sent to the 13 professionals who participated in the previous round and obtained a 100% return rate with the answers. The maximum period available for return was one week.

Respondents are characterized by logistics and sustainability professionals working in Brazil, where 23% have more than 20 years of experience in the area, 15% have between 10 and 20 years of experience and 62% have up to 10 years of experience in the area. . Respondents

correspond to professors, researchers, consultants and business managers in the area of logistics and sustainability working in Brazil.

Finally, with the results in hand, debates were presented considering a critical analysis of the literature and focusing on identifying the implications for theory and practice. In addition, it was possible to establish study conclusions according to the proposed objective and the results achieved.

Findings

Proposed roadmap

The roadmap was prepared through a thorough analysis of the literature on the use and development of roadmaps and also through the identification of social sustainability practices (Appendix A) that companies are expected to incorporate in the development of their activities.

The starting point proposed in the roadmap corresponds to compliance with the law, since it is understood that companies that aim to meet the social sustainability guidelines must initially comply with the laws of the country in which they operate, and at an international level in case of work with operations internationally. In the social context, the focus of this study, complying with the law means that companies must adhere to regulations related to health and safety at work, prevent child and forced labor and all forms of discrimination, and respect freedom of association and the right to collective bargaining. In this sense, the importance of prioritizing suppliers that also comply with current legislation is highlighted. As a starting point for achieving sustainable goals, compliance with the law is an important agent in ensuring the coherent incorporation of sustainability in organizational activities and processes (Moretto *et al.*, 2018).

Then, phase 1 corresponds to the identification of the company's current scenario (initial diagnosis), that is, the identification of its level of alignment about meeting social aspects. To this end, it is important to map the activities and processes that make up each sector of the company and then define indicators to be used for a coherent assessment of the organization in terms of social practices. Martins *et al.*, (2020) present an important set of social indicators that can contribute to the realization of this initial diagnosis, are: Measurement of employee satisfaction in the workplace; Monitoring the impacts of operations on neighboring communities; Evaluation of occupational health and safety in the corporate environment; Social demands employability index; Participatory management index; and, the Satisfaction rate of inhabitants of neighboring communities. This phase is consistent with the roadmap literature, which states that if the ultimate goal is to define directions for the future, it is necessary to initially assess the level of performance of the present (Caritte *et al.*, 2015; Moretto *et al.*, 2018; Reuver *et al.*, 2013).

Phase 2 consists of consolidating the importance of social sustainability with the company's senior management. It is understood that to reach a level of commitment and development of social practices on the part of everyone involved with the activities, it is initially necessary that the members of senior management understand the concepts and internalize the importance of social actions. At this stage, the practices expected by companies that intend to obtain a better

performance in meeting social sustainability are presented, aiming to identify which practices are possible to be inserted according to the specificities of the activities developed in each company.

Once the importance of social sustainability has been consolidated with the company's senior management and the identification of possible practices to be inserted according to each activity, we move on to phase 3. This phase consists of actions to promote and facilitate the development of social practices (see Appendix A) by the sectors belonging to the company. As a strategy to enhance this phase, we highlight the development of benefit programs for managers and employees that promote the inclusion of social practices in their activities. The company must promote actions to develop the necessary skills with employees based on a competency management system aligned with the guidelines of ISO 10015:2020 (Appendix B) and assess whether its organizational structure is adequate for social sustainability. At this stage, the company needs to be able to demonstrate to employees that the inclusion of social practices is aligned with the company's strategic objectives.

Finally, phase 4 consists of the evaluation and post-insertion registration of social practices in the company. The strategy is the use of indicators capable of measuring the social practices inserted and, in addition, elaborating a standard report model with the results and lessons learned. This phase aims to analyze the current scenario of the company after the insertion of social practices and support the planning of future actions. Table 1 below shows the proposed initial roadmap.

Table 1 – The proposed initial roadmap

| Phase | Strategy | Objectives | Goal | Means to reach |
|--|--|--|--|--|
| 0. Compliance with the law | Respect for the law about the health and well-being of the employee. | Compliance with national/international law. | Promote decent work in all sectors of the company. | Alignment with the legal sector. |
| 1. Initial diagnosis | Use of social sustainability indicators. | Evaluate the activities developed by the company considering the internal environment; Evaluate the impact of the activities developed by the company considering the environment external to the organization. | Identify the company's current scenario regarding compliance with socially sustainable guidelines. | Map the company's activities and processes and define coherent indicators for measurement. |
| 2. Consolidation of social sustainability | Approach at strategic level (top-down). | Consolidate social sustainability concepts; Improve social performance; Identify among the social practices the ones that can be inserted in the company. | Make all members of senior management aware of the importance of social sustainability. | Training on TBL and the focus of social sustainability. |
| 3. Insertion of social practices | Benefits program for managers and employees. | Develop skills aligned with social practices considering the guidelines of ISO 10015:2020; Develop adequate structures for social sustainability. | Enhance the inclusion of as many sustainable practices as possible in the company. | Training with employees demonstrating the importance of inserting social practices considering the |

| | | | | |
|--------------------------------------|---|--|---|--|
| 4. Evaluation and registration | Use of indicators; Preparation of social sustainability report. | Analyze the post-insertion scenario of social practices; Identify opportunities for improvement; Generate a periodic document formalizing the results and lessons learned. | Identify the current status of the company regarding the achievement of social goals and possible opportunities for improvement in future actions. | company's objectives. Define coherent indicators to be used in the evaluation and prepare a standard periodic report template. |
|--------------------------------------|---|--|---|--|

Source: Authors,
2021.

Roadmap Validation - DELPHI Rounds

As mentioned in the methodological procedures section, the proposed roadmap was evaluated by a group of professionals working in the field of logistics and sustainability in Brazil, aiming at its validation as to the achievement of its objective (potentiate the insertion of social sustainability practices in logistics activities developed by companies operating in Brazil). It was possible to reach a consensus on the structure of the roadmap after 3 rounds following the DELPHI method guidelines. The results obtained in each round and the validated roadmap are presented below.

For the results obtained in round 1, inductive analysis of the content of the professionals' answers was performed and it was possible to define analysis categories to help identify the necessary improvements and consensus between the professionals' notes, aiming to support the redefinition of the proposed roadmap. Initially, the necessary improvements were identified regarding the strategies adopted in each phase.

In this sense, respondents highlighted that phase 0 was focusing only on workers and that it should also include issues related to customers and the local community. In addition, it was highlighted that the term "well-being" has a broad concept and that it would be interesting to explain better what this term refers to. Concerning phase 1, the need to improve the definition of the strategy was pointed out regarding the measurement of what level/degree of social sustainability exists in the organization. For phase 2, the lack of coherence of the strategy presented with the other steps of this phase was also considered, requesting a better definition of it. In phase 3, a better detailing of the suggested benefits program was requested, however, it is highlighted that the roadmap aims to define a macro path and that each organization has its particularities, which makes it impossible to detail / define a benefits program that meets the needs of a general way to all organizations. For Moretto et al., (2018) a roadmap is suitable when the objective is to design a possible path within the organization.

About the objectives of each phase presented in the proposed roadmap, it was highlighted by the respondents that in phase 0 it would be interesting to have a scope exception regarding

compliance with national and international legislation (when the company develops logistical activities abroad). In addition, it was proposed that in phase 4 one of the objectives would be the establishment of plans to achieve the possible improvements identified. It is noteworthy that both notes were included in the redefined roadmap after this first round of evaluation.

As for the goals, in phase 0 it was highlighted that the term "decent work" is a broad term and that there is a need for a better definition of it, aiming at a better understanding. Respondents also highlighted that goal is a position in the future related to time and value, that is, quantifiable, and this needed to be revised since the goals presented in each phase did not have a quantitative character. Other terms were considered superficial, such as in phase 3, "enhance the insertion of the maximum" and adjustments were requested in this sense. Therefore, according to the considerations, it was decided to carry out a review of the terms used and replace the word "goals" with "expected results" to provide greater coherence of the proposed context.

Regarding the means to achieve results, in phase 0, it was requested to highlight the need for a consistent alignment of the legal sector with the other sectors that make up the organization. Also in phase 0, it was suggested the development of training and the elaboration of a good practice manual for the company to clarify and share information with all employees about the importance of the subject. In phase 1, the insertion of a set of base indicators was suggested to guide the organization when structuring it, it is noteworthy that a set of indicators was suggested in the new version of the redefined roadmap (see Appendix C). The same was suggested for the practices adopted by the company and in the roadmap, there is a table with a set of sustainable social practices to be developed as complementary material. A better alignment between the means of achievement presented in phases 2 and 3 was also suggested. In phase 4, the opportunity to carry out internal audits or inspections was identified, to evaluate and calculate the indicators that were previously defined, this suggestion was incorporated in the redefined roadmap. In addition, also in phase 4, it was suggested the inclusion of an action plan to identify mainly those responsible for each proposed action. Therefore, the new version was chosen to include a column "responsible" where the actors in the organization responsible for each phase are presented.

In this round 1, some textual adjustments were suggested, such as standardizing the text in the same verbal tense, and some general considerations were also made, such as defining the actors of each action by phase (defining those responsible), a better coherence between the items presented, the possibility of defining the dimensions before defining indicators and then defining the indicators for each dimension. However, the objective of the roadmap is to point out a macro path that meets the different organizational forms and definitions of companies that develop logistics activities, therefore, specifying each action in each phase may not contemplate such organizational specificities. The insertion of some complementary documents, capable of expressing more frequent specificities of logistical activities, was also suggested. It is noteworthy that the textual restructuring of the roadmap aimed to give greater emphasis in this regard, making it clear that the actions are related to logistical activities. Finally, some comments were registered to highlight the quality presented in the preparation of the roadmap, guaranteeing the achievement of its proposed objective. Below, Table 2 presents the redefined roadmap with the considerations presented in round 1 by the respondents.

Table 2 – Roadmap redefined after round 1

| Phase | Strategy | Objectives | Means to reach | Responsible | Expected result |
|--|---|---|---|---|--|
| 0. Compliance with the law | Respect the law about the employee, customers, and the local community. | Comply with national and international law when the organization develops operations abroad. | Define legal guidelines and put them into practice in the sectors that make up the organization through registration and training manuals. | Sector / legal consultancy and employees at a strategic level. | All logistical activities following current legislation. |
| 1. Initial diagnosis | Measure what level of social sustainability of the logistical activities developed by the organization. | Evaluate activities considering the internal environment; Evaluate the impact of activities considering the external environment. | Map the company's activities and processes and define coherent indicators for measurement. | Tactical-level managers, coordinators and assistants involved in logistical activities. | Identification of the company's current scenario regarding compliance with socially sustainable guidelines. |
| 2. Consolidation of social sustainability | Raise employee awareness at a strategic level about the importance of social sustainability. | Consolidate social sustainability concepts; Improve social performance; Identify among the social practices the ones that can be inserted in the company. | Share among employees the importance of TBL and social sustainability; Disclose the practices adopted by the company. | Strategic-level managers are involved with logistical activities. | Awareness of all employees involved in logistical activities about the importance of social sustainability. |
| 3. Insertion of social practices | Use benefit programs for managers and employees to promote their awareness of the importance of including social sustainability practices in logistical activities. | Develop skills aligned with social practices considering the guidelines of ISO 10015:2020; Develop adequate structures for social sustainability. | Training with employees to enhance the inclusion of social practices considering the company's objectives. | Tactical level managers and coordinators involved with logistical activities. | Empowerment the insertion of sustainable practices in the development of logistical activities. |
| 4. Evaluation and registration | Use indicators; Prepare social sustainability report. | Analyze the post-insertion scenario of social practices; Identify opportunities for improvement and establish plans for achieving them; Generate a periodic document formalizing the results and lessons learned. | Carry out audits and internal inspections of logistical activities as a basis for the use of social indicators and prepare a standard periodic report template. | Tactical-level managers involved with logistical activities. | Identification of the company's current status regarding the achievement of social results and possible opportunities for improvement in future actions. |

Source: Authors, 2021.

Considering the results obtained in round 2 of DELPHI, it is possible to see a trend towards validation of the presented roadmap, since all stated that their suggestions were met or justified consistently. Even so, in this second round, there were occurrences of additional improvements to

be introduced, pointed out by two respondents. For example, the first strategy of phase 4 "Use indicators" was requested to be more specific in terms of definition with social indicators, in phase 2 the replacement of the verbs "awareness" and "consolidate" by others more objective and with meaningless broadly, in phase 3 a better definition of the word "potentiation" was requested. Additionally, it was requested a better relationship and identification of the roadmap appendices with the steps they are related to, and finally, analyze the replacement of the name of phase 4 from "Assessment and registration" to "Identifying opportunities for improvement and establishing execution plans". It is noteworthy that all suggestions indicated in this round were included in the new roadmap proposed to be evaluated in round 3, as shown in Table 3.

Table 3 – Roadmap redefined after round 2

| Phase | Strategy | Objectives | Means to reach | Responsible | Expected result |
|--|---|---|--|---|---|
| 0. Compliance with the law | Respect the law about the employee, customers, and the local community. | Comply with national and international law when the organization develops operations abroad. | Define legal guidelines and put them into practice in the sectors that make up the organization through registration and training manuals. | Sector / legal consultancy and employees at a strategic level. | All logistical activities following current legislation. |
| 1. Initial diagnosis | Measure what level of social sustainability of the logistical activities developed by the organization. | Evaluate activities considering the internal environment; Evaluate the impact of activities considering the external environment. | Map the company's activities and processes and define coherent indicators for measurement (see Appendix C) | Tactical-level managers, coordinators and assistants involved in logistical activities. | Identification of the company's current scenario regarding compliance with socially sustainable guidelines. |
| 2. Consolidation of social sustainability | Incorporate the importance of social sustainability into the organizational culture. | Make the use of social sustainability concepts a practice; Improve social performance; Identify among the social practices the ones that can be inserted in the company. | Share among employees the importance of TBL and social sustainability; Disclose the practices adopted by the company. | Strategic-level managers are involved with logistical activities. | Awareness of all employees involved in logistical activities about the importance of social sustainability. |
| 3. Insertion of social practices (see Appendix A) | Use benefit programs for managers and employees to promote their awareness of the importance of including social sustainability practices in logistical activities. | Develop competencies aligned with social practices considering the guidelines of ISO 10015:2020 (See Appendix B); Develop adequate structures for social sustainability. | Training with employees aimed at developing skills for the insertion of social practices. | Tactical level managers and coordinators involved with logistical activities. | Empowerment the insertion of sustainable practices in the development of logistical activities. |
| 4. Identifying opportunities for improvement and establishing execution plans | Use social indicators (see Appendix C); Prepare social sustainability report. | Analyze the post-insertion scenario of social practices; Identify opportunities for improvement and establish plans for achieving them; Generate a periodic document formalizing the results and lessons learned. | Carry out audits and internal inspections of logistical activities as a basis for the use of social indicators and prepare a standard | Tactical-level managers involved with logistical activities. | Identification of the company's current status regarding the achievement of social results and possible opportunities for |

periodic report
template.

improvement in
future actions.

Source: Authors,
2021.

Finally, after performing and analyzing the results obtained in round 3 of DELPHI, a 100% consensus was reached by the professionals participating in this research that the roadmap (Table 3) can enhance the insertion of sustainability practices social in logistics activities of companies operating in Brazil.

Associated Discussions

According to the results achieved, it is possible to see the importance of considering the existing literature in the area and also the perceptions of professionals involved in the management of logistics activities of companies operating in the Brazilian market, for the validation of a roadmap. Through the proposition of a roadmap based on the literature and the suggestions for improvement pointed out by market professionals, it was possible to validate a robust roadmap model for companies that aim to develop and include social sustainability practices in their logistics activities. According to Reuver et al., (2013) ensuring that the roadmap meets the most diverse specificities and organizational characteristics provides a better fit and, consequently, a coherent definition of a detailed plan to guide the organization's progress towards an expected result. Therefore, the roadmap is an important model that aims to encourage organizations to provide different options and action plans to meet strategic objectives.

Analyzing the validated roadmap, it is possible to see that it has a logical sequence of actions and strategies that provide a constant flow of continuous improvement within a given organization. It is formed by the initial phase (phase 0) and 4 more phases. The initial phase is characterized by the company's suitability to comply with legal guidelines related to practices with customers, employees and the local community in which the organization is inserted. According to Moretto et al., (2018) compliance with the law becomes the basis and an important ally of an organization that aims at coherent incorporation of sustainability in its activities and organizational processes. Once the company has adapted to the current laws, it starts with the initial diagnosis, aiming to identify the current level of social sustainability of the logistical activities developed by the organization. This phase becomes important because the roadmap needs to direct the organization towards the future and therefore it is necessary to assess the organization's performance level in the present (Caritte *et al.*, 2015; Moretto *et al.*, 2018; Reuver *et al.*, 2013).

Then, it is necessary to develop actions in search of the consolidation of social sustainability within the company, that is, to incorporate in the organizational culture the importance of social sustainability at all levels and sectors belonging to the organization. In this sense, Chakroun et al., (2019) emphasize the importance of promoting social responsibility throughout the value chain and agents involved in the process of consolidating the new culture defined by the organization.

Once the sustainability-oriented culture has been consolidated, social practices are included in the logistical activities developed by the company through the definition and creation of benefit

programs for managers and employees, aiming to promote their awareness of the importance of including social sustainability practices in logistical activities. Therefore, programs that aim to guarantee the means for career development, social security funds, and productivity bonuses are allied strategies to achieve the expected results (Bubicz *et al.*, 2021; Kumar and Anbanandam, 2019; Schönborn *et al.*, 2019), such as, for example, enhancing the inclusion of sustainable practices in the development of logistical activities.

Finally, the last phase consists of identifying opportunities for improvement and establishing execution plans using social indicators and the preparation of periodic social sustainability reports, thus providing continuous improvement regarding the development of actions for the insertion of social sustainability practices in logistical activities by organizations operating in Brazil. Therefore, the validated roadmap is focused on enhancing the insertion of social sustainability practices and becomes an important ally in achieving the company's sustainable objectives and, consequently, in ensuring competitive advantages.

Conclusions

According to the results achieved, it can be stated that the objective of this research was achieved, as a roadmap model capable of enhancing the inclusion of social sustainability in logistics activities was obtained, considering the scenario of companies operating in Brazil. It is worth noting that the validated roadmap has as its main characteristics the restructuring and redefinition of an organizational culture oriented towards meeting sustainable guidelines and that the actions belonging to the roadmap include the dynamic of continuous improvement throughout all levels and sectors belonging to a given organization. It is important to emphasize that the validated roadmap corresponds to broad actions and strategies to guide companies that develop logistical activities and that aim to include social sustainability practices in their activities.

The results of this study can contribute to the development of the area of logistics and social sustainability both in theoretical and practical aspects. From a theoretical point of view, the findings presented here can serve as a basis for researchers in the field who aim to broaden debates on the importance of inserting sustainability aspects in logistical activities and especially on the importance of considering social aspects together with the environmental and economic aspects. From the point of view of practical implications, it is possible to highlight the importance of the roadmap validated as an ally of logistics system managers who aim to conduct their management processes in line with the insertion of sustainable practices, especially practices related to social aspects, transforming the company into an organizational culture guided by sustainable guidelines and consequently generating competitive advantages for the organization to which it operates.

As a limitation of the study, it is important to highlight that the model was validated considering the opinion of only professionals working in Brazil, and therefore, the results achieved here cannot be generalized to other contexts and regions where logistical activities are developed.

This study can serve as a basis for the development of further research in the area of logistics and sustainability. Therefore, as a proposal for future studies, the following stand out: a) the use of the roadmap in companies that develop logistics activities operating in Brazil, aiming at

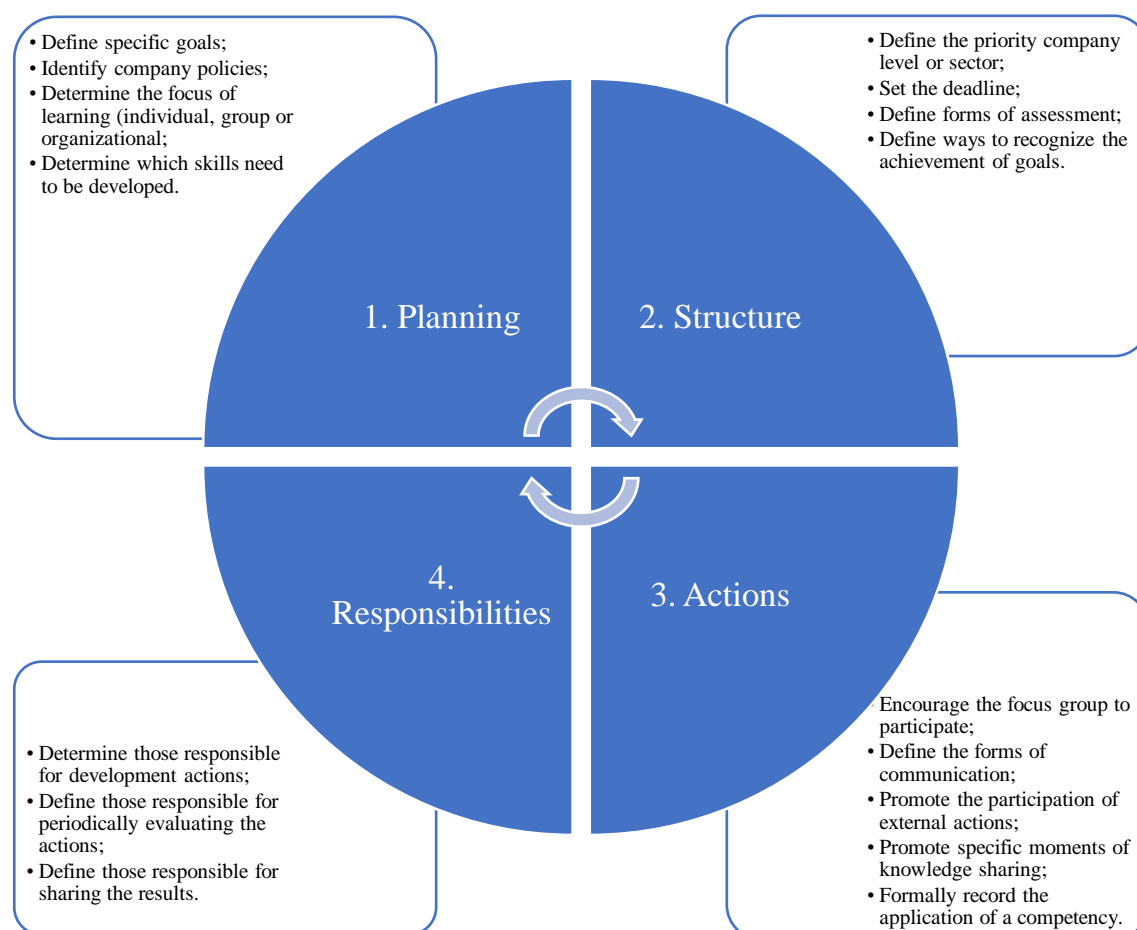
its validation under the practical point of view of implementation; b) the participation of logistics and sustainability professionals from other countries aiming at validating the roadmap considering other logistical scenarios; and, c) analyze means for the insertion and adaptation of the roadmap so that it also considers the environmental and economic sustainability practices.

Appendix A: Social sustainability practices identified in the literature

| Stakeholders | Social practices | References |
|--|--|--|
| Collaborator | <ul style="list-style-type: none"> Define accident prevention strategies; such as: driving the speed limit, night driving time restrictions, time off and rest time planning. | (Amirmokhtar Radi and Shokouhyar, 2021; Bloemhof <i>et al.</i> , 2015; Kumar and Anbanandam, 2019; Singh <i>et al.</i> , 2020; Walker <i>et al.</i> , 2021) |
| | <ul style="list-style-type: none"> Ensure accessibility in the development of operations and activities. | (Chamseddine and Ait Boubkr, 2020) |
| | <ul style="list-style-type: none"> Assess the employee's health and well-being. | (Amirmokhtar Radi and Shokouhyar, 2021; Bubicz <i>et al.</i> , 2021; Chakroun <i>et al.</i> , 2019; Chamseddine and Ait Boubkr, 2020; Guo and Lu, 2021; Walker <i>et al.</i> , 2021) |
| | <ul style="list-style-type: none"> Conduct training for skills development. | (Chakroun <i>et al.</i> , 2019; Kelling <i>et al.</i> , 2020; Yadava and Sinha, 2016) |
| | <ul style="list-style-type: none"> Make employees aware of the importance of inclusion and gender differences. | (Bubicz <i>et al.</i> , 2021; Ryan, 2020; Schönborn <i>et al.</i> , 2019; Walker <i>et al.</i> , 2021; Yadava and Sinha, 2016) |
| | <ul style="list-style-type: none"> Ensuring means for career development (Provision of retirement benefit, pension fund and bonus). | (Bubicz <i>et al.</i> , 2021; Kumar and Anbanandam, 2019; Schönborn <i>et al.</i> , 2019) |
| | <ul style="list-style-type: none"> Set firm rules and regulations about not drinking and driving. | (Kumar and Anbanandam, 2019) |
| | <ul style="list-style-type: none"> Have health insurance for drivers. | (Kumar and Anbanandam, 2019) |
| | <ul style="list-style-type: none"> Guarantee regular and equal salaries at the same level. | (Kumar and Anbanandam, 2019; Schönborn <i>et al.</i> , 2019; Yadava and Sinha, 2016) |
| | Neighboring communities | <ul style="list-style-type: none"> Prioritize the employability of neighboring communities and social demands contributing to the development of the local economy. |
| <ul style="list-style-type: none"> Assess the impact of operations on neighboring communities to maintain their well-being. | | (Govindan, Paam, <i>et al.</i> , 2016; Martins <i>et al.</i> , 2020; Pilouk and Koottatep, 2017; Walker <i>et al.</i> , 2021) |
| <ul style="list-style-type: none"> Develop assistance projects with neighboring communities to access essential services (Example: access to potable water and free assistance services). | | (Chakroun <i>et al.</i> , 2019; Fraser, 2018; Kumar and Anbanandam, 2019; Walker <i>et al.</i> , 2021) |
| <ul style="list-style-type: none"> Develop educational, philanthropic and cultural activities. | | (Amirmokhtar Radi and Shokouhyar, 2021; Chakroun <i>et al.</i> , 2019; Han and Lee, 2021; Kelling <i>et al.</i> , 2020; Walker <i>et al.</i> , 2021) |
| Customers | <ul style="list-style-type: none"> Use services from local community providers. | (Schönborn <i>et al.</i> , 2019) |
| | <ul style="list-style-type: none"> Carry out the development of products together with customers, including allowing them to participate in sustainable projects. | (Walker <i>et al.</i> , 2021) |
| | <ul style="list-style-type: none"> Demonstrate socially ethical behavior towards the client. | (Walker <i>et al.</i> , 2021) |
| Society | <ul style="list-style-type: none"> Provide a customer service channel for support and conflict resolution. | (Chakroun <i>et al.</i> , 2019) |
| | <ul style="list-style-type: none"> Subsidize low-income household accounts. | (Walker <i>et al.</i> , 2021) |
| | <ul style="list-style-type: none"> Respect national legislation. | (Han and Lee, 2021; Kumar and Anbanandam, 2019; Walker <i>et al.</i> , 2021) |
| | <ul style="list-style-type: none"> Create a protection system against child labor. | (Bradley and Botchway, 2018; Bubicz <i>et al.</i> , 2021) |
| Society | <ul style="list-style-type: none"> Make a public commitment and contribute to social sustainability initiatives. | (Walker <i>et al.</i> , 2021) |
| | <ul style="list-style-type: none"> Adopt an anti-corruption system. | (Bubicz <i>et al.</i> , 2021; Chakroun <i>et al.</i> , 2019; Schönborn <i>et al.</i> , 2019) |

| | |
|--|---|
| <ul style="list-style-type: none"> • Ensure animal welfare. | (Bubicz <i>et al.</i> , 2021) |
| <ul style="list-style-type: none"> • Prepare period reports of actions related to social sustainability. • Ensure the transparency of information. | (Rotondo <i>et al.</i> , 2019; Schönborn <i>et al.</i> , 2019; Svensson and Wagner, 2015) (Han and Lee, 2021; Toussaint <i>et al.</i> , 2021; van der Watt and Marais, 2021) |
| <ul style="list-style-type: none"> • Have a social sustainability support committee. | (Schönborn <i>et al.</i> , 2019) |
| <ul style="list-style-type: none"> • Promote social responsibility throughout the entire value chain. | (Chakroun <i>et al.</i> , 2019) |
| Total of 27 practices. | |

Appendix B: Competency management system based on ISO 10015:2020



Source: Adapted from (ISO-10015, 2020)

Appendix C: Base Set of Social Indicators

| Social indicators | References |
|---|--|
| Assessment of employee satisfaction in the workplace | (Irfani <i>et al.</i> , 2019; Pilouk and Koottatep, 2017) |
| Monitoring the impact of operations on neighboring communities | (Govindan, Garg, <i>et al.</i> , 2016; Pilouk and Koottatep, 2017; Seguí <i>et al.</i> , 2016) |
| Assessment of employee health and well-being in the corporate environment | (Govindan, Garg, <i>et al.</i> , 2016) |
| Social demands employability index | (Govindan, Garg, <i>et al.</i> , 2016) |
| Participatory management index | (Pilouk and Koottatep, 2017) |
| Satisfaction level of inhabitants of neighboring communities | (Morana and Gonzalez-Feliu, 2015) |

Source: (Martins *et al.*, 2020) and references presented in the table.

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3 DISCUSSIONS

As highlighted in the introduction, this thesis was divided into four phases. These phases are interconnected to meet the objective of proposing a roadmap to enhance the insertion of social sustainability practices in logistics systems considering the Brazilian context. Therefore, the first phase of this research aimed to understand the sustainable transport methods that have been used by companies and to identify research gaps in the area of sustainable logistics. The second phase aimed to identify sustainable practices that have been developed by companies in the Brazilian logistics sector. Once sustainable transport methods were identified, the thesis set out to understand the Brazilian context about the development of sustainable practices in its operations. According to Persdotter Isaksson et al. (2019) and Lu et al. (2019), analyzing sustainable practices developed by companies becomes important as the demand from society has grown in terms of the demand for the development of increasingly sustainable manufacturing, supply and distribution operations. This point of view is corroborated by Bask et al. (2018) and Björklund; Forslund (2019) that highlight the need to better understand the role of sustainability in the development of logistic activities. The third phase sought to understand and analyze the perception of logistics professionals working in Brazil regarding the understanding of the TBL through the analysis of a set of environmental, economic and social indicators. According to Frayret et al. (2017), many professionals and companies still do not consider TBL guidelines jointly in their operations and there is still a scarcity of key performance indicators to assess sustainable logistics systems. With the results achieved in the previous phases, it was possible to define the objective of the fourth phase as being the proposition and validation of a roadmap to enhance the insertion of social sustainability in the logistics operations of companies operating in the Brazilian scenario. A roadmap aimed at enhancing the inclusion of social practices in logistic activities becomes important for achieving sustainable objectives and guaranteeing the competitive advantages of a given company Hojnik et al. (2020).

According to the reading of the previous section and analyzing together the results achieved, it is possible to realize that even with the use of different research strategies, in general, the results converge to illustrate that companies and professionals in the area of logistics operating in Brazil, relegate social, environmental and economic

aspects of sustainability to a lower level. This shows the need to develop a roadmap that promotes the insertion of social sustainability in logistics systems. Caritte et al. (2015) argue that roadmaps are considered essential for organizations to assess and develop action plans to meet their strategic objectives. According to Moretto et al., (2018) a roadmap is suitable when the objective is to define a sustainable path within companies, identifying practices to transform companies to follow sustainability guidelines.

When analyzing the actions for the sustainability of the transport methods identified in phase one, it is possible to see that the majority are directly related to environmental and economic aspects. For example, efforts to reduce CO₂ emissions and green practices in business management. Social actions are registered only in the aspects of urban mobility. In phase two, among the 22 practices identified, only 4 are related to the social context of TBL, namely: ergonomics and operational safety of warehouses to improve working conditions; inclusion of social criteria and human rights in purchase processes; prioritization of purchase of inputs available in the local community; and, free transport for social projects. In phase three, it is possible to notice that among the 6 social indicators considered in the study, 4 of them were among the 10 worst-ranked, that is, evidence that the social aspects were neglected. Stindt (2017) argues that there is a lack of guidelines to support comprehensive analysis, especially regarding the assessment of social performance, which hinders advances in corporate sustainability. Therefore, there is a convergence to this reality as demonstrated in the results achieved.

In phase four (third article) a roadmap was validated that aims to enhance the inclusion of social sustainability practices in the logistics operations of companies operating in Brazil. The roadmap encompasses actions ranging from meeting and adapting legal issues related to sustainability, an initial diagnosis of the company, motivation and awareness of the importance of social sustainability, followed by encouraging the inclusion of social sustainability practices in logistic activities, and finally, identification of improvement opportunities and establishment of execution plans within the company. In general, the roadmap converges towards restructuring and redefinition of the organizational culture aimed at meeting sustainable guidelines and also contemplates the dynamics of seeking continuous improvement throughout all levels and sectors belonging to the organization. According to Rostain (2021), Oriade et al. (2021) and Azeem et al. (2021) the organizational culture consists of the behavior

and mentality guide that must be passed on to employees and becomes important as it enhances the achievement of the company's objectives and purposes through the coherent definition of its strategy, therefore, is considered essential for achieving of sustainable goals.

Additionally, Fok et al. (2022) and Shea et al. (2021) emphasize that although it is possible to find robust studies in the literature on the impact of sustainability on organizational performance, it is still unclear whether organizational culture directly influences better sustainable performance. The authors also emphasize that there is a lack of literature addressing how organizational culture contributes to achieving sustainable goals.

Krauss; Vanhove (2022) highlight that organizational culture is often considered an important variable behind organizational success in environments that require rapid changes, such as the need to include sustainable aspects in logistics systems. The authors also emphasize that it is important to understand how the perceptions of culture within the organization can provide more information about the relationship between culture and the change behavior of the employees involved.

Another important point is to analyze the organizational climate. Agbejule et al. (2021) argue that the organizational climate is an important component in the employees' learning process, that is, considering the results achieved in the studies of this thesis, it is possible to affirm that the organizational climate has a direct influence on the success of the redefinition of an organizational culture oriented to the adoption of practices of social sustainability.

Regarding continuous improvement within the organization, Lleo et al. (2021), Sanchez-Ruiz; Blanco (2019) and Blaga (2020) emphasize its importance to support the success of a company, mainly through waste management, whether in financial terms, time, or even extensive and unnecessary processes, ensuring a competitive advantage for the organization.

In general, it is also worth highlighting the importance of the results achieved considering the aspects of the circular economy, since its concept is directly related to the sustainability guidelines. Ünal et al. (2019) highlight that the circular economy, when well developed, enables the creation of new jobs and the growth of the business ecosystem, generating value creation, cost reduction, revenue generation and increased

resilience and legitimacy for organizations. Additionally, Kwarteng et al. (2021) highlight the power of the circular economy in producing economic and environmental value through resource efficiency and recycling.

According to Sehnem et al. (2021) circular economy practices have been increasingly present in organizations, however, it is worth noting the lack of external policies and governance to enhance their insertion. Thus, sustainable policies play an important role as drivers in the insertion of circular economy practices at the organizational level.

4 CONCLUSIONS

This thesis aimed to propose and validate a roadmap model to enhance the inclusion of social sustainability practices in logistics activities considering the scenario of companies operating in Brazil. To this end, four phases with well-defined objectives were developed. Initially, sought to understand the sustainable transport methods that have been used, their type, benefits and difficulties. Then, the sustainable practices that have been developed in logistics systems by Brazilian companies were identified through the content analysis of 30 sustainability reports. The third phase identified the importance attributed by Brazilian professionals in the field of logistics about performance indicators for evaluating sustainable logistics systems, considering environmental, economic and social aspects. Finally, in possession of the results of the previous phases, the fourth phase consisted of the proposal and validation of a roadmap to enhance the insertion of social sustainability in the logistics systems of companies operating in Brazil. According to the findings presented, it can be concluded that the main objective of the research was achieved.

Through the results achieved, it is possible to conclude that Brazilian companies and professionals in the logistics area still relegate aspects of social sustainability to the background of environmental and economic aspects. This fact increases the relevance of a roadmap that aims to enhance the inclusion of social practices in logistics operations. Among the twenty-two sustainable practices that have been developed by logistics companies operating in the Brazilian scenario, only four are related to social aspects. Among the 33 sustainable indicators considered in this study, only 6 are directly linked to social aspects, and of these, 4 were among the last 10 positions in the ranking generated, which considers, in the opinion of professionals in the area, the importance of the indicator for the management of logistic activities.

Additionally, it should be noted that, through this research, it was found that systematic literature review techniques, content analysis, TOPSIS and the DELPHI method are relevant techniques that can guide researchers in conducting exploratory investigations. The credibility of such methods in international journals was proven, the results provided interesting insights that can generate further debates in the area of logistics and sustainability.

As research limitations, its exploratory character stands out. Therefore, it is noteworthy that the results and conclusions presented here are valid for the context and sample considered in this study. The social sustainability in logistics systems, as it is still a little-explored topic, converges to the need to develop exploratory research aimed at expanding debates on the subject. Furthermore, it is noteworthy that the quantitative techniques used to increase the validity and reliability of the results achieved.

As proposals for future research, the following stand out: a) proposal of models to assess the maturity of logistics systems in terms of sustainability; b) development of new tools that enable better performance of the logistics systems in terms of meeting sustainability considering the three aspects of the TBL; c) the use of the roadmap in companies that develop logistics activities operating in Brazil, aiming at its validation under the practical point of view of implementation; d) the participation of logistics and sustainability professionals from other countries aiming at validating the roadmap considering other logistic scenarios, and; e) Development of studies aimed at proposing ways to achieve a considerable reduction in the emission of polluting gases resulting from processes and logistics activities.

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ATTACHMENT 1 - Authorizations Research Ethics Committee



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PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Sistema logístico brasileiro: análise das dificuldades e identificação de indicadores associados à inserção da sustentabilidade

Pesquisador: VITOR WILLIAM BATISTA MARTINS

Área Temática:

Versão: 2

CAAE: 18725119.0.0000.5404

Instituição Proponente: Faculdade de Engenharia Mecânica

Patrocinador Principal: Financiamento Próprio

DADOS DA NOTIFICAÇÃO

Tipo de Notificação: Envio de Relatório Final

Detalhe:

Justificativa: Relatório final de projeto de pesquisa.

Data do Envio: 06/01/2021

Situação da Notificação: Parecer Consubstanciado Emitido

DADOS DO PARECER

Número do Parecer: 4.529.788

Apresentação da Notificação:

Pesquisadores enviam relatório final de atividades do projeto citado acima

Objetivo da Notificação:

Apresentar relatório final de atividades do estudo

Avaliação dos Riscos e Benefícios:

Mantidos em relação ao projeto original

Comentários e Considerações sobre a Notificação:

Data da aprovação do projeto por este CEP:

- 11/09/2019 (parecer número 3.567.513, em 'PB_PARECER_CONSUBSTANCIADO_CEP_3567513.pdf', de 11/09/2019 10:47:28)

- 19/12/2019 (parecer número 3.783.870, em

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Continuação do Parecer: 4.529.788

'PB_PARECER_CONSUBSTANCIADO_CEP_3783870_E1.pdf', de 19/12/2019 12:37:21)

Data de conclusão do estudo: 15/6/2020

Embora originalmente previstos 60 voluntários para a pesquisa, foram incluídos 50 participantes no estudo
Não houve registro de intercorrências

Estudo foi publicado:

Vitor William Batista Martins, Rosley Anholon, Vasco Sanchez-Rodrigues, Walter Leal Filho, Osvaldo Luiz Gonçalves Quelhas "Brazilian logistics practitioners' perceptions on sustainability: an exploratory study". The International Journal of Logistics Management Volume 32 Issue 1 (2020)

<https://doi.org/10.1108/IJLM-02-2020-0091>

Considerações sobre os Termos de apresentação obrigatória:

Para avaliação desta notificação foi analisado o relatório final anexado no documento intitulado 'Formulario_relatorio_final.pdf', de 06/01/2021 10:31:55

Relatório enviado adequadamente, em formulário próprio deste CEP

Recomendações:

(nenhuma)

Conclusões ou Pendências e Lista de Inadequações:

Relatório final aprovado

Considerações Finais a critério do CEP:

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

| Tipo Documento | Arquivo | Postagem | Autor | Situação |
|--------------------------|--------------------------------|------------------------|----------------------------------|----------|
| Envio de Relatório Final | Formulario_relatorio_final.pdf | 06/01/2021 10:31:55 | VITOR WILLIAM BATISTA MARTINS | Postado |

Situação do Parecer:

Aprovado

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Continuação do Parecer: 4.529.788

Necessita Apreciação da CONEP:

Não

CAMPINAS, 08 de Fevereiro de 2021

Assinado por:
Renata Maria dos Santos Celeghini
(Coordenador(a))

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PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Roadmap para potencializar a inserção da sustentabilidade social em sistemas logísticos considerando o contexto brasileiro

Pesquisador: VITOR WILLIAM BATISTA MARTINS

Área Temática:

Versão: 2

CAAE: 48817821.4.0000.5404

Instituição Proponente: Faculdade de Engenharia Mecânica

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 4.895.858

Apresentação do Projeto:

As informações contidas nos campos "Apresentação do Projeto", "Objetivo da Pesquisa" e "Avaliação dos Riscos e Benefícios" foram obtidas dos documentos apresentados para apreciação ética e das informações inseridas pelo Pesquisador Responsável do estudo na Plataforma Brasil.

Introdução:

A inserção da sustentabilidade em sistemas logísticos é um tema de crescente interesse entre os pesquisadores. Avaliar o comportamento sustentável da gestão das atividades logísticas de uma determinada empresa é um desafio, a complexidade aumenta quando se objetiva analisar a cadeia como um todo, pois requer certo grau de influência, confiança e colaboração por parte das empresas, além disso, há a necessidade de ferramentas e técnicas adequadas (XIA; LIPING TANG, 2011). Embora pesquisadores e profissionais concentrem sua atenção na dimensão econômica e ambiental da sustentabilidade, menos atenção é dada à dimensão social da sustentabilidade, particularmente nos países em desenvolvimento (KUMAR; ANBANANDAM, 2019). Portanto, torna-se importante analisar a inserção da sustentabilidade em sistemas logísticos, principalmente no que tange as diretrizes e práticas relacionadas aos aspectos sociais. Este contexto ainda é pouco explorado na literatura. Diferente dos aspectos ambientais e econômicos os aspectos sociais tendem a ser negligenciados por parte de gestores atuantes neste contexto. Acredita-se que isto se deve ao fato do retorno para a empresa ser a longo prazo e de difícil mensuração e

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Continuação do Parecer: 4.895.858

compreensão dos valores gerados para a empresa (ALDAKHIL et al., 2018; KAUR; SHARMA, 2018; MARTINS et al., 2019, 2020).

Hipótese:

A hipótese de pesquisa é a de que um roadmap focado na inserção de práticas sociais em sistemas logísticos pode proporcionar o alcance de resultados sustentáveis no desenvolvimento de atividades logísticas.

Metodologia Proposta:

Para a pesquisa será utilizado o Método Delphi, seguindo as etapas desenvolvidas por (CHEN; PAK, 2017). Na literatura, o método Delphi tem sido amplamente utilizado para identificar e explorar contextos para se alcançar consensos desconhecidos e incertos, e tem sido amplamente utilizado na área de logística (CHEN; PAK, 2017). O público alvo consiste em profissionais especialistas e atuantes na área de logística e sustentabilidade e a amostra possui o tamanho de pelo menos 10 profissionais que irão compor o grupo; ressalta-se que desistências ao longo do processo podem ocorrer e, conseqüentemente, a amostra final pode ser menor que a inicial. Em seguida, inicia-se a rodada 1 do Delphi onde o profissional tomando por base seus conhecimentos e sua experiência sobre os conceitos de sustentabilidade social e práticas sociais esperadas por parte de empresas que desenvolvem atividades logísticas, serão convidados a analisar e expressar sua opinião sobre o roadmap inicial proposto considerando a sua adequação com o contexto brasileiro do setor logístico. Nesta etapa inicial do Delphi o profissional pode livremente sugerir alterações, complementos, exclusões e/ou agrupamentos das fases propostas, avaliar objetivos de cada uma e os meios sugeridos para o desenvolvimento de cada fase. Nesta primeira rodada do Delphi os profissionais receberão por e-mail via plataforma do Google Forms o convite para analisar e registrar sua percepção (resposta) do roadmap inicial proposto de forma discursiva com o limite máximo de 400 palavras. Em seguida, tomando por base o resultado da primeira rodada será realizada uma análise de conteúdo entre as respostas obtidas seguindo as diretrizes propostas por Elo & Kyngäs (2008). O pesquisador refinará o roadmap conforme indicações e o mesmo é colocado em avaliação por meio de uma nova rodada junto aos profissionais, buscando assim o alcance do consenso por parte da maioria dos respondentes. Além da análise de conteúdo, será utilizado também caso seja necessário técnicas quantitativas para possível identificação de consenso das respostas. Após a aprovação deste projeto pelo Comitê de Ética em Pesquisa da Unicamp, será iniciada a fase de coleta de dados, na qual os respondentes serão contatados via e-

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mail e convidados a responder as etapas de pesquisa via link online da plataforma Google Forms. Para a primeira rodada, após assinalar a concordância com o TCLE (disponibilizado no link do Google Forms), os especialistas deverão analisar o roadmap proposto e responder a questão chave de forma discursiva e utilizando no máximo 400 palavras. Cada respondente terá até 15 dias para registrar sua resposta. Almeja-se a realização de pelo menos mais duas rodadas além da inicial, em acordo com as diretrizes do método Delphi. Por fim, destaca-se que em atendimento ao OFÍCIO CIRCULAR Nº 2/2021/CONEP/SECNS da Comissão Nacional de Ética em Pesquisa em que trata de pesquisas realizadas em ambiente virtual, no que se refere ao item 1.2 “O pesquisador deverá descrever e justificar o procedimento a ser adotado para a obtenção do consentimento livre e esclarecido, bem como, o formato de registro ou assinatura do termo que será utilizado”. Para esta pesquisa, será coletado via google forms a ciência e concordância do TCLE (disponível de forma eletrônica via link na parte inicial do questionário) por parte do respondente participante no começo do questionário, para tal é solicitada a marcação de um campo específico no começo do questionário indicando sua concordância e para que o mesmo consiga evoluir nas próximas etapas da pesquisa/questionário, sem tal marcação o mesmo não conseguirá responder e participar da pesquisa (ver arquivo “questionario”, parte deste projeto).

Critério de Inclusão:

Profissionais atuantes na área de logística e sustentabilidade no Brasil que tenham respondido do questionário de forma completa.

Critério de Exclusão: Serão excluídos das pesquisas informações que possuam dados incompletos. Também serão excluídas informações por solicitação dos respondentes, em qualquer momento. Entendemos que os participantes têm esse direito.

Metodologia de Análise de Dados:

Para a pesquisa será utilizado o Método Delphi, seguindo as etapas desenvolvidas por (CHEN; PAK, 2017). Na literatura, o método Delphi tem sido amplamente utilizado para identificar e explorar contextos para se alcançar consensos desconhecidos e incertos, e tem sido amplamente utilizado na área de logística (CHEN; PAK, 2017). O público alvo consiste em profissionais especialistas e atuantes na área de logística e sustentabilidade e a amostra possui o tamanho de pelo menos 10 profissionais que irão compor o grupo; ressalta-se que desistências ao longo do processo podem ocorrer e, conseqüentemente, a amostra final pode ser menor que a inicial. Em seguida, inicia-se a rodada 1 do Delphi onde o profissional tomando por base seus conhecimentos e sua experiência

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sobre os conceitos de sustentabilidade social e práticas sociais esperadas por parte de empresas que desenvolvem atividades logísticas, serão convidados a analisar e expressar sua opinião sobre o roadmap inicial proposto considerando a sua adequação com o contexto brasileiro do setor logístico. Nesta etapa inicial do Delphi o profissional pode livremente sugerir alterações, complementos, exclusões e/ou agrupamentos das fases propostas, avaliar objetivos de cada uma e os meios sugeridos para o desenvolvimento de cada fase. Nesta primeira rodada do Delphi os profissionais receberão por e-mail via plataforma do Google Forms o convite para analisar e registrar sua percepção (resposta) do roadmap inicial proposto de forma discursiva com o limite máximo de 400 palavras. Em seguida, tomando por base o resultado da primeira rodada será realizada uma análise de conteúdo entre as respostas obtidas seguindo as diretrizes propostas por Elo & Kyngäs (2008). O pesquisador refinará o roadmap conforme indicações e o mesmo é colocado em avaliação por meio de uma nova rodada junto aos profissionais, buscando assim o alcance do consenso por parte da maioria dos respondentes. Além da análise de conteúdo, será utilizado também caso seja necessário técnicas quantitativas para possível identificação de consenso das respostas. Após a aprovação deste projeto pelo Comitê de Ética em Pesquisa da Unicamp, será iniciada a fase de coleta de dados, na qual os respondentes serão contatados via e-mail e convidados a responder as etapas de pesquisa via link online da plataforma Google Forms. Para a primeira rodada, após assinalar a concordância com o TCLE (disponibilizado no link do Google Forms), os especialistas deverão analisar o roadmap proposto e responder a questão chave de forma discursiva e utilizando no máximo 400 palavras. Cada respondente terá até 15 dias para registrar sua resposta. Almeja-se a realização de pelo menos mais duas rodadas além da inicial, em acordo com as diretrizes do método Delphi.

Objetivo da Pesquisa:

O presente projeto possui o objetivo de propor e validar um modelo de roadmap para potencializar a inserção da sustentabilidade social em sistemas logísticos considerando o cenário de empresas logísticas atuantes no Brasil.

Avaliação dos Riscos e Benefícios:

Segundo informações do pesquisador:

Riscos:

Entendemos que para esta pesquisa os riscos não são previsíveis, uma vez que se trata de pesquisas envolvendo “opiniões”. O tempo estimado para a participação na pesquisa em cada fase é de 15 minutos. Entretanto, caso sinta qualquer tipo de desconforto, o participante tem o direito de não responder a mesma ou procurar os pesquisadores para esclarecer dúvidas. O participante

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pode interromper o preenchimento do questionário a qualquer momento. Uma via do TCLE pode ser requerida e salva pelo participante a qualquer momento no navegador.

Benefícios:

Não há benefícios diretos aos participantes da pesquisa. O grande benefício social associado às pesquisas está relacionado à contribuição para o conhecimento científico na área de logística e sustentabilidade. Além disso, os resultados poderão motivar novos debates e pesquisas futuras, contribuindo assim para a melhoria no setor logístico brasileiro.

Comentários e Considerações sobre a Pesquisa:

Este protocolo se refere ao projeto de pesquisa intitulado "roadmap para potencializar a inserção da sustentabilidade social em sistemas logísticos considerando o contexto brasileiro", cujo pesquisador responsável é Vitor William Batista Martins, com a colaboração da pesquisadora assistente Rosley Anholon. A Instituição Proponente é a Faculdade de Engenharia Mecânica da UNICAMP. Segundo as Informações Básicas do Projeto, a pesquisa tem orçamento estimado de R\$ 500,00 (Quinhentos reais) para material de consumo e o cronograma apresentado contempla início do estudo para agosto de 2021, com término em dezembro de 2021. Serão abordadas ao todo 10 pessoas, sendo todos profissionais especialistas e atuantes na área de logística e sustentabilidade.

Considerações sobre os Termos de apresentação obrigatória:

Foram analisados os seguintes documentos de apresentação obrigatória:

- 1 - Folha de Rosto Para Pesquisa Envolvendo Seres Humanos: Foi apresentado o documento "Folhaderosto.pdf" devidamente preenchido, datado e assinado.
- 2 - Projeto de Pesquisa: Foram analisados os documentos "Projetocep.pdf" e "PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1785318.pdf" de 02/08/2021. Adequado.
- 3 - Orçamento financeiro e fontes de financiamento: Informações sobre orçamento financeiro incluídas nos documentos "PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1785318.pdf" de 02/08/2021 e "Projetocep.pdf". De acordo com o pesquisador, o financiamento é próprio e se espera gastar R\$500,00 com material de consumo. Adequado.
- 4 - Cronograma: Informações sobre o cronograma incluídas nos documentos "PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1785318.pdf" de 02/08/2021 e "Projetocep.pdf". Adequado.
- 5 - Termo de Consentimento Livre e Esclarecido: Foi apresentado o documento "TCLE.pdf", que contém o Termo de Consentimento Livre e Esclarecido. Adequado.
- 6 - Currículo do pesquisador principal e demais colaboradores: Foi apresentado o arquivo

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“LattesVitor.pdf” com o currículo do pesquisador principal. Os links dos Currículos Lattes dos dois pesquisadores estão no documento “Projetocep.pdf”.

7 - Comprovante do vínculo institucional do pesquisador responsável com a Unicamp. Foi apresentado atestado de matrícula no programa de Doutorado em Engenharia Mecânica da UNICAMP com prazo de integralização até agosto de 2023. Adequado.

8 - Outros documentos que acompanham o Protocolo de Pesquisa:

- Arquivo “questionario.pdf” com o questionário a ser apresentado aos participantes. Adequado

Recomendações:

A Comissão Nacional de Ética em Pesquisa (Conep), do Conselho Nacional de Saúde (CNS) orienta a adoção das diretrizes do Ministério da Saúde (MS) decorrentes da pandemia causada pelo Coronavírus SARS-CoV-2 (Covid-19), com o objetivo de minimizar os potenciais riscos à saúde e a integridade dos participantes de pesquisas e pesquisadores.

De acordo com carta circular da CONEP intitulada “ORIENTAÇÕES PARA CONDUÇÃO DE PESQUISAS E ATIVIDADE DOS CEP DURANTE A PANDEMIA PROVOCADA PELO CORONAVÍRUS SARS-COV-2 (COVID-19)” publicada em 09/05/2020, referente ao item II. “Orientações para Pesquisadores”:

- Aconselha-se a adoção de medidas para a prevenção e gerenciamento de todas as atividades de pesquisa, garantindo-se as ações primordiais à saúde, minimizando prejuízos e potenciais riscos, além de prover cuidado e preservar a integridade e assistência dos participantes e da equipe de pesquisa.
- Em observância às dificuldades operacionais decorrentes de todas as medidas impostas pela pandemia do SARS-CoV-2 (COVID- 19), é necessário zelar pelo melhor interesse do participante da pesquisa, mantendo-o informado sobre as modificações do protocolo de pesquisa que possam afetá-lo, principalmente se houver ajuste na condução do estudo, cronograma ou plano de trabalho.
- Caso sejam necessários a suspensão, interrupção ou o cancelamento da pesquisa, em decorrência dos riscos imprevisíveis aos participantes da pesquisa, por causas diretas ou indiretas, caberá aos investigadores a submissão de notificação para apreciação do Sistema CEP/Conep.
- Nos casos de ensaios clínicos, é permitida, excepcionalmente, a tramitação de emendas concomitantes à implementação de modificações/alterações no protocolo de pesquisa, visando à segurança do participante da pesquisa, assim como dos demais envolvidos no contexto da pesquisa, evitando-se, ainda, quando aplicável, a interrupção no tratamento dos participantes da pesquisa. Eventualmente, na necessidade de modificar o Termo de Consentimento Livre e

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Esclarecido (TCLE), o pesquisador deverá proceder com o novo consentimento, o mais breve possível.

Conclusões ou Pendências e Lista de Inadequações:

Lista de inadequações e pendências emitidas no parecer CEP nº 4.877.430:

Quanto aos documentos "PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1785318.pdf" de 02/07/2021 e "Projetocep.pdf", é necessário apresentar detalhes relativos às ações dos pesquisadores para cumprirem alguns itens específicos do Ofício Circular 2 do CONEP, de 24/02/2021, quais sejam:

1.2.1. Caberá ao pesquisador destacar, além dos riscos e benefícios relacionados com a participação na pesquisa, aqueles riscos característicos do ambiente virtual, meios eletrônicos, ou atividades não presenciais, em função das limitações das tecnologias utilizadas. Adicionalmente, devem ser informadas as limitações dos pesquisadores para assegurar total confidencialidade e potencial risco de sua violação.

Resposta: Esta informação foi adicionada no projeto na seção de "Riscos e benefícios envolvidos na execução da pesquisa" e destacada em amarelo. Por gentileza, verificar o projeto que foi atualizado.

Análise: PENDÊNCIA ATENDIDA

2.1. O convite para participação na pesquisa não deve ser feito com a utilização de listas que permitam a identificação dos convidados nem a visualização dos seus dados de contato (e-mail, telefone, etc) por terceiros.

2.1.1. Qualquer convite individual enviado por e-mail só poderá ter um remetente e um destinatário, ou ser enviado na forma de lista oculta.

Resposta: Esta informação foi destacada no projeto na seção de "Riscos e benefícios envolvidos na execução da pesquisa" e está em amarelo no texto. Por gentileza, verificar o projeto que foi atualizado.

Análise: PENDÊNCIA ATENDIDA

3.1. É da responsabilidade do pesquisador o armazenamento adequado dos dados coletados, bem como os procedimentos para assegurar o sigilo e a confidencialidade das informações do

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participante da pesquisa.

Resposta: Esta informação foi adicionada no projeto na seção de “Riscos e benefícios envolvidos na execução da pesquisa” e destacada em amarelo. Por gentileza, verificar o projeto que foi atualizado.

Análise: PENDÊNCIA ATENDIDA

3.2. Uma vez concluída a coleta de dados, é recomendado ao pesquisador responsável fazer o download dos dados coletados para um dispositivo eletrônico local, apagando todo e qualquer registro de qualquer plataforma virtual, ambiente compartilhado ou "nuvem".

Resposta: Esta informação foi adicionada no projeto na seção de “Riscos e benefícios envolvidos na execução da pesquisa” e destacada em amarelo. Por gentileza, verificar o projeto que foi atualizado.

Análise: PENDÊNCIA ATENDIDA

4.2. O convite para a participação na pesquisa deverá conter, obrigatoriamente, link para endereço eletrônico ou texto com as devidas instruções de envio, que informem ser possível, a qualquer momento e sem nenhum prejuízo, a retirada do consentimento de utilização dos dados do participante da pesquisa. Nessas situações, o pesquisador responsável fica obrigado a enviar ao participante de pesquisa, a resposta de ciência do interesse do participante de pesquisa retirar seu consentimento.

Resposta: Esta informação foi destacada no projeto na seção de “Riscos e benefícios envolvidos na execução da pesquisa” e está em amarelo no texto. Por gentileza, verificar o projeto que foi atualizado.

Análise: PENDÊNCIA ATENDIDA

Considerações Finais a critério do CEP:

- O participante da pesquisa deve receber uma via do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado (quando aplicável).

- O participante da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (quando aplicável).

- O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado. Se o

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pesquisador considerar a descontinuação do estudo, esta deve ser justificada e somente ser realizada após análise das razões da descontinuidade pelo CEP que o aprovou. O pesquisador deve aguardar o parecer do CEP quanto à descontinuação, exceto quando perceber risco ou dano não previsto ao participante ou quando constatar a superioridade de uma estratégia diagnóstica ou terapêutica oferecida a um dos grupos da pesquisa, isto é, somente em caso de necessidade de ação imediata com intuito de proteger os participantes.

- O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo. É papel do pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária – ANVISA – junto com seu posicionamento.

- Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas e aguardando a aprovação do CEP para continuidade da pesquisa. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprovatório do CEP, para serem juntadas ao protocolo inicial.

- Relatórios parciais e final devem ser apresentados ao CEP, inicialmente seis meses após a data deste parecer de aprovação e ao término do estudo.

- Lembramos que segundo a Resolução 466/2012, item XI.2 letra e, “cabe ao pesquisador apresentar dados solicitados pelo CEP ou pela CONEP a qualquer momento”.

- O pesquisador deve manter os dados da pesquisa em arquivo, físico ou digital, sob sua guarda e responsabilidade, por um período de 5 anos após o término da pesquisa.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

| Tipo Documento | Arquivo | Postagem | Autor | Situação |
|----------------|-----------------------------|------------|-------|----------|
| Informações | PB_INFORMAÇÕES_BÁSICAS_DO_P | 02/08/2021 | | Aceito |

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|--|-----------------------|------------------------|----------------------------------|--------|
| Básicas do Projeto | ETO_1785318.pdf | 14:29:50 | | Aceito |
| Outros | CartaResposta.pdf | 02/08/2021 14:28:21 | VITOR WILLIAM BATISTA MARTINS | Aceito |
| Projeto Detalhado / Brochura Investigador | Projetocep.pdf | 02/08/2021 14:27:42 | VITOR WILLIAM BATISTA MARTINS | Aceito |
| Outros | AtestadoMatricula.pdf | 02/07/2021 09:26:27 | VITOR WILLIAM BATISTA MARTINS | Aceito |
| Outros | questionario.pdf | 02/07/2021 09:25:52 | VITOR WILLIAM BATISTA MARTINS | Aceito |
| TCLE / Termos de Assentimento / Justificativa de Ausência | TCLE.pdf | 02/07/2021 09:25:16 | VITOR WILLIAM BATISTA MARTINS | Aceito |
| Folha de Rosto | Folhaderosto.pdf | 02/07/2021 09:23:58 | VITOR WILLIAM BATISTA MARTINS | Aceito |

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

CAMPINAS, 10 de Agosto de 2021

Assinado por:
Renata Maria dos Santos Celeghini
(Coordenador(a))

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