Revista Gestión y Desarrollo Libre
Year 9, N° 18, july-december 2024, pp. 1-11
ISSN 2539-3669
https://doi.org/10.18041/2539-3669/gestionlibre.18.2024.12109

ORIGINAL
Research article

Optimization of the logistics process in the supply chain with a view to sustainability*

Optimización del proceso logístico en la cadena de suministro con miras a la sostenibilidad

Received: November 20, 2023 - Evaluated: February 22, 2024 - Accepted: May 24, 2024

Carlos Miguel Cañedo-González **
ORCID: https://orcid.org/0009-0009-3658-7556
Jessica Garizurieta-Bernabé***
ORCID: https://orcid.org/0000-0002-1443-4737

To cite this Article
Cañedo-González, C. M., & Garizurieta-Bernabé, J. (2024). Optimization of the logistics process in the supply chain with a view to sustainability. *Revista Gestión y Desarrollo Libre*, 9(18), 1-11. https://doi.org/10.18041/2539-3669/gestionlibre.18.2024.12109

Editor: PhD. Rolando Eslava-Zapata

Abstract
Today, sustainability has become an imperative for logistics and supply chain operations, as it is paramount to respond to the demands of consumers, regulators, and society in general, with more responsible and sustainable practices; therefore, the development of the organizations must emphasize the use of renewable energies which promote the delivery of products in an effective way in addition to working strategically vectorizing the application of strategic cubicages which allow to make transfers that provide security, stability and compliance with the objectives demanded by the market, in this sense, this research aims to propose parameters in the production processes, product delivery and after-sales services, allowing the sequential implementation of optimization activities and productive compliance under a sustainable approach; For this purpose, a descriptive-analytical research is carried out, which allows describing and analyzing traditional logistic models, as well as the factors associated to sustainable practices, allowing identifying the main characteristics of the existing logistic systems and the areas of opportunity within these models. By comparing sustainability factors and their influence on the operation and performance of logistics processes, it was possible to determine parameters for evaluating the impact of these practices on logistics. Finally, the research presents a proposal for a sustainable logistics system that aligns traditional models

* Original article. Research and innovation article. Research article. Work linked at the Universidad Veracruzana, Mexico.

**.PhD. in Business Administration and Development by the Universidad Veracruzana, Mexico. Professor at the Universidad Veracruzana, Mexico. Email: ccanedo@uv.mx

*** PhD. in Economic and Strategic Sector Development by the Universidad Veracruzana, Mexico. Professor at the Universidad Veracruzana, México. Email: jgarizurieta@uv.mx

with the principles of sustainability and, thus, integrates sustainable practices in the logistics processes for the delivery of goods at national and international levels.
Keywords: Efficiency, Cubing, Logistics, Transportation, Sustainability

Resumen
En la actualidad la sostenibilidad se ha convertido en un imperativo para las operaciones logísticas y de cadena de suministro, al ser primordial responder a las demandas de consumidores, reguladores, y la sociedad en general, con prácticas más responsables y sostenibles; por lo tanto, el desarrollo de las organizaciones debe hacer hincapié en el uso de energías renovables las cuales promuevan la entrega de los productos de forma efectiva además de trabajar de forma estratégica vectorizando la aplicación de cubicajes estratégicos los cuales permitan realizar traslados que otorguen seguridad, estabilidad y cumplimiento de los objetivos que demanda el mercado, en este sentido, la presente investigación tiene por objetivo proponer parámetros en los procesos de producción, entrega del producto y los servicios postventa, que permitan la implementación secuencial de actividades de optimización y cumplimiento productivo bajo un enfoque sostenible; para ello, se realiza una investigación descriptiva-analítica la cual permite describir y analizar modelos tradicionales logísticos, así como los factores asociados a prácticas sostenibles, permitiendo identificar las características principales de los sistemas logísticos existentes y las áreas de oportunidad dentro de estos modelos. Mediante la comparación de los factores de sostenibilidad y su influencia en el funcionamiento y desempeño de los procesos logísticos, fue posible determinar parámetros de evaluación de los impactos de dichas prácticas en la logística. Finalmente, la investigación presenta una propuesta de sistema logístico sostenible, al alinear los modelos tradicionales con los principios de sostenibilidad, y con ello, integrar prácticas sostenibles en los en los procesos logísticos para la entrega de mercancías a nivel nacional e internacional.
Palabras Clave: Eficiencia, Cubicación, Logística, Medios de Transporte, Sostenibilidad

SUMMARY

INTRODUCTION. – RESOLUTION SCHEME. – I. Research problem. – II. Methodology. – III. Writing plan. – 1. The traditional logistics process. – 2. Sustainability indicators in the logistics process. - IV. Research results. - 1. Proposal for a sustainable logistics system. - CONCLUSIONS. – REFERENCES.

Introduction

Previously, sustainability and sustainability issues were not seen as development factors, being common to hear in the marketing area terms related to the effectiveness and productivity in delivery times, given the importance of making a delivery that makes a closing impact by generating an effective cognitive dissonance in the customer, at the time of receiving their orders.

For this, the supplying companies are always in search of diverse methods that allow them to take care of the necessities that are in demand and, at the same time, to give a solution to the most important factor in logistic subjects, that is: Without taking into account the damages that can be generated by the excessive use of means of transportation, which make use of fuels that bathe the environment, specifically the aquifers, the land and the air space initially, but secondarily also affect flora and fauna of the regions, which is why nowadays it is sought that through various techniques the use of these energies is made efficiently.

However, after industrialization, the increase in environmental problems in the countries generated a growing concern and alarm, giving rise to the term sustainable development, which

recognizes the connection between economic and environmental policy within the social context and, in turn, the concept of sustainability arises as the search for efficiency, equity, and self-sufficiency, extending economic and material rationality (Achkar et al., 2005).

In the same sense, the term sustainability arises, which, unlike sustainability, seeks to maintain in the long term the necessary conditions for human welfare and ecological balance, encompassing a broader approach and including both the present and the future, human development, social equity and environmental conservation (Hernández Maya et al., 2020).

In recent years, the phenomenon of globalization has led companies to seek internationalization, which has increased production and market coverage, compromising humanity and evidencing the lack of awareness on the environmental issue (Manjarres-Mejia & Chirino-García, 2020). It is necessary to make a conscious review of international practices using a sustainable approach.

According to Hernández Maya et al. (2020), "good sustainable practices refer to actions that have a tangible, measurable or measurable impact and contribute to improving the quality of life of citizens and the environment sustainably" (p.12). In this sense, analyzing sustainability from the practice of international trade involves considering the entire supply chain, i.e., from the initial stage of raw material production, the transformation of this into finished products and the distribution of these products until reaching the final consumers (Fontalvo-Herrera et al., 2019); with the objective of achieving an attunement with the sustainable development models that are at the forefront in order to minimize global costs and improve the use of resources and thus be able to guarantee the protection of natural resources and mitigate environmental pollution (Puentes-Manrique, 2021, p. 4).

Within the supply chain, we find logistics, which is a set of resources and techniques through which organizations perform different activities, such as offering services, distributing products, or storing them, with the objective of satisfying a demand (Manjarres-Mejia & Chirino-García, 2020), and must ensure that their products and/or services are transported to the right place, at the right time and the lowest possible cost, without neglecting the quality and safety of the service and/or product.

In this sense, this paper presents an analysis of the traditional logistics process from a sustainable approach in order to determine which characteristics organizations should comply with in terms of cubic capacity, use of means of transportation, and forms of shipments to achieve not only a more efficient process but also a sustainable one.

Resolution scheme

1. Research problem

What actions should be implemented to effectively generate marketing systems that contribute to sustainability within the framework of the traditional logistics process?

2. Methodology

Under a qualitative approach, a comparative study of the traditional models with the factors of sustainable practices was developed in order to identify key differences and potential improvements essential to formulating the proposal of a sustainable logistics system. To this end, the methodological design was divided into three phases:

- Evaluate traditional logistics models. Examine traditional logistics systems in terms of efficiency, costs, and other performance indicators.
- Identify sustainable parameters. Analyze sustainable practices in logistics, evaluating their viability and effectiveness in different contexts.
- Develop a proposal. Based on the analysis, a sustainable logistics system is proposed that integrates the best practices identified and adjusts traditional models to improve their sustainability.

With the above, it was possible to define a logistics model that not only improves the efficiency and effectiveness of the traditional system but also promotes the efficient use of resources and is economically and operationally viable.

3. Writing plan

3.1. The traditional logistics process

According to Acosta (2017), Stern et al. (1998), and Sumba-Bustamante et al. (2022), several types of marketing channels are differentiated by being traditional or contemporary. The former refers to ways of getting the product to the consumer, being classified in turn into:

- Direct channel. It has had a great boom nowadays since the manufacturer passes directly to the consumer, and therefore, today, the marketing, communication, and delivery system has become more agile; for example, buying a product online from the Apple brand.
- Short indirect channel. It is also known as the retail channel. It is used by organizations in order to purchase finished products that can be delivered to the end consumer with fast logistics methods since they go from the manufacturer to the retailer, and the retailer delivers the product to the consumer; for example, buying a Coca-Cola brand product at the corner store.
- Long indirect channel. It is also known as the wholesale channel since it is used by SMEs in order to buy products in mass or on a large scale, and the traditional brands of this sales system are Costco or Sam's Club; for example, petal sells toilet paper, and Costco sells it in large volume packages to retail stores, and the customer can buy a single roll in that establishment.
- Agent channel. It is used in the field of imports and exports since people function in positions in the international field known as brokers, and the reason is that an international company can penetrate a foreign market. For example, in Mexico, there is a tequila called Santo Gusano, and this wants to market in Russia, so a person is sent to visit that country in order to make international negotiations which allow the product to penetrate the country with a company of mass sales and that it can make its distribution to smaller stores to ensure the arrival to the target customer.

As can be seen, these logistics systems refer to the way in which a product reaches its final consumer. Various types of transportation must be used, namely land, sea, air, rail, and river. When talking about the transportation of goods, the cubic capacity becomes an important phase

to establish measures of action since this technique allows the establish the three-dimensional measure that the goods occupy at the moment of being transported to their final geographical location, taking into account the length of the spaces, with the purpose of making efficient the number of units that can be transported.

The cubic capacity is calculated by multiplying the length, width, and height of the objects, which are normally expressed in cubic units such as cubic meters or cubic feet, depending on the unit of measurement used by the transportation or logistics system. Another important factor to consider when determining the logistics system to be used is the type of container to be used. At present, it is considered that consolidated containers allow an optimal shipment because they can be made up of various types of goods without having to fill the means of transport so that they can be mixed with those of another supplier.

Nowadays, goods can be shipped under different schemes of consolidating companies in order not to have to wait to have complete shipments referring to reach the total load of a vehicle, container, or pallet but rather to meet the needs of demand and thus to make the delivery of the order more efficient. For example, the use of the cross-docking technique refers to receiving products at a distribution center and shipping them quickly, without prolonged storage; instead of storing the products in the warehouse for extended periods, the items are transferred directly from the receiving area to the shipping area.

This technique is used to streamline the supply chain, reduce warehousing costs, and speed up the delivery of products to the customer, in addition to optimizing fuel usage, intersection of communication routes, and effectiveness of deliveries. Cross docking is especially beneficial in situations where high volumes of goods are handled and intermediate storage times are to be minimized as it seeks to optimize logistics efficiency by reducing storage times and facilitating the rapid distribution of products.

3.2. Sustainability indicators in the logistics process

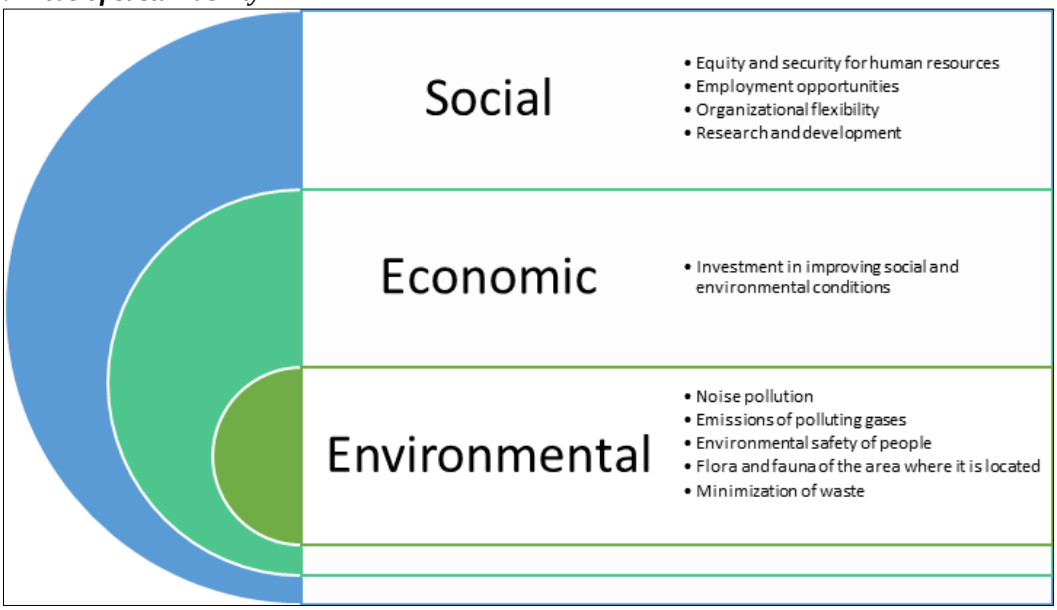
Nowadays, in order to move towards sustainable development, organizations must follow guidelines to minimize the ecological impact generated by their logistics operations, making it possible to find two sustainable logistics practices: reverse logistics and green logistics. While reverse logistics focuses on the management of information related to the return of products after their sale or consumption in order to reintegrate them into a production process (Dávila-López, 2019), green logistics seeks “a balance between economic and ecological efficiency” (Puentes-Manrique, 2021, p. 4).

Thus, it includes actions such as the promotion of sustainable storage, environmentally friendly transportation, design of products respectful of non-renewable natural resources, conscious processing of pollutant emissions, responsible use of roads, mitigation of noise pollution, and proper disposal of waste (Dávila-López, 2019; Manjarres-Mejia & Chirino-García, 2020). In accordance with the above, there are the sustainable international logistics practices proposed by Ospina-Aldana & Caicedo-Gil (2022) and Pérez & Sánchez (2019), referring to:

- Streamlining the transit of goods should translate into a decrease in costs and times.
- Modes of transportation should allow for efficient development and reduce risks and logistical bottlenecks.
- Physical infrastructure and technology are available, which determine the price, time, and quality of products.
- Regulatory frameworks and regulations seek to eliminate inefficiencies or cost overruns.

However, before establishing sustainable practices, it is necessary to evaluate each of the activities that make up the logistics process. In general, considering sustainable practices in any process implies analyzing various categories from the three spheres that make up sustainability, as shown in Figure 1.

Figure 1. ***Areas of sustainability***



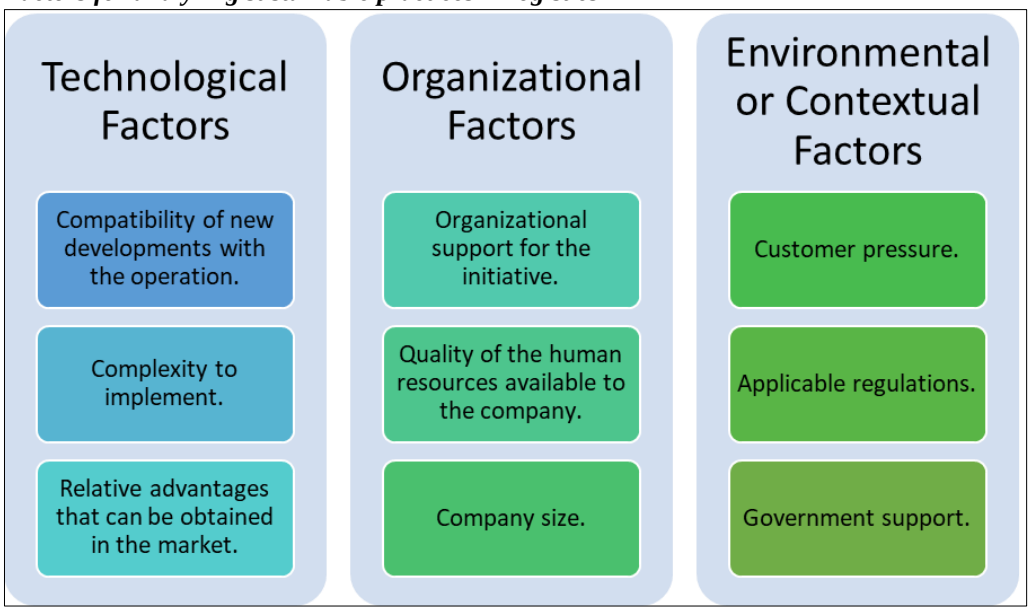
Source: own elaboration.

Specifically for the analysis of the logistics process, Arango-Serna et al. (2020) suggest that the following should be considered: the organization's human resources and relations with suppliers and customers as part of the social sphere; waste management and the reduction of resource use, in the economic sphere; and the management of product collection and delivery, in the environmental sphere. For his part, García-Sabater (2021) encompasses the analysis of logistics only in three main variables:

- Distance traveled. It refers to the study of the distance from the point of loading to the point of unloading.
- Efficiency of use of equipment and transportation. It consists of determining whether the least amount of equipment and transportation is used for handling, loading, and unloading.
- Environmental impact. It involves determining the type of fuels or energy sources consumed by the means of transport and equipment used.

Finally, there is the proposal of analysis factors by Dávila-López (2019), who, based on the characteristics of sustainable practices, proposes three categories of analysis, with their respective factors to be evaluated, which are shown in Figure 2.

Figure 2. ***Factors for analyzing sustainable practices in logistics***



Source: own elaboration.

Therefore, based on the characteristics of the sustainable practices proposed by the various authors, as well as the characteristics of the analysis above factors, it is considered viable to use the evaluation indicators proposed in Table 1. In summary, and taking into consideration the various proposals of the authors analyzed, the categories and indicators in Table 1 are the most viable for analyzing the logistics process from a sustainability approach.

Table 1. ***Indicators for the evaluation of sustainable practices in logistic processes***

SPHERE	CATEGORY	INDICADOR
Social	Factores organizacionales	Availability of human capital
	Envío	Specific customer demands on delivery times
	Entrega	Customer satisfaction
Economic	Factores organizacionales	Warehousing
	Envío	Physical infrastructure
		Technology
	Factores organizacionales	Modes of transportation used
	Envío	Distance traveled
	Factores organizacionales	Shipping costs
		Logistics bottlenecks
	Envío	Regulatory compliance costs
		Costs and delivery time
		Product returns
Environmental	Factores organizacionales	Pollutant emissions
	Envío	Waste management
		Use of non-renewable resources
	Factores organizacionales	Fuel or energy sources used by means of transport
	Envío	Waste minimization

Source: own elaboration.

ISSN 2539-3669
Research article
https://doi.org/10.18041/2539-3669/gestionlibre.18.2024.12109

4. Research results

4.1. Proposal for a sustainable logistics system

In order to effectively generate marketing systems that contribute to sustainability, a series of actions are presented below based on the indicators above and the traditional logistics process presented.

Organizational Factors

One of the main vectors of importance in the industry is human talent, which becomes one of the main approaches for adapting to change. Therefore, it is recommended to have personnel who are open to change or have an approach that allows them to identify the importance of business sustainability, for which the human talent department should recruit and maintain personnel who share ideas that are related to the sustainable organizational philosophy, in addition to having the skills that allow them to adapt to the technology demanded by current processes.

Another important point is to have the necessary infrastructure to meet the needs demanded by current customers, among which predominates the availability in warehouses of raw materials, tools, machinery, and equipment, which make up an installed capacity to cope with the supply of satisfiers that meet the needs, desires or problems of the target markets.

Without forgetting that human talent must attend the ideology of the reasonable use of resources in order to reduce the emission of polluting waste and that those that are not able to be eliminated are integrated into forms of adaptation that do not impact future generations since what is sought is the reduction of the use of non-renewable resources, so it is proposed that organizations incorporate Lewin's model which will allow them a moderate change that allows the adaptation of talent. Lewin's model allows understanding and managing changes in an organization through three stages:

- Unfreezing: Also known by its English term unfreeze, which refers to creating awareness of the need for change and proposes to break old structures that create mentalities that hinder organizational change in order to create motivation and willingness to accept new organizational practices.
- Change: Also known by its English term change, which proposes the implementation of actions necessary to put change into practice in which processes and organizational structures are taken into account and focused on the attention of relevant policies or aspects that imply a transition from current situations.
- Freezing: also known by its English term refreeze, which refers to the fact that after implementing the organizational change, it is proposed to stabilize the new practices which are sought to be identified as an integral part of the organizational culture in order to avoid resistance to regress old ways of working and consolidate the current adaptation.

This model emphasizes the importance of the management of labor forces by providing a clear structure that allows guiding the organization's collaborators through the processes, highlighting that changes are not always linear and that there may be readjustments or setbacks that must be open to being able to face them; without forgetting that this psychological model focuses on the processes of individuals with a focus on the organization.

Shipping

Now that we have identified how human talent can be incorporated into the new requirements of the delivery systems that are part of the supply chain, it is vitally important to consistently attend to the receipt of orders, which will allow customers to make their requests with agile technologies and incorporate the use of GPS in order to generate accuracy when generating logistics routes.

By identifying the geographical area to which the goods will be sent, the logistics route can be generated, which will allow organizations to decide the best alternative for delivery, either through their fleets of vehicles or by using specialized companies for delivery, with the aim of shortening the distances to be traveled to comply and costs. At the same time, it is of vital importance the decision of the means of transportation to be used since it must be made according to the volume of the shipment, type of product, the materials of the container, packaging, and packing; in addition to the safety demanded by the product, in order to identify the best option that generates reasonable costs and promotes sustainable logistics.

That is why, prior to the choice of the consolidated company for the shipment, the use of sustainable fuels by the organization must be considered and, in addition, it must be interested in providing a quality service at the time of delivery since it must be open to the possibility of instant returns, which should not require a new route to satisfy the customer, so that, at the time of delivery, customer satisfaction must be corroborated, in order to optimize the necessary resources.

Delivery

It is one of the most tangible aspects of the closing process since the customer can evaluate the product and the delivery service, which is why the planning process is of vital importance at this stage. This process should focus on identifying future scenarios in order to meet the requirements demanded by customers, such as the arrival of the satisfactory in optimal conditions, compliance with the agreed date for the delivery of the satisfactory, and the shipping cost, which should be similar to the shipping costs that the customer perceives as a necessary element for obtaining the satisfactory.

Finally, it should not be forgotten to make correct and effective use of the materials that ensure the arrival of the products; for example, in the packaging, it tends to be seen that the greater the use of material, the greater the safety for the satisfactory; however, it should be the other way around, thinking about the reasonable use of materials with a focus on safety which does not encourage the appearance of unnecessary waste.

In this section, the results of the study are analyzed using three fundamental axes: teacher training, curriculum transformation, and self-evaluation. These aspects are crucial to understanding how research, teaching, and university institutions interact and mutually enhance each other in the field of public accounting. The analysis seeks to unravel current dynamics and practices, as well as to propose improvements that can be integrated into accounting programs to strengthen research training and educational quality.

Conclusions

Sustainability is a topic that deserves a hasty incorporation, with the objective of ensuring efficient use of the resources available today; and it is that by carrying out actions, no matter how small they may be, they contribute to the sustainable development of society, it is economy and the environment. In this sense, it is possible to affirm that logistics is crucial for the

achievement of sustainability since it has a significant impact on each of the spheres that make it up. When we talk about sustainable logistics, we refer to the efficient management of the processes of transportation, storage, and distribution of goods and services, minimizing their negative impact and contributing to sustainable development.

In this sense, in order for organizations to carry out sustainable practices during their logistics processes, they must consider, prior to the use of delivery services, analyzing their offer and knowing extensively the product to be marketed, identifying elements such as type of container, packaging, and packing; and the specifications of the requirements for the transfer of the goods, such as, for example: if it requires refrigeration, ventilation, temperature, and structure. Subsequently, they must identify the logistic routes to visualize the geographical schemes demanded by the delivery routes, taking into account the vehicles to be used and the ways in which the product can reach its final destination. At the same time, they must select the necessary intermediaries based on the different vectors demanded by the consolidating companies, such as measurements, cubic sizes, and specifications, to ensure an effective mix of products in the shipment.

It is considered pertinent that organizations periodically apply evaluations of their logistics processes, either through an after-sales service or a satisfaction survey, in order to obtain information regarding costs, ease of reception, and delivery; this will serve as feedback for future decision-making. In summary, sustainable logistics involves the integration of environmentally responsible, socially equitable, and economically viable practices in supply chain management. It is not only beneficial for the environment but can also generate operational efficiencies and enhance the reputation and competitiveness of companies in an increasingly sustainability-conscious marketplace.

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