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Sustainability as a Resilience Factor in the Agri-Food Supply Chain

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Abstract: What factors have a positive impact on the resilience of supply chains? This question has been raised in several academic research papers, particularly in recent years, coinciding with a series of disruptions (healthcare, political and climate) that have shaken the reliability of a global logistics gear that seemed infallible. In this context, the motivation of this article is to provide new knowledge that helps identify the key elements of business management that guarantee greater reliability and security in the supply of products. More specifically, this research focuses on studying the causal relationship that exists between resilience and sustainability in the management of agri-food chains to generate valuable knowledge for the leaders of companies that have to deal with these two transformations. Through a qualitative comparative analysis methodology, taking a sample of eight Spanish distribution companies, the results obtained indicate that the strength of supply chains has a strong link to strategies to improve environmental, social and governance sustainability. This is a conclusion that provides interesting value, reaffirming that it is possible to design and execute supply chains that make sustainability and resilience compatible.

Keywords: supply chain; resilience; sustainability; logistics; ESG; GRI

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1. Introduction

Research on the resilience of supply chains has experienced exponential growth in recent years, as can be seen in the main academic databases. In fact, according to Scopus and WoS, more articles have been published on this topic since 2021 than in all previous years. This great impact on the scientific literature is not accidental, but responds to the social, economic and political interest that the resilience of supply chains has generated in recent years, caused, to a large extent, by a series of events that can be grouped into three main categories [1]:

- Healthcare crisis: The global pandemic of COVID-19 has had serious consequences in the operation of the global logistics gear, with mismatches that have particularly affected demand forecasting, productive capacity and transport reliability [2].
- Political crisis: The Russian invasion of Ukraine has also had important effects on supply chains since the territories in conflict are producers of essential raw materials in sectors such as food and energy [3]. On the other hand, the war in Gaza, in the Middle East, has also caused large shipping companies to avoid passing through the Red Sea, having to chart new routes that increase journey time and associated costs [4].
- Climate crisis: Extreme weather phenomena, such as the Gloria storm of 2019 (which mainly affected the United States and Canada) or the Filomena storm of 2021 (with serious consequences in southern Europe), as well as the episodes of extreme drought

that many areas of the planet are suffering from, have a full impact on the productive and logistical processes since they are disruptions that add high complexity to the strategic planning of the entire value chain [5].

The three crises, plus some episodes of an accidental nature, such as the obstruction of the Suez Canal in 2021 due to the breakdown of a cargo ship, have called into question the resilience of global supply chains and, in turn, have triggered the scientific curiosity to understand which factors determine logistical strength in the provision of products and services [6].

In this sense, several previous studies have been able to establish a direct correlation between the resilience of a supply chain and some factors related to its design such as, for example, the accumulated distance from the first suppliers to the final customer [7]. Resilience has also been linked to the level of strategic alignment that exists between the actors of a value chain, showing that collaboration between the parties brings greater solidity to the whole [8]. And some logistics techniques that promote resilience have even been detailed, such as replenishment frequency or stock management [9].

However, the academic literature is inconclusive regarding the role of sustainability in the resilience of supply chains. Despite the fact that these are two concepts that are currently of great relevance, and that are part of the priority list of many organizations [10], it has not yet been possible to establish a clear point of intersection, which determines whether they are dependent, compatible, autonomous or antagonistic [11].

Considering this gap, the present article was devised with the purpose of explaining the causal relationship that exists between resilience and sustainability in the management of agri-food chains through exploratory research with a qualitative approach, always thinking about business and institutional leaders, who not only have the traditional objective of building efficient supply chains, but now also have to consider logistical strength and sustainability requirements. So, the general objective of this research is to answer this specific question: Is sustainability a factor that favors the resilience of agri-food supply chains?

To address this, a literature review was carried out, focusing on the publications of the last four years, which provide a solid and up-to-date theoretical framework on resilience and sustainability, in order to academically contextualize this article and, at the same time, base it on existing knowledge. Precisely, the analysis of existing publications provided the two specific objectives of this research, which take the form of the following questions:

1. Is the resilience of agri-food supply chains positively conditioned by holistic sustainability management (social, environmental and governance)?
2. What specific sustainable management variables are related to greater logistics resilience?

Next, the methodology used during the investigation is detailed, which is qualitative comparative analysis (QCA), which facilitates the holistic study of a sample of eight Spanish food distribution companies, selected for the high degree of resilience that they have shown during recent crises, as evidenced by Nielsen data [12].

In the results section, the sustainability standards (environmental, social and governance) of all cases in the sample are exposed and evaluated, which allows us to observe correspondences with the reliability of their supply chains, thus achieving an approximation relevant and unpublished to the object of study.

In fact, the discussion of results serves to identify which sustainability variables can favor the resilience of the analyzed companies, thus establishing the causal relationships that help to give a consistent answer to the initial question that motivates this research. Finally, in the conclusions section, the six most significant academic contributions are presented, summarized and ordered, at the same time as the lines of research that remain open for the future are pointed out.

2. Literature Review

The Scopus database clearly shows the growing interest of science in studying the resilience of supply chains. Between the years 2004 and 2006, a total of 16 academic articles were published on the matter, while between the years 2021 and 2023, the same number

increased to 2697. In fact, as can be seen in Figure 1, an important turning point occurs during the year 2020, since 72.7% of all articles registered in the last 20 years have been published since then.

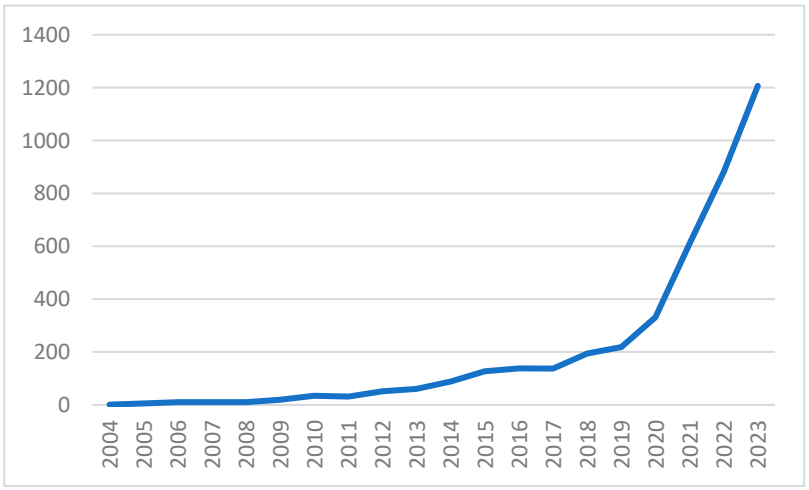

Figure 1. Scientific articles that incorporate the concepts resilience and supply chain in the title, abstract or keywords. Source: Scopus.

Expanding the search in the Web of Science database, in a period between January 2020 and March 2024, the importance of supply chains in all sectors of activity is confirmed and how the impact of the pandemic increases its notoriety even more due to the logistics resilience crisis experienced by various organizations around the world [13].

In this context, a clear line of research stands out, which aims to identify and explain the factors that determine the logistic resilience of supply chains, either positively or negatively [14]. There are researchers who look for the causes in logistical aspects of a technical nature [15], while others focus on strategic elements, more linked to the business model [16,17]. In any case, the scientific literature shows that there are keys to business management that have a direct impact on the resilience of supply chains, understood as the ability to overcome disruptions and guarantee a reliable supply of products [18]. In other words, although resilience is also conditioned by external factors (such as political, climate or health crises), there are internal management factors that determine the response of companies to continue operating normally [19,20].

Considering the objective of this article, the bibliographic research has focused particularly on one of the factors that can determine the resilience of supply chains: sustainability [21]. But since this concept is very broad, we wanted to limit it to three parameters: management of social sustainability (well-being of people), management of environmental sustainability (respect for nature) and management of sustainability in governance (an efficient and fair organization) [22,23].

In this sense, the first thing to note is that 32% of the articles dealing with the resilience of supply chains in the Scopus and WoS databases also include sustainability in their research. Therefore, the two concepts appear linked with a high frequency, showing that it is a relevant topic. But beyond the quantitative dimension, reading these articles allows us to group them into two groups:

- Articles that study resilience and sustainability separately, without looking for causal relationships between the two concepts [24–26].
- Articles that seek to establish causal relationships between resilience and sustainability [27–29].

The second group is the least numerous since, with the search criteria described above, it includes a total of 24 academic articles. They all come to the conclusion that resilience and sustainability are two closely linked management parameters. Some research even

establishes cause-and-effect relationships, concluding that organizations that work to be more sustainable end up having more resilient supply chains [30,31].

But it is true that these studies embrace sustainability only from one of its three dimensions, for example, linking resilience to social management and the well-being of workers [32], or to the management of environmental risks [33] or even to the economic efficiency of operations [34].

So, although there is research that observes mutual influences between resilience and sustainability, there is still a lack of consolidated theoretical foundations that observe sustainability holistically, taking into account its three dimensions at the same time [35].

On the other hand, this review of the literature also invites us to put the magnifying glass on the agri-food sector since its companies have demonstrated a very high level of resilience since the COVID-19 pandemic, overcoming major global disruptions such as the war between Russia and Ukraine [36].

In addition, the agri-food sector is subject to major challenges related to the Sustainable Development Goals (SDGs) of the 2030 Agenda and the provisions of the European Green Deal of 2019, of climate neutrality by 2050 [37,38].

This means that there are already several studies that decide to focus on the agri-food sector to observe how sustainability and resilience interact, making it clear that they are two strategies that must cooperate and not compete [39,40].

In order to deepen this topic, the scientific literature recommends studying distribution companies since they are the part of the value chain with the highest degree of concentration [41] and, at the same time, the one that is located at the end of any procurement process, which is where the degree of resilience can be measured more effectively [42].

Thus, the theoretical framework shows that it is appropriate to contribute more knowledge about the relationship between resilience and sustainability in the management of supply chains, at the same time that it supports the decision to focus this study on the agri-food distribution sector. And, in this context, the academic contribution that this article can make is clear: to explain whether resilience has causal factors in the three dimensions of sustainability (not just one).

3. Materials and Methods

The present investigation is based on the methodology of qualitative comparative analysis (QCA), which consists of the study of specific cases to draw significant conclusions from them owing to the identification of causal configurations that lead to a certain result [26]. This technique, which cannot be framed in classical statistics or in the strictly qualitative tradition, is very suitable for comparative research like that of this article since its epistemological foundations include the desire for a holistic comparison to establish the conditions for the occurrence of a phenomenon, always through a small number of cases but with a high degree of systematization [43,44].

Therefore, to determine whether the resilience of agri-food supply chains can be explained through variables related to their sustainability, a sample of eight companies has been selected (El Corte Inglés, Grupo Dia, Consum, Eroski, Caprabo, Supermercados MasyMas, Plusfresc and Condis) that can be treated homogeneously because, according to the criteria of the official SABI database (Iberian Balance Sheet Analysis System), they have three basic characteristics in common: they are large companies (more than 250 workers and more than EUR 50 million in turnover), which are dedicated to food distribution (in the retail sector) and have points of sale in Spain (as well as their headquarters) [45].

On the other hand, it is a highly significant sample, since, despite the fact that the Spanish distribution sector is characterized by its fragmentation, the selected companies represent almost a quarter of the market. As can be seen in the data in Table 1, the sample accumulates 23.92% of the country's commercial surface.

Table 1. Square meters of commercial surface and market share of the 8 companies selected for the sample. Source: Alimerka.

	Commercial Surface (m^2)	Market Share (%)
Grupo Dia	1,048,895	7.07
Eroski	721,081	4.86
Consum	684,727	4.62
El Corte Inglés	500,355	3.37
Condis	247,302	1.66
Caprabo	202,913	1.36
Superm. MasyMas	104,530	0.70
Plusfresc	42,778	0.28
TOTAL	3,552,581	23.92

In addition, these eight agri-food retailers have also been selected because they show the great independent variable of the research: resilience. This is because these eight companies have participated in the so-called OSA barometer, prepared by the consulting firm Nielsen, which, since 2019, has measured logistical strength through the product availability indicator [46]. According to these data, which this investigation has been able to access, between the years 2020 and 2022, the commercial establishments of these eight companies were able to withstand various disturbances (health, political and climatic), guaranteeing the supply of products to their customers.

In fact, as can be seen in Table 2, these eight companies maintained an index of product availability on their shelves above 93%, adding up to an annual average that is always above 95%. This is a key indicator to measure the resilience of a supply chain since this is related to "the ability to guarantee the supply of acceptable, sufficient and stable food, at the required times and places, through the precise anticipation of interruptions and the use of strategies that delay their impact, aid in rapid recovery and allow for cumulative learning after the interruption" [47].

Table 2. Product availability index of the 8 companies analyzed between the years 2020 and 2022. Source: Nielsen.

	2020	2021	2022
Company 1	94.9	95.6	94.5
Company 2	95.5	95.0	94.5
Company 3	96.4	96.5	96.1
Company 4	93.9	94.8	94.0
Company 5	93.3	95.4	93.3
Company 6	95.7	96.1	95.7
Company 7	95.5	95.7	95.1
Company 8	95.1	95.3	94.7
Average	95.2	95.7	95.1

It should be noted that these data arise from rigorous work by the consulting firm Nielsen, which, for three years, monitored up to 1800 supermarkets of these eight companies distributed throughout Spain [48]. With the daily sales information of each product at each point of sale, the value of the products that have not had enough stock to cover demand is calculated. This calculation is possible due to the contrast with the expected sale, which is

extracted from an algorithm specialized in sales forecasting. Specifically, the mathematical formula used for this barometer (accessible upon payment) is the following:

$$100\% - \frac{\text{Lost sales EUR}}{\text{Lost sales EUR} + \text{Total sales value EUR}} = \text{Product availability index}$$

The convenience of using product availability as an indicator of the resilience of supply chains appears sufficiently supported in the scientific literature [18,19]. For example, in previous research by the authors of this article, a highly qualified sample of 35 managers of companies in the food distribution sector confirmed that reliability in product service is the indicator most related to logistical resilience [49].

As can be seen in Table 3, it not only obtained a score of 4.34 out of 5, but also generated a broad consensus among respondents (with a standard deviation of less than 0.7). Therefore, it can be argued that distribution companies associate resilience with a substantial improvement in product supply processes.

Table 3. Assessment of "product service guarantees" as an indicator of supply chain resilience. Source: IGI Global.

Variable	Mean	Std.Dev	Min	Median	Max	N.Valid	Pct.Valid
Product service guarantees	4.34	0.64	3	4	5	35	100.0%

Once the dependent variable (resilience) has been established, the explanatory variables are selected. Since the aim of this article is to explore possible causal relationships with sustainability, one of the main challenges is to limit this very broad concept and transform it into evaluable parameters. To achieve this, previous research of proven solvency is taken as a reference, which makes it possible to make a first classification of the sustainability of distribution companies in three major areas, known by the acronym ESG: environment, society and governance [50].

On the other hand, the scientific literature also provides indicators to measure these three areas, specifically in the Spanish agri-food sector, where it is recommended to resort to the standards of the Global Reporting Initiative (GRI) since they are internationally recognized and allow for the preparation of sustainability reports adapted to current legislation, which is Law 11/2018 on Non-Financial Information and Diversity [51].

Following these two criteria, and with the study by researchers Anguiano-Santos and Salazar-Ordóñez as a scientific reference [52], a group of six GRI indicators are selected as explanatory variables, which focus on key aspects of sustainability management in supply chains. Consequently, the definition of the variables for the holistic analysis of the cases remains as can be seen below:

- Dependent Variable:
  - Y: supply chain resilience.
- Explanatory Variables:
  Environmental Sustainability
  - X1: The company reduces GHG emissions (GRI 305-5).
  - X2: The company reduces energy consumption (GRI 302-4).

  Social Sustainability
  - X3: The company selects suppliers with social criteria (GRI 414-1).
  - X4: The company ensures the safety and health of its workers (GRI 403-1).

  Governance Sustainability
  - X5: The company promotes diversity and equal opportunities in management and employees (GRI 405-1).
  - X6: The company fights against corruption (GRI 205-2).

It should be noted that these chosen indicators were incorporated into the GRI standards between 2016 and 2018, and that they are currently still in force; so, they are relevant to analyze the sustainability of organizations during the time span covered by this research (2020–2022).

To extract the data relating to the explanatory variables (GRI indicators), the sustainability reports and non-financial reports of the eight selected companies were consulted, referring to the years 2021 and 2022, since they are the most updated figures within the period in which the resilience of its supply chains was analyzed.

Once all the information was collected, a table with dichotomous data was drawn up, starting from the premise that all cases meet the independent variable (Y = 1) and assigning a value of 1 or 0 to each explanatory variable (X) depending on whether they have it included in the documents where they explain their lines of work in the matter of sustainability.

Then, in accordance with the QCA methodology, and with the support of a software called Tosmana (version 1.61) [53], the so-called "truth table" was constructed, where the different possible logical configurations are presented, as well as its corresponding statistical consistency, which allows us to present the results of interest of this article, discuss them and draw conclusions.

At this point in the explanation of the methodology, it is important to point out that the data corresponding to the companies in the sample were treated anonymously to guarantee the privacy of the information and avoid comparisons that do not add any value to this research.

4. Results

The years 2020, 2021 and 2022 were particularly critical for the operation of supply chains but, as explained above, the Spanish food distribution companies that were analyzed demonstrated a very high degree of resilience, managing to maintain a product availability level of over 90%, during each and every month of this critical period.

Aggregating the daily data from 1800 points of sale from the eight companies in the sample, it can be seen that the resilience of their processes has a very cross-cutting nature, as no significant drop in service was recorded in any of the analyzed categories. As can be seen in Table 4, product availability is over 90% in all food, beverage, perfumery and drugstore sections. The only exceptions are beer and milk, which, in 2022, remained at 88.9%, a slightly lower figure, but which is also included in the highest service standards.

Table 4. Index of product availability guaranteed by the 1800 points of sale of the eight companies in the sample, classified by section. Source: Nielsen.

	2020	2021	2022
OIL	96.7	97.1	94.1
COFFEE AND SUBSTITUTES	97.5	97.7	97.3
CHOCOLATE	96.4	96.7	96.7
BISCUITS	97.5	97.9	97.7
CEREALS	97.8	98.2	97.6
PASTRY AND INDUSTRIAL BAKERY	97.5	97.9	97.7
SOUPS, BROTHS AND PURES	96.1	96.9	96.7
FOOD FOR ANIMALS	96.2	96.5	96.5
LIQUID MILK	90.0	91.8	88.9
WATER	92.3	93.3	92.3
REFRESHING BEVERAGES	92.4	92.9	92.4
JUICE	96.9	97.4	97.0

Table 4. *Cont.*

	2020	2021	2022
BEER	90.0	90.1	88.9
ALCOHOLIC DRINKS	97.6	97.0	96.7
CHARCUTERY	97.1	97.8	97.7
FROZEN FISH AND SEAFOOD	96.9	97.1	97.1
FROZEN VEGETABLES	97.2	97.3	97.4
PREPARED DISHES	97.1	97.2	96.5
ICE CREAM	96.4	97.1	95.8
YOGURT AND FERMENTED MILKS	97.5	98.2	98.0
CLOTHES DETERGENT	96.6	96.6	97.1
SHAMPOO	98.0	97.6	98.0
CONDITIONER	98.6	98.3	98.4
GEL AND LIQUID SOAP	97.4	96.9	97.4
DEODORANTS	98.1	98.0	97.9

Taking into account that the eight cases chosen meet the independent variable (the resilience of their supply chains), we proceeded to analyze the correspondences with the six explanatory variables, which refer to different aspects of environmental, social and governance sustainability. Specifically, environmental sustainability was assessed if they have policies to reduce polluting emissions and energy consumption. In terms of social sustainability, the focus was on the responsible selection of suppliers and the safety and health systems of their workers. And with reference to the sustainability of governance, it was studied whether they guarantee diversity in the teams and whether they fight against corruption.

Table 5 shows whether the sustainability information provided by the companies in the sample includes lines of work related to the explanatory variables or whether, on the contrary, they are aspects that do not currently appear in their action plans. As can be seen, there are three variables that appear in all the cases analyzed, which are the reduction in polluting emissions, the safety and health of workers, and the guarantees of diversity in governance. So, we can be faced with three necessary (but not sufficient) conditions to have resilient agri-food supply chains.

Table 5. Dichotomous presentation that analyzes each of the cases to indicate whether the explanatory variables are present (indicated with a 1) or absent (indicated with a 0).

	Independent Variable	**Explanatory Variables (Environmental)**		**Explanatory Variables (Social)**		**Explanatory Variables (Governance)**	
Cases	Y: Resilience	X1: Emissions	X2: Energy	X3: Suppliers	X4: Workers	X5: Diversity	X6: Anti-corruption
A	1	1	1	1	1	1	0
B	1	1	1	1	1	1	1
C	1	1	1	1	1	1	1
D	1	1	1	1	1	1	1
E	1	1	1	1	1	1	1
F	1	1	0	0	1	1	1
G	1	1	1	1	1	1	1
H	1	1	1	1	1	1	1

On the other hand, there are three variables that are present in seven of the eight companies in the sample, which are the reduction in energy consumption, the selection of suppliers with social criteria and the practices to avoid corruption. In this case, these are sustainability factors with a very high degree of correspondence with resilience.

With these first results, and following the methodology of qualitative comparative analysis, a "Truth Table" was drawn up to visualize the different configurations of variables that were given. In this regard, as can be seen in Table 6, up to three logical configurations emerged with a consistency of 100% (which means that, in all of them, the independent variable is verified).

Table 6. The different configurations of explanatory variables that verify the result of interest: the resilience of supply chains.

Configuration	X1	X2	X3	X4	X5	X6	Y = 1	N	Ny	Consistency	X→Y
1	1	1	1	1	1	1	B, C, D, E, G, H	6	6	1000	SUCCESS
2	1	0	0	1	1	1	F	1	1	1000	SUCCESS
3	1	1	1	1	1	0	A	1	1	1000	SUCCESS

So, the first verified configuration, which is the most repeated because it appears in six of the eight research cases (B, C, D, E, G and H), is the one that combines all the explanatory variables: reduction in the emission of pollutants, reduction in energy consumption, selection of suppliers with social criteria, safety and health of workers, commitment to diversity in management bodies, and prevention of corruption.

The second configuration linked to the resilience of supply chains, present in case F, is that of organizations that strive to reduce polluting emissions, take care of the health and safety of their workers, guarantee diversity in governance and take action against corruption.

Finally, the third configuration that generates logistic resilience is the one that groups together all the sustainability variables considered in this research, except for the one that refers to the prevention of corruption. This is the case observed in company A.

In summary, in all the cases analyzed, there is a strong link between the independent variable (resilience) and the explanatory variables (environmental, social and governance sustainability), emphasizing that no company in the sample presents an inverse logic.

5. Discussion

The first thing to emphasize when assessing the results of this research work is the homogeneity and quality of the selected sample since it was possible to analyze eight large distribution companies that share a very high level of resilience of their supply chains. This has been proven due to the access the authors had to very valuable data relating to product availability recorded daily, for three years, in 1800 supermarkets throughout Spain.

The fact that the eight cases are successful in terms of the result that this research aims to explain makes the qualitative and holistic analysis of them very pertinent in order to extract those common points that can link resilience and sustainability. Along these lines, the most relevant conclusion brought to us by the results is the possibility of affirmatively answering the question posed at the beginning of this research (the general objective): Is sustainability a factor that favors the resilience of supply chains?

Indeed, a causal relationship can be established between sustainable management and reliability in the supply of products since all companies studied are not only examples of resilience but also include a large part of the sustainability variables contemplated in this investigation. Specifically, six companies fulfill 100% of the variables, one company registers 83%, and the remaining 66%.

The fact that this research does not include cases of negative results, i.e., with companies that have low-resilience supply chains, means that a relevant comparative element is lost, forcing special attention to be paid to more coincident elements of the cases' success

(since they are the ones with the most empirical strength). In this sense, it should be emphasized that all the selected companies have elements of sustainability in the three ESG areas (environmental, social and governance).

With this information, the question that represents the first specific objective of this research can be addressed: Is the resilience of agri-food supply chains positively conditioned by holistic sustainability management (social, environmental and governance)? According to the results, resilience is not linked to just one or two areas of sustainability, but is explained through comprehensive sustainable management, ranging from ecological issues to management ethics, through the selection of responsible suppliers and fair treatment of workers.

On the other hand, entering into the second specific objective of this article (What specific sustainable management variables are related to greater logistics resilience?), it can be seen that there are three explanatory variables that have a more relevant specific weight since they appear in the non-financial information reports of all companies of the sample. It can be concluded that the keys to sustainable management that have the greatest impact on the resilience of supply chains are as follows:

- The reduction in pollutant emissions (environmental sustainability).
- The safety and health of workers (social sustainability).
- Diversity in management bodies and employees (sustainability of governance).

The three remaining variables (the reduction in energy consumption, the selection of suppliers with social criteria and the fight against corruption) have a slightly lower level of presence, although they could also be considered determining factors to increase the resilience of supply chains supply since all of them are found in seven of the eight companies analyzed.

Beyond the individualized analysis of the dependent variables, this research also provides the three logical correlations of explanatory factors that lead to the expected result (resilience). But, here, this study cannot be limited to the statistical consistency of the correlations (which is the same in all of them), as the number of cases that support each option must be observed. In this way, it can be verified that one of the correlations obtains a very prominent level of repetition, since it is what six companies in the sample follow. In addition, it is the correlation that brings together all the explanatory variables.

Consequently, two more conclusions are drawn. On the one hand, that there are at least three correlations with a high weight of sustainability factors (always in the three areas: environmental, social and governance) that lead to the resilience of supply chains. On the other hand, the logical correlation most present in resilient companies is the one that collects a higher number of variables related to sustainable management.

Finally, regarding the validity of the results, it is important to underline that all the GRI indicators that have been selected to evaluate the sustainability of companies have their equivalence in the European Standards for Sustainability Reporting (NEIS), approved by the European Commission through Directive 2013/34/EU, and which member states must apply from 2024.

Specifically, the GRI indicators referring to the reduction in emissions and energy consumption are found in NEIS E1; the GRI indicators on worker health and diversity in management bodies appear in NEIS S1; and the GRI indicators that determine whether suppliers have been selected with social criteria and whether the company fights corruption are included in NEIS G1.

In summary, this article carries out an exploratory investigation, through a qualitative approach, which leads to concrete and suggestive results for business leaders since it is evident that resilience and sustainability are not contradictory objectives. Rather, the opposite is observed: the strongest supply chains also act responsibly towards the environment, people and governance.

6. Conclusions

Interest in the resilience of supply chains has increased significantly in recent years, due to the various healthcare, political and environmental crises, which have highlighted the weaknesses of the global logistics system.

In this context, the Spanish agri-food sector has become a positive example since it has been able to withstand the onslaught of disruptions as important as the coronavirus pandemic or the war in Ukraine, maintaining at all times the supply of products demanded by their customers.

For this reason, the present article takes a sample of eight Spanish food distribution companies, showing that, between the years 2020 and 2022, they had an excellent level of resilience, and observes whether this strength of their supply chains has any significant link to the commitment to sustainable management.

Two general conclusions can be drawn from the results obtained:

1. Sustainability can be considered a factor that has a positive impact on the resilience of agri-food supply chains.
2. To build a resilient supply chain, comprehensive sustainability management is needed, embracing the environmental, social and governance spheres.

And four more specific conclusions can also be highlighted:

1. The sustainable management variables most shared by companies with solid value chains are as follows: the reduction in pollutant emissions, the safety and health of their workers, and the commitment to diversity in management bodies and teams.
2. There are three more variables that also have a notable link to resilience: the reduction in energy consumption, the selection of suppliers with social criteria, and the fight against corruption.
3. All the logical correlations that lead to the resilience of supply chains account for more than 60% of the sustainability variables analyzed.
4. The most frequent logical correlation in the companies in the sample is the one that includes all explanatory variables of environmental, social and governance sustainability.

Thus, this exploratory research, through the qualitative study of eight success cases, reinforces the academic literature that supports business management that makes resilience and sustainability compatible in the design of supply chains. But it also adds a new contribution of knowledge, which is related to the need to commit to sustainability in a holistic way, embracing its three ESG dimensions.

Likewise, companies can see in this article some specific sustainability strategies that, at the same time, promote resilience, such as reducing polluting emissions, selecting responsible suppliers and promoting diversity in organizations.

Regarding the limitations of this study, it should be noted that it would have been interesting if the sample analyzed had data from companies that are not successful from the point of view of resilience (Y = 0). This would have enriched the qualitative comparative analysis since correlations of variables that do not generate the expected result would have emerged, thus providing a more complete and empirically more robust view.

Also, the type of research that has been carried out allows for the inclusion of more dependent variables since the range of indicators of the GRI standard exceeds one hundred. In this way, it could focus on new aspects of environmental sustainability (such as waste treatment), social sustainability (such as respect for human rights) or governance sustainability (such as the relationship between company and workers) to determine whether they also have causal relationships with the reliability of supply chains.

Another limitation of this article is that the explanatory variables were treated dichotomously without assessing and differentiating their degree of compliance. And it is highly likely that each company works with greater or lesser intensity on sustainability strategies.

Therefore, the new lines of research related to this work would expand its scope in three directions: more cases of analysis, more explanatory variables, and more depth in the comparison.

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