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# From COVID-19 to the war in Ukraine: evidence of a Schumpeterian transformation of food logistics

Silvia Andrés González-Moralejo<sup>1\*</sup>

\*Correspondence:  
silangle@upv.edu.es

<sup>1</sup> Grupo de Economía Internacional y Desarrollo, Universitat Politècnica de València, Escuela Técnica Superior de Ingeniería Agronómica y Medio Natural, Edificio 3B, 2º Planta, Camino de Vera, S/N, 46022 Valencia, Spain

## Abstract

This study analyzes the changes that have occurred in food logistics in the three years since the emergence of the COVID-19 pandemic and the one year since the war in Ukraine commenced. Food logistics companies are highly sensitive to demand shocks, energy prices, and staff availability. In this study, “first-hand” information was collected in the Iberian Peninsula, and it showed a process of Schumpeterian transformation. This crisis environment in which food logistics companies have been operating has opened a unique opportunity to renew operating procedures and seek new solutions, products, and markets. Therefore, food logistics companies have developed more effective communication strategies and innovative, profitable, and forward-looking commercial strategies to adapt to the new needs of their clients, applied more efficient transport planning and management methods, implemented new technologies to increase automation and digitization in warehouses, transport platforms, and trucks, and boosted market concentration and investment in infrastructure. Therefore, public authorities and top executives must focus on promoting and facilitating these improvements.

**Keywords:** Perishable food, Refrigerated logistics, Crisis, Schumpeterian transformation

## Introduction

The coronavirus disease 2019 (COVID-19) lockdown put unexpected strain on the food supply chain, simultaneously affecting production, processing, transport, logistics, and final demand. In this context, the relevant actors quickly reorganized the food supply chain to ensure food availability, thus demonstrating their flexibility and resilience (Food and Agriculture Organization of the United Nations [FAO] 2021). However, these unprecedented tensions have been exacerbated instead of disappearing. Shortage of raw materials, supplies, and human capital, carrier strikes, and inflationary tensions caused by the escalation in gas, electricity, and fuel prices, all factors that have appeared in the context of the war in Ukraine, have been restricting companies, especially the most energy-dependent ones.

This paper focuses on cold chain logistics (CCL) companies, operators specializing in refrigerated storage and transport activities, because they depend heavily on energy and increased energy costs directly affect their bottom line. The study area was the Iberian Peninsula (IP), which plays a strategic role as a national and international food supplier. According to the Annual Food Industry Report published by the Ministry of Agriculture, Fisheries and Food (*Ministerio de Agricultura, Pesca y Alimentación*—MAPA) (MAPA 2022), cold chain logistics accounted for around 2.5% of the Gross Domestic Product (GDP) of the food industry in Spain and Portugal in 2021.

A crisis is a time of change, and companies that adapt their strategies to it and survive become stronger. This dynamic has been supported by economists such as David Ricardo, Friedman, Samuelson, and Schumpeter. Schumpeter argued that progress and creation require simultaneous destruction. According to his central idea, creative destruction is the motor of development, and the key element in this process is the differential innovative capacity of economic agents to generate new products, processes, organizational methods, and means of market access. Hence, the “Schumpeter Paradigm” states that any economic crisis opens opportunities for structural changes, which are not possible during periods of prosperity. Along these lines, Rothengatter (2011) simulated different scenarios for the 27 EU member states and, applying the “Schumpeter Paradigm,” established how the 2008 financial crisis prompted changes in the transport sector, making operations more efficient in terms of their planning and management methods and tools and more environmentally friendly. Subsequently, opportunities for sector renewal opened in several countries subjected to austerity measures (Gomes et al. 2015; Seign et al. 2015).

Identifying previous studies is essential to understand the contributions of this paper to the literature. Among these studies, Ferreira and do Couto (2015), Schneider et al. (2010), Tsekeris (2013) and Stamos et al. (2016) stand out for having quantified the decrease in road freight transport activities in southern Europe resulting from the 2008 financial crisis. Paradoxically, they also demonstrated how those years of austerity measures provided opportunities for companies to develop innovative, cost-effective, and forward-thinking problem-solving strategies. When addressing the stresses caused by COVID-19, Deconinck et al. (2020) and Hobbs (2020, 2021) highlighted the high speed at which the actors in the supply chain were able to reorganize logistics to ensure uninterrupted food availability in the developed world.

In this context, this study aims to determine if CCL companies can innovate and find new solutions, products, and markets in the current economic chaos. For this purpose, the following specific objectives have been set:

1. Segmenting the perishable foods logistics market, thus recognizing the key stakeholders that use logistics services.
2. Assessing the economic size of the market to characterize its importance.
3. Identifying the most relevant bottlenecks for CCL companies.
4. Explaining in detail the responses of CCL companies and their renewal and survival strategies in the unprecedented crisis, based on in-depth interviews with senior managers.

## **Empirical framework**

### **Materials and procedure**

In this case study, we comprehensively analyzed a sample of 10 CCL companies that provide storage and transport services in the Iberian Peninsula, in both break bulk or groupage and full load. In compliance with data protection laws, these service providers have been identified merely as TOP 30 companies, as outlined in Table 1, and represent a 45% market share of the sector. The data were collected through in-depth interviews with open-ended questions to enable companies to reveal their real experiences. A total of 20 interviews were conducted, two per company. The professionals interviewed in this study comprised Sales and Operations Managers and Branch Directors.

As shown in Table 1, the top 10 CCL companies ranked by turnover accumulated a turnover of 1814 million euros in 2022. According to Alimarket (2023), this turnover represented 57% of the sector. In addition, these companies operated with 5,112,000 cubic meters of cold storage capacity, 3216 own vehicles and 8825 contracted vehicles.

### **Market segmentation and size**

CCL companies segment their market based on their clients' type of activity. Thus, three segments can be distinguished in the IP:

1. Food Manufacturers (food industry)
2. Food Service Providers (hotel/restaurant/catering (HORECA) channel)
3. Retailers or Large Distributors Segment (hypermarket and supermarket chains)

In the first segment, CCL companies include a second level of segmentation by product category and even by temperature, thus differentiating between refrigerated and frozen products. Figure 1 shows the most detailed market segmentation of perishable food logistics as possible in this study, including the most relevant and documentable categories from the Alimarket Sectoral Reports (Alimarket 2022), which provide the name and legal entity of the main companies of each segment.

Segmenting a market is the first step in calculating its size. In this study, we estimated the size of the CCL market in the IP in terms of potential annual revenue based on direct information provided by the CCL companies we interviewed. These companies estimate market size by calculating percentages on the sales figures and other variables of their potential customers. This measurement enables them to quickly grasp potential business opportunities and growth offered by the market in terms of value and is, therefore, crucial for the business strategy and decision-making of CCL companies.

Table 2 outlines the data on each segment. It shows that the CCL market will "move" more than 4600 million euros in the IP in 2023, with food manufacturers accounting for almost 2700 million euros.

### **COVID-19 tested the adaptability of CCL companies**

2020 stood out as an extraordinary year. Following consecutive years of growth (as illustrated in Table 1 with a 6% increase in 2019), the refrigerated logistics sector, grappling with the impact of the COVID-19 pandemic, concluded 2020 with virtually unchanged

**Table 1** Main cold chain logistics companies in Spain

| Company   | Turnover  | Turnover  | Turnover  | Turnover  | Turnover  |
|---|-----------|-----------|-----------|-----------|-----------|
|   | 2018 (M€) | 2019 (M€) | 2020 (M€) | 2021 (M€) | 2022 (M€) |
| DHL SUPPLY CHAIN SPAIN, S.L                       | 320       | 328       | 320       | 315       | 344       |
| STEF IBERIA, S.A                                  | 269       | 291       | 285       | 309.4     | 340       |
| CARRERAS GRUPO LOGÍSTICO, S.A                     | 187.5     | 199       | 220       | 254       | 300       |
| GRUPO ID LOGISTICS IBERIA                         | 186       | 195       | 192       | 202       | 210       |
| SALVESEN LOGÍSTICA, S.A                           | 159.8     | 165.4     | 152       | 153       | 193       |
| TRANSPORTES AGUSTÍN FUENTES E HIJOS, S.L. (GRUPO) | 93.6      | 98        | 102.7     | 103.5     | 105       |
| KUEHNE + NAGEL, S.A                               | 80        | 80        | 75        | 95        | 95        |
| LOGIFRÍO GESTIÓN FRIGORÍFICA, S.L. (GRUPO)        | 79.8      | 88.1      | 96.5      | 88        | 92        |
| LUIS SIMOES LOGÍSTICA INTEGRADA, S.A              | 61.33     | 69.3      | 65.8      | 75.6      | 77        |
| HERMES LOGÍSTICA, S.A                             | 30.8      | 33.2      | 66.6      | 57        | 58        |
| CARBÓ COLLBATALLÉ (GRUPO)                         | 41.5      | 47.8      | 41        | 54.3      | 58        |
| FACTOR CINCO SOLUCIÓN, S.L                        | 29.6      | 31.4      | 30.3      | 37.4      | 47        |
| GARVASA – GARCÍA VALLE, S.L                       | 27        | 27        | 27        | 39        | 43.4      |
| TRANSPORTES FRIGORÍFICOS NARVAL, S.L              | 24.2      | 26.4      | 24        | 29.8      | 35.2      |
| MONTFRISA, S.A                                    | 22        | 24.2      | 22.5      | 25.5      | 27        |
| ARM LOGÍSTICA (GRUPO)                             | 23.2      | 24.7      | 22.3      | 19.8      | 18.4      |
| AMERICOLD GROUP                                   | 13.2      | 13.5      | 13.6      | 18        | 22        |
| FREDIST, S.L. (GRUPO)                             | 9         | 11.3      | 12.6      | 12        | 16        |
| JOSÉ GUILLÉN E HIJOS, S.L                         | 8.3       | 11.3      | 10.5      | 10.4      | 12.9      |
| TRÍO OPERADORES LOGÍSTICOS (GRUPO)                | 11        | 10.2      | 9.5       | 9         | 10        |
| GRUPO PEMIJA                                      | 11        | 12.7      | 7.3       | 9.7       | 10.4      |
| D.I.R.E. USIETO, S.A. (GRUPO)                     | 8.2       | 8.6       | 8.7       | 9.9       | 11.5      |
| CEFRUSA SERVICIOS FRIGORÍFICOS, S.A               | 7.4       | 7.7       | 8.3       | 9.6       | 10.8      |
| DISAYT, S.L. (GRUPO)                              | 11.2      | 8.6       | 7.8       | 8.4       | 9.2       |
| ONDARA LOGÍSTICA, S.L. (GRUPO)                    | 5.6       | 5.9       | 7.3       | 8.1       | 11        |
| INTERLOGÍSTICA DEL FRÍO, S.A. (INTERFRISA)        | 6.2       | 6.5       | 6.3       | 5.8       | 6.5       |
| TRANSPORTES TRESSERRAS, S.A                       | 6.5       | 6.2       | 5.2       | 7.4       | 8.5       |
| OLANO VALENCIA, S.L                               | 1.9       | 4.5       | 5.1       | 6         | 7.7       |
| DISFRIMUR LOGÍSTICA, S.L                          | 3.3       | 3.3       | 3.4       | 4         | 4         |
| TUDEFRIGO LOGÍSTICA, S.L                          | 3         | 3         | 3         | 4         | 4.5       |
| TOTAL   | 1741.33   | 1841.8    | 1851.3    | 1980.6    | 2188      |
| ANNUAL VARIATION                                  |           | 5.80%     | 0.52%     | 7%        | 10.50%    |

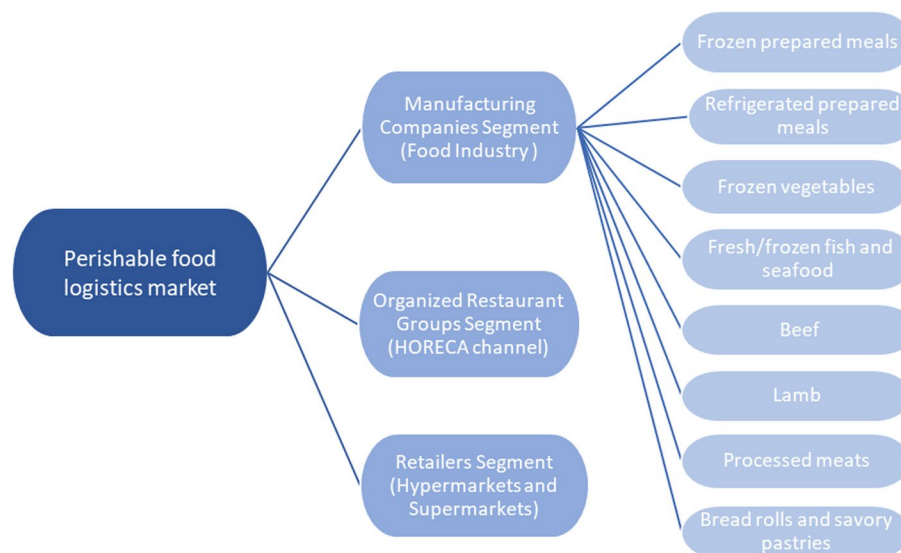
  

| Company   | Cooling                    | Own      | Contracted |
|---|----------------------------|----------|------------|
|   | Capacity (m <sup>3</sup> ) | Vehicles | Vehicles   |
| DHL SUPPLY CHAIN SPAIN, S.L                       | 4,00,000                   | 0        | 850        |
| STEF IBERIA, S.A                                  | 1,553,000                  | 51       | 900        |
| CARRERAS GRUPO LOGÍSTICO, S.A                     | 5,00,000                   | 1000     | 766        |
| GRUPO ID LOGISTICS IBERIA                         | 1,90,000                   | 200      | 900        |
| SALVESEN LOGÍSTICA, S.A                           | 8,21,000                   | 0        | 1500       |
| TRANSPORTES AGUSTÍN FUENTES E HIJOS, S.L. (GRUPO) | 657,000                    | 1175     | 550        |
| KUEHNE + NAGEL, S.A                               | 1,30,000                   | 0        | 1500       |
| LOGIFRÍO GESTIÓN FRIGORÍFICA, S.L. (GRUPO)        | 4,05,000                   | 0        | 600        |
| LUIS SIMOES LOGÍSTICA INTEGRADA, S.A              | 33,000                     | 600      | 1000       |
| HERMES LOGÍSTICA, S.A                             | 4,23,000                   | 190      | 140        |
| CARBÓ COLLBATALLÉ (GRUPO)                         | 2,19,000                   | 123      | 259        |
| FACTOR CINCO SOLUCIÓN, S.L                        | 40,000                     | 15       | (n.d.)     |

**Table 1** (continued)

| Company                                    | Cooling Capacity (m <sup>3</sup> ) | Own Vehicles | Contracted Vehicles |
|--|------------------------------------|--------------|---------------------|
| GARVASA – GARCÍA VALLE, S.L                | 1,41,660                           | 75           | 280                 |
| TRANSPORTES FRIGORÍFICOS NARVAL, S.L       | 52,000                             | 112          | 80                  |
| MONTFRISA, S.A                             | 3,39,027                           | 22           | 140                 |
| ARM LOGÍSTICA (GRUPO)                      | 29,700                             | 81           | 203                 |
| AMERICOLD GROUP                            | 5,00,000                           | 0            | (n.d.)              |
| FREDIST, S.L. (GRUPO)                      | 40,900                             | 65           | 70                  |
| JOSÉ GUILLÉN E HIJOS, S.L                  | 2,76,000                           | 120          | 60                  |
| TRÍO OPERADORES LOGÍSTICOS (GRUPO)         | 12,000                             | 15           | 70                  |
| GRUPO PEMIJA                               | 19,000                             | 43           | 9                   |
| D.I.R.E. USIETO, S.A. (GRUPO)              | 68,000                             | 47           | 10                  |
| CEFRUSA SERVICIOS FRIGORÍFICOS, S.A        | 1,16,000                           | 24           | 15                  |
| DISAYT, S.L. (GRUPO)                       | 60,000                             | 15           | 65                  |
| ONDARA LOGÍSTICA, S.L. (GRUPO)             | 68,000                             | 133          | 50                  |
| INTERLOGÍSTICA DEL FRÍO, S.A. (INTERFRISA) | 1,55,000                           | 0            | 55                  |
| TRANSPORTES TRESSERRAS, S.A                | 41,315                             | 74           | 50                  |
| OLANO VALENCIA, S.L                        | 1,76,540                           | 0            | 2                   |
| DISFRIMUR LOGÍSTICA, S.L                   | 60,000                             | 0            | 25                  |
| TUDEFRIGO LOGÍSTICA, S.L                   | 34,000                             | 200          | 30                  |
| TOTAL                                      | 7,560,142                          | 4380         | 10,179              |

Source Alimarket (2023)



**Fig. 1** Perishable food logistics market segmentation. Source: The authors, based on empirical evidence

turnover (refer to Table 1). Despite facing considerable month-to-month fluctuations during the lockdown, the sector demonstrated agility in managing its activities. Subsequent years presented additional challenges, including a conflict in Europe and a transportation strike that paralyzed a significant portion of the industry. Prices, particularly those of energy and food, experienced substantial surges. Nevertheless, the sector,

**Table 2** Market size in 2023 (millions of euros)

| Segments  | Logistics expenditure (M€) |
|---|----------------------------|
| Total logistics expenditure of food manufacturers (Food industry)             | 2686.85                    |
| Total logistics expenditure of food service providers (HORECA channel)        | 819.65                     |
| Total logistics expenditure of retailers (Hypermarket and supermarket chains) | 1107.11                    |
| TOTAL   | 4613.61                    |

Source: The authors, based on empirical evidence

known for its adaptability and resilience, successfully rebounded. By the end of 2021 and 2022, it achieved impressive average sales growth of 7% and 10.5%, respectively.

The near future looks uncertain. Specifically, consumption is expected to decline across the board and fuel and food prices will continue to rise. Nevertheless, annual growth of around 8% is expected to continue, according to the managers interviewed in this study.

**Looming market vulnerabilities requiring attention**

The interviews with the CCL companies highlighted the main bottlenecks that require a solution.

The pandemic has demonstrated how a rapid change of context can disrupt the plans of CCL companies, thus highlighting the need for constant communication with suppliers, customers, and recipients to maintain competitiveness. CCL companies must anticipate events due to inefficiencies throughout the distribution chain caused by panic buying. Fearing shortages caused by carrier strikes, lack of raw materials, and price hikes, consumers purchased large amounts of food products both at the beginning of the pandemic and subsequently. Panic buying overwhelms the production capacity of manufacturing companies, with endless queues affecting drivers, interrupting their work hours, and congesting retailer transport platforms; product variety may decrease in hypermarkets and supermarkets, which prioritize some products. Consequently, storage and transport processes fail to maintain logical and orderly planning. In this context, CCL companies must anticipate the demand of large retailers and make daily, weekly, and monthly forecasts to ensure the availability of human and material resources to meet this demand.

The pandemic has intensified home delivery as a line of business, as it includes both deliveries from manufacturers directly to the end consumer and online orders from retailers. The drawback for manufacturers and retailers with online sales through CCL companies is that their rates are unsuitable for last-mile distribution, since these orders remain very small and limited in number in the food sector, and only high-value products can justify the associated costs. The infrastructure of CCL companies, which is based on large-tonnage trucks adapted to palletized goods, is neither appropriate for last-mile distribution within urban centers nor cost-effective for small-scale food distribution.

Reaching historical records, energy prices have skyrocketed the operation costs of CCL companies and jeopardized their viability. The Association of Cold Storage, Logistics, and Distribution of Spain (*Asociación de Explotaciones Frigoríficas, Logística y Distribución de España*—ALDEFE) and the Association of International Road Transport (*Asociación del Transporte Internacional por Carretera*—ASTIC) have estimated the figures that threaten the sector. Specifically, the increase in electricity prices, which particularly affects companies working under controlled temperatures, has raised the operating costs of CCL companies by 40%, while hikes in the price of gas for trucks and price of fuel have raised them by 328% and 75%, respectively. These price hikes make it difficult to maintain profitability.

Lastly, shortages have become another bottleneck. They include cargo capacity constraints, lack of drivers, logistics specialists, and ship crews, container shortages, and limited storage space in ports and warehouses. These shortages have significantly increased transport times and costs worldwide. For CCL companies, the problem stemming from these shortages is the lack of drivers, which has increased worldwide in the wake of Brexit and the COVID-19 pandemic. According to the International Transport Forum, the shortage of professional drivers reached 40% last year, accounting for 2.6 million job vacancies worldwide. In addition, generational replacement is not guaranteed. Transport does not attract youth, as drivers under the age of 25 are a minority, comprising only 7% of all truckers. The age gap is especially pronounced in Europe, where the average age of truckers is 50 years, and those over 55 account for 32% of all truckers (ILO 2022). In the IP, this problem is further compounded by job insecurity resulting from the usage of mileage-based pay rather than an hourly rate. This job insecurity has led to longer working hours and worsened economic conditions, and the unsafe conditions of the roads and the occasionally poor conditions of the rest areas further exacerbate the situation.

### **CCL companies' resilience and business strategies adopted**

CCL companies have been developing different measures to adapt to the ongoing challenges that continue to impact the sector and the emerging needs resulting from these obstacles.

The first adaptation mechanism involves developing a constant and fluid dialogue inside and outside CCL companies. To enhance external communication with customers and recipients, CCL companies have replaced monthly or weekly communication, typical of the pre-COVID-19 era, with constant communication for daily sales estimates. By doing this, they can more accurately forecast transport and storage activities for the following days, thereby ensuring the availability of human and material resources, preventing transport platform congestion due to excessive demand, maintaining service excellence, controlling production costs, and avoiding losses that jeopardize their viability.

In addition, they have strengthened internal communication so that employees are aware of the established measures and understand the needs of the company, thus promoting their flexibility and willingness. They have also encouraged intense interdepartmental coordination, especially between the sales and operations departments. This

emphasis on communication, networking, and personal relationships is improving the integration and efficiency of the supply chain (Thilmany et al. 2021).

Communication is being strengthened by updating CCL computer systems to increase synergy with customers and within the company. Implementing e-commerce platforms (replacing telephone and email) reduces human errors, increases customer satisfaction, and provides CCL companies with a competitive advantage, setting them apart. These e-commerce platforms integrate, through an application on the drivers' smartphones, an optimization system that facilitates cost control by reducing route times. Such a route optimization system collects and categorizes information, notifying users of any incidents, such as traffic jams, accidents, road closures, congestion at transport platforms, and unavailable recipients. The system provides feedback by modifying current routes and always notifies customers and recipients of the whereabouts and status of their goods.

Another mechanism consists of opening new markets by establishing agreements with partners to tackle the last-mile distribution of small packages (also called last mile). In this new line of business, namely, direct delivery to the end consumer, CCL companies are developing strategic partnerships with courier companies that specialize in small package delivery within urban areas and with cold chain shipping, such as SEUR and DHL. CCL companies provide the goods, and the courier company provides the infrastructure required for last-mile distribution. They are currently considering such agreements for grocery delivery from supermarkets and hypermarkets. Their adaptability and flexibility have led CCL companies to seek diversified markets (Chenarides et al. 2021).

CCL companies have also adopted other fuel-saving measures by redirecting their planning toward increasing truck utilization rates and eliminating unnecessary routes. In the medium and long term, they are considering replacing their fleet with hybrid models, including short-range electric and hydrogen vehicles (technology still in the research phase) and models with 1.80-m-high containers to increase load capacity from 33 to 50 pallets.

According to the Spanish Road Freight Transport Observatory (*Observatorio del Transporte de Mercancías por Carretera—OTMC*) of the Ministry of Transport, Mobility, and Urban Agenda (*Ministerio de Transportes, Movilidad y Agenda Urbana—MITMA*), fuel accounts for at least one-third of the direct cost of operating a semi-trailer truck. Accordingly, CCL companies have introduced fuel clauses in their transport contracts. These clauses are based on a formula defined and agreed upon by CCL companies and the client, which specifies the effect that variations in diesel prices will have on the value of services provided by CCL companies. Therefore, if the price of diesel increases, so will the value of services and vice versa.

Regarding improving the working conditions of drivers, the CCL companies strive to minimize their daily distance traveled by enabling truck and driver exchanges at specific locations. In the long term, technological advances incorporated into autonomous vehicles (currently in the experimentation stage) will open opportunities for solving the generational replacement problem.

Another adopted measure has been to reactivate investments to enlarge their infrastructure by expanding and developing projects for opening new warehouses. In the last year, more than fifty projects have been recorded, covering a total area of over one



million square meters in the IP, including warehouses owned by the client but managed by the CCL company. For example, Carrefour has temperature-controlled warehouses managed by Stef in Villanueva de Castellón and Salvesen Logística in Getafe. Similarly, Alcampo's warehouses in Zaragoza are managed by ID Logistics. Examples of new transport platforms include the opening of Stef in Portugal and ID Logistics in Burgos (exclusively dedicated to the Campofrío Food Group) and Carrefour's first e-commerce hub for food products in the IP. The new warehouses are equipped with innovative mechanization, robotization, and artificial intelligence technologies (Weersink et al. 2021).

Lastly, CCL companies are stimulating their inorganic growth by accelerating buying and selling operations in the sector, within the framework of a trend toward capital concentration, as increasingly more capital is needed to research and develop new technologies and innovations (to increase productivity sustainably). For example, Logifrío has been acquired by Zolve, Logista has absorbed "El Mosca" and Carbó, and Stef has acquired Enaboy Castilla. Internationally, this trend implies the inland expansion of large maritime groups through the acquisition of companies that specialize in logistics services to expand their portfolio of services provided to the entire supply chain. In its annual reports, Alimarket (2022) provides detailed information on investments and buying and selling operations regarding CCL companies.

### **Implications**

In the current period of economic instability, anticipating events is now more important than ever. The economic and social context in which CCL companies operate is uncertain and can change at any time. CCL companies are quickly reorganizing and innovating their operations to ensure their survival, thus demonstrating their flexibility, robustness, and resilience, a testament to the Schumpeterian Growth Paradigm. This paradigm postulates that every critical situation provides companies with opportunities to renew themselves and find new solutions, products, and markets, a stimulus that is inhibited in periods of economic boom. The innovation processes observed in CCL companies, specifically, their adaptation mechanisms in response to the effects of the crisis, provide evidence of a Schumpeterian transformation.

In conclusion, the crisis triggered by COVID-19 has driven a highly positive change in the behavior of transport companies, as they have emerged stronger. CCL companies have reinforced their internal and external communication, strongly focusing on dialogue to quickly redirect their capacity and make it available to clients experiencing demand spikes. This demonstrates how informal networks and strong personal relationships enhance planning, integration, and supply chain efficiency, providing adaptability and flexibility as proactive strategies for improving resilience. These companies have also intensified automation and the use of new technologies and digital platforms, optimizing conditions for their human resources (especially drivers) and their operational capacity management, thus ensuring their viability in a context of soaring energy prices. Additionally, they have innovated by entering new markets and offering new services, implementing novel delivery methods, and fostering collaborations with new partners to provide highly personalized services to each client and strengthen their delivery capabilities. Finally, they have reactivated investments aimed at expanding their infrastructure

through expansion projects and/or acquisitions. These data highlight the importance of making decisions based on rigorous facts and effective communication.

Although international transport flows are returning to normal, the uncertainty caused by the war in Ukraine and inflation are worrying the industry. CCL companies are particularly concerned about changing consumer habits as spending power declines. CCL companies fear lower per capita spending and are preparing for reduced storage and transportation. However, due to the continuous updating of their tariffs, the impact on CCL companies' profitability is expected to be less than that of the pandemic.

In a context where operating costs are very high due to energy inflation, the question is whether the costly strategies adopted by CCL companies (opening of new markets, investment in infrastructure, progress in the concentration of the sector) could lead to cost increases that could jeopardize their viability. In this respect, managers agree that their strategies are part of a more integrated to logistics and transport approach. CCL companies' objective is to increase business volume, synergies, efficiency, and competitiveness, to expand the range of services and to have a stronger financial capacity, in an environment that will require major investments to adapt to the challenges of energy and environmental sustainability, robotization and automation. However, restructuring processes may lead to closures, so we will probably see even greater sector concentration, allowing the survivors to strengthen their position.

Several lessons emerge from this study. Overcoming the challenges faced by traditional logistics and CCL companies will require the attention and cooperation of political and business leaders as current trends with a significant impact on the supply chain, such as the growth of online shopping and demand for local products, continue to consolidate. Meeting customer requirements will require further adjustments aimed at achieving better-planned timing, a high degree of customization and individualization of orders, last-mile deliveries, and direct contact with the end customer. CCL companies are undergoing transformation to ensure that food is reliably delivered to its destination.

The study's main limitations are the number of companies interviewed and the data provided by companies. The study is based on in-depth interviews with 10 CCL companies. This limits the generalizability of the results. Regarding the data collected, it is undoubtedly very valuable as it represents a unique source of knowledge that cannot be replaced or found in any other way. However, variables such as gross margin, productivity, or operating costs could not be included in the study because they are confidential by CCL companies.

Looking ahead, it is important to deepen this research and broaden the analysis of the opportunities and challenges facing the food chain, new practices adopted by food chain actors, and the implications for the food system, always based on real and carefully collected data. In this sense, our next line of research will include an in-depth analysis of the concentration process that is taking place in the sector: Which acquisitions have taken place? Which CCL companies are investing in creating new platforms? What are the threats and opportunities of this trend? Has the sector become a focus of attraction for international players?

#### **Abbreviations**

ALDEFE Spanish Association of Refrigerated Operations, Logistics and Distribution  
ASTIC International Road Transport Association

CCL  
Cold Chain Logistics Companies  
FAO  
Food and Agriculture Organization of the United Nations  
GDP  
Gross Domestic Product  
HORECA  
Hotel/Restaurant/Catering  
ILO  
International Labor Organization  
IP  
Iberian Peninsula  
MAPA  
Ministry of Agriculture, Fisheries and Food  
MITMA  
Ministry of Transport, Mobility and Urban Agenda  
OTMC  
Spanish Road Freight Transport Observatory

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