The Effect of European Environmental Regulations and Innovation Strategies on the Competitiveness of Intra-European Logistics Service Providers

Master Thesis

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I hope that by reading this thesis, either for leisure or educational purposes, you feel inspired to learn more about the impact of environmental regulations on logistics service providers (LSPs).

Delft University of Technology — Alejandro van Meer Cordón

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Executive Summary

In the upcoming years, freight transportation demand is expected to increase, and thus, raise the environmental impact of logistics service providers (LSPs). Transport and logistic activities are the second-largest emitters of greenhouse gas emissions (GHGE) and have a significant impact on air quality, noise pollution, water quality, and, among many other, land take. In efforts to collectively reach the goal of reducing GHGE by at least 55% by 2030, compared to the 1990 levels, there is an increasing number of initiatives such as the Fit for 55 package, European Climate Law, EU strategy on adaptation to climate change, CO2 emissions from transport, EU emissions trading system, effort sharing, land use and forestry, and clean energy. Through these initiatives, governments aim to fight climate change and drive urban action that reduces greenhouse gas emissions and climate risks, while increasing citizens' health, well-being, and economic opportunities. As part of the transport and logistics industry, LSPs play a significant role in changing the current trajectory of GHGE and other environmental problems. However, not many companies are acting upon these issues, and those who are, have not been ambitious enough. Some of the reasons include: the highly competitive, low margin, and capital-intensive market LSPs operate in, as well as the high level of green investment needed, the uncertainty of their payback period, the lack of employees with a focus on environmental initiatives, and the lack of a well-defined regulatory framework and financial incentives. In this context, research indicates that many of the barriers are highly influenced by how regulations are designed and how governments support LSPs in improving their environmental performance. To this end, many researchers have evaluated the relationship between environmental regulations, innovation, and a firm's competitiveness.

In this regard, evolutionary economists believe that environmental regulations can trigger innovation that may partially or more than fully reduce the costs of complying with them (increase in competitiveness) (i.e., Porter Hypothesis). In contrast, neoclassical economists believe that this "win-win" situation does not exist. To this date, the overall findings of the Porter Hypothesis have been inconclusive and context specific. Therefore, the objective of this study is to carefully evaluate the Porter Hypothesis in LSPs and understand whether environmental regulations are appropriately designed, understand the importance of the involvement of LSPs in the development of environmental regulations and provide insights on how they can design practical corporate environmental approaches. More specifically, the main research question the study aims to answer is: "*Under which conditions can European environmental regulations increase competitiveness for Intra-European Logistics Service Providers (LSPs)?"*

Considering that this is the first time the Porter Hypothesis has been evaluated on LSPs, the type of research and data collection method used in this study is a single-case study (exploratory) and a combination of primary and secondary data, respectively. The primary data was collected using semi-structured interviews. The secondary data collection method used was "desk research" which comprises a variety of methods, including informal talks, company documents, observations, and reports of previous studies. Primary and secondary data were analysed to understand, in the context of LSPs, whether the research findings are aligned with the literature review findings, and under which conditions the conceptual model selected in the literature review holds. Ideally, this study evaluates a larger number of LSPs and considers the perspective from governments. Doing this would help better understand whether certain conditions can be omitted or if new ones need to be considered. In addition, considering that the Porter Hypothesis has a dynamic dimension to it, it is important to evaluate this relationship in the coming years (longitudinal study) as regulations and market conditions constantly change while new technologies are being discovered.

The study's findings indicate that, in contrast to LSPs that operate in a few regions/cities, LSPs that operate in multiple regions/cities perceive environmental regulations at the European level as inflexible. However, the inflexibility is not due to the limited availability of processes or technologies to comply with them, but because on a country/city level, the environmental regulations vary and are susceptible to many changes. Furthermore, when evaluating environmental regulations individually, the results indicate that while there are existing technologies and processes to comply with them, current technologies suffer from scalability issues and are too costly to acquire. In this context, LSPs must collaborate closely with governments to create regulations, receive financial support (e.g., grants and incentives), and highlight the importance of reducing the complexity of environmental regulations.

Regarding the Porter Hypothesis, the researchers claim that companies must take a proactive approach toward environmental sustainability. In the case of intra-European LSPs, the findings highlight that the approach (i.e., proactive or reactive) is not mutually exclusive. While a fully proactive approach towards environmental sustainability is ideal, the current regulatory framework (i.e., not consistent, prone to changes), the transport and logistics industry (i.e., low margins, CAPEX and OPEX intensive) and the market in which LSPs operate in (i.e., highly competitive, low customer awareness) inhibit LSPs from taking this approach. Instead, besides ensuring that no internal barriers are present, LSPs need to carefully develop a strategy that would allow them to find the “sweet spot” between a reactive and proactive approach.

Regarding the impact of environmental regulations on LSPs’ competitiveness, the findings indicate that companies that do not have sustainability as part of their commercial proposition have not been directly benefitted. On the other hand, LSPs that offer green products/services, customer insights (sustainability), offsetting schemes, carbon sequestration, and sustainable certifications (subcontractors) have seen a positive impact on their competitiveness (market share, sales, etc.). However, the reason certain LSPs have seen a direct positive effect in their growth is not necessarily because they are green companies but because they appear to be more environmentally friendly than they are (i.e., whitewashing/greenwashing). Thus, European environmental regulations can increase the competitiveness for Intra-European LSPs if:

1. Environmental regulations are more consistent among member states, easily accessible, and promote collaboration between governments and private companies (i.e., Ambition Loop).

2. LSPs carefully develop a strategy that would allow them to find the “sweet spot” between being reactive and proactive.

Through the findings, this study highlights how crucial it is for LSPs and governments to collaborate so that governments can design future environmental regulations in such way that they support companies achieve their targets and LSPs demonstrate commercial demand and economic possibilities to governments.

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List of Abbreviations

CAPEX	Capital Expenditures
ESG	Environmental, social, and governance
ETS	Emissions Trading System
EU	European Union
GHGE	Greenhouse Gas Emissions
GL	Green Logistics
LSP	Logistics Service Provider
OPEX	Operating Expenditures
PH	Porter Hypothesis
SAF	Sustainable Aviation Fuels
SMEs	Small and medium-sized enterprises

1 Introduction

Experts expect the world's population to increase by 2 billion in the next 30 years, reaching 9.7 billion in 2050 due to the increasing numbers of aging people, reproductive age, changes in fertility rates, increasing urbanization and accelerating migration (United Nations, 2019). This rapid population growth is increasing freight transportation demand and rising issues for logistics service providers (hereafter LSPs[1]). An example of a logistic issue is the environmental impact of freight distribution. As part of the logistics service sector, transport and logistic activities are the second-largest emitters of greenhouse gas emissions (hereafter GHGE) (Evangelista, Santoro, & Thomas, 2018), accounting for 27% of global emissions in 2019 (International Energy Agency: IEA, 2021). Since the 1990s, the trend of GHGE in Europe has been steadily increasing. Although this trend stopped in 2020, due to the COVID-19 pandemic, where the EU's domestic transport emissions dropped by 12.7%, experts expect a rebound that will peak in 2025 if no additional measures are enforced. If this is the case, carbon emissions in 2030 are expected to be 10% higher than 1990 levels. However, with additional measures, carbon emissions could reach their maximum in 2022 and be 6% below the 1990 levels in 2030 (EEA, 2021).

While LSPs play a significant role in changing the current trajectory of GHGE and other environmental problems, not many companies are acting upon any of these issues, and those who are, have not been ambitious enough. Some of the reasons include: the highly competitive, low margin, and capital-intensive market LSPs operate in, as well as the high level of green investment needed, the uncertainty of their payback period, the lack of employees with a focus on environmental initiatives, and the lack of a well-defined regulatory framework and financial incentives. As a result, in efforts to collectively reach the goal of reducing GHGE by at least 55% by 2030, compared to the 1990 levels, there is an increasing number of initiatives. Such initiatives include the Fit for 55 package, European Climate Law, EU strategy on adaptation to climate change, CO2 emissions from transport, EU emissions trading system, effort sharing, land use and forestry, and clean energy. All these initiatives aim to fight climate change and drive urban action that reduces greenhouse gas emissions and climate risks, while increasing citizens' health, well-being, and economic opportunities (C40 cities, 2017). According to the European Commission, "*These initiatives are no longer aspirations or ambitions, but obligations laid down in the first European Climate Law that create new opportunities for innovation, investment and jobs*" (European Comission, 2021).

While for many evolutionary economists, typically Michael Porter and Claus van der Linde, environmental regulations can trigger innovation that may partially or more than fully offset the costs of complying with them (i.e., Porter Hypothesis), for neoclassical economists[2], this "win-win" situation does not exist (Porter & Van der Linde, 1995). These conflicting views have resulted in an increasing body of research with the aim of better understanding the relationship between environmental regulations, innovation, and a firm's competitiveness.

1.1 Problem Statement

While there is a clear consensus on the need for governmental regulations to minimize the environmental impact of corporations, the debate on whether such regulations positively or negatively impact a firm's competitiveness has not been evaluated on LSPs as part of the transport

[1] LSPs are companies that offer companies services surrounding the warehousing, distribution, and transportation of freight. These services may include inventory management, international logistics, and transportation services.

[2] Neoclassical economists focus on supply and demand as the driving forces behind the production, pricing, and consumption of goods and services.

industry. Moreover, in line with the European Union's efforts to reduce greenhouse gas emissions, LSPs are constantly faced with stringent environmental regulations that impact the way in which they operate. Therefore, from a practical perspective, having a good understanding of this relationship can help LSPs better understand under which conditions can environmental regulations increase competitiveness.

1.2 Research Objective

The research objective is to better understand the impact of European environmental regulations and LSPs innovation approach and, ultimately, the effect on its overall competitiveness. This objective will help LSPs to carefully evaluate whether environmental regulations are appropriately designed, understand the importance of their involvement in developing environmental regulations and provide insights on how to design practical corporate environmental approaches. This study will also shed light on the partial and ambiguous results of the Porter Hypothesis by analysing it using two conditions many studies have not adequately considered: (1) the design of environmental regulations and (2) the firm's capabilities and innovation power.

1.3 Research Question

Given the growing importance of environmental regulations and the lack of studies on the relationship between regulations, innovation, and firms' competitiveness for LSPs, assessing the relationship remains an important research topic. Therefore, this study aims to answer the following main research question: *Under which conditions can European environmental regulations increase competitiveness for Intra-European Logistics Service Providers (LSPs)?*

To help answer the main research question, the following five sub-research questions will be addressed:

1. What is the role of governments and LSPs in the reduction of greenhouse gas emissions?
2. What are the factors that influence LSPs from adopting green practices?
3. What, according to literature, is the relationship between environmental regulations and firms' competitiveness?
4. How do environmental regulations impact the competitiveness of LSPs?
5. How can LSPs respond to the changes introduced by environmental regulations?

1.4 Thesis Structure

This study is composed of 7 chapters. Chapter 1 consists of the introduction to the research. Chapter 2 consists of desk research and illustrates the influence and role of LSPs and governments on sustainability as well as the relationship between environmental goals and industrial competitiveness. Chapter 3 describes the methodology used in this study. Chapter 4 summarizes the findings gathered from the case study and semi-structured interviews. In Chapter 5, the findings are discussed and analysed. Chapter 6 provides the conclusions to the study. Finally, Chapter 7 consists of a series of recommendations and future research on the topic at hand.

2 Theoretical Background

This chapter describes and discusses the existing literature on the impact of LSPs on climate change, climate related EU legislation and policy incentives, the role of governments and LSPs in the sustainable transition, and the Porter Hypothesis. The literature review was performed using different academic databases including Scopus, Science Direct, and Wiley Online Library. Additionally, Google Scholar was used as the main search engine. Search terms used were *climate change, environmental regulations, legislation, policy incentives, Europe, logistics service providers, innovation strategies, Porter Hypothesis, competitiveness, and transport and logistics.*

Moreover, this chapter presents the conceptual model used in this study to evaluate the relationship between regulations, innovation, and firms' competitiveness as well as the conceptualization of the framework elements used as part of the research methodology.

2.1 Theoretical Background Introduction

A recent report on the global climate crisis by the United Nations (UN) determined that increases in extreme weather events are well above what many natural systems can endure, resulting in irreversible consequences. The irreversibility of such consequences depends on society's efforts to limit global warming below 1.5 °C compared to pre-industrial levels. However, even at 1.1 °C, avoiding impacts society can no longer avert is prominent. According to the European Environment Agency (EEA), even if global efforts to reduce emissions prove effective, Europe will still be affected by big climate shocks such as droughts, floods, forest fires, and extreme weather conditions. All of which will have one of multiple adverse impacts on the ecosystem, economic sectors, and human well-being (EEA, n.d.). Since the 1990s, the trend of GHGE from the transport industry in Europe has been steadily increasing. Although this trend stopped in 2020, due to the Covid-19 pandemic where the EU's domestic transport emissions dropped by 12.7%, experts expect a rebound that will peak in 2025 if no additional measures are implemented. If this is the case, carbon emissions in 2030 are expected to be 10% higher than 1990 levels. However, with additional measures, carbon emissions could peak in 2022 and be 6% below the 1990 levels in 2030 (EEA, 2021).

2.2 The Impact of LSPs on Climate Change

The transport industry alone accounts for 27% of the EU's total GHGE and, depending on the mode of transportation, it has a significant impact on air quality, noise pollution, water quality, and, among many other, land take. For instance, GHGE generated by transport are linked to climate change and the depletion of the stratospheric ozone layer. Highway vehicles such as diesel vans and line-haul trailers, marine engines, locomotives, and aircraft affect air quality with gas emission and particular matter, including carbon monoxide and nitrogen oxides. All of which are associated with cancer, cardiovascular, and respiratory diseases. Noise is emitted from the cumulative movement of transport vehicles and aircraft engines. Water quality is affected by fuel, chemicals and hazardous particulates discarded mainly from ships and aircraft, which risk marine biological diversity. Lastly, transportation facilities, including airports and ports, impact the urban landscape by creating physical barriers and reducing urban aesthetics (Rodrigue, 2020).

As part of the transport industry, LSPs play a significant role in changing the current trajectory of GHGE and other environmental problems. However, not many companies are acting upon these issues, and those who are, have not been ambitious enough. According to an insight report by the World Economic Forum (WEF) and the Boston Consulting Group (BCG), from a total of 872 transport companies, 610 companies (70%) do not report their emissions, and only 200 companies

(23%) have set clear targets. Of the companies that have set a target, less than half have been able to reduce emissions compared to the previous year. Lastly, most companies target a 30% emissions reduction by 2030, whereas the industry's overall target is 50% (Egloff, Herhold, Krogsgaard, Pieper, & Italiano, 2020). Although it is evident that decarbonizing the transport and logistics industry requires a significant financial investment, it is expected that abatement costs will only increase over time. Currently, in the US, abatement costs for heavy road freight range between $180 to $230 per ton of CO2, which is well above the cost of fuel efficiency measures. If transport and logistic companies do not start acting now, the cost of full decarbonization of heavy-duty transportation would exceed $1 trillion and increase $400 billion by 2030 and 2050, respectively. This increase is if, by 2030, the technology to achieve full decarbonization is available.

More and more companies are considering the environmental impact of their supply chain and responding to the growing public awareness of sustainability. As part of their supply chain, LSPs must assess, report, and improve their environmental impact. A survey of companies who actively collaborate with LSPs across the US, Europe, the Middle East, and the Asia Pacific indicated that 25% were actively collaborating with LSPs to become more environmentally friendly and push their green projects forward. Another 27% were considering doing it soon. Although this study indicates an increase in interest in green logistics [1] (hereafter GL), this is not reflected in current LSPs' efforts to become more sustainable. To this end, there is an increasing body of research examining the factors influencing a firm's willingness to adopt green practices (Sureeyatanapas, Poophiukhok, & Pathumnakul, 2018).

Lin and Ho (2008) examined six factors influencing LSPs' intention to adopt green practices in Taiwan. Their study showed that significant factors were explicitness of technology, accumulation of technology, organizational encouragement, quality of human resources, environmental uncertainty, and governmental support. As part of the technological dimension, the factors explicitness of technology and accumulation of technology indicate the firm's ability to learn and acquire green technologies and the firm's experience with implementing green technologies. Under the organizational dimension, organizational encouragement, and quality of human resources, which include organizations themselves, structures, climates, and cultures, have a significant effect on the adoption of innovation. Lastly, under the environmental dimension, environmental uncertainty and governmental support are external factors that influence firms' innovation capabilities. In a second study, Lin and Ho (2011) once again evaluated factors that affect the adoption of GL practices on Chinese LSPs. In this study, the authors determined that only some factors from their previous study remained relevant. For Chinese LSPs, pressure from customers and changes in the competitive business environment were irrelevant. Instead, they emphasized that laws, regulations, and governmental support were significant factors. According to the authors, the incongruent findings are explained by the size of the interviewed companies. In contrast to large companies (first study), small and medium-sized enterprises (hereafter SMEs) tend to prioritize improving their core business activities rather than investing in improving their environmental performance due to their limited resources.

Similarly, Evangelista (2014) interviewed 13 Italian transport and logistics service providers to analyse their environmental sustainability initiatives and the positive and negative factors influencing them. The companies were grouped based on their environmental profiles regarding types of green initiatives and drivers/barriers to adopting green initiatives. Group one (seven companies) provides transportation and warehousing services. These companies are interested in green initiatives that improve their vehicle operations and are mainly concerned about cost and efficiency rather than sustainability. Group two (four companies) comprised companies with a

broader supply chain involvement (e.g., modal choice and inter-modality, energy efficiency, recycling materials and packaging, and environmental training and information). Group three (two companies) comprised companies that service customers that outsource a significant amount of their logistic activities and consider environmental sustainability a feature of an LSP service offering.

Group one indicated that the most critical barriers were both internal and external to the company. Internal barriers include the high level of green investment needed, the uncertainty of their payback period, and the lack of employees with a focus on environmental initiatives. External barriers include the lack of a well-defined regulatory framework and financial incentives. This group considers environmental sustainability as a source of additional costs rather than an opportunity to differentiate themselves from the competition and increase their competitiveness. Some of the reasons include the highly competitive environment they operate in and the low margins. Most companies in this group operate as subcontractors for other larger LSPs, and the investments in sustainability depend on the availability of financial incentives and a supportive regulatory framework. Group two indicated the same barriers as group one (i.e., financial, and regulatory factors); however, for this group, the environmental awareness by customers can act as either a driver or a barrier. If the customer's awareness of environmental sustainability is perceived as low, LSPs see it as a barrier to green initiatives. However, if perceived as high, LSPs consider it as a driver. As a result, this group of companies adopt a reactive approach toward environmental sustainability. Group three, although aware of the different internal barriers mentioned by groups one and two, mainly emphasized external barriers, more specifically, the lack of well-defined environmental regulations and insufficient human resources.

The researcher derived a series of managerial implications for each one of the groups. For group one, the researcher emphasized that achieving higher environmental sustainability and better cost performance are not mutually exclusive. Moreover, considering that their main concern is the high investment needed, financial resources and incentives could be facilitated through EU programs. Simultaneously, employees should receive training programs to improve their skills and reduce the cost of sustainability for the company (e.g., eco-driving courses, dynamic route optimization). Finally, the researcher suggests signing longer-term contracts with customers to help companies in group two ensure an adequate return for their sustainability investments. Doing so would incentivize customers to collaborate on better planning and environmental control.

Additionally, since more customers are looking to become carbon neutral, LSPs could require them to pay a higher price for green logistic solutions. First, companies in group three need to improve customer collaboration and increase the visibility of their sustainability efforts. These changes have the potential to improve their environmental sustainability and financial performance. Second, the researcher suggested companies to improve their capabilities to support collaborative green actions with customers by exchanging data to increase the visibility of collaborative initiatives and building-up environmental performance indicators with relevant stakeholders.

These studies indicate that while internal factors play an essential role in adopting green practices, many of these decisions are highly influenced by external ones. More specifically, how regulations are designed and how governments support LSPs in improving their environmental performance. Therefore, in efforts to minimize the consequences of climate change and push companies' environmental transition, in Europe, the EU aims to develop regulations that enable the creation of conditions for a just transition by identifying risks, evaluating the consequences, and developing the knowledge and skills required. Ultimately, these regulations aim to promote

innovation, foster networking, mobilize the creativity of communities and cities, and reorient finance towards sustainability (EEA, 2019). However, it is essential to note that while regulations have a vital role in accelerating sustainability transitions, a combination of top-down government interventions and bottom-up action by various actors is required. Governments cannot simply enforce regulations and expect significant changes to occur. Instead, sustainability transitions are long-term, multi-actor processes that highly depend on the emergence, diffusion, and adoption of diverse forms of innovation that allow for different ways of thinking and living.

2.3 Climate Related EU Legislation and Policy Initiatives

Although national projections indicate that, even with additional measures, member states will have difficulty reducing GHGE by at least 55% by 2030 (compared to the 1990 levels), the European Commission adopted a set of initiatives to reach this goal (i.e., The European Green Deal) (EEA, 2021). Examples of initiatives include the Fit for 55 package, European climate law, EU strategy on adaptation to climate change, CO2 emissions from transport, EU emissions trading system, effort sharing, land use and forestry, and clean energy (Council of the European Union, 2019).

2.3.1 Fit for 55

The Fit for 55 package is a set of proposals to revise and update the EU legislation and ensure that new initiatives align with the European climate goals. Some legislative proposals and policy initiatives that affect the transport and logistics industry in the Fit for 55 package are alternative fuel infrastructure, CO2 emissions standards for cars and vans, and sustainable aviation fuels. The alternative fuels infrastructure initiative aims to accelerate the deployment of infrastructure to recharge or refuel vehicles with alternative fuels (e.g., electric chargers and hydrogen stations) and to provide alternative power supply for ships in ports and stationary aircraft. The CO2 emissions standards for cars and vans initiative aims to reduce emissions by 100% by 2035 (previously, the target year was 2030). This standard ensures that from 2035, it will be no longer possible to place internal combustion cars or vans on the European market. Lastly, the sustainable aviation fuels initiative aims to reduce the aviation's sector environmental footprint by increasing the demand and supply of Sustainable Aviation Fuels (SAFs) while ensuring a level playing field across the EU air transport market (Council of the European Union, 2019).

2.3.2 European Climate Law

The European climate law outlines a framework for irreversible and gradual reduction of GHGE and legally promotes the goal of a climate-neutral EU by 2050. Although the European climate law does not define which measures each union member must take, they define and set the goal. For example, based on an impact study, instead of the original 40% reduction of net emissions, the European Commission proposed the ambitious target of 55% by 2030 (Council of the European Union, 2019).

2.3.3 EU Strategy on Adaptation to Climate Change

The EU strategy on adaptation to climate change outlines a long-term vision for the EU to become a resilient climate society. The strategy includes better gathering and sharing of data to improve access to and exchange of knowledge on climate impacts, nature-based solutions to help build climate-resilient and protect ecosystems and integrating adaptation into macro-fiscal policies (Council of the European Union, 2019).

2.3.4 CO2 Emissions from Transport

Additionally, to bring the EU closer to achieving its climate targets, the EU council adopted stricter CO2 emission standards for cars and vans. According to the European Council, the goal of the regulation is to ensure that from 2030 onwards, new cars and vans will emit 37.5% and 31% less CO2 compared to 2021 levels, respectively. However, as part of the transition, between 2025 and 2029, cars and vans will be required to emit 15% fewer CO2 (Council of the European Union, 2019). Similarly, manufacturers of trucks and other heavy-duty vehicles are required to cut emissions by 15% from 2025 and 30% from 2030, compared to 2019 levels (Council of the European Union, 2019).

2.3.5 EU Emissions Trading System

The emissions trading system is designed to reduce EU greenhouse gas emissions by setting a cap on the total amount of emissions heavy industry, and power stations are allowed to have each year. The total volume of allowed emissions is distributed to companies as permits (where one permit is equivalent to one ton of CO2). Companies can trade these permits with one another. The idea behind the ETS is that by reducing the number of permits each year, the value of the permits will increase, and emissions will decrease. However, when established, there were too many circulations permits and low carbon prices. As a result, in 2018, the EU Commission decided to reform the EU emissions trading system to meet the targets of the Paris Agreement (Council of the European Union, 2018).

2.3.6 Effort Sharing

The effort-sharing regulation regulates sectors that fall outside the scope of the EU emissions trading system. This regulation aims to ensure that other sectors also contribute to meeting the Paris Agreement by reducing greenhouse emissions by 30% by 2030, compared to 2005 levels. The sectors included in this regulation are construction, agriculture, waste management, and transport (excluding aviation and international shipping) (Council of the European Union, 2018).

2.3.7 Land Use, Forestry, and Clean Energy

Even though land use, forestry, and clean energy regulations do not directly affect the transport and logistics industry, they are crucial to reducing greenhouse gas emissions and play an essential role in the 2030 climate and energy framework. The land and forestry regulation aims to improve the protection and management of land and forests. The clean energy regulation aims to decarbonize the energy sector (a central element of the green transition) (Council of the European Union, 2018).

2.4 The Role of Governments and Firms in the Sustainability Transition

As described in the previous section, researchers emphasized the crucial role that adequately designed environmental regulations play in firms' decision to adopt green innovations. However, while regulations aim to promote innovation, foster networking, mobilize the creativity of community and cities, and reorient finance towards sustainability, this may not be necessarily the case. Therefore, to deliver on these targets and ensure that existing and future legislation is designed to create the best opportunities for innovation to thrive, the European Commission uses a tool known as the "Innovation Principle" (European Commission, n.d.).

2.4.1 The Innovation Principle

The Innovation Principle was first introduced in 2013 to ensure that the impact of policy or regulatory decisions is properly assessed and addressed. The innovation principle was first

addressed by 34 CEOs from various multinational companies, backed by a report of the European Risk Forum, emphasizing their concern on the negative impact of recent developments in risk management and regulatory policy on the innovation environment in Europe. However, this view was heavily criticized by civil society representatives. According to the Corporate Europe Observatory[3], the Innovation Principle was initially portrayed as business-friendly approach companies from the dirtiest industries in Europe used to undermine EU laws to keep their products on the market. In their analysis, they determined that creating the Innovation Principle opened opportunities for corporations to use the "impact assessment phase" to their advantage by claiming that regulations harm innovation.

To this end, a study by Pelkmans and Renda (2014) rejected the view of regulations as an obstacle to innovation. The reseacrhers determined that regulation can, under certain circumstances, be a powerful stimulus to innovation and entrepreneurship. Moreover, the initial concept of the Innovation Principle has been slowly shifted into one which aims to place innovation in a more central position in the EU's better regulation agenda.

Today, the Innovation Principle covers Tool #21 of the Better Regulation Toolbox and the innovation deals. The latter focuses on removing perceived barriers to innovation from implementing existing EU legislation. The former guides the assessment of the impact of EU regulations on innovation. More specifically, it focuses on:

- Broadening stakeholder consultation to capture the research and innovation angle of EU initiatives;
- Assessing the potential impacts of EU initiatives on research and innovation;
- Considering the impacts of the legislative design on research and innovation;
- Improving the design of EU initiatives to make them more innovation friendly.

By considering the "Innovation Principle" in the policy-making cycle, the pace and scale of innovation and investments in low-carbon solutions accelerate. Therefore, collaborating between private companies and governments in creating regulations is imperative. Furthermore, considering that an increasing number of companies are acting on climate change, governments must work together to develop ambitious yet feasible policies that provide clarity and confidence for companies to further invest in innovation. This positive feedback loop is known as the "Ambition Loop". In this way, businesses and governments can continuously push each other to reach the objective of the Paris Agreement and Sustainable Development goals (Egloff, Herhold, Krogsgaard, Pieper, & Italiano, 2020).

2.4.2 The Ambition Loop

The Ambition Loop is a positive feedback loop between the private sector and governments to accelerate progress toward the objectives of the Paris Agreement and Sustainable Development Goals. While companies in the private sector help demonstrate commercial demand and economic possibilities, governments help companies achieve their targets with bold targets and robust policies that add clarity and build confidence. The loop continues when, through more substantial business investments and government policies, action is accelerated and more opportunities to achieve goals faster emerge.

[3] Corporate Europe Observatory (CEO) is a research and campaign group working to expose and challenge the privileged access and influence enjoyed by corporations and their lobby groups in EU policy-making.

Table 1: The Ambition Loop

Government Climate Policy	Business Climate Action
Clear, ambitious targets and policy	Ambitious, science-based targets
Predictable regulatory environment	Public updates on progress
Incentives and infrastructure	Investments and growth strategies aligned with a zero-carbon future
Long-term market signals	Commercial demand for zero-carbon transportation
Support research, development, and deployment	Responsible policy engagement (individually and through trade associations)
Clear plans and timelines for full transition to a zero-carbon economy	

In the transportation industry, examples of ambition loops include clear timelines and incentives for alternative fuels and transportation modes, new or bolder targets for electric vehicles and clean fuels in national policies, supportive financing to overcome high initial costs of electric vehicles and infrastructure gaps, and clear, time bound plans to phase out gasoline and diesel-fuelled vehicles.

The reasoning behind the use of the Innovation Principle, Ambition Loop, and the findings from Pelkmans and Renda (2014) go hand in hand with the work of evolutionary economists Michael Porter and Claus van der Linde. They proposed that: "*Properly designed environmental regulation can trigger innovation that may partially or more than fully offset the costs of complying with them*". In the literature, this is better known as the Porter Hypothesis (hereafter PH) (Figure 1). However, neoclassical economists reject that regulations can achieve environmental protection and economic gains resulting in a "win-win" situation. The conflicting views have resulted in an increasing body of research with the aim of better understanding the relationship between regulations, innovation, and a firm's competitiveness (Porter & Van der Linde, 1995).

2.5 The Porter Hypothesis

In the past, the relationship between environmental goals and industrial competitiveness has been perceived as mutually exclusive. In this perspective, environmental regulations are seen as static where technology, products, processes, and customer needs are all fixed, and firms already made the right decisions to reduce costs as much as possible. As a result, in this static model, environmental regulations only increase firms' compliance costs which tend to reduce their competitiveness along with their market share. Examples of environmental regulations include technological standards, environmental taxes, or tradable emission permits (Ambec, Cohen, Elgie, & Lanoie, 2020).

However, over time, industrial competitiveness has shifted from a static to a dynamic model where a firm's competitiveness depends on its ability to improve and innovate continuously. In this view, a firm's competitive advantage is not measured by its static efficiency or ability to optimize within fixed constraints but by its capacity to innovate.

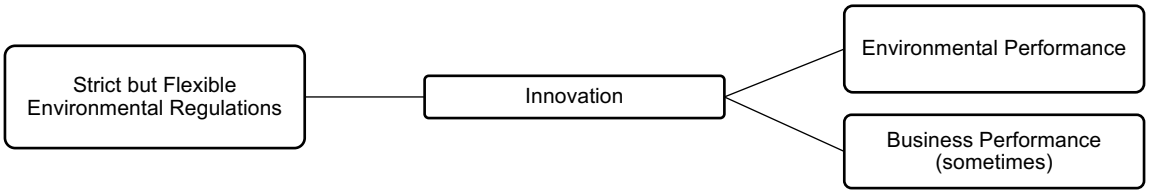

Figure 1: Porter Hypothesis

Michael Porter and Claus van Der Linde provide five reasons that explain how environmental regulations may lead to these outcomes. First, regulations indicate that companies likely suffer resource inefficiencies and benefit from technological improvements. However, firms are still inexperienced in measuring their environmental impact and are unaware of improvement opportunities. Second, regulations focused on information gathering can achieve significant benefits by raising corporate awareness. Better understanding a firm's environmental impact increases management's attention on those areas. Third, regulations reduce the uncertainty of investments that address the environment. Fourth, regulations create pressure that promotes innovation and progress. While the common perception is that pressure is sparked by competition and customer demand, the authors believe that regulations can also be a source of pressure. Fifth, regulations level the transitional playing field. Regulations affect all companies that operate in the same market; therefore, they ensure that no company can gain a competitive advantage by avoiding environmental regulations.

According to Porter and van der Linde, there is an important distinction to make regarding how companies approach innovation in response to environmental regulations. The first is that firms get smarter about dealing with pollution once it occurs. This form of innovation reduces compliance costs but does not change anything else. In other words, this form of innovation ensures that firms are not subjected to non-compliance fines, legal costs, and liability for environmental damage and clean-up. The second form of innovation addresses environmental impacts while simultaneously improving the affected process/product [4]. While innovation offsets result in a pollution reduction, they can be divided between product offsets and process offsets. The former occurs when environmental regulations create higher quality, better performing, safer, higher resale value and lower cost of production products. The latter occurs when environmental regulations result in higher resource productivity, including better utilization of by-products, lower energy consumption, and reduced handing costs.

However, the PH has been heavily criticized by neoclassical economists. The first argument is that the PH was initially established using evidence from a small number of case studies, making it difficult to extrapolate the results to the entire population of firms. Second, a “win-win” scenario where environmental regulations protect the environment and enhance a firm’s competitiveness is not possible.

Derived from the neoclassical theory (perfect information, perfect competition, exogenous technology) of a profit-maximizing firm, a firm’s decision to innovate should be based on analysing innovations on specific profit-maximizing criteria. Profit-maximizing firms will adopt profit-maximizing cleaner technology without the need of regulatory stimulus. Consequently, environmental regulations hinder innovation and result in a limited number of innovations for profit-maximizing firms to choose from (Ambec, Cohen, Elgie, & Lanoie, 2020). While this is true in a

[4] This is the type of innovation the authors are referring to in the Porter Hypothesis.

static optimization framework, this does not describe reality. On the contrary, firms are constantly exposed to changing technological opportunities, incomplete information, and failures (both behavioural and organizational).

In efforts to better analyse the PH, many authors have evaluated three distinct versions of the PH, namely weak, strong, and narrow. The weak version states that properly designed environmental regulations may spur innovation. The strong version states that innovations often more than offset the regulatory costs (i.e., environmental regulations often increase a firm's competitiveness). Finally, the narrow version of the PH states that, in contrast to prescriptive forms of regulation, flexible environmental policies give firms greater incentives to innovate.

2.5.1 Theoretical Evidence

Many researchers have found behavioural and organizational failures that prove the inconsistency of neoclassical environmental economics in assuming that markets are flawed, but firms are perfect. Considering that managers drive firms' decisions, studies have focused on how environmental regulations can help managers make decisions that are often too risky, too costly, or out of their habits and routines. Gabel & Sinclair-Desgagné (1998) determined that, when first devised, a firm's systems, procedures, and routines are optimal. However, changes in relative prices, regulatory and other environmental conditions, and the firm's competitive situation decrease its capacity to adapt, forcing managers to reconsider their decisions. Similarly, Kennedy (1994), determined that risk-averse managers tend to underinvest in research and development projects that could have increased the firm's profitability. Therefore, by increasing the return on research and development investments, environmental regulations can bring managers closer to the optimal investment decision.

André, González, & Porteiro (2009) evaluated the PH within a quality competition matrix context. The authors used a duopoly model in which firms could simultaneously set the environmental quality of a given product (i.e., high or low) before defining the price of their product. The model showed that if both firms would increase their products' environmental quality, they could charge a higher price for their product. Nevertheless, either firm would find it optimal to continue producing the regular quality product. Consequently, this would provide the deviator with a price advantage that would increase their demand. In this context, neither firm is incentivized to improve the environmental quality of its product. Considering that both firms stand to benefit from an agreement to increase the quality of their products, this is inefficient from an environmental point of view. However, if the government were to impose a penalty for firms that produce the regular product quality, both firms would opt to produce products of better environmental quality, which would increase the firms' environmental and financial performance.

2.5.2 Empirical Evidence

Jaffe & Palmer (1997) measured whether changes in regulatory stringency are associated with innovative activity (i.e., weak version). The authors used total private expenditures on research and development to measure innovative activity and the number of successful patent applications by domestic firms in an industry. The authors found that at the industry level, the results were mixed. While they did not find a statistically significant relationship between regulatory compliance expenditures and patenting activity, they found a positive relationship between regulatory compliance and research and development expenditures. However, the increase in research and development expenditure could not be directly attributed to firms' innovation efforts because it could be that the increase was merely an expensive diversion from firms to cope with the burden of regulations. However, considering the distinction Porter and van der Linde make on the type of innovation, the PH remains valid.

Brunnermeier & Cohen (2003) employed panel data models to evaluate the effect of changes in pollution abatement expenditures and regulatory enforcement on environmental innovation by 146 US manufacturing industries between 1983 and 1992. Although the authors determined that increased abatement pressures increased environmental innovation (measured by successful environmental patent applications), they did not conclude whether this implies an increase in net profits. Additionally, the authors did not find any evidence indicating that an increase in monitoring effort motivates innovation. Arimura, Hibiki, & Johnstone (2003) had opposite results. Their study estimated the effects of environmental policy and other factors on investments in environment-related research and development in a sample of OECD[5] manufacturing facilities. The results indicate strong evidence that public policy induces investments in environmental research and development. However, the reason for such findings was not because flexible policy instruments supported such investments but because their enforcement promoted the adoption of environmental accounting systems which induced environment-related research and development. The researchers also determined that industries with high foreign competition tend to have more environmental patents.

While the previous studies have mixed results, two older studies indicated a negative relationship between environmental regulations and innovation investment. In the electric utility industry, Nelson, Tietenberg, & Donihue (1993) evaluated the impact of environmental regulations on capital turnover and sulphur dioxide emissions. Their study used data from 44 privately owned utilities operating between 1969 and 1983. The results indicated that environmental regulations increased the average age of the plants by 3.29 years (i.e., 22.64%) and did not have an impact on sulphur dioxide emission rates. Although the authors pointed out that without environmental regulations, sulphur emissions would have increased by an average of 3.79 tons per million kWh (i.e., 34.60%), they extended the operational time of old machines, increasing other emissions levels. In a different study, Maloney & Gordon (1983) determined that, although environmental regulations did not have a statistically significant impact on sulphur emissions, they did increase the average age of plants. However, the results indicate that investments were towards abatement rather than productivity, highlighting how air pollution regulations in the 70s were not adequately designed (consistent with the PH). In a similar study, Gallop & Roberts (1983) concluded that sulphur dioxide emission restrictions resulted in significantly higher generating costs and lower productivity growth rates. In the 1970s, environmental regulations were popularly blamed for the poor productivity of electric utilities.

A critical condition that many of the studies with negative results overlook is the PH's dynamic dimension. According to the PH, environmental regulation work on technical innovation for the long term. To evaluate this, Lanoie, Patry, & Lajeunesse (2008) analysed the relationship between environmental regulations and the total factor productivity (TFP) over several years. The study's results indicate that environmental regulations positively impact productivity growth, especially in sectors highly exposed to international competition. Moreover, although in the first year the results showed a reduction in productivity, in the second, third, and the fourth year, productivity increased to the point that it could offset the first year's loss.

Even though all versions have been tested theoretically and empirically, the results are partial and mostly ambiguous (Lanoie, Laurent-Lucchetti, Johnstone, & Ambec, 2011). Some argue that the mixed findings are because most studies ignore two conditions Michael Porter and

[5] The Organization for Economic Co-operation and Development (OECD) is an intergovernmental economic organization focused on stimulating economic progress and world trade.

Claus van der Linde stated as being necessary for the PH to hold: (1) the design of environmental regulations and (2) firm's capabilities and innovation (Ramanathan, He, Black, Ghobadian, & Gallear, 2017).

The design of environmental regulations significantly impacts the result of the PH. According to Lopez-Gamero et al. (2010), there are two environmental regulations: command-and-control and voluntary norms. Regarding command-and-control regulations, policymakers prescribe specific processes/products needed to achieve a specific result. These types of regulations are also known as inflexible. In contrast, voluntary norms, also known as flexible regulations, encourage firms to explore and discover innovations that allow them to meet regulatory requirements. In their study, the authors determined that command-and-control regulations stifle innovation, considering that firms were not encouraged to innovate nor desired to develop new processes/products that would allow them to comply with regulations. However, voluntary regulations allowed firms to find creative ways to comply with regulations which, at the same time, led to cost savings and enhanced the firm's competitive position. Thus, their study indicated that the design of environmental regulations (i.e., voluntary vs command-and-control) significantly affects innovation and a firm's competitiveness.

The second dimension of the PH is the firm's corporate environmental practices approach to environmental regulations (i.e., proactive vs reactive). If a firm takes a reactive approach, the firm complies with environmental solutions and implements environmental activities at the minimum level. In contrast, if the firm takes a proactive approach, the firm's environmental practices go beyond compliance by developing pollution-prevention activities, redesigning existing processes and introducing new technologies. Another distinction between the two approaches is the need for expertise or skills in dealing with new technologies or processes and the level of priority given to environmental concerns. For example, reactive environmental practices need no expertise or skills, little involvement from top management, and no company-wide employee education. On the other hand, proactive environmental approaches require developing organizational capabilities and resources, introducing novel/emerging technologies, as well as internal and external collaboration between multiple stakeholders (e.g., government, universities, and private firms).

To evaluate the aforementioned conditions, Ramanathan, He, Black, Ghobadian, & Gallear (2017) conducted a qualitative study with nine firms in the UK and China. Even though all companies operate in different sectors (e.g., chemical, pharmaceutical and energy), the increasing number of environmental regulations can affect their operations and competitive position. It is worth mentioning that the companies had prior experience in dealing with environmental regulations and developing innovative ideas in response. In their study, the researchers evaluated the impact of environmental regulations on innovation and the adoption of environmental management practices, the impact of firm's capabilities on their responses to regulations, the impact of innovation and the adoption of proactive environmental management practices on firm's financial performance, and the impact of environmental regulations on firm's private sustainability benefits.

Regarding the impact of environmental regulations and innovation and the adoption of environmental management practices, they found that regulations can be positive or negative depending on the balance of incentives. For example, in some cases, well-designed regulations incentivized companies to redesign their production process, reducing hazardous waste. However, when poorly designed, they increase firms' administrative burden of compliance, reducing their focus on improving their environmental performance. Interestingly, the authors found that, prior to

the enforcement of specific regulations, some companies decided to undertake voluntary actions to improve, in advance, their environmental performance.

When it comes to the impact of a firm's capabilities on their response to regulations, the firms identified internal resources and capabilities that influenced their decision to take a proactive or reactive approach towards innovation. Examples of internal resources include a firm's environmental consciousness and strategic readiness and whether environmental management roles are in place. Firms that adhere to higher environmental standards than those required could adopt environmental practices proactively.

On the impact of innovation and the adoption of proactive environmental management practices on a firm's financial performance, the results indicate that, for many firms, innovation increased their financial performance. Product and process innovation allowed companies to improve their energy efficiency and reduce hazardous waste production, making them increasingly attractive to customers. In some cases, this increased market share.

Concerning the impact of environmental regulations on firms' private sustainability benefits, all companies indicated that the type of environmental regulation (i.e., command-and-control vs flexible) significantly affects their approach toward innovation. While command-and-control regulations lead to a firm's reactive approach to innovation, significantly increasing their financial and administrative costs, flexible regulations, through market-based instruments, resulted in much lower burden costs. However, depending on the timescale surrounding their implementation, flexible regulations can force companies to take a reactive approach as they do not have enough time to innovate. Similarly, to command-and-control regulations, flexible regulations can be inflexible due to being sudden, ambiguous, and overcomplicated.

2.6 Literature Review Conclusion

In the literature study, it was identified that while LSPs play a crucial role in reducing GHGE, not many companies are acting upon it, and those who are, have not been ambitious enough. Furthermore, many studies indicate that while internal factors play an essential role in the adoption of green practices, many of these decisions are highly influenced by external ones. More specifically, how regulations are designed and how governments support LSP in improving their environmental performance. To this end, the European Commission is actively ensuring that existing and upcoming regulations enable the creation of conditions for a just transition by identifying risks, evaluating the consequences, and developing the knowledge and skills required.

In this context, Michael Porter and Claus van der Linde researched the relationship between environmental regulations, innovation, and a firm's competitiveness. They concluded that environmental regulations could trigger innovation that may partially or more than fully offset the costs of complying with them (i.e., Porter Hypothesis). However, researchers that evaluated the PH have found inconclusive results over the years. As a result, Ramanathan, He, Black, Ghobadian, & Gallear (2017) demonstrated that previous studies on the Porter Hypothesis have not adequately considered two necessary conditions for it to hold, namely (1) the design of environmental regulations and (2) firm's capabilities and innovation. In their study, they determined that flexible environmental regulations combined with a firm's proactive approach can increase its competitiveness. More importantly, they highlighted two critical key points (1) flexible regulations can be inflexible if they are sudden, ambiguous, and overcomplicated and (2) the increase in a firm's competitiveness is not short-term.

2.7 Conceptual Model

Ramanathan, He, Black, Ghobadian, & Gallear (2017) developed a conceptual framework of environmental regulations, innovation, and the private benefits of sustainability that better explain the PH. While the results of their study validate the PH, the overall findings obtained thus far have been inconclusive and context specific. Therefore, this research intends to evaluate the conceptual framework shown in Figure 2 and to understand under which conditions environmental regulations can result in an increase in competitiveness of European Logistics Service Providers as part of the transport and logistics industry.

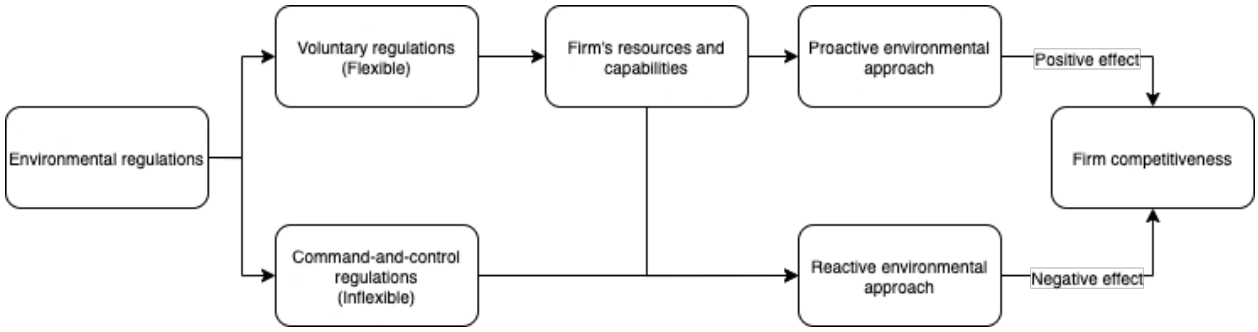

Figure 2: Porter Hypothesis (Ramanathan, He, Black, Ghobadian, & Gallear, 2017)

2.8 Conceptualization of the Framework Elements

It is necessary to conceptualize the elements that compose the conceptual framework to evaluate it. The elements include (1) environmental regulations, (2) the firm's resources and capabilities, and (3) the firm's competitiveness.

2.8.1 Environmental Regulations

Flexible regulations do not mandate the method of compliance; instead, firms can decide the best approach. Additionally, in case of firms fall short of the requirement, they can purchase compliance credits between regulated entities. Therefore, flexible regulations incentivize firms to innovate, create a new stream of revenue, and allow regulated firms the freedom to choose the lowest cost abatement channel. Additionally, governments have different programs under flexible regulations to support firms' transition to green practices. In contrast, command-and-control regulations set specific limits for pollution emissions and mandate the technologies to control emissions. In addition, command-and-control regulations offer no incentive to improve the quality of the environment beyond the standard set, draw no distinction between firms that have the resources and capabilities to meet the pollution standard, and are subject to compromises in the political process.

2.8.2 Firm's Resources and Capabilities

While in the literature, there are no commonly agreed constructs, dimensions, and variables in measuring a firm's approach towards environmental management, González-Benito & González-Benito (2005) did a comprehensive literature review to construct a list of environmental management practices that properly evaluate and measure the environmental proactivity of a firm. The authors distinguished the environmental practices between planning and organizational practices, and operational and communicational practices. Planning and operational practices denote the extent to which the company has defined an environmental policy, has developed procedures to establish and implement environmental practices, and has allocated environmental responsibilities. Operational practices imply the changes in the production system and the

company's operations. These practices are classified into two groups: product-related practices and process-related practices. Lastly, communicational practices aim to communicate to the company's social and institutional environment the actions taken in favour of the environment.

Considering that this research measures the proactive environmental strategy of Intra-European LSPs, the environmental practices proposed by (González-Benito & González-Benito, 2005) were adapted to fit the research and only those applicable to LSPs were considered (Table 2).

Table 2: Characteristics of a Proactive Firm

Planning and organizational	Explicit definition of environmental policy Clear objectives and long-term environmental plans Well-defined organizational responsibilities Full-time employees devoted to environmental management Natural environment training programs for managers and employees Systems for measuring and assessing environmental performance Environmental emergency plans
Operational (product related)	Design focused on reducing resource consumption and waste generation during production and distribution Substitution of polluting and hazardous materials/parts Design for disassembly, reusability, and recyclability
Operational (process related)	Emission filters and end-of-pipe control Process design focused on reducing energy and natural resources Production planning and control focused on reducing waste and optimizing materials exploitation Acquisition of clean technology/equipment Preference for green products in purchasing Environmental criteria in supplier selection Shipments consolidation Selection of cleaner transportation methods Recyclable or reusable packaging containers in logistics Ecological materials for primary packaging Recuperation and recycling systems Responsible disposal of waste and residues (separation and preparation)
Communicational	Period elaboration of environmental reports Sponsoring environmental events/collaboration with ecological organizations Environmental arguments in marketing Regular voluntary information about environmental management to customers and institutions

2.9 Firm Competitiveness

According to Chikán (2008), firm competitiveness is the capability of a firm to sustainably fulfil its double purpose: meeting customer requirements at profit. Additionally, this capability is realized through offering on the market goods and services which customers value higher than those offered by competitors. Consequently, in this report, firms' competitiveness is measured by the firm's registered sales, market share, diversified portfolio, geographical markets, as well as whether new products/services were introduced to the market.

3 Research Methodology

The literature review revealed that while recent studies have supported the Porter Hypothesis, the overall results have been inconclusive and context specific. Additionally, the Porter Hypothesis has not been evaluated on intra-European Logistics Service Providers. Therefore, this study aims to answer the main research question: *Under which conditions can European environmental regulations increase competitiveness for intra-European Logistics Service Providers (LSPs)?*

A research methodology is required to answer the main research question. The methodology outlines how the research is carried out and defines the techniques and procedures used to identify and analyse information scientifically. This section contains the methodological approach taken, including the data collection and analysis methods. Additionally, this section indicates which research method was used to answer each of the following sub-research questions:

1. What is the role of governments and logistics service providers in the reduction of greenhouse gas emissions?
2. What are the factors that influence logistics service providers to adopt green practices?
3. What, according to literature, is the relationship between environmental regulations and a firm's competitiveness?
4. How do environmental regulations impact the competitiveness of logistics service providers?
5. How can logistics service providers respond to the changes introduced by environmental regulations?

3.1 Research Method and Data Collection

Considering that this study aims to explore under which conditions can environmental regulations result in an increase in competitiveness for LSPs, the appropriate research method for this study is explorative. Explorative research is mainly used when the issue at hand has not yet been evaluated as well as when the data collection process is challenging.

The type of exploratory research method used in this study is a case study. According to Yin (2018), a case study is "*An empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident."* In other words, a case study helps understand a real-world case and assumes that such an understanding is likely to involve important contextual conditions pertinent to the case. More specifically, the case study design that will be used is a single-case study. Some of the advantages of performing a single-case study are that the data is richer and of greater depth, the results obtained are more practical than ideal, and, given the complexity of the phenomenon, is a flexible method of doing research. On the other hand, the main disadvantages of performing a single-case study are that the results are not generalizable to the broader population, and it takes more time to analyse data. However, considering that the relationship of environmental regulations, innovation and a firm's competitiveness has not been evaluated before on intra-European LSPs and that the results so far have been ambiguous and context-specific, a single-case study is a suitable exploratory research method for this study.

The type of data used in this study is a combination of primary and secondary data. The primary data will be collected through semi-structured interviews. The main reason for choosing semi-structured interviews is that this data collection method allows the researcher to gain a better

understanding of the context, encourages two-way communication, and it allows respondents to open up and speak freely about sensitive issues, which can be of great importance to understand the relationship at hand. Additionally, in semi-structured interviews, additional questions might be added depending on the interviewee's responses. This flexibility allows the researcher to collect additional information that would not have been provided with the initial questions.

Regarding the formulation of the questions, they were carefully reviewed to prevent them from being leading, loaded, and doubled-barrelled. This way, questions are not (1) worded in a way that will sway the reader to one side of the argument, (2) written in a way that forces the respondent into an answer that does not accurately reflect his or her opinion or situation, and (3) forcing the interviewee to answer two questions at once. This research method provides a systemic and objective mean, including verbal, visual, or written data to describe a specific phenomenon. This research method's advantages include unobstructed data collection, transparency and replication, and flexibility. Conversely, some disadvantages include being reductive, subjective, and time-intensive (Luo, 2019).

The secondary data collection method is also known as “desk research”. It comprises a variety of methods, including informal talks, company documents, observations, and reports of previous studies. Primary and secondary data are analysed to understand, in the context of LSPs, whether the research findings are aligned with the literature review findings, and under which conditions the conceptual model selected in the literature review holds.

The semi-structured interviews were developed in English as it is the language spoken by all participants. Before the interviews, all interviewees were asked for their consent to participate, record the interview, and use their responses in the report. The semi-structured interviews were recorded and transcribed. More specifically, the transcription method used is an edited transcription. In this type of transcription, a summary of the responses is provided, and irrelevant fillers are omitted (e.g., emotions, pauses, and hesitation). Transcriptions were read and verified by the interviewees, and corrections to the responses were made if necessary. Once approved, recordings were deleted, and the responses were used for analysis.

Sub research questions one, two, and three were all answered in the literature review, and they were crucial to understand the impact of LSPs on the environment, the factors influencing them from adapting green practices, and the results of other researchers regarding the relationship between environmental regulations, innovation, and a firm’s competitiveness. Considering this relationship has not been evaluated on Intra-European LSPs, the information gathered in the literature review was crucial to answering the remaining two sub-research questions. Finally, sub-research questions four and five were answered through the semi-structured interviews as part of the case study research.

3.2 Case Study Company and Context

Qualitative research methodology requires a detailed description of the case study company[6] and any other additional contextual information that might influence the interviewee’s responses.

[6]Due to confidentiality reasons, the company name and detailed description are not included in this report. Additionally, when referring to the company, the name “ABC” will be used throughout this report.

At the time of the study, European countries had just started to recover from the COVID-19 pandemic, and in February 2022, Russia launched a full-scale invasion of Ukraine. Regarding the COVID-19 pandemic, logistics service providers were seen directly affected. Some bottlenecks that prevented LSPs from working optimally include lockdowns, border closures that restricted the movement of goods, and additional protocols (social distancing in warehouses). The impact can further be evaluated on freight capacity in each of the three global transportation segments: ocean, land, and air. For ocean freight, the drop of total containers handled at Chinese ports dropped by 10.1% in the first months of 2020. Even though the volumes recovered, companies were affected for several months due to the low demand. In the case of land freight, lockdowns prevented companies from operating properly. However, the increased demand for their services, especially for the transportation of food and medical supplies, combined with the reduced employee availability, led to higher road freight rates. Due to the reduction of passenger flights, air freight volume fell by 20% in the first months of 2020. However, with the increased demand for air cargo for essentials, carriers increased their rates and stabilized (Twinn, et al., 2020). In the case of the Russia-Ukraine war, Russian forces are cutting off shipping routes and closing Ukrainian and Russian airspace. As a result, LSPs are suspending their services and increasing air freight rates. Without the Russian and Ukrainian airspace, more than 10 million miles of airspace are removed, and companies are forced to take longer routes requiring additional fuel (Tan, 2022). To this date, LSPs are still recovering from the pandemic while the war between Russia and Ukraine is still ongoing. As a result, it could be the case that the results of this study are highly influenced by these two events.

3.3 Interview Sample

Considering that the study evaluates the relationship between environmental regulations, a firm's resources and capabilities, and a firm's competitiveness; the interviewees were selected based on their background and expertise on the different elements. To this end, to cover all the concepts in the relationship, employees from different departments within the same LSP were approached to participate.

Table 3: Sample Selection

Concept	Department
Environmental regulations	Government Affairs
Firm's resources and capabilities	Marketing Strategic Planning
	Planning and Engineering
	Innovation
	Health and Safety
Firm's competitiveness	Marketing

The final sample size (i.e., seven interviewees) was determined by thematic saturation, the point at which new data appears to no longer contribute to the findings due to repetition of themes and comments by participants. When interviewing the last two interviewees, significant repetition of concepts were occurring, suggesting ample sampling (Vasileiou, Barnett, Thorpe, & Young, 2018).

Table 4 shows an overview of the selected interviewees as well as the department in which they work in and the rationale behind their selection.

Table 4: Interviewees

Interviewee	Department	Rationale
A	Government Affairs	These interviewees have been selected due to their focus in preventing potential legal obstacles and their role in influencing the legislation in favour of ABC. Their perspective is important to evaluate as the design, implementation, and enforcement of environmental regulations on a European level can have a substantial effect on a company's environmental approach (i.e., proactive/reactive) and competitiveness.
B	Government Affairs	
C	Marketing Strategic Planning	This interviewee has been selected due to his/her role in leading different strategy teams as well as his/her superior understanding of ABC's organizational dynamics. His/her insights are beneficial to understand how the company manages its resources and capabilities and the reasoning behind strategic decision-making processes.
D	Planning and Engineering	This interviewee has been selected due to his/her experience in the package, freight, express, and logistics industry as well as for his/her knowledge in implementing various innovative sustainable solutions with a performance management approach. His/her practical experience can help better understand the feasibility of implementing environmental initiatives within ABC.
E	Innovation	This interviewee has been selected due to his/her role in researching, evaluating and implementing innovative solutions to reduce ABC's sustainable impact. His/her knowledge and experience in corporate innovation fits the study at hand.
F	Health and Safety	This interviewee has been selected due to his/her previous knowledge on the planning and engineering, and health and safety departments. Additionally, his/her job tenure provides valuable insights on ABC's culture and way of working.
G	Marketing	This interviewee has been selected due to his position in the marketing department with focus on e-commerce strategy, planning, and analytics. His/her understanding of the logistics industry is crucial to better understand other factors influencing LSPs decision-making processes.

3.4 Interview Guide

The interview guide contains all the high-level topics covered in the interview as well as most of the questions asked. The questions were formulated based on the literature review and the conceptualization of the conceptual framework elements.

1. Introduction
    a. Introduce the thesis project and the goal of the project.
    b. Explain the structure of the interview.
    c. Create comfort zone.
        i. Explain how this study will benefit the organization and the industry.
        ii. Obtain interviewees' consent to record interview and use their answers.
        iii. Explain that recordings will be deleted once transcribed and anonymity.

2. General information about the interviewee
    a. Job description and time at the company
    b. Main responsibilities and tasks

3. Environmental regulations
    a. Are you familiar with any European environmental regulations that are relevant to the organization?
    b. In your experience, would you qualify the environmental regulations as flexible or inflexible?
    c. Do you believe that the regulations are achievable for your organization? Why or why not?
    d. On a scale from 1 to 5, how actively is your organization collaborating with governments (e.g., creation of regulations, incentives, and support)?

4. Organization's resources and capabilities
    a. On a scale from 1 to 5, how important do you think is environmental sustainability for your organization?
    b. Does your organization have a clear objective and long-term environmental plans?
    c. Do you think that your organization takes decisions on environmental sustainability based on regulations or are there other important factors that play a role?
    d. On a scale from 1 to 5, how actively is your organization looking to become greener?
    e. Given the fact that your organization's corporate goal is to become carbon neutral by 2040, do you believe that it can be achieved? Why or why not?
    f. In which way is your organization measuring its environmental impact? Are there any systems in place to measure and assess your organization's environmental performance?
    g. Considering that subcontractors play an important role in your day-to-day operations (Scope 3), in which way are you collaborating with them to become greener?
    h. What are the barriers, if any, preventing your organization from becoming greener?
    i. What organizational changes, if any, do you think are necessary to improve your current organization's environmental performance?

5. Organization's competitiveness
    a. Given the different environmental regulations your organization has been subjected to, is your company registering good sales growth/increase in market share? Have you diversified your service portfolio? Have you reached new geographical markets? Have you introduced new products in the market?
    b. What has been the economic impact of the company's improving environmental performance? If possible, please refer to direct and indirect costs and benefits of the various initiatives undertaken.

6. Conclusion
    a. Ask the interviewee if there is any additional information, he/she would like to share.
    b. Thank the interviewee for participating.
    c. End interview.

The following section aims to summarize the findings from the semi-structure interviews. To distinguish the answers from the different interviewees, superscripts of the letter corresponding to each interviewee were added to the end of specific sentences/paragraphs.

4 Findings

The findings are based on the answers provided by the interviewees during the semi-structured interviews. The results can be subdivided into three themes: environmental regulations, the organization's resources and capabilities, and the organization competitiveness.

4.1 Environmental Regulations

All interviewees are familiarized with different types of environmental regulations affecting the organization. Some examples of environmental regulations impacting the organization are AFIR (Alternative Fuel Infrastructure Regulation), emissions restrictions, low emission zones, zero-emission zones, the authorized emission levels for aircraft, ISO 14001 (i.e., environmental management systems), and the required percentage of SAF (Sustainable Aviation Fuels) aircraft must use. Considering that intra-European LSPs have road, ground and air operations, these different environmental regulations impact how LSPs operate.

For instance, the AFIR aims to ensure sufficient European public charging infrastructure to follow the deployments of zero-emission vehicles. This regulation is critical for LSPs as they are actively looking to replace their existing internal combustion vehicles with electric/hydrogen-powered vehicles. However, until a fully functional and extensive network of chargers is in place, many companies face adoption problems. Low and zero-emission zones prevent LSPs from entering specific areas with internal combustion vehicles. As a result, companies have introduced cargo bikes, locker boxes and electric vans to operate in these areas. Regarding the authorized emission levels for aircraft and the percentage of SAF, LSPs are actively replacing their fleet with more modern and fuel-efficient aircraft and investing in alternative fuel sources to continue operating. When analysing whether environmental regulations are flexible or inflexible, all interviewees made a clear distinction between regulations on a European, national, and city level, as well as whether LSPs had the opportunity to choose from various technologies and processes to comply with them.

Regarding regulations on a European level, all interviewees claimed that regulations were flexible. While the regulations are designed to comply with a specific goal (e.g., Paris Agreement), governments do not enforce a specific technology, or process companies must adopt to comply with them. Nevertheless, when analysing environmental regulations on a national or city level, each country or city has a specific way in which they plan to reach the goal. This results in a significant number of distinct environmental regulations that makes it difficult for companies to keep track of and ensure that the technologies and processes they employ are adequate. In this context, while regulations on a European level are considered flexible, the complexity and high number of environmental regulations on a national or city-level is what cause the inflexibility.

When analysing environmental regulations from a technology/process availability perspective, the results varied depending on the type of operations being affected (i.e., road, ground and air). Environmental regulations affecting road network operations are seen as flexible given that various technologies and processes are available. However, environmental regulations affecting air operations are more complicated to comply with as there is no technology/process available that can make LSPs carbon neutral (other than carbon capture or offsetting). In this regard, one of the most utilized intermediate solutions to reduce aircraft emissions are Sustainable Aviation Fuels (SAFs). However, the price of SAFs is high, and their availability is limited. Therefore, regulations impacting air operations are considered inflexible. Regulations affecting ground operations present similar challenges. Line-haul vehicles typically cover between 500-1800 kilometres per operational day, and current emission-free technologies (i.e., electric trucks) are not

yet capable of covering long distances. While LSPs can use sustainable fuels (e.g., bio-LNG), scalability and prices are important aspects to consider especially for companies that operate in CAPEX (Capital Expenditure) and OPEX (Operational Expenditure)-intensive industries. As a result, LSPs are already experimenting with other potential solutions such as transport mode shift that aims to combine a series of different modes of transportation to avoid the use of aircraft and line-haul vehicles. However, there are many challenges inhibiting intra-European LSPs from implementing this solution. The two main challenges are the difficulty of matching schedules between the different modes of transportation and having the right partners to share the modes of transportation with (interviewee D). Nevertheless, interviewee C expects that air transportation will eventually shift to ground, rail, and ocean. Currently, it is too cheap to move freight by plane. Moreover, while this would affect "next-day deliveries", supply chain disruptions have taught ABC that overnight delivery, in most cases, it is not needed. Highlighting that, customers play an important role in the reduction of GHGE and that transport mode shift an attractive solution for the future. If customers were to consume less and more environmentally conscious, the whole supply chain would drastically change and LSPs emissions would be much lower. For instance, if customers would avoid requesting next-day deliveries, LSPs could use slower but more environmentally friendly modes of transportation to deliver packages. Similarly, locker boxes could be used to consolidate shipments and decrease the number of kilometres driven by the different last-mile delivery vehicles (interviewee D).

Another important aspect to consider is that the European Commission constantly adapts regulations to ensure that goals are met. While adapting regulations is important and necessary, it complicates LSPs decision-making and implementation processes. Even though many companies are in a good position to influence the legislation to better adapt it to their needs, many have been fully occupied with other priorities or are not influential enough (i.e., sustainability is not yet their main priority and LSPs with small market share). In this context, even though LSPs are aware that support from governmental institutions is crucial to become greener, at the moment, LSPs are not actively collaborating with governments (e.g., creation of regulations, incentives, and support). In the case of ABC, although the company has a significant market share, ABC Europe is internally focused and highly influenced by the head office (located in a different country) (interviewee G). In Europe, ABC has small sustainability and legal team, which depends on the rules stated by the head office. Nevertheless, in Europe, ABC is actively looking to participate in preventing and anticipating potential problems and proposing solutions through a series of strategies. However, the legal team needs to be much bigger to accomplish this (interviewee A and B). On a scale from 1 to 5 (1 being not active at all and 5 being very active), interviewees scored ABC a 2.4 (average) in how actively ABC is collaborating with governments.

In this regard, interviewee F highlighted that, with some exceptions (e.g., Utrecht, the Netherlands), governments are not proactively looking to collaborate with private companies. Instead, most governments expect the private sector itself to take the first step which increases the complexity for LSPs to adapt and comply with environmental regulations.

4.2 Organization’s Resources and Capabilities

The aim of the questions under the theme “organization’s resources and capabilities” is to evaluate whether LSPs take a proactive or reactive approach towards innovation. In the case of ABC, the company’s corporate goal to become carbon neutral by 2040. This goal is influenced by the fact that the transportation industry accounts for about 16-20% of all greenhouse emissions as

well as that LSPs conform Scope 3[7] emissions of many companies. As more companies transition to sustainable practices, LSPs are pressured to become carbon neutral. ABC's strong commitment to become carbon neutral indicates that sustainability is very important for the organization. However, most interviewees believe that ABC's current decisions and actions on environmental sustainability are not sufficiently reflecting their commitment in the short-term. On a scale from 1 to 5 (1 being not active at all and 5 being very active), interviewees scored ABC a 3.3 (average) in how important environmental sustainability is to the company. This is because, while ABC wants to become carbon neutral ten years ahead of the industry and that there are strategies in place for the different types of operations, ABC is still determining the best way to achieve these goals. For instance, ABC has a pickup and delivery strategy for fleet electrification, a renewable energy strategy for facilities, and a sustainable aviation fuels strategy for air operations, however, these strategies are currently lacking a detailed roadmap of what exactly needs to be accomplished and their execution. As stated by one of the interviewees, "*there is a goal, there is a governance structure, there are intermediate goals, but it all comes down to execution*" (interviewee D). Moreover, ABC Europe does not have an established sustainability department with sufficient resources and a good governance structure to work on sustainability (interviewee D). At the moment, ABC Europe is prioritizing other areas and acts on environmental sustainability as regulations are enforced. Within the company "*employees (incl. executives) believe that there is enough time for ABC to comply with regulations*" (interviewee D).

In Europe, ABC is aware that the company needs to take a proactive approach. However, the company has not fully embraced and adopted this concept and instead is focusing on other areas that, at the moment, require more attention. Another factor playing an essential role in ABC's decisions on environmental sustainability is business profitability. For LSPs, decisions on environmental sustainability need to be cost-effective; otherwise, their business is at risk. As a result, for big corporations like ABC, taking decisions take more time and effort. To accelerate this process, an important first step is for everyone within the organization to understand the importance of sustainability and how ABC can benefit from such investments. On a scale from 1 to 5 (1 being not active at all and 5 being very active), interviewees scored ABC a 2.3 (average) in how actively ABC is looking to become greener. According to the interviewees, ABC needs to invest time to understand better what a sustainable business model means and how to translate it into actions. "*It is often the case that big corporations have a small team working on sustainability that struggles to convince the rest of the organization*". Within ABC, those working on sustainability believe that investing in green practices is essential; however, they struggle in translating ideas into concrete actions. Additionally, there is a lack of understanding of what is needed to become carbon neutral. Many employees within the organization think that "*electrifying the fleet is enough, when in reality, this is not the case*". To improve this, interviewees suggested for all employees to "*take courses, webinars, or anything else to educate themselves more on sustainability*" (interviewee D and E).

With ABC's corporate goal in mind, all interviewees believe that the company will have difficulty achieving carbon neutrality by 2040 (without carbon offsetting). However, their reasoning is unrelated to the road network and ground operations. They believe that in these two areas achieving carbon neutrality is possible. Instead, the real challenge lies in air operations. Interviewees are doubtful as to how air operations can further reduce emissions considering that aircraft's lifespan is very long, no aircraft can fly with 100% sustainable aviation fuels, and more sustainable technologies (e.g., electric aircraft) are not yet available. As interviewee D stated,

[7] Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value chain.

"*there is a technical dependency for air operations to achieve carbon neutrality* ". Consequently, companies that depend on air operations must closely collaborate with governments to adjust regulations accordingly.

To better monitor companies' progress in achieving carbon neutrality, companies present a yearly ESG report[8]. In the case of ABC and many other LSPs, the ESG report evaluates the companies' progress on environmental sustainability on a high (i.e., corporate) level. The report does not show progress on a detailed level. To this end, many LSPs have their own proprietary carbon calculator. Even though, ABC is currently developing their own carbon calculator, the company has access to the one developed by another LSP. According to interviewees E and F, the main problem is that ABC's proprietary calculator does not consider all emissions. For instance, while emissions from vehicles (Scope 1), electricity consumption (Scope 2) and subcontractors (Scope 3) are being considered, emissions from facilities, packaging, and materials sent through the network are missing (interviewee E). While the calculator from the other LSP is much more detailed, ABC is still struggling to integrate it as it uses a different system. Nevertheless, "*it is just a matter of time and energy before we solve it*" (interviewee D).

As part of Scope 3 emissions, LSPs recognize that subcontractors play an important role in their own transition to become carbon neutral. This means that LSPs need to closely collaborate with subcontractors and help them transition to green practices. To this end, ABC has an impact team and subcontractor collaboration program. At the moment, ABC is looking to understand the current situation, the subcontractor's take on sustainability, and the type of support they need. While at this time LSPs do not require their subcontractors to be carbon neutral, in the future, it is expected that this will become contractual (interviewee C). If subcontractors want to continue working with LSPs, they must comply with specific standards. In this context, ABC is aware that for subcontractors to properly transition to green practices, the possibility to do so must be in place. However, LSPs need to be careful on how they support them as, according to interviewee F, "*subcontractors can be seen as LSPs own employees*" and not as legal independent companies. In addition, in most cases, subcontractors lack the knowledge and the capital to engage in a sustainable transition. Consequently, LSPs need to work with subcontractors and offer them more attractive contracts for extended periods and support to acquire the respective technologies. From internal research, it has already been determined that subcontractors' main barrier to transition to green practices is not their unwillingness to participate but the high initial investment needed and the uncertainty around the return on their investment. To this end, ABC is actively working with subcontractors in the UK, France, and Italy in specific operational areas to better understand what is needed from them. While more effort is certainly needed, these programs are helping all parties better understand what is required to overcome many of the barriers all stakeholders are facing during this transition. This is especially important for companies that operate in high volume, low margin, and capital-intensive industries.

All interviewees highlighted different barriers that can be classified under two categories, namely internal and external. Internal barriers include the overall mindset of the organization, the availability of resources, and the lack of strong and clear strategic plans. External barriers include the nature of the industry in which LSPs operate in, the existing flexibility in the legislation, the sheer number of regulations enforced by individual countries/cities, technology constraints, scalability issues, and the high capital required to become greener.

[8] ESG reporting is the disclosure of environmental, social, and corporate governance data. Its main purpose is to shed light on a company's ESG activities while improving investor transparency and inspiring other organizations to do the same.

Typically, LSPs make decisions based on profit, service (i.e., its commercial proposition), and customer satisfaction. At the moment, LSPs have not fully recognized that sustainability is just as important as the criteria mentioned above (or even an overarching one). According to interviewee D, if a decision is not sustainable, LSPs should not make it. LSPs do not yet acknowledge that investing in sustainability positively affects revenue, service and people (interviewee D). "*Sustainability needs to become a core value that everybody adopts, and this means that a cultural change is needed. However, a cultural change does not happen overnight, and that is a problem. The first company that can accomplish this, will win*" (interviewee D).

Interviewees believe that LSPs needs to ensure the availability and prioritization of resources for sustainability initiatives and projects. LSPs need to appoint more employees to the sustainability team and efforts to become sustainable should be reflected in their performance bonuses. "*If you do not reward your employees, they will not act on it*" (interviewee C). A suggestion to increase the sustainability awareness within the organization is to require all employees to complete a sustainability course as part of their training (interviewee E). From an operations perspective, LSPs are already educating their drivers by implementing an eco-driving course which aims to reduce emissions in internal combustion vehicles and, in a later stage, extend the range of electric vehicles. Finally, even though it is common practice for LSPs to collaborate with other companies in terms of innovation, there are many LSPs that prefer to innovate in-house. The main downside of innovating in-house is that it limits them from deploying sustainable solutions at a faster rate. This is important considering that investing in sustainability and offering green solutions gives LSPs a competitive advantage against their competitors, especially now that sustainability has become an important topic for companies to cover.

From a market perspective, LSPs operate in a highly competitive market where customers are not ready to pay the price of sustainable delivery services. As a result, LSPs constantly compete to offer a cheap, fast, and sustainable delivery service. However, no LSP can offer all three value propositions with the high initial investment required. Internal research within ABC confirms that consumers want a green service but are unwilling to pay extra for it. In this context, the existent flexibility in the legislation inhibits companies from heavily investing in green practices. The main reason is that if LSPs decide to heavily invest in green initiatives from the start, the burden cost on their operation would be too high, and customers would not make use of their service. As a result, LSPs would end up pricing themselves out of the market and thus, prefer legislation to be enforced before investing in sustainability (interviewee C). Conversely, as mentioned before, since more and more attention has been given to sustainability, customers are looking to partner with companies offering green services. Ultimately, LSPs need to balance between investing in sustainability and offering a service at a competitive price point.

4.3 Organization's Competitiveness

At this point in time, ABC has not seen a real benefit from their commitment to become carbon neutral by 2040 and their current environmental sustainability efforts. In contrast to the competition, sustainability is not yet part of ABC's commercial proposition. The main reason is that while many LSPs purchase carbon credits (i.e., carbon offsetting) and strongly market their efforts to become carbon neutral (i.e., whitewashing[9] or greenwashing[10]), ABC promotes their plans but does not offer them as part of their service portfolio.

[9] Whitewashing is when an organization covers up or glosses over scandalous information by presenting a biased representation of the facts.

[10] Greenwashing is when an organization spends more time and money on marketing itself as environmentally friendly than on actually minimizing its environmental impact.

Considering that LSPs find it challenging to reduce their emissions by 100%, carbon offsetting is important in accelerating their decarbonization. There are three different carbon offsetting approaches: (1) 100% reduction, 0% offsetting, (2) offsetting to close the gap, and (3) offsetting as a focus area. In the first approach, companies can eliminate their emissions by 100%. The main downside of this approach is that companies need to redesign how they operate. The second approach is offsetting to close the gap; in this approach, companies aim to reduce emissions as much as possible and buy offsetting credits to close the gap. The last approach is to mainly focus on offsetting, with little effort in changing the business at its core.

While the first approach is the best one, it is the most expensive one, and it could be the case that reducing emissions by 100% is impossible (e.g., air and line-haul operations). To this end, in the transport and logistics industry, while most LSPs plan to follow the second approach, many focus on offsetting. In this regard, "*ABC chooses to offset as the last resource and not as a starting point* (interviewee E). From a competitiveness standpoint, this route is ideal; however, it is also the one in which LSPs can benefit the least from. This is because, even though many customers are starting to request green practices, they are not ready to pay the price. As a result, LSPs need to be careful when it comes to investing in green initiatives. Nevertheless, if LSPs delay green investments, implementing them becomes much more expensive over time. Therefore, while LSPs like ABC have not seen a real benefit, they are aware that there is a need to actively invest in green practices (at a moderate rate) and that, depending on the type of initiative, the return on their investment can vary from medium to long term.

From an operational perspective, interviewee D believes that the main explanation as to why LSPs have not seen a real benefit is because is the solutions have not been scaled, companies evaluate the return on their investment to early in the process, and companies do not look for/receive governmental support. "*If you consider scalability, the price to implement the different solutions would drop significantly" (*interviewee D*).* Similarly, the interviewee believes that if there is government support (e.g., subsidies, incentives, and grants), the outlook is quite positive. However, by "*taking these aspects out of the equation, the outcome is far from positive*", indicating that LSPs greatly depends on government support.

From a commercial perspective, interviewee E believes that "*in the short term, environmental regulations will put pressure on ABC's profitability, but not complying with them will put pressure on the long-term existence of the company*". Therefore, even though the true price of a green transportation service is not being accounted for, the price will be more apparent in the future. Similarly, interviewee C believes that ultimately, the benefits outweigh the costs. For this reason, LSPs need to better understand where to invest and decide what has the highest priority for the company.

From a legal perspective, in the future, LSPs will not have a choice but to lower their carbon footprint (interviewee A and B), otherwise, companies will not be able to continue operating, and their competitiveness will be seen affected. As a final remark, interviewee C highlighted that, environmental regulations encourage companies to act and, given the competitive nature of the industry, level the playing field. Environmental regulations ensure that no company can take advantage by offering cheap and polluting services.

4.4 Findings Summary

Even though European environmental regulations are considered flexible, the high number and complexity of environmental regulations on a country/city level is what causes the inflexibility. This is because country/city is free to create and enforce their own regulations as well as the constant changes the European Commission makes to ensure regulations meet the EU goals. As a result, LSPs that operate in multiple countries/cities have a difficult time complying with every regulation as well as adapting their decision making and implementation processes.

Regarding the organization's resources and capabilities, there are internal and external barriers inhibiting LSPs from taking a proactive approach. Internal barriers include the overall mindset of the organization, the availability of resources, and the lack of strong and clear tactical plans to execute on the different strategic plans. External barriers include the nature of the industry in which LSPs operates in (i.e., low margin, highly competitive), the existing flexibility in the legislation, the sheer number of regulations enforced by individual countries/cities, technology constraints, scalability issues, and the high capital required to become greener. Thus, even though interviewees understand that ABC needs to be proactive, the different external and internal barriers inhibit the LSP from taking a proactive approach. As a result, a balance between the two approaches (i.e., reactive and proactive) is needed.

In terms of the effect of environmental regulations and a firm's resources and capabilities on its competitiveness, not all LSPs have seen a real benefit from investing in green initiatives. Some of the reasons are because many companies opt to purchase carbon credits instead of changing the business at its core, have not been able to scale their solutions, evaluate the return on their investment too early in the process, and do not look for/receive governmental support.

This chapter described the findings from the semi-structured interviews categorized under the three overarching themes of the conceptual model (i.e., environmental regulations, firm's resources and capabilities, and a firm's competitiveness). The following chapter aims to evaluate the findings by connecting them to the research objective and research question.

5 Discussion

This research aims to understand better the impact of European environmental regulations and LSPs innovation approach and, ultimately, the effect on its overall competitiveness. According to Michael Porter, "*Polluting firms can benefit from environmental policies, arguing that well-designed and stringent environmental regulation can stimulate innovations, which in turn increase the productivity of firms or the product value for end-users.*"

The study's findings indicate that, in contrast to LSPs that operate in a few regions/cities (i.e., regional LSPs), LSPs that operate in multiple regions/cities (i.e., Intra-European LSPs) perceive environmental regulations at the European level as inflexible. However, the inflexibility is not due to the limited availability of processes or technologies to comply with them, but because on a country/city level, the environmental regulations vary and are susceptible to many changes. As a result, Intra-European LSPs have a more challenging time understanding the required changes to continue operating and require more resources to comply with them. Similar results were found in a study by Ramanathan, He, Black, Ghobadian, & Gallear (2017), where the researchers determined that flexible regulations could be inflexible if they are sudden, ambiguous, and overcomplicated. Furthermore, when evaluating environmental regulations individually, the results indicate that while there are existing technologies and processes to comply with them, current technologies suffer from scalability issues and are too costly to acquire (e.g., availability of electric vehicles, charging infrastructure, and SAF). As a result, specific environmental regulations (especially those affecting air operations) are considered inflexible. Ultimately, the interviewees highlighted that environmental regulations on a country/city level are inflexible because governments do not consider the complexity and the high number of environmental regulations Intra-European LSPs are subjected to.

In this context, LSPs and governments must collaborate to create regulations, receive financial support (e.g., grants and incentives), and highlight the importance of reducing the complexity of environmental regulations (for Intra-European LSPs). This close collaboration also applies to small subcontractor companies that have limited resources to invest in green initiatives and influence governments. Governments need to better understand the industry in which LSPs operate in and reduce the complexity of the regulations by standardizing them. Otherwise, LSPs (Intra-European and regional) will have a more challenging time scaling their green initiatives and will be more limited to experimenting with new technologies and processes. In this regard, while smaller local LSPs are better capable of initiating the ambition loop (i.e., they deal with a small number of environmental regulations), intra-European LSPs have a harder time due to complexity of managing an organization that operates in various regions where regulations vary. Currently, there is no ambition loop between LSPs and governments is limited. While the government is limiting the private sector from accelerating its progress due to the complexity of complying with the different environmental regulations, the findings also indicate that LSPs are not collaborating with governments. To this end, LSPs need a stronger sustainability and legal teams with sufficient ownership to make decisions on behalf of the bigger organization, and governments need to evaluate and adapt current legislation accordingly. LSPs need to understand better the regulations being enforced, influence upcoming regulations, and negotiate the different incentive mechanisms already in place. This active participation from both parties would initiate the ambition loop.

For the PH to hold true, Michael Porter claims that companies must take a proactive approach toward environmental sustainability. In contrast to reactive companies that comply with environmental solutions and implement environmental activities at the minimum level, proactive companies go beyond compliance by developing pollution-prevention activities, redesigning

existing processes and introducing new technologies. Additionally, Michael Porter claims that there needs to be sufficient expertise in dealing with new technologies and processes. Regarding the approach Intra-European LSPs need to take towards environmental sustainability (i.e., proactive vs reactive), the findings highlight that the approach is not mutually exclusive. This is because, besides the impact of the regulatory framework, other factors such as nature of the transport and logistics industry and the market in which LSPs operate in also have a huge influence.

As part of the transport and logistics industry, logistics services are characterized by low margins, CAPEX and OPEX intensive, and highly competitive. Therefore, it is crucial to identify and develop new services that can meet their customers' increasingly complex needs and, at the same time, improve the overall profitability of the logistics business. To this end, while investing in sustainability and offering green solutions can give LSPs a competitive advantage against competitors, especially now that sustainability has become an important topic to society, it can also be counterproductive. In addition to the findings of Evangelista (2014), the present study indicates that while environmental awareness by customers can act as either a driver or a barrier for companies to invest in green practices, customers are not ready to pay for it. In this context, while at this point, customers prefer to partner with companies that offer cheaper services, the results indicate that, in the future, these dynamics will change. As a result, sustainability efforts by LSPs will be priced in rather than absorbed, and the actual cost of transportation will be more apparent (i.e., prices and the cost will rise). To this end, while in the short term, investing in green practices will put pressure on LSPs' profitability, in the long term, continuing with the current business model will jeopardize the future existence of LSPs.

The findings also indicate that while external factors play an essential role in adopting green practices, many of these decisions are highly influenced by internal ones. This study corroborates that, even though LSPs play a significant role in changing the current trajectory of GHGE and other environmental problems, not many companies are acting upon these issues, and those who are, have not been ambitious enough. Similar to the findings of Evangelista (2014), this study highlights that the high level of investment needed, the uncertainty in the payback period, and the lack of employees focused on sustainability play a significant role. While the LSP evaluated in this study has committed to becoming neutral by 2040 (10 years ahead of the industry) and has many plans for getting there, with current efforts, the LSP is not likely to achieve this goal as there is much work needed to scale up. LSPs need to understand what a sustainable business model means and, more importantly, know how to translate plans into actions. Often, big organizations rely on small teams to push sustainability and innovation to the agenda. To this end, sustainability must become mainstream within the organization and part of everyone’s objectives. In this regard, LSPs could offer sustainability courses and offer bonus schemes.

Ultimately, while a fully proactive approach towards environmental sustainability is ideal, the current regulatory framework, the transport and logistics industry and the market in which LSPs operate inhibit LSPs from taking this approach. Instead, besides ensuring that no internal barriers are present, LSPs need to carefully develop a strategy that would allow them to find the “sweet spot” between the two approaches (i.e., reactive and proactive). Bearing this in mind, even though regulations are not considered “strict but flexible” for LSPs, the findings indicate that they successfully: force LSPs to measure their environmental impact, raise corporate awareness, reduce investment uncertainty, create pressure to find sustainable, cost-efficient, and customer-attractive solutions, and level the playing field amongst competitors.

Regarding the impact of environmental regulations on LSPs’ competitiveness, the findings indicate that companies that do not have sustainability as part of their commercial proposition have

not been directly benefitted. On the other hand, findings indicate that, LSPs that offer green products/services, customer insights (sustainability), offsetting schemes, carbon sequestration, and sustainable certifications (subcontractors) have seen a positive impact on their competitiveness (market share, sales, etc.). However, the reason certain LSPs have seen a direct positive effect in their growth is not necessarily because they are green companies but because they appear to be more environmentally friendly than they are (i.e., whitewashing/greenwashing). As a result, even though it is not ethical, many companies benefit from high customer awareness of sustainability without being subjected to the high upfront investment needed.

In addition to the findings from Lin and Ho (2008) about the effect of the size of the firms on the internal/external barriers, the results indicate that the age of the LSPs also plays an essential role. Before, sustainability was not a topic companies needed to address. Thus, LSPs operating for many decades (like the one in the study) have a different and well-established way of doing things. As a result, changes are more expensive and challenging to accomplish. Additionally, considering that companies do not benefit from the scalability at the start of any change, the early stages of the transition are “a bitter pill to swallow” for any company. Scalability decreases significantly the price of implementing green initiatives.

Finally, there is an indirect benefit of becoming more sustainable as findings indicate that LSPs that are not actively looking to become green will be negatively affected from a reputation and brand perspective. Thus, although not directly benefitted in the short term, LSPs investing in green practices see an increase in their competitiveness (i.e., brand awareness, higher volume and growth).

Ultimately, the conceptual model that best explains the Porter Hypothesis in the context of LSPs is presented in Figure 3. What is important no notice is that, in contrast to the model developed by Ramanathan, He, Black, Ghobadian, & Gallear (2017), the proposed conceptual model:

- Considers the ambition loop as a determinant factor for the design of environmental regulations;
- Considers the transport and logistics industry, the current regulatory framework, and the LSPs market as moderating variables;
- Includes the possibility for LSPs to adopt a hybrid approach (i.e., proactive and reactive) as part of their environmental strategy.

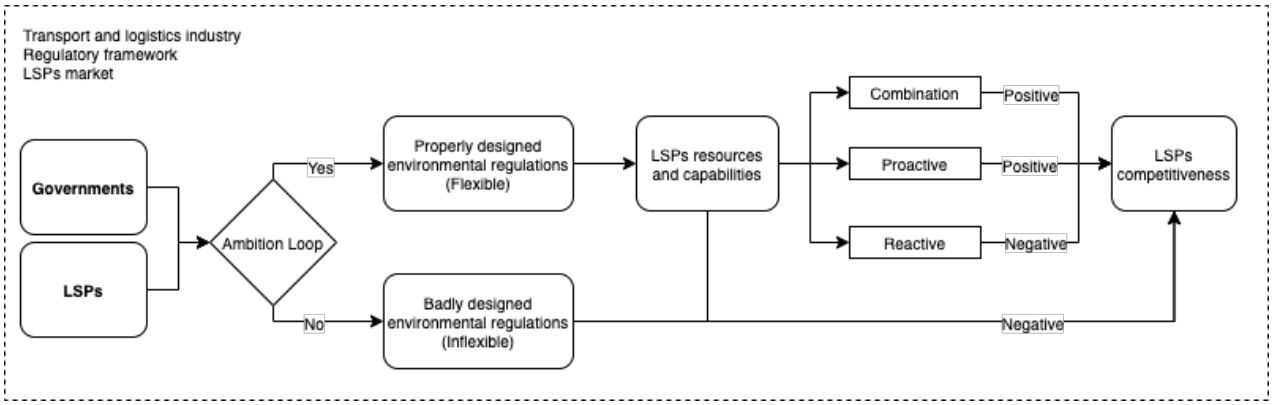

Figure 3: Conceptual Model (Porter Hypothesis - LSPs)

5.1 Limitations

Even though there are many studies evaluating the relationship between environmental regulations and the competitiveness of companies, this is the first study evaluating this relationship on LSPs specifically. Therefore, certain limitations must be considered to understand the applicability and external validity of the findings. First, study was performed using information from a single LSP (ABC). Second, although governments' perspective is important, it was not considered in this study. Third, at the time of the study, European countries and companies had just started to recover from the COVID-19 pandemic, and in February 2022, Russia launched a full-scale invasion of Ukraine. These two events might have influenced the results of this study.

6 Conclusions

The study aims to understand the conditions under which European environmental regulations can increase the competitiveness for Intra-European Logistics Service Providers (LSPs). The study consisted of a literature review on the relationship between regulations, innovation, and a firm's competitiveness and a case study on an intra-European LSPs in Europe. To answer the main and sub-research questions, primary and secondary data was collected through semi-structure interviews and desk research, respectively.

What is the role of governments and logistics service providers in the reduction of greenhouse gas emissions?

The transport industry alone accounts for 27% of the EU's total GHGE and, depending on the mode of transportation, has a significant impact on air quality, noise pollution, water quality, and, among many others, land take. As part of the transport industry, LSPs play a significant role in changing the current trajectory of GHGE and other environmental problems. Unfortunately, not many companies are acting upon these issues, and those who are, have not been ambitious enough. In this context, the European Commission adopted a series of initiatives to reach the goal of becoming a carbon neutral continent by 2050. Examples of initiatives include the Fit for 55 package, European climate law, EU strategy on adaptation to climate change, CO2 emissions from transport, EU emissions trading system, effort sharing, land use and forestry, and clean energy. Many researchers emphasized the crucial role that adequately designed environmental regulations play in firms' decision to adopt or not green innovations. However, not under all scenario's regulations promote innovation, foster networking, mobilize the creativity of community and cities, and reorient finance towards sustainability.

By considering the "Innovation Principle" in the policy-making cycle, the pace and scale of innovation and investments in low-carbon solutions accelerate. Therefore, collaboration between private companies and governments in creating regulations is imperative. Furthermore, considering that more and more companies are acting on climate change, governments must work together to develop ambitious yet feasible policies that provide clarity and confidence for companies to further invest in innovation. This positive feedback loop is known as the "Ambition Loop". In this way, businesses and governments can continuously push each other to reach the objective of the Paris Agreement and Sustainable Development goals. While companies in the private sector help demonstrate commercial demand and economic possibilities, governments help companies achieve their goals with bold targets and robust policies that add clarity and build confidence. The loop continues when, through more substantial business investments and government policies, action is accelerated and more opportunities to achieve goals faster emerge. However, now, the high number and complexity of European environmental regulations hinder LSPs from taking a proactive approach, and hence preventing the ambition loop from happening.

What are the factors that influence logistics service providers from adopting green practices?

The factors influencing LSPs from adopting green practices are both internal and external. Internal factors include the high level of green investment needed, the uncertainty of their payback period, organisational encouragement, the firm's environmental consciousness and ability to execute on environmental strategies and whether environmental management roles are in place. External factors include the current regulatory framework, the availability of financial incentives, the type of industry (incl. customer awareness), the existing flexibility in the legislation, technology constraints, and technology scalability issues. While internal factors play an essential role in adopting green practices, many of these decisions are highly influenced by external ones. More specifically, how regulations are designed and how governments support LSPs in improving their

environmental performance. Findings indicates that the current regulatory framework influencing LSPs varies too much per country/city and it is very hard to find/understand, making it very complex for LSPs to comply with and benefit from economies of scale. In addition, in Europe, governments expect private companies to take the lead and collaborate with other LSPs in looking for ways to become greener. However, the competitive nature of the industry does not inherently promote collaboration. On the contrary, the reality is that LSPs expect governments to take the first step and help them become greener. This includes a proactive attitude towards collaboration and the availability of financial incentives for LSPs to use. Given the high investment needed, financial incentives are crucial for big and small LSPs. However, even when available, the process for obtaining these incentives is not straightforward for LSPs to follow.

What, according to literature, is the relationship between environmental regulations and a firm's competitiveness?

According to neoclassical economists, the relationship between environmental goals and industrial competitiveness has been perceived as mutually exclusive. In this perspective, environmental regulations are seen as static where technology, products, processes, and customer needs are all fixed, and firms already made the right decisions to reduce costs as much as possible. As a result, in this static model, environmental regulations only increase firms' compliance costs which tend to reduce their competitiveness along with their market share. However, over time, industrial competitiveness has shifted from a static to a dynamic model where a firm's competitiveness depends on its ability to improve and innovate continuously. In this view, a firm's competitive advantage is not measured by its static efficiency or ability to optimise within fixed constraints but by its capacity to innovate. According to Michael Porter and Claus van Der Linde, "properly designed environmental regulation can trigger innovation that may partially or more than fully offset the costs of complying with them". In the literature, this is better known as the Porter Hypothesis. The researchers provide five reasons that explain how environmental regulations may lead to these outcomes.

1. Regulations indicate that companies likely suffer resource inefficiencies and benefit from technological improvements.
2. Regulations focused on information can help raising corporate awareness.
3. Regulations reduce the uncertainty of investments that address the environment.
4. Regulations create pressure that promotes innovation and progress.
5. Regulations level the transitional playing field.

However, researchers that evaluated the PH have found inconclusive results over the years. To this end, Ramanathan, He, Black, Ghobadian, & Gallear (2017) demonstrated that previous studies on the Porter Hypothesis have not adequately considered two necessary conditions for it to hold, namely (1) the design of environmental regulations and (2) firm's capabilities and innovation. In their study, they determined that flexible environmental regulations combined with a firm's proactive approach can increase its competitiveness. More importantly, they highlighted two critical key points (1) flexible regulations can be inflexible if they are sudden, ambiguous, and overcomplicated and (2) the increase in a firm's competitiveness is not short-term.

How do environmental regulations impact the competitiveness of logistics service providers?

In contrast to LSPs that operate in a few regions/cities (i.e., regional LSPs), LSPs that operate in multiple regions/cities (i.e., Intra-European LSPs) perceive environmental regulations at a European level as inflexible. However, the inflexibility is not due to the limited availability of processes or technologies to comply with them, but because on a country/city level, environmental regulations vary and are susceptible to many changes. As a result, Intra-European LSPs have a

more challenging time understanding the required changes to continue operating and require more resources to comply with them. Additionally, findings indicate that the environmental regulations are very hard to find. In this context, environmental regulations form part of one of the external barriers influencing logistics service providers from adopting green practices and indicate that, in accordance with Ramanathan, He, Black, Ghobadian, & Gallear (2017), environmental regulations are inflexible as they are overcomplicated for LSPs to comply with.

While the inflexibility of the environmental regulations and the industry in which LSPs operate in highly influence the approach companies take towards green initiatives, there are many organizational factors that play a role. From a planning and organizational perspective, it is crucial for companies to have an explicit definition of environmental policy, clear objective, long-term environmental plans, well defined organizational responsibilities, and, amongst many other, systems for measuring and assessing their environmental performance. From an operational perspective (process related), companies need to redesign processes focused on reducing energy and natural resources, acquire clean technology/equipment (e.g., electric vehicles), environmental criteria in supplier selection (e.g., subcontractors), shipment consolidation (e.g., locker boxes/retail points), and selection of cleaner transportation methods. From a communicational perspective, companies need to constantly elaborate environmental reports, sponsor environmental events/collaborate with ecological organizations, include environmental arguments in marketing, and provide regular information about environmental management to customers and institutions.

How can logistics service providers respond to the changes introduced by environmental regulations?

Due to the increasing rate of climate change, sustainability has gained a lot of importance in the past couple of years. Now more than ever, customers and companies are looking to partner with companies that offer green services. Ultimately, the findings indicate that companies that overlook sustainability will be subjected to higher abatement costs and will lose a competitive advantage. In this context, from an organizational perspective, logistic service providers can respond to changes introduced by environmental regulations by ensuring the availability of resources and making sustainable conscious decisions. It is until recently that LSPs are starting to consider sustainability as part of their culture and decision-making criteria.

Under which conditions can European environmental regulations increase the competitiveness of Intra-European Logistics Service Providers (LSPs)?

Regarding the impact of environmental regulations on LSPs' competitiveness, the findings indicate that companies that do not have sustainability as part of their commercial proposition have not been directly benefitted. On the other hand, LSPs that offer green products/services, customer insights (sustainability), offsetting schemes, carbon sequestration, and sustainable certifications (subcontractors) have seen a positive impact on their competitiveness (market share, sales, etc.). However, the reason certain LSPs have seen a direct positive effect in their growth is not necessarily because they are green companies but because they appear to be more environmentally friendly than they are (i.e., whitewashing/greenwashing). Thus, European environmental regulations can increase the competitiveness for Intra-European LSPs if:

1. Environmental regulations are more consistent among member states, easily accessible, and promote collaboration between governments and private companies (i.e., Ambition Loop).

2. LSPs carefully develop a strategy that would allow them to find the "sweet spot" between being reactive and proactive.

7 Recommendations and Future Research

This study aims to better understand the conditions under which environmental regulations increase the competitiveness of Intra-European Logistics Service Providers (LSPs). This chapter provides recommendations for LSPs, governments and academia (i.e., future research).

7.1 Recommendations

For LSPs and governments, this study highlights how crucial it is for both parties to collaborate (Ambition Loop). It is recommended to strengthen this relationship to ensure that (1) governments design future environmental regulations in such way that they support companies achieve their targets and (2) LSPs demonstrate commercial demand and economic possibilities to governments. In this context, through more substantial business investments and government policies, action is accelerated and more opportunities to achieve goals faster emerge. It is imperative for governments to better understand the industry and market conditions that LSPs operate in. This way, environmental regulations can be easier for LSPs to comply with.

LSPs need to take a proactive approach towards environmental sustainability by having clear objectives and long-term environmental plans, a department devoted to environmental management, systems for measuring and assessing environmental performance, a process designed on reducing resource consumption and waste generation, the opportunity to experiment with new technologies, and amongst many other, environmental arguments in their marketing strategies. Similarly, governments need to better understand the industry in which LSPs operate in so that environmental regulations are properly designed. Additionally, they need to ensure that the right financial incentives are in place to help LSPs accelerate their green transition (especially for small LSPs and subcontractors).

7.2 Future Research

To add to the value of the findings discussed in the report, future research is recommended on different aspects. First, while this is a good first step to better understand the relationship, it is crucial to verify the findings of this study using a larger sample of LSPs. Evaluating this relationship with more LSPs (big and small) would help better understand whether certain conditions can be omitted or if new ones need to be considered. Second, given that governments play a very important role, they should also form part of the sample of participants. Third, considering that environmental regulations and market conditions are subject to change as new technologies and processes are being discovered, it is important to evaluate this relationship in the coming years (longitudinal study). Lastly, even though standardizing environmental regulations on a European level would allow intra-European LSPs to lower their investment risk and scale up their green initiatives, it also entails that governments would have less freedom to adapt their regulations (on a regional level). Hence, even though intra-European LSPs could greatly benefit from this, regional LSPs (subjected to a small number of regulations) could be negatively affected as regulations would be less subjected to change.

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