Chapter 1
Introduction

1.1 Synthesis Study on Horizontal Collaboration and 4C

Transport is fundamental to our economy and society. This is especially so for the open economy of the Netherlands, which is heavily depending on international trade. CBS (2019) calculates that in 2017 export accounted for 34% (or roughly 250 billion euro's) of the Dutch GDP. Sixty-one percent of this is created by the export of physical goods produced in the Netherlands (119 billion euro's) and re-exports (33 billion euro's).

So, logistics is a big deal. And at the same time, it is a challenging industry. Profit margins are usually thin, roads are more and more congested, long-distance intermodal transport is difficult because of the different infrastructures in European countries, and the logistics workforce is decreasing. Therefore, the Dutch government and the logistics industry are keen to keep logistics profitable in the long run, by stimulating relevant applied academic research and innovative business models that reduce inefficiency in transport and logistics and strengthen the position of the Dutch logistics industry in the years to come.

A prominent topic in logistics innovation is horizontal collaboration. To remain competitive in the long run, logistics companies have an incentive to form horizontal collaborations that pool their capacities and as such increase their overall efficiency (Cruijssen et al. 2007a; Gansterer and Hartl 2018). To study and promote horizontal collaboration, the Dutch government has launched a support program in 2010 that is called *Cross Chain Control Centers* (or: 4C). This program has run for about 10 years and will now transition into a new program that is more directly oriented to the societal goal of a sustainable economy, instead of the industry-focused approach of improving logistics functions in the Netherlands. After a decade of investment in research and commercial initiatives in the area of 4C, it is time to look back on the program, both its achievements and the areas where the program did not deliver what was expected.

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This report has four main goals:

- To provide an overview of the main results, insights, and other accomplishments in the (academic) field of horizontal collaboration.
- To give recommendations to governments, commercial companies, and academia on how to proceed with horizontal logistics collaboration in the years to come.
- To use 4C project results to enrich existing horizontal collaboration typologies.
- To zoom in on the Netherlands as a case study of intense public-private partnerships to develop 4C as a mature logistics value proposition. We will provide an overview of the accomplishments in government supported Dutch 4C projects and will give a critical reflection of why some more ambitious and structural solutions have not found solid ground yet.

Given these goals, the expected main audience for this synthesis report consists of the academic community and policy makers. We will now proceed with providing some relevant background to this 4C synthesis report.

1.2 Background

The website of the Dutch top-sector logistics[1] introduces the concept of Cross Chain Control Centers (4C) as follows:

> "4Cs are control centers where the most recent techniques, advanced software concepts and supply chain professionals come together. In a 4C, information flows are coupled to flows of physical goods in an innovative way. By exchanging this information between various entities, a 4C makes it possible to orchestrate across multiple supply chains. This increases the scale of jointly controlled transport flows, which makes it possible to use rail and waterways as alternatives for road transport. In addition, the load factors of trucks may increase, leading to not only cost reductions, but also to improved accessibility of cities and a more sustainable management of physical flows. The realization of a 4C ensures an improved overview, better alignment and bundling of activities, reduction of supply chain costs through load consolidation, a smaller environmental footprint, the creation of more jobs, and new knowledge that can also be applied in other industry sectors. 4C therefore is the next revolutionary step in supply chain management (SCM). The importance of 4C is to enable coordinated decision making in complex European or global supply chains across multiple organizations and industries. A 4C can be realized in a single sector, but also across industries. Key is that the respective supply chains show enough similarities and synergy to joint orchestration through a 4C possible."

[1] https://top-sectorlogistiek.nl/cross-chain-control-centers/

This introduction or extensive definition of a 4C makes it clear that expectations are high. As we will see further in this report, collaboration between multiple supply chains may significantly improve efficiency. Successful cases have shown that collaboration or joint orchestration can reduce transport cost and distance travelled, lower CO_2 emissions, enable modal shift, reduce capacity shortages, act a catalyst for joint innovation, etc. All this makes that there is a broad desire for more intense logistics collaboration. However, building and maintaining successful 4C proves to be difficult in practice. We will discuss the opportunities and impediments for 4C and horizontal collaboration in detail in Chaps. 6 and 7.

The Dutch 4C program has financially supported over 70 projects, both academic and practice oriented. In addition to the (yearly) measurement of quantitative KPI improvements brought about by these projects, this synthesis study provides a critical reflection in words of the results of these projects. This will give valuable input to policy makers deciding on how to proceed with the topic of 4C and horizontal logistics collaboration. Follow-up programs will focus more on energy transition and sustainability and given the promise of 4C that it can reduce emissions by making the transport sector more efficient, 4C will likely remain of interest in the years to come.

In this synthesis report we will also review empirical studies of 4C and the related topic of horizontal collaboration. This will map the experiences, good and bad, of 4C-like logistics collaborations. This part also provides valuable information to policy makers. Is the time right to leave cross-chain collaboration to the market? Or should governments still participate or incentivize? The 10 years of experience with 4C in the Netherlands and beyond should give ample evidence to answer this question.

We will now continue with a 10-year step back in time, to the year 2010, when the 4C program took off.

1.2.1 Situation Around 2010

To understand where the idea of a 4C originated, it is worthwhile to look at the perceived threats and opportunities for the logistics industry in 2010. Topteam Logistiek (2011) wrote a report describing the state of the Dutch logistics industry and defined several concrete ambitions.

Firstly, there were several clear challenges, or even threats. Firstly, in the period 2003–2010 the port of Rotterdam dropped from rank 3 to rank 11 globally in terms of TEU throughput, being overtaken mostly by fast-growing Chinese ports.[2] Also, on the global Logistics Performance Index (LPI) the Netherlands went down from

[2] Note that this development indeed has stopped. Rotterdam is still in 11th place in 2019 (http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports)

rank 2 in 2007 to rank 4 in 2009.[3] Then, the strengthening position of China on the world stage was dramatically changing global transport flows in which the Netherlands was a longtime important player. Fourth, there was the centralization wave of European Distribution Centers (DCs), with the risk that the Netherlands would lose some DC activities of multinationals. And finally, the trend towards more customer-specific production and deliveries was transforming the logistics industry.

Next to these threats, there were also several clear opportunities from these dynamics in the logistics industry. First and foremost, the Netherlands is still very well positioned geographically to be the "gateway to Europe," as the Port of Rotterdam slogan says. In addition to that there is the digitization of logistics processes, which makes it possible to orchestrate logistics flows that take place outside the Dutch borders. This opportunity is strengthened by the high-level customs expertise in the Netherlands. The digitization of the Dutch logistics industry is also shown by the fact that already in 2010, 90% of the bigger transport companies in the Netherlands were using Transport Management Software (TMS) and were therefore able to easier optimize and combine transport flows. In many cases these TMS's were integrated in the companies' Enterprise Resource Planning (ERP) systems. The Netherlands was also an early adopter of RFID, Wi-Fi, GPS, and mobile Internet in logistics applications, which strongly enables real-time management and orchestration of transport flows. Many of these applications were developed by Dutch software companies, which also provided digital services such as spend and tender management, cargo portals, transport marketplaces, trade compliance accounting, etc.

Taking in these opportunities and threats, Topteam Logistiek (2011) listed five very concrete goals for the year 2020[4]:

1. The Netherlands is the European leader in the global LPI.
2. The Netherlands earns at least €10 billion from supply chain orchestration services.
3. The number of companies that opens logistics facilities in the Netherlands grows by 30%.
4. The load factor of trucks grows from 45% to 65%.
5. Logistics has 50% more higher-education jobs.

One of the prominent strategies that was developed to reach goal number 4 was to incentivize bundling of logistics flows across supply chains. This idea was still quite new at the time, although the Netherlands was already taking quite a few steps in this direction. For example, Raad voor Verkeer en Waterstaat (2003) mentions the "Logistics Datahub Netherlands"[5] initiative by the company Informore that aimed

[3] The Netherlands was in sixth place in the most recent ranking of 2018, after Germany, Sweden, Belgium, Austria, and Japan (https://lpi.worldbank.org/international/global)

[4] This will be elaborated on in Sect. 8.2

[5] Logistieke Datahub Nederland in Dutch.

at gathering real-time logistics data from many shippers and Logistics Service Providers (LSPs) to find bundling possibilities. On the academic side, at Tilburg University the first literature review specific for horizontal collaboration in transport and logistics was published (Cruijssen et al. 2007a).

Van Laarhoven (2008) in a strategic advice for the Dutch government coined the term Cross Chain Control Centers (or: 4Cs), which combined a number of logistics developments into a collaboration concept that answered to a number of challenges in the logistics sector and also leveraged on the Dutch logistics strengths described above. Developing 4Cs became a part of a significant investment program that started in 2012 where the Dutch government chose a hybrid strategy between active intervention (incentives, regulation, taxing) and self-organization by the industry to make supply chains more efficient, cleaner, and more resilient.

1.2.2 The Birth of 4C: Supply Chain Control and Collaboration as a Conscious Strategy

Van Laarhoven (2008) found that there were many opportunities for the Netherlands in the area of chain orchestration and logistics configuration. The ambition was to lead the Netherlands to the position of market leader for European logistics orchestration functions in 2020. The concept of 4C was the materialization of this ambition and was defined as *the joint logistics orchestration of many big shippers across multiple supply chains.* The idea of a 4C was that by coordinating and orchestrating multiple supply chains together by means of the best technology and experts, efficiency gains and new services would arise. An innovation program by the government was launched to further develop the concept through research and commercial pilots.

Looking back at this birth of the concept of 4C, it is striking that even in the definition the proposition is focused on big (international) shippers. As the program developed in the years 2010–2020, this emphasis shifted to include and even focus on LSPs and SME shippers. This now seems logical, since SMEs have less scale than big multinationals, and therefore usually have more to gain by bundling flows with other companies. Most of the 4C pilot projects have indeed focused on SMEs. Hence, the 4C program over the years has broadened its scope from mostly "big shippers" to all actors in the supply chain, big or small.

From an ICT perspective, van Laarhoven (2008) notes that the rapid development of international supply chains would not have been possible without the rise of new ICT systems. The development of international ICT networks, ERP systems, "transparency layers" and specific supply chain automation solutions will make it possible to better control and orchestrate supply chain complexities. With the help supply chain transparency software companies can automatically check where in the supply chain components are, assess current and project inventory levels, and decide which transport movement are needed to bring them to the correct location for assembly. The rise of these ICT systems makes collaborative management of

multiple supply chains in complex environments possible, thereby enabling the development of 4Cs.

These insights from the situation of the logistics industry in 2010 made that the Dutch government decided to invest in the development of logistics control towers and make it part of their strategic innovation agenda for the logistics industry. As we will see later in this document, by 2010 some early initiatives for 4Cs were already in place.

1.2.3 Meanwhile in Europe

Not only in the Netherlands, but across Europe thought leaders and policy makers concluded that increased collaboration in the logistics industry was called for. Before 2010, EU funded research mostly focused on technical innovations in transport infrastructure, vehicles, and ICT systems. An overarching supply chain view was missing and therefore was only indirectly included in the European Union research agenda. As a result, it was difficult for disruptive logistics innovations that potentially span the entire supply chain from raw materials to the end consumer, such as control towers, vertical and horizontal collaboration, to get financial support from European innovation funds. This changed with the launch of the FP7 research and innovation program, in which a few clear supply chain calls were included. Later, the supply chain industry finally got a strong foothold in Brussels with the recognition of ALICE (acronym for: *Alliance for Logistics Innovation through Collaboration in Europe*) as a formal European Technology Platform in 2013.

> (ETPs) are industry-led stakeholder fora that develop short to long-term research and innovation agendas and roadmaps for action at EU and national level to be supported by both private and public funding. ETPs are a key element in the European innovation ecosystem and will help foster innovation in the EU and will help to (1) develop strategies and provide a coherent business-focused analysis of research and innovation bottlenecks and opportunities related to societal challenges and industrial leadership actions, (2) mobilize industry and other stakeholders within the EU to work in partnership and deliver on agreed priorities, and (3) share information and enable knowledge transfer to a wide range of stakeholders across the EU.

ALICE (2016) has identified five different areas that need to be specifically analyzed and addressed in terms of future research and innovation needs. These areas are:

1. Sustainable, Safe, and Secure Supply Chains.
2. Corridors, Hubs, and Synchromodality.

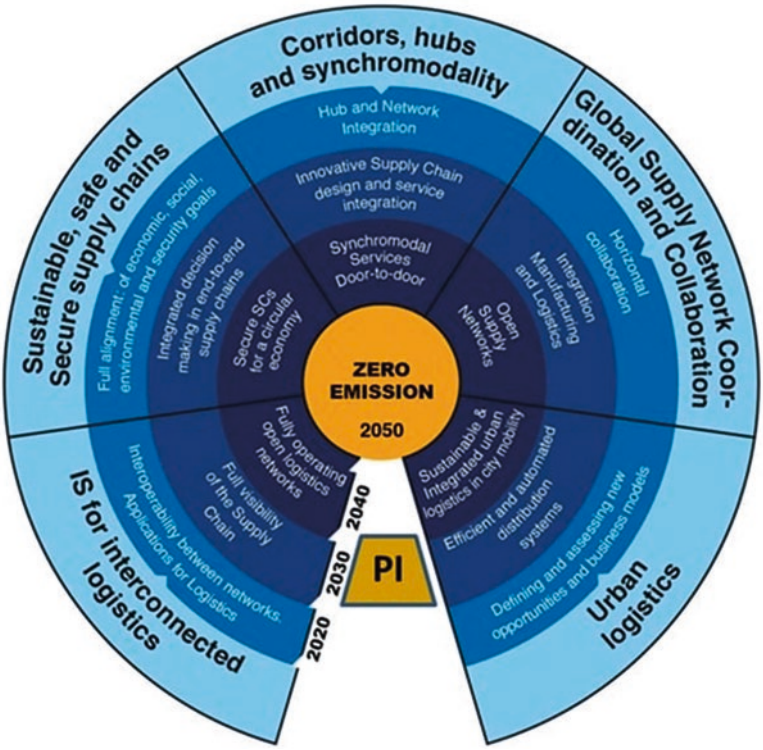

Fig. 1.1 ALICE roadmap

3. Information Systems for Interconnected Logistics.
4. Global Supply Network Coordination and Collaboration.
5. Urban Logistics.

Since 2016, these five research areas have been taken up by separate working groups. Working group 4 on Global Supply Network Coordination and Collaboration is the group that studies 4Cs and horizontal collaboration in transport and logistics and its main research topics are represented in the ALICE agenda in Fig. 1.1. As can be seen from the figure, horizontal collaboration is the first topic to be taken up on the road towards the final goal of zero emission logistics in 2050.

ALICE (2015) explains that the mission statement of the global supply network coordination and collaboration working group is to develop supply networks that are operated as a whole, meaning with full vertical and horizontal coordination and collaboration. Coordination and collaboration here concern the full scope of supply chain operations from sales planning and order management, logistics and transport planning to strategic network design. The goal is to identify and define research and innovation challenges to achieve the following vision: “a breakthrough in EU logistic efficiencies via removing possible barriers through new concepts and approaches,

for closer vertical and horizontal collaboration among different network owners in Europe." This will create a smooth transition from independent supply chains to open global supply networks. To make the most efficient use of available resources and modes, they must be compatible, accessible, and easily interconnected.

As is clear from this mission statement, this ALICE working group is very much connected to the Dutch topic of Cross Chain Control Centers. Network coordination and 4C are different ways to refer to a similar ambition, which is to arrive at a far more efficient and clean transport and logistics industry by structural and seamless collaboration between many logistics operators across many supply chains. Next to these two terms, there are more terms arising in the logistics literature that also refer to this same ambition. In Sect. 5.1 we will give an overview of the terminology encountered in literature and practice, but it is good to mention here already that the term 4C has not been widely taken up outside the Netherlands. Therefore, in the remainder of this report, we will also use other terminology than 4C when this is more intricately linked to the discussed literature or case study under consideration.

1.3 Outline of the Report

This report is further organized as follows. In Chaps. 2 and 3 some major logistics developments are discussed in general and with a specific focus on horizontal collaboration. Then, in Chap. 4 we compare the adoption of collaboration and innovation in the logistics industry with other sectors. The next three chapters provide an overview of the relevant literature around 4C and horizontal collaboration in logistics. Next to a meta-review of existing literature studies (Chap. 5), we pay special attention to collaboration typologies (Chap. 6) and empirical research on the achieved and potential benefits of collaboration and its perceived or encountered impediments (Chap. 7). In Chap. 8 we discuss the case study of the Netherlands, and in Chap. 9 we summarize the lessons learned in this report by discussing a number of hypotheses on 4C. In the final chapter we formulate the main conclusions and recommendations for business, academia, and policy makers.