

Chapter 6

Cross-Chain Collaboration Typology



In the previous chapter we have discussed the most important literature that is needed to understand the theoretical rationale behind the 4C concept. In this chapter we will take a first step towards practical implementations of 4C by reviewing typologies of horizontal collaboration initiatives in literature. Once categorized, commercial collaboration initiatives form a particularly useful base to learn from when setting up new collaborations. With this goal in mind, next to the formal typologies, we will close this chapter with several more qualitative recommendations for the successful management of horizontal collaboration. In the chapters following this typology chapter, we will continue our journey from theory to practice: from a summary of (European) applied research projects, via learnings from Dutch collaboration projects, to recommendations to policy makers, academia, and commercial companies wishing to set up a logistics collaboration consortium.

6.1 Review of Existing Horizontal Collaboration Typologies

Horizontal logistics collaborations come in many shapes in practice. To learn from the experiences and to understand which setups succeed and which ones tend not to succeed, a typology for horizontal collaboration is required. In literature, several structured descriptions of (horizontal) collaboration projects can be found. In this section we describe the most relevant ones.

First, we must explain what we mean by a typology. We define it as *a scheme of the most relevant aspects of horizontal collaboration initiatives, where possible accompanied by a scale on which these aspects can be scored.*¹

¹Other terms that have similar goals to this are: classification, taxonomy, categories, framework, etc. In this report we stick to the term typology.

A typology is useful for various reasons. First, it can be used as a design tool for new initiatives, making sure that all important aspects are carefully considered. Second, it enables finding “similar” initiatives that can be benchmarked against each other and among which information and experiences can be shared. Third, a typology is a structuring tool that can help to understand which types of collaboration projects have the highest probability of success. Finally, a clearly structured typology can be useful to come up with project setups (combinations of various typology elements) that have not yet been tested in practice.

Considerable academic attention has been given to the various types of horizontal collaboration that are observed in practice and/or conceptually possible in theory. In the subsections below we discuss the ones that are most relevant for the topic of 4C.

6.1.1 Lambert et al. (1999)

Lambert et al. (1999) identify three types of collaboration depending on the level of integration of partners (see Fig. 6.1). Although this categorization was initially designed for vertical supply chain relationships, it can straightforwardly be translated to accommodate horizontal collaboration. This spectrum is demarcated on the left-hand side by *Arm’s length collaboration*, and on the right-hand side by *Horizontal integration*, which are not considered to be genuine horizontal collaboration. However, it can be stated that horizontal integration, or a merger, is in fact an extreme case of horizontal collaboration.

In an arm’s length collaboration, communication is of an incidental nature and companies may collaborate over a short period of time, involving only a limited number of exchanges. There is hardly a sense of joint commitment or joint operations. An example in the logistics industry is if one LSP subcontracts a comparable LSP in the event of a capacity shortage.

A *Type I* collaboration consists of mutually recognized partners that coordinate their activities and planning, though to a limited degree. The time horizon is

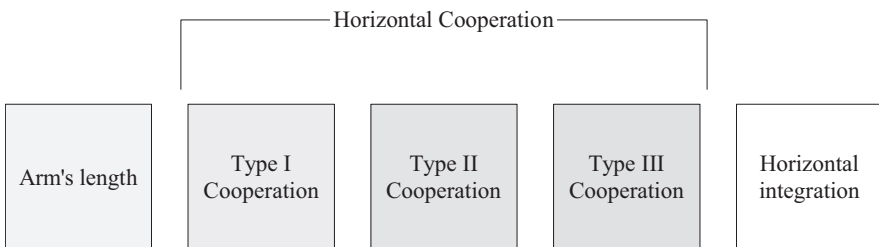


Fig. 6.1 Horizontal collaboration and the level of integration (inspired by Lambert et al. 1999)

Table 6.1 Types of relationships (Lambert et al. 1999)

Relationship	Description	Example
Type I	The organizations involved recognize each other as partners and, on a limited basis, coordinate activities and planning. The partnership usually has a short-term focus and involves one division within each organization	Data exchange Joint distribution or linehaul Back loading Purchasing/ tendering group
Type II	Although not expected to last “forever” the partnership has a long-term horizon. Multiple divisions within the firm are involved in the partnership	Synchronized planning Multimodal collaboration Warehouse/cross dock sharing
Type III	The organizations share a significant level of integration. Each party views the other as an extension of their own firm	Network integration Joint investments

short-term, and the collaboration involves only a single activity or division of each partner company. *Type II* is a collaboration in which the participants not merely coordinate, but also integrate part of their business planning. The horizon is of a long though finite length and multiple divisions or functions of the companies are involved. In *Type III* collaborations, the participants have integrated their operations to a significant degree and each company regards the other(s) as an extension of itself. Typically, there is no fixed end date for such a collaboration. Type III collaborations are often referred to in literature as *strategic alliances*. Table 6.1 describes the three types identified by Lambert et al. (1999).

6.1.2 Cruijssen (2006)

The first typology specifically focusing on horizontal collaboration was proposed by Cruijssen (2006). The paper identified four main discriminating characteristics of collaboration initiatives:

- Decision level (operational, tactical, or strategic).
- Competitive or non-competitive.
- Assets shared (orders, logistics facilities, rolling stock, market power, supporting processes, and expertise).
- Objectives (cost reduction, growth, innovation, quick response, and social relevance).

Based on these four dimensions the then known types of horizontal collaboration were universally described, not per practical implementation, see Table 6.2.

Table 6.2 Typology by Cruijssen (2006)

	O/T/S	C/NC	OR	LF	RS	MP	SP	E	CR	G	I	QR	SR
Lobbying group	S	C				◐		◐	◐	◐	◐	◐	◐
Maintenance group	O	C/NC		◐	◐	◐	◐	◐	◐				
Purchasing group	O	C/NC			◐	◐	◐	◐	◐		◐		◐
Chartering	O/T	C	◐		◐				◐	◐			
Warehouse sharing	O/T	C/NC	◐	◐	◐				◐	◐	◐		◐
Freight sharing	O/T	C	◐			◐			◐	◐			◐
Knowledge centre	S	C				◐	◐	◐		◐	◐	◐	◐
Road assistance	O	C			◐		◐		◐				◐
Co-branding	S	C/NC				◐	◐	◐		◐	◐	◐	
Tendergroup	T/S	C		◐	◐	◐		◐			◐		
Asset pooling	O/T	C	◐	◐	◐	◐			◐	◐			◐
Intermodal group	S	NC	◐	◐	◐	◐		◐	◐	◐	◐	◐	◐
Shared crossdock	T	C/NC	◐	◐					◐				◐
...													

- O Operational
- T Tactical
- S Strategic
- C Competitive
- NC Non-competitive
- OR Orders
- LF Logistics facilities
- RS Rolling stock
- MP Market power
- SP Supporting processes
- E Expertise
- CR Cost reduction
- G Growth
- I Innovation
- QR Quick response
- SR Social relevance

6.1.3 Leitner et al. (2011)

The next typology of horizontal collaboration came 5 years later by Leitner et al. (2011). They argue that many collaboration approaches fail due to insufficient targets and insufficient organizational involvement. Therefore, the definition of organizational aspects as well as forms and specifications of collaboration models are needed to guarantee sustainable success of horizontal collaborations.

This motivated the development of the framework depicted in Fig. 6.2. The two discriminating dimensions they consider are collaboration level (or: intensity) and the potential of consolidation. Using these two dimensions they map four collaboration situations in order of increasing level and potential: (1) no collaboration, (2) purchasing collaboration, (3) transport collaboration, and (4) supply chain collaboration.

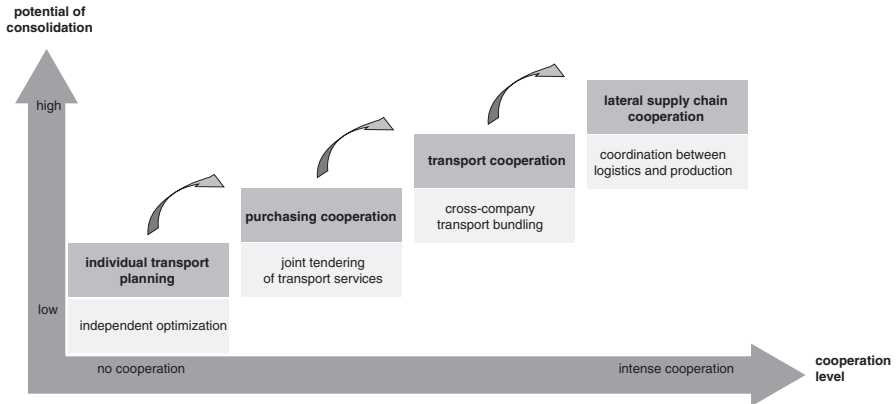


Fig. 6.2 Framework for horizontal logistics collaboration by Leitner et al. (2011)

Contractual scope	Unwritten agreement	Contractual agreement		Minority stake agreement	Joint venture agreement	
Organizational scope	Bilateral			Multilateral		
Functional scope	Shared production	Shared marketing and sales		Shared supply	Quasi-concentration	
Geographical scope	Regional	Nationwide		Continental	Intercontinental	
Service scope	Road services	Rail services	Sea services	Air services	Intermodal services	Value-added services
Resource scope	No resource similarity	Similar market competence	Similar market penetration	Similar corporate structure	Extended resource similarity	

Fig. 6.3 The logistics collaboration landscape (Schmoltzi and Wallenburg, 2011)

6.1.4 Schmoltzi and Wallenburg (2011)

A more detailed typology is offered by Schmoltzi and Wallenburg, also in 2011. They introduce a typology based on six dimensions for which, like the approach used by Cruijssen (2006), they then provide the possible values. This typology is summarized in Fig. 6.3, which they refer to as the “logistics collaboration landscape.”

The goal is that this typology will help logistics managers to position themselves better within the collaboration landscape. It also facilitates the identification and development of innovative collaboration concepts. Moreover, transparency in structural complexities, for instance, driven by the large number of partners or by the broad geographical scope, helps to direct management attention to the setup of appropriate governance structures and management capabilities. To keep collaboration structures manageable over the lifecycle of the partnership, logistics managers are recommended to pay special attention to the structural aspects outlined. In

particular, the high complexity driven by strong functional integrations and complementary resource setups requires logistics managers to strike the right balance between the independence of their individual company and the interdependence within the collaboration.

Based on observed horizontal collaboration projects in practice, Schmolzi and Wallenburg (2011) use the collaboration landscape to define six archetypes of horizontal collaboration:

1. Dense road-based networks with shared production focus.
2. Customized road transport networks with broad functional integration.
3. Situational road transport networks with shared production.
4. Sea and air freight collaborations with marketing and sales focus.
5. National value-added service collaborations with broad functional integration.
6. Bilateral hinterland collaborations with shared production focus.

These six archetypes (or clusters) are then mapped on the earlier developed collaboration landscape in Fig. 6.4.

6.1.5 Pomponi et al. (2013)

The fifth typology is proposed by Pomponi et al. in (2013). They segment collaboration initiatives based on (1) their aim and (2) the assets shared. Combined with these two elements, a three-phase growth path is proposed in which initiatives become

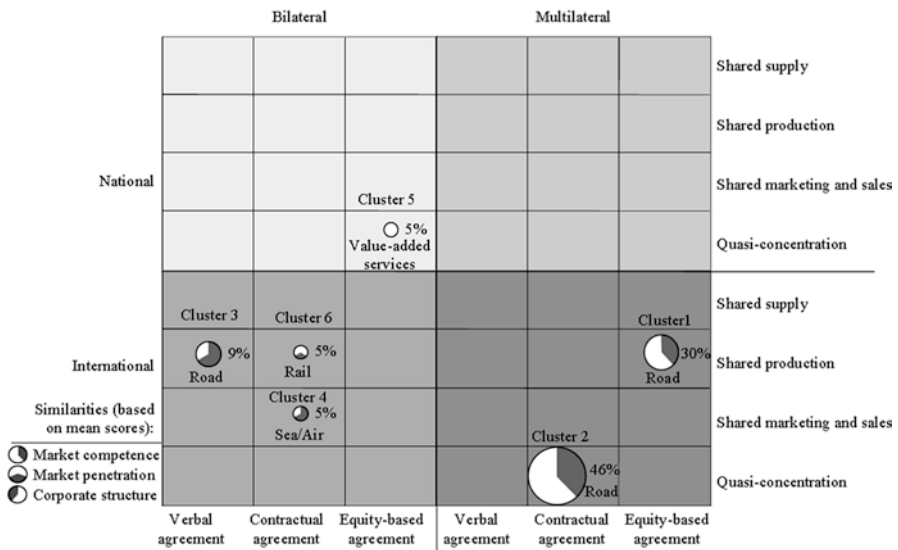


Fig. 6.4 Collaboration archetypes positioned in the collaboration landscape (Schmolzi and Wallenburg 2011)

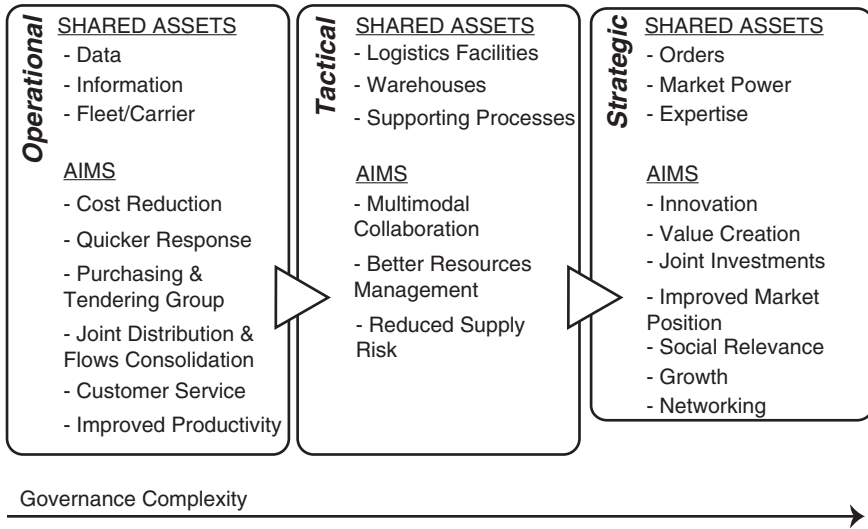


Fig. 6.5 Framework for horizontal collaboration proposed by Pomponi et al. (2013)

more ambitious in their aims and more assets are shared, see Fig. 6.5. Each of the three identified stages is characterized by a specific combination of aims and shared assets. Furthermore, they make a remark about the in-company management of various types of collaboration: evolving from operational towards strategic collaborations implies more complex governance architectures and an increasing level of managerial involvement. More specifically, especially in collaboration among SMEs, while the operational and tactical phases may be managed at the Supply Chain Manager level, the strategic ones need direct involvement of the top management.

6.1.6 Martin et al. (2018)

Martin et al. (2018) identify two key dimensions to categorize horizontal collaborations among LSPs specifically: the activity scope of the alliance and the degree of structural intertwinement among partners. The first dimension, activity scope, refers to the domains in which LSPs join forces. The collaboration can be limited to non-core activities, e.g. purchasing or truck maintenance, or can involve LSP core activities, i.e. transport and warehousing services. A broad activity scope, including both non-core and core activities, is also possible. The structural intertwinement among LSPs, the second dimension in the typology, reflects the degree to which partners' business processes are integrated, their actions are synchronized, and intensive interpersonal relationships are maintained. Moreover, it determines the consequences for an LSP when the alliance's activity scope is reduced, or the collaboration terminates

<i>Activity scope</i>	<i>Comprehensive</i>	Restrained multidisciplinary alliance	Integrative alliance
	<i>Core activities</i>	Noncommittal alliance	Profound alliance
	<i>Non-core activities</i>	Avoidance alliance	Peripheral alliance
		<i>Low</i>	<i>High</i>
		Degree of structural interwinement	

Fig. 6.6 Horizontal collaboration typology developed by Martin et al. (2018)

altogether. These two dimensions with, respectively, two and three levels result in six archetypes for horizontal collaboration, which Martin et al. (2018) define as follows:

- Restrained multi-disciplinary alliance.
- Noncommittal alliance.
- Avoidance alliance.
- Integrative alliance.
- Profound alliance.
- Peripheral alliance.

While a vertical movement in Fig. 6.6 indicates a broadening or narrowing of the collaboration scope, its horizontal counterpart reflects changes in the degree of structural intertwinement. The straightforward structure of the typology allows practitioners to gain insight in the various horizontal collaboration types and position their current or aspired alliance within one of the six categories.

6.1.7 Palmer et al. (2019)

Palmer et al. (2019) take yet another approach by listing the archetypical horizontal transport collaborations. They observe the following possible collaboration types:

1. *Co-loading of small deliveries*—the combination of part loads originating from depots located near to each other and destined for the same, or nearby, customer locations.
2. *Consolidation of small deliveries*—the combination of part loads belonging to different companies but originating from the same, multi-user, depot and destined for the same, or nearby, customer locations.

3. *Use of regional consolidation centers*—channeling part loads through a consolidation center in each region whose location would be optimized with respect to inbound and outbound part load flows and enabling full load movements between regions.
4. *Optimization of urban freight and use of urban consolidation centers*—to receive consolidated part loads from depots or regional consolidation centers some distance from cities and to make freight movement within cities more efficient.
5. *Multi modal opportunities*—being able to achieve critical mass for train movements has been one of the main reasons for not using rail. With the volume from several European companies the use of modes of transport other than road will be examined.
6. *Consideration of logistics clusters*—co-locating of company depots in a cluster to enable consolidation of all flows and enabling full load movements between clusters.

Like Palmer et al. (2019), Pan et al. (2019) conducted a literature review on horizontal collaboration and mapped the papers based on the solution (or collaboration approach) proposed and the main implementation issues discussed (Tables 6.3 and 6.4).

Table 6.3 Solutions and implementation issues by Pan et al. (2019)

	Solutions		Implementation issue
S1	single carrier collaboration	I1	collaborative network design
S2	carrier alliance and coalition	I2	transport planning optimization
S3	transport marketplace	I3	mechanism for exchanging requests
S4	flow-controlling entities collaboration	I4	gain sharing
S5	logistics pooling	I5	communications technology
S6	physical internet	I6	Organization
		I7	Management and governance

Table 6.4 Number of papers per solution and per implementation issue in the survey (Pan et al. 2019)

HCT Solutions	Implementation issues							Total
	I1	I2	I3	I4	I5	I6	I7	
S1	0	3	0	0	0	1	0	4
S2	2	19	13	3	1	3	2	43
S3	0	0	9	0	0	0	0	9
S4	1	9	0	19	1	3	5	38
S5	2	0	0	0	0	4	0	6
S6	0	3	1	0	0	7	0	11
General	0	2	0	2	0	1	4	9
Total	5	36	23	24	2	19	11	120

6.2 Selected Dimensions

In the previous section we discussed seven typologies for horizontal collaboration in transport and logistics proposed in the last 20 years. As mentioned before together these are useful because they can be used as (1) a design tool for new initiatives, (2) a benchmarking tool, (3) an indicator for changes for success, and (4) an innovation tool to propose initiatives that have not yet been tested in practice.

Although the discussion of collaboration elements in the various typologies is rather detailed already, it can still be argued that some relevant characteristics are still unknown once one typology (or in fact all the typologies) is filled out. Although it is certainly valuable to have a typology that is simple and has as few dimensions as possible, it is not helpful if arguably relevant situational elements are not considered.

Below we discuss six additional collaboration characteristics that, based on literature and the conversations with the expert panel, in our view should be added to the typology to make it more comprehensive.

6.2.1 *Number of Partners*

The optimal management of a collaboration project of two or three companies is quite different from a consortium of 10 or even many more partners. For example, game theoretical gain sharing based on actual synergies as discussed in Sect. 5.6 is still possible until a maximum of five or six partners, but more than that makes calculations impractical or even computationally intractable. The more partners, the more difficult it also becomes to reach absolute consensus about the setup and operation of the collaboration. Therefore, it should be managed more centrally and based on predefined rules of engagement. When the number of partners exceeds ten there will likely be a breakpoint for “classical” horizontal collaboration. From that point onwards, it is best to move from active collaboration to a coordinated market structure with fixed rules, rates, and services, for example, like a small-scale Physical Internet setup, see Sect. 3.7. An example of such a collaboration is the Dutch Transmission (www.trans-mission.nl) initiative, a collaborative network of 18 independent transport companies that redistribute transport orders based on their geographical region.

6.2.2 *Shipper- or Carrier-led*

There is a long debate in the Netherlands, and in the European Union through ALICE, if a collaboration is preferable led by shippers or by LSPs. As Leitner et al. (2011) observe, the relevant literature on horizontal collaboration in landside logistics mainly deals with collaboration on the level of LSPs and only few focus on collabo-

ration among shippers. In Dutch collaboration projects, the first wave starting around 2010 was managed by LSPs, then there was a period where shippers took the initiative and recently focus seems to be an LSP collaboration again. Shipper collaboration makes sense because in the end the shipper are the cargo owners and they pay the bill for the transport. Furthermore, transport is not their core activity, so it is easier for shippers to make changes to it without running competitive risks. On the other hand, LSPs are the actors that have most knowledge about the actual process of transport and are therefore better able to judge what is possible and what not. Whatever the preferable setup, it surely is an important element of a collaboration.

6.2.3 Government Support

In many European countries government subsidy programs exist for innovative collaborative projects, as they aim at contributing positively to important societal goals such as sustainability, reduced congestion, and overall industrial efficiency. This is very defendable from a policy perspective, but it is also observed that a subsidy might change the dynamics in collaboration project. In some cases, it brings the necessary incentive to make the collaboration work, but in other cases it keeps projects running that would have been stopped much earlier if they were purely business driven.

Next to implementing subsidy programs, governments can also be more proactive in supporting collaboration, or in some cases even enforce it. This arguably should only be considered to solve a societal challenge that cannot be solved by market actors alone. Such societal challenges, e.g. reducing congestion or pollution, are the external drivers for horizontal collaboration. Some examples of this more pro-active government role can be seen in city logistics, where city centers are closed for conventional heavy-duty vehicles, only allowing zero-emission vehicles for the last-mile distribution. Tax incentives or tolls can also be considered as a way to promote collaborative logistics. This increases the cost of freight transport, and as a result companies will look harder for ways to become more efficient, such as horizontal collaboration.

6.2.4 Partner Size

From project experiences in Europe and the Netherlands it can be concluded that a collaboration initiative between large multinationals should be managed much differently than a collaboration between SMEs. In the former, a collaboration initiative among direct competitors will usually be managed much more formally (regarding legal contracts etc.) than if the companies are competing SMEs.

6.2.5 *Industry Specificity*

As we will see in Chap. 8, there is a large variety in collaboration initiatives. Notably, some projects are motivated ad-hoc in a certain industry because one or two individuals or companies see a potential to reduce cost or emissions among them. They then start up a collaboration in such a way that it maximizes the probability of success for their company setting. Such a collaboration is perhaps a one-off, but helps the involved companies achieving their goals. On the other hand, there are also collaborations that are initiated by companies that have collaboration support as their business model. Typically, these are more software/technology-based initiatives that are aimed a pool of potential users that is as big as possible, and mostly will not be restricted by a specific industry.

6.2.6 *Collaboration Experience*

Experience with collaboration projects in the last years has shown that it is not easy to make it work, and even more difficult to scale it. Especially in the early phases of development, its success is largely dependent on a small group of *collaboration champions* in the project teams of the consortium partners. Many pitfalls only become clear once they are experienced in a true project. Having these experienced champions with collaboration in the team strongly improves the odds of success.

6.3 **An Extended Horizontal Logistics Collaboration Typology**

Together with the dimensions coming from the literature review, these six new elements make up a new extended collaboration typology that is summarized in Tables 6.5 and 6.6.

Our new typology is richer in dimensions than the typologies found in academic literature today. The logical question now is if this is rich enough or will there still be unknown and unexpected complexities even if a collaboration project is described using this complete typology. Unfortunately, the expected answer is that indeed it will be almost impossible to make a complete blueprint of a collaboration based on a fixed number of categorized characteristics. The diversity of industry sectors, logistics processes, geographical aspects etc. is just too big to make this into an exact science. However, we are convinced that carefully describing every aspect in this typology improves the chances of success for a collaboration project.

Table 6.5 Dimensions of our extended typology of horizontal collaboration

Dimension	Based on
Intensity of the collaboration	Lambert et al. (1999) Leitner et al. (2011)
Decision level	Crujssen (2006) Pomponi et al. (2013)
Competitive or non-competitive	Crujssen (2006) Schmoltzi and Wallenburg (2011) Martin et al. (2018)
Assets shared	Crujssen (2006) Schmoltzi and Wallenburg (2011) Pomponi et al. (2013)
Objectives	Crujssen (2006) Leitner et al. (2011) Pomponi et al. (2013)
Formalization (contractual scope)	Schmoltzi and Wallenburg (2011)
Geographical scope	Schmoltzi and Wallenburg (2011)
Solutions	Palmer et al. (2019) Pan et al. (2019)
Hurdles	Basso et al. (2018) Pan et al. (2019)
<i>Number of partners</i>	<i>Expert consultation</i>
<i>Shippers and/or carriers led</i>	<i>Expert consultation</i>
<i>Government stimulated</i>	<i>Expert consultation</i>
<i>Partner size</i>	<i>Expert consultation</i>
<i>Industry specificity</i>	<i>Expert consultation</i>
<i>Collaboration experience</i>	<i>Expert consultation</i>

6.4 Collaboration Development

In the previous section, we have discussed in detail the various aspects that define a collaboration initiative, finally arriving at an extended typology for horizontal logistics collaboration. In addition to this, once a collaboration project is clearly defined based on this typology, it is also important to discuss how the envisioned result can be achieved. A collaboration project is a complex arrangement that cannot simply be “switched on.” On the contrary, it requires careful management and a step-by-step growth model. Several tools and publications on this topic are available and we will discuss them below.

6.4.1 *Verstrepen et al. (2009)*

Verstrepen et al. (2009) to be best of our knowledge were the first to propose a formal stepwise procedure for setting up horizontal collaborations, see Fig. 6.7. In four subsequent phases (strategic positioning, design, implementation, moderation),

Table 6.6 Extended typology for horizontal collaboration initiatives

Intensity of the collaboration	Arm's length	Type I	Type II	Type III	Integration
Decision level	Operational	Tactical	Strategic		
Competitive or non-competitive	Competitive	Non-competitive			
Assets shared	Orders	Logistics facilities	Fleet	Market power	Supporting processes
Objectives	Cost	Growth	Innovation	Service	CSR
Formalization (contractual scope)	Unwritten agreement	Contractual agreement	Minority stake agreement	Joint venture agreement	
Geographical scope	Local	Regional	National	Continental	Intercontinental
Solutions	Co-loading	Consolidation	RCCs	Urban freight	Multimodality
Hurdles	Design	Planning and operations	Business/market	Behaviors	
Number of partners	2	[3,5]	[6,10]	More than 10	
Shippers and/or carriers led	Shippers	Carriers	Third party		
Government stimulated	Yes	No			
Partner size	SME	Large	Mix		
Industry specificity	Industry-specific	Generic			
Collaboration experience	None	limited	Broad		

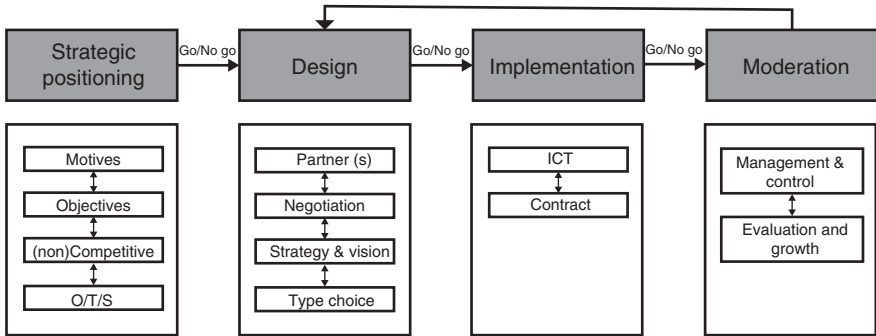


Fig. 6.7 Verstrepen et al. (2009) typology for horizontal collaboration

some key aspects of a collaboration initiative based on Cruijssen (2006) are listed, together with the potential settings of each aspect.

6.4.2 Nextrust Protocol

The Nextrust project is an innovation and coordination action sponsored by the European Union, which will be described in more detail in Sect. 7.3. One of the main results of this project is the establishment of the so-called Nextrust protocol, see Fig. 6.8, a conceptual collaboration framework to build trusted networks bottom-up.

In their protocol, Nextrust is following a 3-step trusted network research methodology. The first research step is the “Identification” of opportunities, followed by Preparation, implementing potential matches into pilot scenarios, and then the Operation phase, where the trusted network pilot scenarios are validated in real market environments. Nextrust learned that an identification phase is needed to map the appropriate collaboration components to achieve a breakthrough. They observe that it is challenging that collaboration has historically been regarded a buzzword that invariably has different meanings and attitudes among stakeholders in the supply chain.

6.4.3 Dinalog Supply Chain Collaboration Tool

This tool is developed by Dinalog in the Netherlands based on the supervision of many collaboration projects that were co-funded by the Dutch government since 2010, see Chap. 8. The tool proposes a four-step procedure for successfully setting up collaborations. The four main steps (Identification, Design, Implementation, and Evaluation) consist of a few subtopics that are documented with qualitative advices, benchmark projects, references, etc. The tool is summarized in Fig. 6.9.

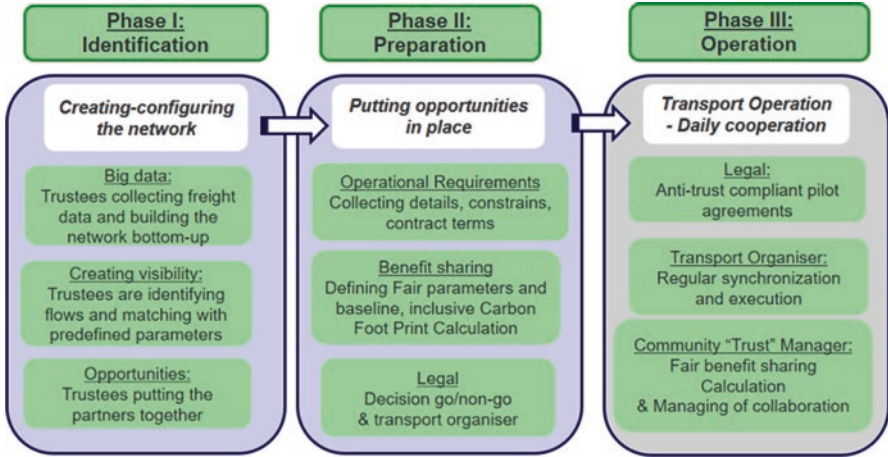


Fig. 6.8 Nexttrust collaboration protocol



Fig. 6.9 Dinalog Collaboration tool [Source: <https://www.dinalog.nl/samenwerking/>]

6.5 Qualitative Collaboration Insights and Advices

To conclude the discussion of horizontal collaboration typologies, in this section we provide some additional insights and qualitative experiences that can be useful to remember when setting up or managing a collaboration project. As such, although maybe not rigorously established in academic literature, these insights contribute to the four goals of a collaboration typology described in Sect. 6.1.

6.5.1 *Gaming*

In the western world, generations of students have learned in their industrial economics classes at secondary school how competitive behavior can help companies reach their goals. Concepts such as predatory pricing to push competitors out of the market, profit maximization by monopolists, first mover advantages, etc. are all examples of rather reckless competition that are extensively studied. Much less attention is given to the question how companies can work together to pursue common goals. And once working for a company, often personal and company targets confirm the importance of outperforming your competition. In that sense, horizontal collaboration is a true paradigm shift. Although the current generation of secondary school and university students learn much more about the benefits of collaboration, it is still to be expected that it will take some effort to make collaboration more commonplace in today's competitive markets.

One interesting tool to promote behavioral change and learning is a so-called serious game. Serious gaming is successfully used in various areas such as education, healthcare, marketing, and other businesses and industries. The power of serious games is that they are entertaining, engaging, and immersive, while almost unconsciously bringing new possibilities to the minds of the players. Well-designed serious games combine learning strategies, knowledge, and game elements to teach specific skills, knowledge, and attitudes. They are designed to solve problems in several areas and involve challenges and rewards, using entertainment and engagement components that appeal to the players.

Recently, several serious games around the topic of horizontal collaboration have been introduced. These are briefly discussed below.

CO3 Trustee Game

In the “Collaboration Trustee Game” (Genta and Cruijssen 2013) a single player acts as a trustee who wants to create a coalition between shippers taken from a provided set of shippers in France. For these shippers, some relevant shipping data are available. The game is based on an actual collaboration project conducted in France concerning a joint inventory centralization with collaborative deliveries to customers, which are the distribution centers of several retailers.

In this game, the player is challenged to act as a trustee. The set of proposed shippers (all shippers are imaginary) is heterogenic and has different volumes and also

a different willingness to cooperate, ranging from hesitant to willing. To create the illusion of a real scenario, the tool offers a short description of each shipper, with logo and KPIs values.

At each turn (equal to one year) all costs, savings and budgets are updated and recorded. A chart reports the evolution of costs during the turn, the collaboration savings, and the final budget at the end of each year. There is also a scoreboard table where best players are reported together with their final budgets, see Fig. 6.10.

Each turn the player can:

- Change the coalition: the player can change the coalition by adding or removing shippers. Each change has a cost that depends on the number of shippers that enter or leave the coalition, due to management and legal work needed to change the coalition.
- Ask for an advice: the player can pay a sum of money to ask an external advice to identify the best change he can make (or the best two shippers coalition to start with).
- Improve the gain sharing rule: while not directly affecting savings, the gain sharing rule used affect the stability of the coalition. To improve the stability the player can invest in changing the sharing rule to a more stable rule.
- Do nothing: a possible action is also to do nothing, letting the coalition unchanged. In this case costs and savings are applied and the budget changes consequently.

TRUST Cards Game

Trust is mentioned by many academics and practitioners as an essential condition for successful horizontal collaboration, see also Sect. 5.3. But in practice it is often treated as a static phenomenon: it is there, or not. Little attention is given to the question how trust can be deepened. In 2017, the Dutch organization TKI Dinalog has developed a cards game (see Fig. 6.11) to let players experience how trust can add to the success of collaborative logistics projects. In the game, various aspects of trust are explored, and players are challenged to apply the lessons learned to their own organization. Each card has a statement about collaboration, which is discussed among the players. The group then decides if they agree or disagree with the state-

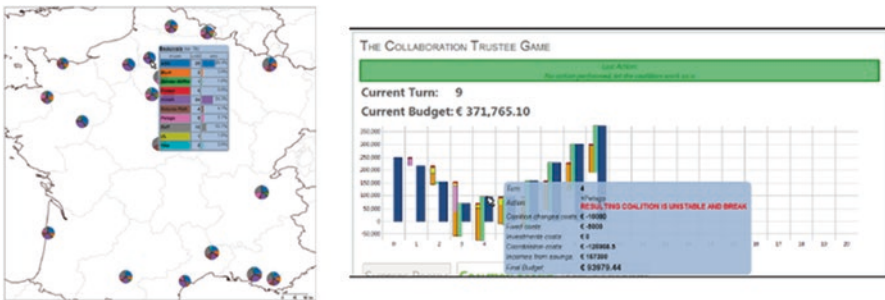


Fig. 6.10 CO3 trustee game



Fig. 6.11 Trust cards game

ment and, they rank the card (and statements) in order of relevance for a successful management of a collaboration.

The Fresh Connection

The Fresh Connection is a web-based business simulation game. It challenges participants to make the best strategic decisions in the management of a manufacturing company of fruit juices. Working in teams of four, participants will represent the company's management team and will be confronted with various real-life dilemmas. Cross-functional understanding and collaboration are key components, as teams work together to make the company successful (Fig. 6.12).

The Fresh Connection immerses its participants in turning around a manufacturer of fruit juices. Faced with declining performance, the management team must get the company back on track as soon as possible. It is a high-pressure environment in which effective SCM is the key to success. The management team has four roles:

- **VP Purchasing:** Responsible for selecting the right suppliers and agreeing SLAs with suppliers, including possible collaboration options.
- **VP operations:** Must decide on capacity in warehouses and production areas and approve investment in bottling lines and mixers. Can introduce various improvement projects. Has the ability to outsource outbound warehousing.
- **VP Supply Chain:** Manages inventories (safety stock and lot size settings), production intervals, and the frozen period of production.
- **VP Sales:** Agrees SLAs with customers, manages the product and customer portfolio, forecasts demand, and can introduce collaboration concepts.

Every decision a participant makes has trade-offs, both within and across roles, so participants will only succeed if they align all the disciplines. As the simulation evolves it becomes clear that a smart and collaborative supply chain strategy is essential for success.

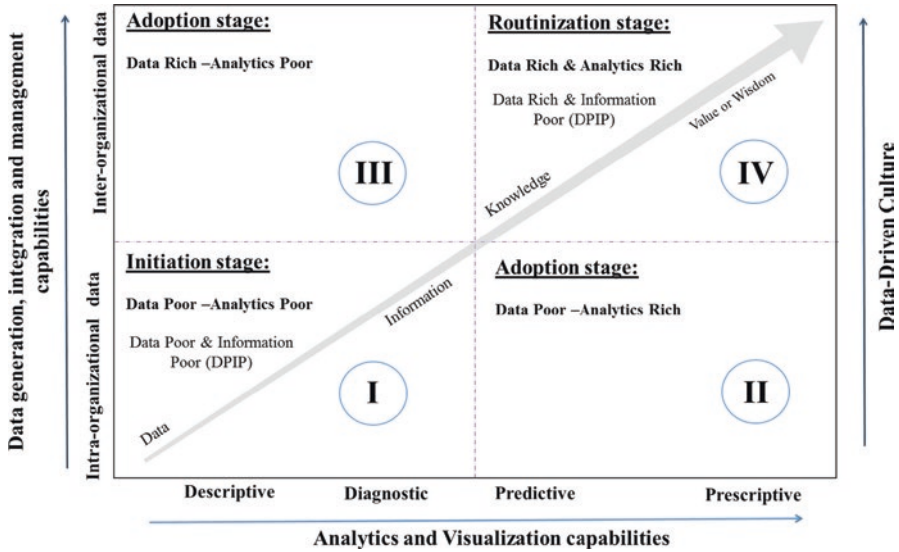


Fig. 6.12 The Fresh Connection game [Source: thefreshconnection.biz]

Freight Transport Game

In 2018, a consortium of French research institutes headed by Armines/ParisTech developed a freight transport game with the objective to let players experience:

1. The difficulty for transport companies to increase their efficiency.
2. The potential mechanisms for a reliable and efficient transport market.
3. Behaviors of the actors in some situations of competition versus collaboration.
4. The dynamics of the transport industry efficiency.

The game challenges players to compare a simplified traditional transport industry (no transit nodes and no re-allocation) with a Physical Internet inspired industry organization with multiple transit nodes, collaboration between carrier companies and possible re-allocation of loads among carriers, see Fig. 6.13.

On a stylized map of Europe (see Fig. 6.14), players must carry out transport requests in an auctioning setting. Every round, each player chooses the route he/she wants to travel, the request bundles he/she wants to carry out, and the price he/she is willing to pay or receive for transport requests he/she sells or buys. In the collaboration scenario, in the central node transport request exchange is possible between carriers, while in the traditional situation carriers must always execute the transport requests from their own customers.

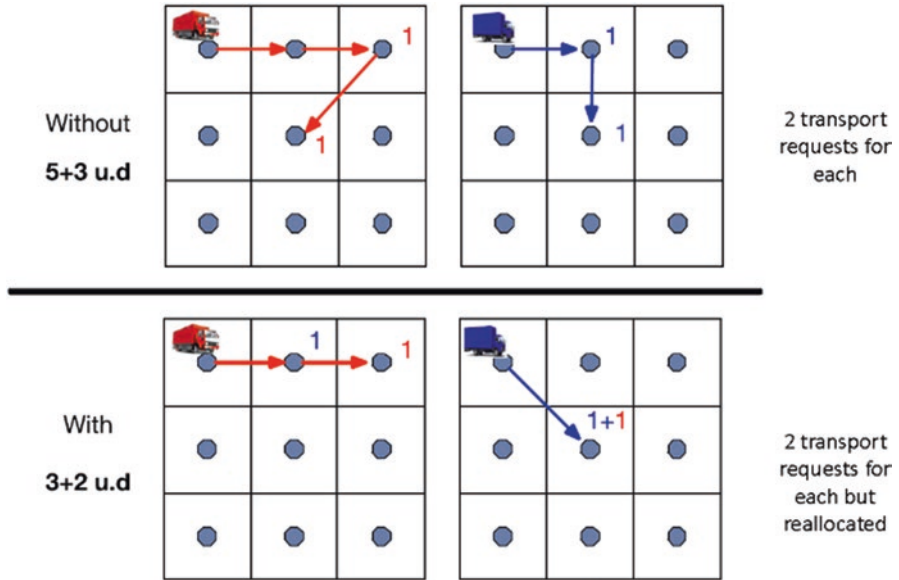


Fig. 6.13 Armines/ParisTech Freight Transport Game

Fig. 6.14 The game board of Armines/ParisTech Freight Transportation Game



6.5.2 Qualitative Critical Success Factors

The serious games described in the previous subsection are useful tools to clarify and sometimes modify behavior of logistics decision makers in collaborative settings. In this section we continue with this topic by providing some qualitative advice for these decision makers based on experience and lessons learned from practical projects.

One of the earliest extensive reports on shipper collaboration was produced by TNO (2005). Based on early experiences with horizontal collaboration among shippers they identified ten success factors subdivided into three categories, see Table 6.7. Later, these insights were tested in three Dutch pilot cases as described in TNO (2018), see also Sect. 8.4.6.

BCI (2017) documented the qualitative lessons learned from ten years of collaboration projects in the Netherlands. Through a series of workshops with collaboration experts from industry and academia, a list of lessons was created, an anthology of which is listed below:

1. *Collaboration is all about leadership and responsibility, the willingness to act.*
2. *Do not give up. Collaboration pays off in the long run.*
3. *Do not communicate benefits in monetary values, but in common goals such as reduced emissions.*
4. *Listen to each other.*
5. *Formulate short-term goals to also reap long hanging fruit.*
6. *Use simple, commonly understandable language.*
7. *Stress the importance of logistics to senior management, it is more than a cost factor.*
8. *Try to understand each other's motivations to collaborate.*
9. *Horizontal collaboration is not limited to working with your competitor, the company next door might also be a good partner.*

Table 6.7 Critical success factor for horizontal collaboration among shippers (TNO 2005)

<i>Purpose</i>	
1	Look beyond logistics cost savings, often improved service is the true key to success
2	Horizontal collaboration is easier with companies that deliver to the success customers but are not directly competing
3	Be selective in which part of the product flow is bundled. For example, start with only the small LTL shipments
4	Make sure of a fair gain sharing model
<i>Organization and management</i>	
5	Start the collaboration with a small group of shippers
6	At the beginning of the collaboration, clearly describe the conditions for entry and exit
7	Carefully discuss how (ICT systems of) the consortium members share information
<i>Process and culture</i>	
8	Think in each other's best interest and commit to the collaboration
9	Make sure that both the people and organizations collaborating have a good fit
10	Success takes time

10. *Guarantee openness and fairness and avoid arbitrariness.*
11. *Transparency is needed, but only for the necessary information. You do not have to share everything.*
12. *Organize regular workshops and inspiration meetings to create trust and a sense of commonality.*
13. *Organize good consortium meetings with a clear agenda and mandate.*
14. *Be flexible and tolerant toward your partners.*
15. *Celebrate successes, both in the consortium and externally with press releases.*

Another set of advices is listed by Professor Ard-Pieter de Man. Based on this experience, in 2015 he formulated the following *ten commandments* for horizontal collaboration:

1. *Have measurable goals.*
2. *Start simple, with a stepwise approach.*
3. *Ensure enough capacity.*
4. *Work on behavior, trust, and commitment.*
5. *Keep your eyes on the long-term.*
6. *Ensure good communication.*
7. *Construct a good governance structure.*
8. *Agree on the financial model beforehand.*
9. *Be flexible to change agreements when necessary.*
10. *Determine clear conditions for entry and exit.*

A final qualitative tool we present is the collaboration matrix, see

Figure 6.15 and Table 6.8, which can be used by companies to judge if another company could be a possible partner to collaboration with. The matrix categorizes companies into four groups depending on two main aspects: their willingness to

Fig. 6.15 Horizontal collaboration matrix

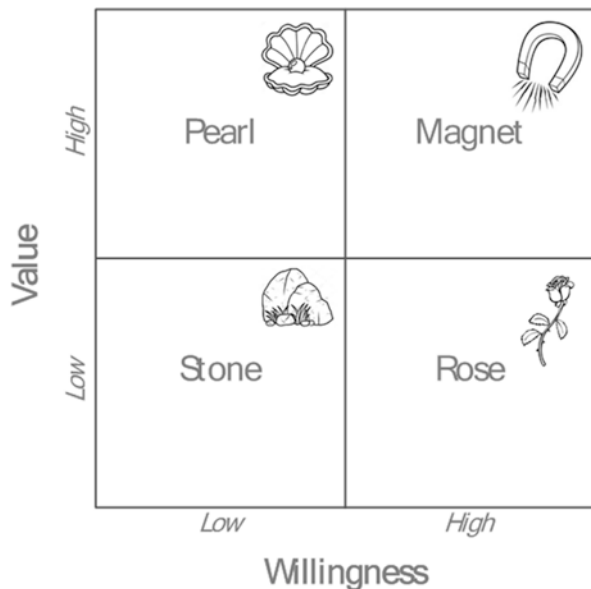


Table 6.8 Legend of the horizontal collaboration matrix

	Explanation
Pearl	This company has a supply chain that can provide interesting savings should it enter horizontal collaboration. However, the willingness (or in some cases awareness) is not there yet. Successful project examples might help to give horizontal collaboration a chance
Magnet	There is both a strong willingness to collaborate and the logistics profile of the company allows many bundling opportunities with other companies. This is the ideal collaboration partner and can even perform a motivating role for other companies to engage in collaboration
Stone	No willingness and no synergetic value. This company can be left out of consideration for collaboration
Rose	A company with a strong willingness to collaborate, however, there is no synergetic fit with it as a bundling partner. This can possibly be changed by relaxing some transport restrictions, service levels, or time constraints. If that is successful, a Rose can change into a Magnet

collaborate and their “collaboration value,” which is the additional synergy that a company adds to a consortium.

As a final remark in this chapter, we can conclude that collaborative logistics has become a hot topic in all kinds of media, ranging from rigorous academic journals to mainstream- and social media. Typically, the larger share of the publications is written by “believers,” i.e. people who in principle have a positive attitude towards horizontal collaboration. With their contributions they wish to stimulate collaborative behavior in SCM, although sometimes by pinpointing their challenges and disappointments. It is good to keep this in mind while going through the growing body of formal and informal literature on collaborative logistics.