

Innovative Logistics Concepts in the Floriculture Sector

Jack G.A.J. van der Vorst, Jacqueline M. Bloemhof, and Marlies de Keizer

*Logistics, Decision and Information Sciences, Wageningen University, Hollandseweg 1,
6706 KN, Wageningen, The Netherlands,*

Jack.vanderVorst@wur.nl, Jacqueline.Bloemhof@wur.nl, Marlies.deKeizer@wur.nl

Abstract

Today most flowers physically pass through the auction houses on their fixed routes from (inter)national growers to (inter)national customers. Physical presence is necessary to allow for physical inspection, quality control and break-bulk activities. Several developments, such as new markets in Eastern Europe and increased virtualization, stimulate the chain to become an efficient floricultural hub-network, in which cut flowers, plants and other products are delivered to customers taking different (direct) routes and using different logistics concepts. The Dutch sector aims to (continue to) be the (virtual) floricultural trading hub of Europe, and has therefore started a 4-year new project called DAVINC³¹. The project's objective is to strengthen the international leading competitive position of the Dutch floriculture sector in a global, virtualized trade network by researching (1) the opportunities for new logistics coordination, consolidation and collaboration concepts in extended international trade networks, and (2) the possibilities for making chain information directly and real-time available and usable to support decision making of all partners in the horticultural network. The aim of this paper is to discuss current floriculture sector developments in supply and demand and identify the main logistics bottlenecks and opportunities for improvement. Based on literature reviews and expert knowledge the research (logistics) challenges that arise from the market developments are revealed.

Keywords: *floriculture, distribution networks, cold chain management, logistics concepts*

1 Introduction

The floriculture sector in the Netherlands is of world-class quality, and serves as main trading hub for Europe. The sector as a whole has a huge impact on the Dutch economy, being the largest exporter of fresh-products in Europe, the top-3 largest exporter in the world with still significant opportunities for further growth. Despite the current leading position, the sector needs to look forward and innovate to stay in the lead. Today, most flowers physically pass through the auction houses on their fixed routes from (inter)national growers to (inter)national customers to allow for physical inspection, quality control and break-bulk activities. However several developments, such as new markets in Eastern Europe and increased virtualization, stimulate the chain to become an efficient floricultural hub-network, in which cut flowers, plants and other products are delivered to customers taking different (direct) routes and using different logistics concepts. Cross-dock centers and hubs (trade parcs) are being set-up in Europe (linking local with global flows) and the sector is searching for efficient coordination and control mechanisms for the complete logistics network to consolidate flows and fulfill market demands. However, this is not an easy task as the sector is characterized by a large number of independent SMEs (many growers, traders, and small LSPs) and a large cooperative auction each with their own objectives and views on roles and functions of parties in the supply chain network.

The Dutch sector wants to (continue to) be the (virtual) floricultural trading hub of Europe, and has therefore started a 4-year project called DAVINC³¹ (Van der Vorst et al.,

2010). DAVINC³ stands for **D**utch **A**gricultural **V**irtualized **I**nternational **N**etwork with **C**oordination, **C**onsolidation, **C**ollaboration and **I**nformation availability. The project started in 2011 and has as objective to strengthen the international leading competitive position of the Dutch floriculture sector in a global, virtualized trade network by researching (1) the opportunities for new logistics coordination, consolidation and collaboration concepts in extended international trade networks, and (2) the possibilities for making chain information directly and real-time available and usable to support decision making of all partners in the floricultural network.

This paper presents current floriculture sector developments in supply and demand (section 2) and identifies the main logistics bottlenecks and opportunities for improvement (section 3). Based on literature reviews (section 4) and expert knowledge the research (logistics) challenges that arise from the market developments are revealed (section 5).

2 Sector characteristics

The horticulture sector in the Netherlands is concentrated in so-called greenports. *Greenports Holland* is a network, representing the Dutch cluster of businesses related to horticulture, including arboriculture and floriculture. The added value and employment of the whole agricultural sector in the greenports in the Netherlands is with 130.000 employees and 5.2 billion Euros roughly comparable to the mainport Rotterdam in the Netherlands, which is the largest port in Europe. For the agrologistics sector, road transport is the main transport mode. More than a quarter of all national road transport volume in the Netherlands in 2006 (28%) is related to agrologistics, while for the EU this is 19% in national transport volume. In international Dutch and EU transport the share of agrologistics is 25% or more – see Figure 1.

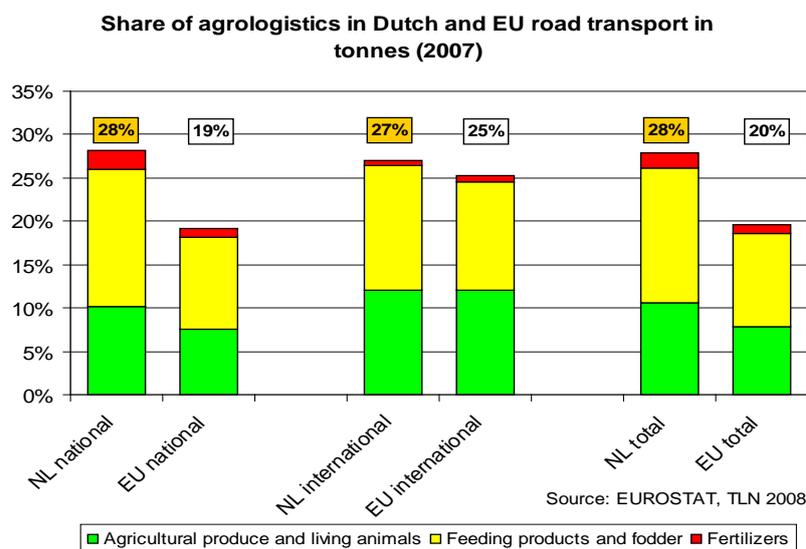


Figure 1. Importance of Agrologistics in road transport

The Netherlands is the heart of the international floriculture sector. It has an intricate and high-quality network of companies, ranging from breeders and growers to sales experts and export firms, representing every aspect of the business. The supply chain network consists of the following links: growers, auctions, traders, logistics service providers and outlets (Figure 2).

- FloraHolland flower *auction* has six auction centers for trading in cut flowers (about 70% of turnover) and ornamental plants (about 30%), a national intermediary organization (FloraHolland Connect) and an internationally active import department. Veiling Rhein-Maas (Herongen, Germany) is a joint venture between FloraHolland and Landgard. FloraHolland is a primary cooperative: the business is owned by its roughly 6,000 members, especially *growers* in the Netherlands, but also beyond.
- The *traders* can be split up in three groups: wholesalers, exporters and importers. Sometimes this overlaps, when a Dutch wholesaler also acts as exporter. There are about 1200 Dutch traders, dealing with many (inter)national customers. Most important import countries are Kenya, Ethiopia, Israel, Ecuador and Germany. Most important export countries are Germany, United Kingdom, France, Italy and Belgium.
- In many cases the transport between two chain stages is outsourced to a *logistics service provider*. In some cases the providers execute extra activities like quality control, handling and packaging.
- Different *sales channels* can be identified in the national and international market places. We can divide them into retail (supermarket, garden and construction centre, etc.) and detail (self-employed garden center, flower shop, street market, etc.).

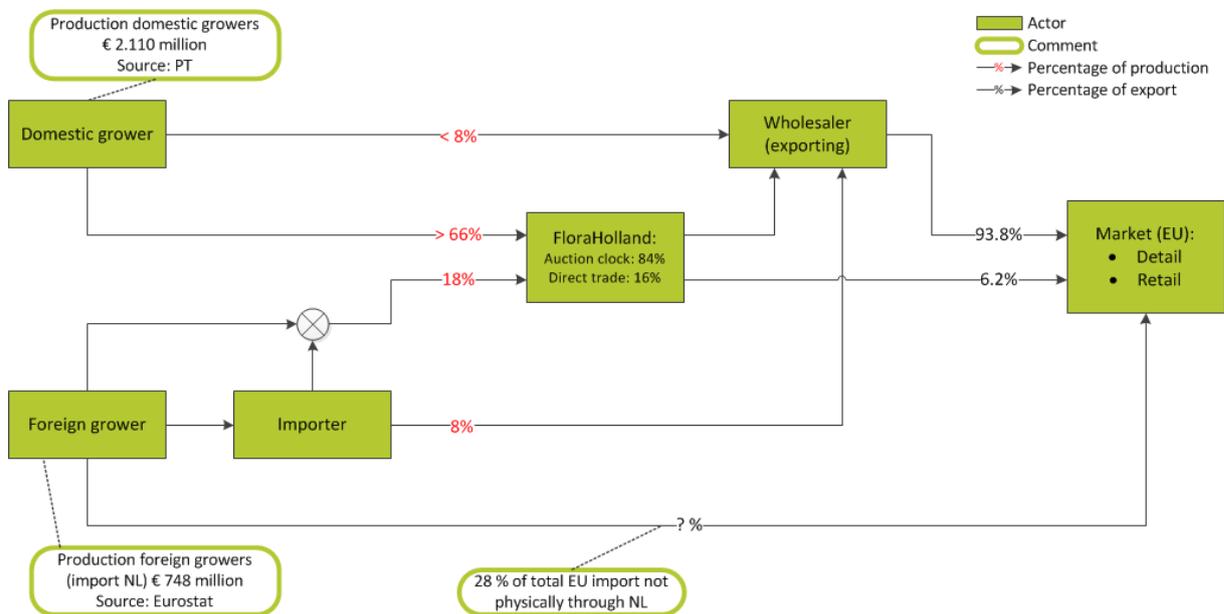


Figure 2. The floricultural network

The supply chain network of ornamental plants and cut flowers is not the same. The most important difference between both chains is the fact that a flower after being cut can decrease 15% in value a day in case not delivered to the customer, whereas an

ornamental plant is almost non-perishable. So especially in flower chains speed is essential. A second difference is that consumers normally buy several cut flowers as a bouquet whereas potted plants are sold piece by piece. In the world of the ornamental plants the role of the garden centres and lumber yards is much stronger than in cut flower chains. This leads to direct deals between retailers and growers with a much higher volume.

3 Developments and research challenges

A number of specific developments and sector characteristics result in research challenges on the level of the design and management of logistics processes. Based upon desk research and multiple interviews with key stakeholders we identified five key issues that will be discussed in the following paragraphs: (i) need for robust and flexible quality-driven logistics concepts, (ii) need for differentiated logistics concepts in demand-driven supply chains, (iii) need for transparency and an advanced information infrastructure, (iv) chance for innovative collaborative distribution strategies, and (v) need for collaborative logistics.

Need for robust and flexible quality-driven logistics concepts

One of the main logistics challenges for the sector is to deal with strong dynamics and uncertainty in supply and demand, regarding fresh product quality as well as the available volume in time at a specific place. The sector is characterized by last-minute changes and rush-orders.

Very specific is the difficulty to predict the exact quality of fresh produce before it has been harvested. The prediction of these quality changes is even more difficult during the trade, transport and storage processes (resulting in potentially large product losses if logistics is not organized adequately). At the same time there is a trade-off between expensive measures that can prolong the vase life of flowers and the use of slower and cheaper transport modalities with often less carbon emissions. Typically, next to biological variations, the quality of flowers and plants is determined by time and environmental conditions (such as temperature and humidity during transport). Environmental conditions may be influenced by, for example, the type of packaging, way of loading and the availability of temperature conditioned transportation means and warehouses. Customers demand guarantees on quality specifications leading to strict requirements on the logistics network concepts used in the sector.

As a consequence, the required prediction and planning concept and accompanying logistics system need to be very flexible, enabling last minute changes and reallocations, but also to provide a robust planning (compared to the many rush orders and transports at the moment). More specific, it should allow for advanced logistics decision making taking real-time information on product quality behaviour into account, resulting in the delivery of the right product to the right outlet in time; a concept called "Quality Controlled Logistics" by Van der Vorst et al. (2011).

Need for differentiated logistics concepts in demand-driven supply chains

The sector makes a difference between two types of marketing channels: “retail” (including supermarkets, garden centers and construction outlets) and “detail” (specialist shops). Retail industry has seen significant consolidation and concentration, which led to domination of the market by large retailers. Retail sells flowers and plants as by-product and aims for large volumes of specific products guaranteed via long-term (preferred supplier relationship) contracts and fixed prices. Specialist shops often gain their competitive advantage due to a deep product assortment (and hence small volumes per individual product) and a focus on high-quality products. They market value-added products via small-scale shops using day-to-day prices and volumes available. In both channels, for flowers vase life is one of the most important product attributes (for flowers nowadays about 7 days). As a result, order lead times are continuously being reduced and there is a trend to smaller order batch sizes.

Specialist shops are still dominating the market, but expectations are that in time retail and detail will find an equilibrium in which both have a market share of about 50% (VGB, 2010). Retail chains will be demand driven whereas detail chains might remain foremost supply driven (using the virtual auction clock¹). Obviously, there is a need for differentiated logistics concepts to fulfil the specific requirements of all market segments.

Need for transparency and an advanced information infrastructure

Last years a lot of work has been done to improve information standardisation and exchange in the supply chain. Although major steps have been taken, still improvements are needed. For example, many transport orders are communicated very late resulting in rush activities and reduced efficiency. Furthermore, there is a lack of (electronic) transport status information, resulting in telephone calls to growers about the whereabouts of their product – something they have no insight in. And although growers invest heavily in production automation, investments in digitalisation and management decision support systems are less easily done. At the same time virtualization makes trading methods and price formation more and more admissible and transparent. E-trade and KOA (“Kopen Op Afstand”, buying from a distance) are used by customers far away to buy directly at either producers or auctions, but have challenging implications for the (value-adding) activities of all stages between production and markets.

In a demand-driven virtualized trade network, physical product flows are separated from information and commercial transaction flows. There is a need for transparency that provides information about partners, products, resources and logistics operations in order to effectively trade and operate. Clear definition of roles in the supply chain as well as more advanced information exchanges and collaboration concepts are needed to match supply with demand. It requires, for example, the formal description of a specific flower or plant and its dynamic features such as its “quality”. To be able to support decision making and execution of tasks in the logistics network, there is a need for a new ICT infrastructure containing a knowledgebase (“Greenbase”) that can be used to get the

¹ With a traditional auction clock flowers and plants are physically present at the auction floor for buyers to bid on, with a virtual auction clock flowers and plants are represented by pictures and accompanying information for buyers to bid on.

proper information system functionality available for configured processes and the right information at the right place at the right moment in the network (part of the features envisaged for Greenbase can also be found in the existing Portbase). A Greenbase includes the following capabilities: 1) a repository of the application services, 2) reference information architectures, 3) an internet platform, and 4) methods and tools for the configuration of run-time information systems. During the last decades, much progress has been made in ICT to provide these capabilities; however, these specific capabilities are not yet available or not applied in horticulture (Verdouw, 2010).

Chance for innovative collaborative distribution strategies

It is clear from the earlier text, that the floricultural sector is confronted with too many emergency orders and that ways have to be found to reduce this and enable more efficient and responsive logistics processes. In order to be responsive, a supply chain can make use of multiple delivery modes in which the slower and cheaper modes are employed for shipments under usual planning (push process) to enjoy the economies of scale and contribute to a cleaner way of transportation by emitting less carbon emissions (lean and green), while the faster and more expensive delivery modes are used for speedy and emergency replenishments by market demand (pull process) (Chan and Chan, 2010). Multi- (and synchro-) modal transport receives increased attention in this sector. Rail and sea transport using conditioned containers instead of speedy air transport has already proven to be a successful technology (Greenrail, 2010). This holds true especially for import flows as these containers usually contain large volumes of the same flower or plant type. In export flows multiple types of flowers or plants have to be distributed together, but they each respond differently to specific temperatures and humidity. Cymbidium, anthurium and other exotics require a warm environment, others such as roses and chrysanthemum need a cooler environment to preserve shelf lives.

The above shows it is relevant to research the optimal temperature when facing different quality decay profiles for different products; as well as, given the demand for multiple products, which products could be combined in a common (flexible) container transported via rail, road, water or air. If these new conditioned technologies can be used to transport products over long distances, it could also provide us with opportunities to hold inventories at strategic locations within the network, i.e. at international distribution hubs.

Need for collaborative logistics

The floriculture sector is characterised by intensive cooperation between all actors in the network. However, from supply chain perspective still many logistics flows from source to sink are managed independently by chain actors, resulting in less efficient transport flows. This becomes more and more difficult due to increasing end-customer demands and a growing political pressure to reduce logistic movements. Flowers and plants are sourced internationally and might in the future, instead of being transported via the market place in the Netherlands, be directly distributed via a logistics hub network in Europe to regional customers. These customers require value-added products packed and delivered within a complete assortment with specific logistics service constraints. More logistics collaboration between different actors in the chain, vertical as well as horizontal, may

improve the efficiency of processes as harvesting and transport, and reduce product waste. Key issue is that in the new virtualised network, opportunities arise for different trade-parc network configurations as well as route and process (e.g. where to assemble and pack) configurations of supply chains through the network.

4 Literature review on key concepts

There are a number of key concepts in the DAVINC³I project that require further understanding to finally arrive at more concrete research questions; these are Virtualisation, Consolidation, Coordination and Collaboration. A literature review revealed more insight in these concepts, the main findings are presented in this section.

Virtualisation

In Information Technology, *virtualisation* means that multiple operating systems can run simultaneously on one computer (Shao et al. 1998). Virtualisation in a supply chain setting can be found under the term ‘network virtualization’, which involves the process of combining many networks into a virtual (imaginary) network. Virtualisation in marketing is related to web-shops, buying by apps and other social media. Virtualisation in logistics means a shift from only dealing with the physical flows of goods towards controlling the supply chain and enabling information flows. Anderson et al. (2000) show how a traditional supply chain can change into a virtual supply chain (Figure 3). First step is to integrate functions of the existing supply chain, second to improve collaboration and control with vendors and customers and finally to synchronize the supply chain across players into one virtual enterprise.

Web-Based Entrants are Making Synchronization and the Associated Benefits Achievable

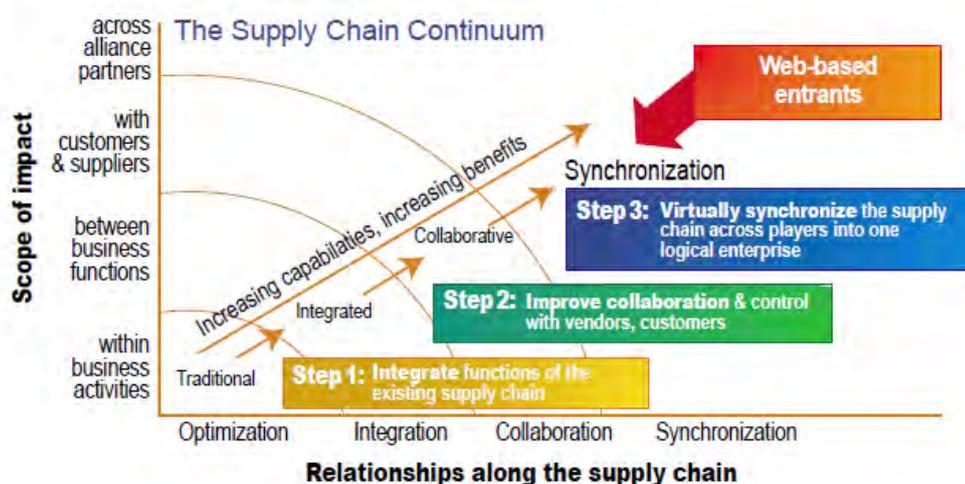


Figure 3. From traditional supply chain towards virtualized supply chain (Anderson et al. 2000)

Examples of virtual concepts to be used in the floriculture sector are (i) e-commerce and (ii) e-auctions (van Heck and Kambil, 1998). KOA (buying from a distance currently applied in the floriculture sector) is a concept of trading in a virtual marketplace, i.e. buyers are not physically in the auction room (they are electronically connected) but products are physically present at the marketplace, whereas in an e-auction, buyers and products are both not physically in the auction room, but electronically connected. In the next part, step 2 of Figure 3 (improve collaboration) will be discussed.

Collaboration

Cao (2009) defines supply chain collaboration as a long-term relationship of partners in the supply chain with a common goal to achieve competitive advantage by working closely together. Horvath (2001) mentions that with the use of e-business/e-commerce networks, all members of the supply chain are able to prevail and grow. Collaboration can take place horizontally, with organizations that operate on the same level of the supply chain, as well as vertically, downstream and upstream the supply chain. Communication is an important factor of collaboration. Communication upstream and downstream the supply chain can enable organisations to optimize the delivery of products and services (Fawcett et al. 2007). The aim of collaboration is to create joint knowledge and value over the whole supply chain to respond to competitors and customer demand. When organizations in the supply chain collaborate, they need to agree on the strategic direction of the supply chain (the goal congruence). Also on the tactical and operational level, decisions in each level of the supply chain need to be adjusted (decision synchronization) (Cao et al. 2009). Collaboration is one of the key elements of the value that e-markets provide to buyers and suppliers (Fawcett et al., 2007). Product lifecycles can be upgraded, time-to-market can be reduced, products better be customized etc. (Anderson et al., 2000).

Consolidation

Consolidation is about joining forces in the field of logistics and information to gain competitive advantage (van Damme, 2005). Consolidation arises from the need to have more efficient and sustainable activities for example to reduce CO₂ emissions. Well-known examples of joining forces are (i) cross-docking and (ii) shipment consolidation. *Cross-docking* means that shipments from multiple suppliers are brought together for further transport to a single buyer or wholesaler (van Damme, 2005). Cross-docking is a distribution concept suitable when shipments have high margin, high value density, low packing density and a limited shelf life. *Shipment consolidation* is the process of grouping different shipments from suppliers into a larger shipment at a consolidation center (hub). Most organisations in the supply chain outsource transportation to 3PL companies that consolidate shipments from several suppliers to fully utilize capacity of transport modes (Cruijssen et al. 2007). Freight sharing occurs when organisations exchange transport orders to better utilize truck capacities or to benefit from a partner's logistics network which might be better developed in a certain geographic area (Cruijssen et al. 2007). With online freight sharing 3PLs can browse logistical needs of shippers and bid on individual lanes that suit their clients (Tyran et al., 2003).

Coordination

Coordination refers to the challenge of integrating geographically dispersed activities such as sharing information or transporting goods among worldwide spread facilities (Fawcett et al., 2007). Fugate et al. (2005) mention that supply chain coordination provides risk reduction, access to resources and competitive advantage. Figure 4 shows how four coordination modes relate to an integrated supply chain.

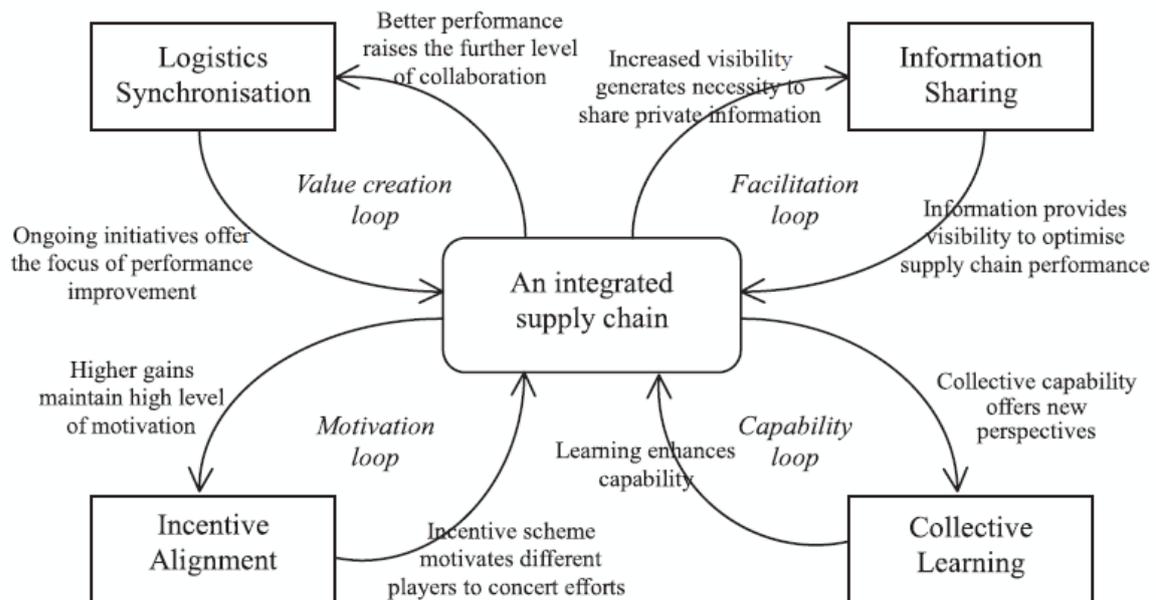


Figure 4. Relation between integrated supply chain and four forms of coordination (Simatupang et al. 2002).

Logistics synchronization can be seen as an example of step 3 of Figure 3 (Synchronization). Synchronising logistics means to incorporate interrelated supply chain activities across different lines of organisational authority and responsibility. It ensures the alignment between logistic process activities to deliver products and customers to full customer needs. By closely monitoring and forecasting customer demand patterns, demand uncertainty can be diminished, leading to quick response to customer requirements, lower inventory costs and better product availability. *Information sharing* will help improving the overall supply chain's performance. *Incentive alignment* attempts to provide various mechanisms to distribute benefits and risks associated with logistic functions to motivate independent actors to achieve supply chain profitability (Simatupang et al, 2002). Creating alignment (see Figure 3) is a long-term process. It starts with information alignment (information sharing), followed by identity alignment, leading to incentives alignment. *Collective learning* depends on the knowledge that is being shared between members of the supply chain. When all organisations share knowledge, they provide a basis for advantageous coordination. IT can help to transfer and store shared (explicit) knowledge. Collective learning can extend organizations's capability to accomplish ongoing improvement and create customer value.

5 Conclusion

The brief literature overview indicates that the four key terms in our project are used in literature in a broad sense and more focus is needed to arrive at concrete research questions for the floriculture sector. Because the sector is only starting to virtualize, a clean sheet can be filled by combining different views on virtualization, i.e. network virtualization, marketing virtualization and logistics virtualization, aiming at coordination and control of a horticultural supply chain network. Anderson et al. (2000; Figure 3) helps us in the transition from a traditional to a virtual supply chain. They show that key is to integrate functions, improve collaboration and arrive at synchronization of processes. Simatupang et al. (2002) show us that information sharing is crucial in improving the chain performance and incentive alignment in 'making it work'. The floricultural sector is already characterized by intensive cooperation, and extending this to strategic collaboration can create a valuable virtual horticulture supply chain network. The horticultural network is a global network which is geographically dispersed. This infers a great potential for coordination and an integrated supply chain leading to risk reduction, access to resources and competitive advantage.

We conclude that the literature review together with the described developments in the floriculture sector result in the following research questions:

- How to design demand driven logistics concepts, linking growers in different international sourcing areas directly to customers, thereby enabling new collaborative supply and logistics management concepts – while considering the continuous need for supply driven concepts (using the (virtual) auction clock)?
- What coordinated logistics control concepts should be used
 - a. with emphasis on responsiveness and guaranteeing product availability and product quality to customers (including supply planning, capacity planning, transportation management and inventory management) i.e. focus on consolidation of product flows and improved matching of uncertain supply with variable demand, and
 - b. using real time or the most actual product quality information in logistics decision making throughout the network (i.e. Quality Controlled Logistics) and taking into account sourcing preferences?
- What dynamic configurations of logistics routes are possible in effective trade networks from sources to sinks (including the use of conditioned containers and multi-modalities), with redefined locations for specific processing activities, such as packing, combining, labelling, quality control, and sorting, taking into account product perishability, high demand and supply uncertainties and the logistics service requirements from the differentiated marketing channels?
- What dynamic configurations of information systems (and technical solutions such as a *Greenbase*), advanced information exchanges and transparency to facilitate virtual trade and advanced coordination and collaboration concepts should be used in the floricultural sector?
- What incentive systems are needed to align interests and make the above innovative logistics concepts work?

These research questions have been placed central in the DAVINC³I project and will be further researched in the coming three years.

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