# Research Proposal, DINALOG, May 2012 – updated July 2012

# Competitive Advantage Through e-Commerce Logistics (CATeLOG)

# Full Proposal Project Plan

**Summary**

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| *Introduction*All market research reports show a continuous, significant increase of online sales at the expense of traditional offline retail. Fulfillment of online orders, however, is challenging. In CATeLOG we focus on logistics opportunities that can help increase online sales in a profitable manner. Three aspects are central to our project:* Cross-border retail logistics. While online channels have no borders and allow for quick international expansion, consumer preferences for types of e-fulfilment are likely to differ across regions and borders. Cross-border expansion will only be successful when retail logistics solutions use the right localized form of last mile distribution, or incentives and demand management techniques to address these different local preferences.
* Cross-chain retail logistics. Online and offline retail are more and more integrated on an operational level (time windows, collection & drop-off points), tactical level (inventory location and assortment planning) and strategic level (market focus, partner selection). Models for successful online expansion, within border and cross-border, should therefore be adapted to include the right role for offline outlets on all three levels.
* Supply chain integration. Not only web shops are involved in order-to-delivery management, but other parties as well: logistics service providers may take care of delivery and collection but there may also be a role (e.g. for stocking parts) for suppliers/manufacturers of products sold. Moreover, consumers can be actively involved for example in the coordination of the delivery (e.g. through social media) and optional returns to reduce peaks and no-shows.

*Activities/Work packages*We defined three PhD-projects for work packages WP1 – WP3: Customer Service Strategies, Cross-Chain Assortment Planning and Order-To-Delivery Coordination Architecture. Work package WP4 Valorization has been defined to motivate the use of the results of our research in practice. Work package WP5 describes the dissemination of knowledge. MSc student projects play a pivotal role in WP4 and WP5. All WP’s consider the three central aspects described above.*Results, innovativeness and valorization/implementation*The primary goal of this research project is to enable Dutch retailers with online channels to increase their market share through best-in-class logistics and fullfilment. In particular, we observe a significant market potential for Dutch e-commerce companies to expand their business via cross-border sales to Belgium and Germany.Innovations that result from the CATeLOG project bring opportunities for new business for Dutch companies. For instance, better consumer knowledge and better knowledge of the effects of ordering behavior on logistics provides new business opportunities for a 4C in e-commerce logistics. Likewise, innovations in ICT tools and architectures bring opportunities for ICT companies. Valorization and knowledge dissemination are key aspects of our project. We have a consortium of industry-leading companies that help to develop best-in-class concepts and tools. We actively support the application of concepts and tools among consortium partners and the development of new ventures based on products developed in CATeLOG. We will apply knowledge developed in this project through amongst others MSc student thesis projects in e-commerce companies and in R&D departments of e-commerce software vendors. Knowledge dissemination will be done through a variety of media, including weblogs, written media (academic and professional journals) and conferences (both academic conferences and dedicated workshops and seminars for practitioners). |

1. **Orientation and Project Goals**

Motivation

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| While traditional retail sales are declining, Thuiswinkel.org research shows that Dutch online consumer sales grew 10 percent in 2011 to € 4.25 bln turnover in the first half of 2011 (Thuiswinkel, 2012). The EU’s Digital Agenda Scoreboard shows that the Netherlands is a front-runner in online sales in the EU, in third position after Denmark and the UK (European Commission Digital Agenda Scoreboard 31 May 2011)). As a leading country in logistics, the Dutch e-commerce community could take an important share from the EU online sales. Since the online channel has a wide reach of audiences, international expansion seems an attractive strategic choice for growth; certainly since the availability and reliability of cross-border online shopping in the EU has improved. Indeed, the growth of cross-border sales in the EU is substantial: up 40% in the first 9 months of 2011 (Accenture, 2011). Despite these positive developments, there are still significant barriers to cross-border shopping; shoppers continue to have problems when accessing websites in other languages and when receiving or returning goods (ECC-Ne, 2011).Currently, just 8.8 percent of Europeans are buying online from retailers located in other countries (European Commission Digital Agenda Scoreboard 31 May 2011). Given this low number, there is ample opportunity for growth of online cross-border sales, both by converting non-users of cross-border shopping into users and by increasing the number of purchases of existing cross-border customers. For Dutch retailers, likely converts are consumers living in neighboring countries Belgium and Germany. Furthermore, consumers who already buy from Dutch providers can be motivated to buy more products or start using other channels; in particular as multi-channel consumers are bigger spenders than those who stick to a single channel, with no significant differences by sector or home country of operations (Accenture, 2011). More needs to be known about consumers and their choices in order to grow the e-commerce market, particularly in a cross-border setting.The success of e-commerce appears to be strongly dependent on logistics performance from supplier down to the doorstep of a consumer. Research shows failure to live up to order fulfillment promises by e-tailers can be detrimental to online sales, with out-of-stocks strongly correlating negatively with a consumer’s loyalty to a web shop (Rao et al., 2011). Also a well-structured reverse logistics program can create substantial value-added and positively affect the bottom-line of the process (Bernon et al., 2010; Genchev et al., 2011). Early entrants such as etoys.com went bankrupt because of lack of attention to supply chain aspects (Pyke et al., 2001). Meanwhile, many traditional retailers have been rather succesful in adding an online channel to their operations. Recent research shows that selling through an additional online or offline channel significantly improves a traditional retailer’s financial performance (Xia and Zhang, 2010), is good for customer loyalty (Wallace et al., 2004), and customer spending. On the other hand, the e-fulfillment of online-only ‘pure players’ is still perceived as better by customers (Xing et al., 2010). If the future of retailing is expected to be in multi-channel retail (ABN-AMRO, 2011; Kindt and Van der Meulen, 2011), much more is to be known on how multi-channel setups will not only be profitable, but also better in e-fulfillment.The industry has shown a boom in supply chain coordination activities, both horizontally with competitors (cf. Cruyssen et al., 2008) and vertically (cf. De Leeuw & Fransoo, 2009). This applies both to forward as well as reverse flows from consumers back to retailers. Although logistics is often outsourced and things such as drop-shipments - a technique where retailers do not keep stock but transmit order and shipment details to a supplier such as a manufacturer - have become more common among e-commerce retailers (Agatz et al., 2008; Rabinovich, 2008), supply chain coordination across partners is limited. Research has been done in the area of, for instance, channel conflict when a manufacturer opens up an e-commerce channel parallel to resellers (e.g. Tsay and Agrawal, 2004) or consolidator functions between suppliers and customers in so-called Channel Extending Intermediaries (Gallaugher, 2002); but other than that little is known about integration of roles in the channel. Online sales are often characterised by a so-called long-tail, a phenomenon that niche products can grow to become a large share of total sales (Anderson, 2004). Internet has the ability to have a web shop carry a much larger product range and variety than traditonal retailers can, leading to an increase in sales in niche products and hence a longer tail in the sales distribution (Brynjolfsson et al., 2011). A traditional retailer has to keep inventory of all the products he offers, a web shop not necessarily. How to integrate the supply chain from manufacturer down to consumer requires more research.We have defined three PhD-projects that take these issues as a starting point: 1. Customer Service Strategies, which focuses on the analysis of consumer behavior and preferences in cross border and multi-channel settings; as well as on incentives and demand management techniques by means of which consumer ordering behavior can be influenced.
2. Cross-Chain Assortment Planning, which is oriented towards understanding consumer requirements with regard to assortment variety, stocking strategies for the long tail of the assortment and pricing guidelines for the assortment to optimize revenues and profits.
3. Order-to-Delivery Coordination Architecture, which focuses on ICT architectures for information systems that can support a coordinated cross-chain Order-To-Delivery process.

We focus on developing the following deliverables:* A Geographic Information System (GIS) similar to Google maps that maps consumer preferences and logistics options by region/neighborhood and market.
* Annually updated benchmark database of e-commerce logistics and service levels.
* Advanced customer service instruments.
* Quantitative model that characterizes the relations between order patterns, logistics costs, customer service levels and commercial benefits.
* Business rules for cross-chain e-commerce stock location and allocation.
* Design of a 4C business model for e-commerce logistics.
* Dynamic pricing software service for companies in order to optimise revenues within strategic constraints.
* A software service for forecasting transport pricing to be used for direct negotiations with consumers.
* ICT architectures for information sharing between relevant e-commerce business network partners and decision support for e.g. stock location, delivery slots and dynamic pricing in a 4C.
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Relation to Dinalog´s innovation themes

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| In this project we focus on developing insights in requirements for the logistics of cross-border e-commerce in multi-channel settings, on pricing models for planning assortments in these settings and on ICT tools and techniques to support a vertically integrated cross border supply chain. In general, costs of setting up a web shop are not extremely high. However, the real difficulty is not in organizing the front-end but the back-end of a web shop. In the US Webvan had trouble competing in the online grocery business and went bankrupt whereas Peapod which was bought by Royal Ahold could piggyback on the experience of a large grocery retailer with experience in logistics ( Lunce et al. 2006, Decision Sciences Institute conference). A focus on market share retention and growth while organizing logistics in an efficient manner is essential for web shops.Our research is conncected to subtheme 1 and 4 of the 4C roadmap of “Topteam Logistiek”: “4C for sectors” and “new business concepts”. In this project we identify the possibilities for using a 4C in managing delivery as well as holding stock for multiple web shops. We also identify the potential of a 4C in reverse logistics in an e-commerce environment. Our research also relates to theme 2 action point 1 in the agenda put forward in “Partituur naar de top”: Cross Chain Control centers that focus on coordinating and directing using advanced technologies and logistics (e-commerce focused) professionals, both nationally and internationally. Our research also relates to action point 10 of that agenda: narrowing the gap between knowledge and practice – with a particular focus on SMEs. A significant portion of Dutch web shops currently are small companies[[1]](#footnote-1).With our focus on cross-border retail we furthermore pay explicit attention to the internationalization of business concepts, which is a specific focal area in the Dinalog R&D call 4. Last, the active involvement of customers and specifically demand management is an area that receives a significant amount of attention in our project (Dinalog R&D call 4, focal area no. 6). We pay specific attention to consumer behavior and how demand can be influenced |

Objectives and goals

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| Although e-logistics is not covered in the topteam objectives our project is linked to the concept of a Cross Chain Control Center. Cross chain control in e-commerce requires new business models and ICT architectures that allow for national and international coordination of physical goods flows and related information and financial flows, dependent on regional diversity of customers. There are significant opportunities for growth in this sector given the increase in web shop sales over the last years as well as a strong focus of the European Commission on increasing cross-border sales in Europe. The Netherlands is well positioned to support cross-border e-commerce due to its leading position in logistics.The main objective of this project is to strengthen the Dutch e-commerce supply chain by identifying business models and best practices for implementation and use that lead to increase e-commerce revenues. More concretely, the project objectives are as follows:1. To substantially contribute to the development of scientific knowledge on the interface of logistics, marketing and ICT in e-commerce.
2. To understand cross-border consumer requirements that enable consumer-focused supply chain activities rendering increased sales
3. To contribute to the further development of the e-commerce sector by means of:
	1. Identifying improvement opportunities in logistics and stock management and implement these improvements in amongst others MSc projects
	2. Defining cross-chain business models and logistics processes and procedures that are both efficient and that entail in increased revenues.
	3. Providing insights in best practices through benchmark study.
	4. Providing architectures and tools that can support cross-chain logistics processes and procedures
4. To reduce obsolescence of retailers and enhance revenues by means of dynamic pricing models.
5. To design and deliver a proof of concept of an agile software architecture for e-commerce logistics execution that can be extended by pluggable software services that incorporate the latest R&D results (e.g. stock location, dynamic pricing services). The architecture does not only offer the transaction environment but also serves as an infrastructure for information sharing, historical information visualization and decision support.
6. To contribute to the development of human capital by means of a pool of about 40 students (10 per year).
7. Dissemination of knowledge to non-participants in the sector as well as outside the sector through open conferences, trade publications, case studies, workshops at Dinalog and MSc projects. We aim at at least 10 scientific papers, of which at least 3 will be published in A-rated journals. Drafts of first academic papers are expected towards the end of 2013. We will commence with writing professional journal articles already by end of 2012.

We expect that this project can contribute considerably to the ambition set forward in e.g. the Topteam goal to become a market leader in logistics control. The pace of growth in e-commerce is consderable and the dynamics resulting from significant growth have the potential to deteriorate performance of companies considerably (cf. Paich & Sterman, 1993).Anecdotal evidence shows that web shop companies are facing major issues keeping abreast with growth in their supply chain. These companies are looking for guidance in keeping up with growth in their supply chain. We are happy that our project is supported by a variety of consortium partners active in e-commerce and we expect our consortium to grow in the near future as various potential consortium partners have expressed interest to participate yet were not able to give final commitment. |

Expected results

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| Over the last years, online sales have increased significantly whereas traditional retail sales have remained stable or even declined. In CATeLOG we focus on how logistics opportunities can help increase online sales in a profitable manner and at the same time enhance sustainability of logistics processes. We estimate the impact of our project as follows:1. Through better understanding of customer demand management strategies and consequences for assortment management strategies we expect that cross border sales can be expanded. To stress our earlier remark, the EU’s Digital Agenda Scoreboard (European Commission, 2011) shows that the Netherlands is a front-runner in online sales in the EU (third position, after Denmark and UK). As a leading country, the Dutch e-commerce community could take an important share from the EU cross-border sales. If Dutch e-commerce sales can be increased 3-5 percent by selling cross-border this would imply an extra revenue of €300-500 mln annually.
2. Tools, insights in best practices and business strategies will greatly help to improve customer service and lower operational costs of e-commerce supply chains. The national e-commerce turnover is estimated at approximately €9 bln per year and growing rapidly (Thuiswinkel, 2012). A 1 percent additional margin would improve profitability by €100 mln per year.
3. Deliverables from our project will also enable the development of new ventures. One area of new venture development that we expect is the use of geographical information systems that contain logistics information. Furthermore, development of the agile software architecture and pluggable software services to be marketed by current or new software vendors. We also expect the development of 4C activities in the area of cross-border delivery to consumers but also in the area of stock management. Given the ongoing increase in online sales at a rate of easily 10-20% growth in supply chain activities will remain considerable.
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Relation to government policy

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| The European Union’s Digital Agenda states that 20 percent of Europeans should buy online in other member states by 2015. At the current pace, this goal is not achieved (European Commission, 2011). Increased cross-border sales by Dutch e-commerce companies could contribute to accomplishing this goal.Coordinating and organizing international e-commerce also fits the Dutch government ambition to be European market leader in controlling flows of goods passing through one or more European Countries by 2020 (Van Laarhoven, 2008). |

Orientation

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| The participating researchers from VU University and University of Twente have experience with previous public- private collaboration projects such as CONNECT and Transumo. Two researchers currently participate in other Dinalog projects: prof. Van Hillegersberg is active in the 4C4MORE project and prof. Boter participates in the project “Cross Chain Order Fulfillment Coordination for Internet Sales”. The 4C4More participation ensures that insights into the technical and organizational aspects of 4C’s can be linked to this project. The latter participation helps to ensure that there is no overlap with existing research in Internet logistics.The core research team has extensive experience with industry driven research projects where cooperation with practice is central, either through a consulting background or a background in industry.  |

1. **Activities and Work Packages**

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| R&D Project CATeLOG |
| Activity 1: Customer Service Strategies | Sep-2012 – Dec-2016 |
| Activity 2: Cross-Chain Assortment Planning | Sep-2012 – Dec-2016 |
| Activity 3: Order-to-Delivery Coordination Architecture | Sep-2012 – Dec-2016 |
| Activity 4: Valorization | Sep-2013 – Dec-2016 |
| Activity 5: Knowledge dissemination | Sep-2012 – Dec-2016 |

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| Activity 1: Customer Service Strategies |
| Description:Research by DeliveryMatch (2011) in The Netherlands and Micros (2012) in the UK indicate that web shops often treat logistics aspects secondary to commercial aspects. Information on inventory availability, delivery times and return options regularly are missing or difficult to find. Moreover, they offer limited choices for delivery options, often only one. Nonetheless, we see that e-commerce retailers view logistics elements (delivery times, inventory availability, delivery fees, return options, etc.) as important competitive weapons. For instance, DeliveryMatch (2011) observes that web shops are setting order cut-off times increasingly at a later time during the day. At the same time, the report states that very late cut-off times after 9.30 PM are offered less frequently. This suggests that e-commerce retailers are rationalizing extreme service levels.In general, e-commerce logistics experiences wide fluctuations in demand for particular products, such as newly released items or during certain (holiday) periods, conflicts between the volume of materials flow and the frequency of shipments and differences between product categories, food, non-food, fashion (Rodrigue, 2012). This creates a challenging situation, where e-commerce logistics operations have to provide rapid market reach and high customer satisfaction (Gunasekaran & Sarkis, 2008). Yet, over the past decade many e-commerce businesses have failed because of the inability to provide cost-effective order fulfillment (Fernie and McKinnon, 2009). This remains a challenge for internet retailers as it can be a major barrier preventing consumers to buy online. ApproachCentral question: How can web shops influence the ordering behavior of online consumers so that it can optimize the logistics impact (logistics costs and service levels) and commercial impact (revenue and profit)?We want to apply a four step approach to answer this question:1. Understand online consumer preferences and behavior in The Netherlands and neighboring countries.
2. Investigate how online customer service instruments can influence ordering behavior.
3. Model the impact of ordering behavior on customer service levels, logistics costs and commercial benefits.
4. Create a 4C business model for e-commerce logistics that integrates (1) consumer preferences, (2) customer service instruments and (3) logistics business practices that aims to align marketing, sales and logistics objectives.

We will identify these issues from a cross-border perspective (Netherlands, Belgium and Germany), both for pure players and multi-channel retailers, including the forward and reverse supply chain.We apply different methods in these steps. The first step will be examined using existing consumer databases, consumer surveys and transaction data analysis. The second step will be based on a combination of transaction data analysis and real-life experiments. The third step on a benchmark database, statistical analysis and quantitative modeling. Finally, the fourth step creates an integral business model based on the results from previous steps.Understanding Consumer PreferencesPreferences for products or services may vary between customer segments, between regions, and also between product categories. According to Van Herk & Poortinga (2011), demographic, social, economic, cultural, psychological and other personal factors, largely beyond the control and influence of marketing, have an effect on consumer behavior and purchasing. Apart from these uncontrollable factors, the web experience adds to the traditional marketing stimuli (price, product, promotion and place) and influences the buyer’s decision process in a more explicit manner.Our research focuses on e-commerce in The Netherlands as well as cross-border sales to Belgium and Germany. These countries are interesting markets for Dutch e-commerce retailers. Germany is a major market for online sales and Belgium lags behind in e-commerce development (Thuiswinkel.org, 2012). Clearly, influencing the ordering behavior of consumers requires a detailed understanding of consumer preferences and behaviors. To understand consumer buying behavior in a cross-national context, cultural values are key constructs. Cultural values are universal and provide a profile of the consumer that underlies manifest behavior such as willingness to try new distribution channels or new providers. For a company that wants to enter a new market abroad or that wants to add a new channel, it is important to know who the consumers are that are the most open to novelties. Preferences for products or services may vary between customer segments, between regions, and also between product categories. In our research we will gather and elaborate information on socio-demographic characteristics from existing databases, such as the European Social Survey (ESS) and Euromonitor (GMID), and combine this information with consumer preferences and online shopping behavior from consumers living in the Netherlands and neighboring countries. After analyzing existing data sources, consumers will be interviewed to obtain more in-depth insight into the motivations to shop online in other countries. We combine the data in a Geographic Information System (GIS) similar to Google maps that maps consumer preferences and logistics options by region/neighborhood and market.Influencing Consumer’s Ordering BehaviorThe marketing literature contains many studies on influencing or shaping the online consumer’s behavior (Darley et al., 2010; Huang et al., 2009; Jin et al., 2008). However, these studies only consider commercial aspects, not logistics. The operations domain holds many publications that link customer service and e-commerce logistics (Blake et al., 2005; Jodlbauer and Reitner, 2012; Xing and Grant, 2006; Xing et al., 2010; Koivumäki, 2010). For instance, Blake et al. (2005) revealed that the variable of quick delivery has the strongest correlation with online shopping convenience, of all variables tested. Jodlbauer and Reitner (2012) investigate the trade-off between service levels and inventory costs for varying safety stock levels and cycle times. They suggest that the best strategies are to reduce demand fluctuations or the number of different product types. However, they do not mention how ordering behavior may be influenced. Yet, these studies primarily focus on the impact of logistics on customer service levels, rather than using service levels to facilitate logistics as we do in our research. Moreover, these studies do not explain how to influence ordering behavior. Our research mixes marketing and logistics principles to enhance logistics, customer service and commercial objectives. In our research we want to investigate how web shops can influence the ordering behavior of consumers through various customer service instruments, such as special promotions, varying delivery fees and response times, offering volume discounts or allowing a selection of delivery time windows, drop-off points and return options with the objective to maximize revenue/profits and optimize logistics costs. Market studies (DeliveryMatch, 2011; Micros, 2012) illustrate that the practical use of these instruments on web shops is still at a rudimentary stage. Clearly, the preferred approach may differ between customer segments, regions, and product categories. Our research aims to understand how these instruments can be used to rationalize order patterns and balance order volumes. As such, they simplify logistics activities which enable e-commerce retailers to improve their logistics performance, reduce operational costs and enhance customer satisfaction. Ultimately, we aim to design advanced dynamic customer service instruments that consider consumer preferences and behavior and aim to optimize logistics, commercial and customer service implications. In our research, we will analyze (big) transaction data from consortium partners and perform real-life experiments at these companies. Logistics ModelsFurthermore, we want to learn how order patterns influence logistics costs, customer service levels and commercial benefits. In order to assess the market standards in service levels, logistics capabilities and practices of e-commerce companies (private and third-party operations), we introduce an annual benchmark study among e-commerce operations. The practices concern all elements of the supply chain, i.e. customer service, warehousing, inventory management, delivery and returns. We perform statistical analysis on the benchmark database to identify best practices. Moreover, we design a quantitative model that characterizes the relations between order patterns, logistics costs, customer service levels and commercial benefits. 4C Business ModelFinally, we investigate the role of a 4C in coordinating customer service objectives with logistics resource capacity planning and execution. We design a business model for a 4C operation in e-commerce logistics. |
| Planning:2013* Start of investigation of consumer preferences
* Investigation of logistics costs and service levels
* Set up annual e-commerce benchmark study

2014* Completion of investigation of consumer preferences
* Investigate influence of online customer service instruments on ordering behavior
* Annual e-commerce benchmark study

2015* Model of impact service levels on logistics costs
* Design and experiment with new customer service instruments
* Annual e-commerce benchmark study

2016* Develop 4C business model for e-commerce logistics
* Annual e-commerce benchmark study
* Complete Ph.D. thesis
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| Work distribution:Much of the work in this WP is done by the Ph.D. candidate and senior researchers. Primary supervision of the Ph.D. candidate is done by the promoters Prof. W. Dullaert and Prof. H. van Herk and co-promotor Dr. J. van den Berg. Mr. Van den Berg also acts as WP leader. The investigation of consumer preferences will be performed in collaboration with the research associate, supervised by senior researchers from the marketing department prof. J. Boter and prof. H. van Herk. Consortium partners are involved in input on research direction, participation in real-life experiments and involvement in data gathering/analysis. MSc projects are used to link the scientific content of the project to practice. Students will be active in several areas: the exploration of the field (via case studies in e-commerce companies), the gathering and analysis of data (e.g. marketing surveys, transaction data) and the actual implementation of results in companies (also through case studies at e-commerce companies). Each year 3-4 students will write their Master thesis on a topic from this WP. Students will be selected early January by the research team from the existing MSc students in Marketing and in Transport & Supply Chain Management at VU University Amsterdam.  |
| Expected results/deliverables/milestones:* Database of consumer preferences in The Netherlands, Belgium and Germany per (detail) region, market and consumer profile.
* Annually updated benchmark database of e-commerce logistics and service levels.
* Advanced customer service instruments
* Quantitative model that characterizes the relations between order patterns, logistics costs, customer service levels and commercial benefits.
* Design of a 4C business model for e-commerce logistics.
* Ph.D. thesis.
* 10-15 MSc theses.
* 3 scientific papers.
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| Activity 2: Cross-Chain Assortment Planning |
| Description:As with any business, e-commerce retailers first need to develop their product offering. This involves both specifying assortment as well as delivered service (Boyer and Hult 2005). Regular out of stocks of items may negatively impact customer loyalty and hence repurchase behavior (Campo & Gijsbrechts, 2000). Because of a decoupling of the place where customers shop (online) and where inventory is located, the economics of assortment decisions change drastically compared to traditional retail. There are, for example, considerable opportunities for pooling stock (Agatz et al. 2008). Assortment decisions deal with determining the number and types of products in a product line (Rajaram 2001). It is a process of item listing decisions based on consumer preference behavior and substitution effects (Hubner & Kuhn 2011). Assortment decisions are a relatively under-researched area compared to e.g. stocking decisions (Campo & Gijsbrechts 2005). We focus particularly on assortment variety, which deals with differentiation of items on offer (such as brands, colors or package sizes). Assortment composition and the effect on profit provide an interesting area for further investigation (Campo & Gijsbrechts 2005). In general, customer orders differ with respect to margin contributions and delivery costs (Agatz et al. 2008). This gives rise to interesting revenue management issues. Simple first come first serve models may hence not be sufficient to deal with inventory and capacity issues. ApproachWe aim at determining which product families, portfolios exist and how they can be best allocated in the channel from supplier down to stock points close to consumers (e.g. a store). The focus is strategic/tactical. We focus on three key questions:* What are key aspects of Dutch and cross-border consumer attitudes and behavior that impact assortment variety and what are the implications?
* How to develop strategic stock location and allocation guidelines in multi-channel settings dependent on consumer, product attributes as well as channel attributes?
* How to develop a model for dynamically pricing items in the assortment dependent on amongst others stock strategy, consumer characteristics and product attributes such that revenues and profitability are optimized.

We will identify these issues from a cross-border perspective in a multi-channel setting and include both forward and reverse flows. We apply different methods to answering these questions. The first question will be answered using a combination of consumer surveys and transaction data analysis, from where we can understand assortment decision behavior (e.g. under which circumstances did consumers cancel their order). The second question will be based on transaction data analysis (where did products come from, what was the achieved performance level). The third question on pricing will be focused on transaction data analysis to derive a model for dynamic pricing strategies.We want to put emphasis on testing our decision models in practice at an early stage. Successful field tests of decision models turn out to be an excellent way to expedite the adoption of these models in practice (Mantrala et al. 2009).Understanding Consumer Demand and Impact on Assortment VarietyAssortment choices are typically related to substitution options: the elimination of an SKU from the assortment depends on the fact whether customers delay their decision, substitutes are available or whether a customer may leave altogether (Kök & Fischer 2008). However, not having products available may impact customer loyalty and trust. Reactions to these out of stocks may differ dependent on consumer and regional characteristics. High service standards are essential for online retailers and particularly in a multi-channel setting. Piercy (2012) found that poor service delivered by online channels has a negative effect on perceived service in the company’s offline channel. Hence, cross-channel effects need to be accounted for. Most academic assortment models apply to single categories (Mantrala et al 2009). However, an approach to managing assortments based on characteristics is necessary. In their study on consumer response to out of stocks, Campo and Gijsbrechts (2000) differentiate between consumer characteristics, product characteristics and situation characteristics. Therefore, we need to understand the effects of these characteristics on required assortment variety, including product characteristics (value, product life cycle length, physical size), consumer attitude and behavior (trust, loyalty, substitution, shopping experience) and channel characteristics (collection vs. drop-off, lead-times, origin).Multi-channel Stock Location and AllocationOnline sales lack the ability to touch and examine products physically, which impacts customers’ anxiety to buy. There are many types of products where customers require some touch (Peck & Childers 2003). Retail stores provide excellent opportunities for pre-purchase trial, instant gratification, and personal attention, while Internet sites provide expanded accessibility, product information, and novelty (Grewal et al., 2004). Operations Management has not been very receptive to modeling the effect of displayed inventory on consumer demand (Turban, 1998). Typically, traditional retailers have space issues that restrict assortment decisions (Mantrala et al., 2009). In e-commerce settings space is less of a constraint. Online consumers are less concerned to know where their products are delivered from (Bendoly et al., 2007). Stock may for example be located at suppliers. Using drop-shipments – a technique where retailers do not keep stock but transmit order and shipment details directly to a supplier–consumers can be delivered directly. This technique has seen an increase in interest over the last years in online retail (Rabinovich, 2008). Bendoly et al. (2007) show that the cost and service impact of inventory pooling across channels is a function of amongst others the location of the inventory in the supply chain. Furthermore, centralizing retail inventories raises the problem of stock allocation to customers (De Vericourt et al., 2009). Combined stock location and allocation problems have received considerable treatment in literature (cf. Sitompul et al., 2008), particularly in the area of Operations Research and often as an integrated part of facility location problems (Melo et al., 2009). Improper allocation may lead to imbalance in local inventories (van Donselaar, 1990). One way to deal with imbalance in stock is lateral shipments (Tlili et al. 2012). However, lateral shipments are expensive. Little research is available on supply chain synergies from jointly optimizing location and allocation decisions in multi-channel settings (Agrawal & Smith, 2009). One example is Mahar et al (2012) – though focusing on operational decision-making once a customer order has been placed – who develop a model for a multi-channel retailer to dynamically determine the best pickup location at checkout incorporating real-time information. This part of the research focuses on identifying strategic guidelines for location and allocation of stock in a multi-channel supply chain dependent on attributes of consumers, products and channels.Dynamic Assortment PricingIn recent years, retail merchandise categories have proliferated and items have become more ‘fashionable’ – implying shorter seasons to sell products (Smith, 2009). Markdown sales have become a significant part of a retailer’s revenues. Such dynamic pricing is as old as commerce itself. However, the last decade has witnessed an increased application of scientific methods and software systems for dynamic pricing, both for estimating demand and optimizing pricing decisions (Talluri and Ryzin, 2005). Many have reported significant improvements in revenues from using pricing models and software. For example, ShopKo reported a 24% improvement in gross margins as a result of using its model-based pricing software (Johnson, 2001) and other retailers report gains in gross margins of 5% to 15% (Friend and Walker, 2001). The key research challenge in dynamic pricing is to determine the optimal initial and markdown prices as well as the time when the markdown occurs. In addition, the effect of demand uncertainty upon these three decision variables should be studied, and the value of demand learning should be evaluated. Although the dynamic pricing literature is rich for the airline, hotel booking, and car rental industry, see Talluri and Ryzin (2005) for an overview, the application to e-commerce retail is rather novel and brings some additional complexities.In e-commerce retail, the dynamic pricing strategy should be studied in light of consumer characteristics and product attributes. The structure of a markdown mechanism influences buyer behavior, and in turn, the seller’s profits. Many fundamental design and associated strategic customer behavior dimensions have not yet been addressed: What quantity will a buyer request at different price steps given a particular markdown schedule? How should the seller set the prices so that high valuation customers purchase at high prices? What is the optimal number of price steps? Under what conditions would the seller be better off implementing a single take-it-or-leave-it price versus markdown pricing? To answer these questions, it requires understanding consumer demand and the required assortment variety thoroughly.The dynamic pricing strategy should also take into account the stocking strategy. Dynamic pricing can be used to steer the inventory to a particular level at a target date. However, in the presence of rational and strategic consumers, inventory management itself becomes more complex. Dynamic pricing strategies can lead to segmented customers with different product valuations so that high (low) valuation customers will purchase the product at the regular (clearance) price, see for instance Smith and Achabal (1998) for a comprehensive discussion.Given that strategic waiting has a detrimental effect on revenues, some retailers have considered various sales mechanisms to discourage high valuation customers to wait for the post-season clearance price. Besides corporate level strategy that calls for no markdown pricing (see discussion of such strategies in Aviv and Pazgal, 2008, Cachon and Swinney, 2008 and Su and Zhang, 2008), there are two operational strategies for enticing high valuation customers to purchase the product at the regular price instead of waiting for the clearance price. The first strategy calls for a limited supply of the product so that high-valuation customers would face a higher risk of stock-outs if they decide to wait for the clearance price; and, therefore, may prefer to purchase the product at the regular price (c.f., Liu and van Ryzin (2008)). The second strategy is the inventory display format. Here, the underlying principle is that a display format can be used as a tool to influence customers’ perceptions about the risk of stockouts if they decide to wait. Therefore, by optimally selecting the display format, an e-commerce retailer could discourage high valuation customers to wait for the clearance sales. Both strategies have a significant impact on inventory management. The literature on this topic is rather scarce. |
| Planning:2013* Start of project by reviewing the relevant literature on assortment planning, consumer behavior and pricing
* Receive education on methodological and conceptual issues related to this marketing and research methodology (ABRI-VU, ERIM, and other PhD courses).
* Deliver a report for Dinalog on consumer traits that are relevant in assortment planning

2014-2015* Investigation of stock location and allocation and of dynamic pricing in e-commerce in practice
* Identify key variables in stock location and allocation and in dynamic pricing
* Develop guidelines for stock location and allocation and for dynamic pricing
* Apply guidelines in practice

2016* Integrate findings in 4C business activities
* Complete PhD thesis
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| Work distribution:Much of the work in this WP is done by the PhD candidate and senior researchers. Primary supervision of the PhD candidate is done by the promoter Prof. W. Dullaert and co-promotors Dr. S. de Leeuw and Dr. S. Bhulai. Mr. De Leeuw also acts as WP leader. The investigation of consumer preferences related to assortment variety will be performed in collaboration with a research associate, supervised by senior researchers from the marketing department Prof. J. Boter and Prof. H. van Herk. Consortium partners are involved in input on research direction, participation in real-life experiments and involvement in data gathering/analysis. We will employ a number of MSc students to conduct their thesis projects in this area.MSc projects are used to link the scientific content of the project to practice. Students will be active in several areas: the exploration of the field (via case studies in e-commerce companies), the gathering and analysis of data (e.g. marketing surveys, transaction data) and the actual implementation of results in companies (also through case studies at e-commerce companies). Each year 3-4 students will write their Master thesis on a topic from this WP. Students will be selected early January by the research team from the existing MSc students in Marketing and in Transport & Supply Chain Management at VU University Amsterdam.  |
| Expected results/deliverables/milestones:* Insight into consumer preferences that relate to assortment variety dependent on attributes of the consumer, product and situation considered.
* Guidelines for location and allocation of stock dependent on customer characteristics.
* Dynamic pricing tool for pricing items dependent on stock strategy (e.g. inventory depletion), consumer characteristics and product attributes.
* PhD thesis.
* 10-15 MSc theses.
* 3 scientific papers.
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| Activity 3: Order-to-Delivery Coordination Architecture |
| Description:This workpackage focuses on the design and implementation of an ICT architecture for functional software components to support effective and innovative logistics networks for on-line retailing. The architecture goes beyond what current standard packaged web shop architectures deliver in offering support for pluggable components that implement innovative algorithms and decision support processes. The architecture as such is a means for testing R&D efforts done in workpackage 1 and 2. Moreover, the architecture is a research deliverable itself, as it incorporates the idea of combining various Software as a Service offerings into a versatile environment replacing traditional software packages and homegrown systems. Finally, the architecture is a means to valorization of R&D results. **Underlying ICT architecture, software and coordination architecture**Networks in which businesses operate also need to be agile. An agile business network is able to respond to largely unpredictable changes rapidly with ease (Van Oosterhout et al., 2006). This requires both the organizations in the network and their horizontal and vertical connections to their business partners to be highly adaptable. Few business environments equal the hypercompetitive environment of online-retailers. Globalization, security threats, fierce price competition, high service demand by customers, decreasing loyalty and an increasing number of return shipments are among the challenges online-retailers face. However, to those providers that find successful strategies online selling can be rewarding as scalable business models can be implemented and innovated. The wealth of data for analysis and execution of on-line strategies available to the retailer is unprecedented in the offline world.While agile logistic networks have been described in several conceptual studies, the lack of suitable ICT support has been a key hindrance to their success in practice. Traditional ICT support for connecting the nodes in business networks has been limited to (often cumbersome) static horizontal and vertical integration of enterprise systems (White et al., 2005). The ICT links established are usually limited to coordination and control at the operational level in the context of fixed collaboration patterns. Only large and globally operating providers have reached a high level of agility at considerable cost and by years of R&D (e.g. Amazon, Ebay). Such investments are infeasible to the vast majority of online retailers.A promising ICT development that can bring formerly too expensive network integration technologies to online retailers are SOA and Cloud computing. Over the last few years, several promising technologies have emerged that may enable micro sourcing of services to create agile logistic business networks(e.g. see van Hillegersberg (2004) for an early prototype of webservice based micro-sourcing in logistics). Service Oriented Architectures (SOA) have started to open up previously unreachable functionality of legacy systems within the enterprise or of formely closed software packages. SOA allows software package vendors to renew their applications into a more open architecture (Allen, 2006). Also, SOA enables specialized vendors to deliver niche services that offer a specialized service that can be integrated easily. Moreover, the emerging stack of cloud technologies (Infrastructure as a Service IAAS, Platform as a Service PAAS, and Software as a Service SAAS) allows enterprises to radically or gradually adopt a flexible service sourcing model (Martson et al., 2011). Services required by the business are acquired based on a pay-per-use rental model. Through flexible contracts services may be sourced quickly and swopped dynamically.In the area of online-payments these developments already have an impact on the on-line retail world. Early web shops used to spend considerable time and effort on building payment gateways to credit card companies and banks to enable online payment. In recent years this role has been replaced by a growing number of payment service providers (PSPs). PSP’s exclusively focus on providing online payments. They can be easily integrated to a web shop frontend and offer seamless integration to payment mechanisms such as Maestro, Visa, IDEAL, Paypal, etc. PSP’s also operate as SAAS, charging the online retailer a small and variable fee based on the transaction volume. The success of the PSPs demonstrates that on-line retailers prefer to focus on their core business, as long as other services can be easily sourced without lock-in and at low cost. Virtually no on-line retailer is still developing and hosting its payment services by himself.However, in the area of on-line logistics the SAAS Model has not yet advanced so rapidly. Granularity of the current ICT offerings are at the level of entire catalogue based web shops inclusing catalogue management, price lists, basic CRM, ERP and WMS functionality etc. While these software systems will quickly enable an offline retailer to start an online web shop, they will not include more advanced logistics execution mechanisms based on the latest research. This research studies the viability of an agile architecture for on-line retail logistic networks. The architecture will use the potential of SAAS to allow fine grained and innovative logistic services to be developed, tested and implemented (e.g. see Hoyer, 2008). The next section describes the components we plan to develop in this research in more detail.**An agile architecture for on-line retail logistic networks**The key objective of the pluggable online-retail logistics architecture is to deliver components that embed data analysis and visualization techniques and decision support. We are not aiming at replacing current packaged on-line retail platforms. Rather, we offer a reference architecture and proof of concept including sample web-based components for:* Advanced analysis of historical buying patterns and supply chain performance taking geographical data, pricing, marketing and logistic decisions into account. The component enables online-retails to analyze transaction data jointly with business partners (e.g. logistic service providers, on-line marketing agencies) to build knowledge about their customer segments, geographical spread and product assortment. (This component builds on the knowledge created in WP1)
* Real-Time decision support for stock allocation decisions. The ICT architecture will visualize location of stock throughout the delivery network and will incorporate decision rules to enable collaborative delivery decisions. Through social media communications, various parties can be involved in the solution scenarios and decision making group. E.g. the end consumer, logistic service provider, wholesaler and even producer can be part of arriving at the most cost effective and convenient delivery setup. Obviously, the complexity and value that can be created in such a process depend on several factors such as the type of product, its value and the type of consumer. (This component builds on the knowledge created in WP2)
* Case-based and Real-Time decision support for dynamic pricing policies. While it is generally known that dynamic pricing can have substantial benefits for logistic efficiency through better use of capacity and “peak shaving”, knowledge and infrastructure to enact dynamic pricing strategies are only available to a few advanced and large volume on-line retailers. Even these forefront players have difficulty in enacting a truly dynamic pricing strategy. Often historical data analyses and forecast are only periodically made and no fine grained analysis for specific product categories or customer segments is conducted. (This component builds on the knowledge created in WP2)
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| Planning:2013* Starting WP3 by reviewing relevant literature on agile logistic service networks and supporting ICT architectures
* Phd candidate is trained in methodological and conceptual issues (UT, BETA, DINALOG, ERIM, and other PhD courses).
* Creating an overview of current e-commerce software vendors, their functionality, openness and architecture
* Deliver a report for Dinalog on current ICT support for e-commerce from a client and vendor perspective focusing on logistics and fulfillment processes
* Organize first ICT vendor and user workshop

2014* Writing first research paper on ICT support for online retail.
* Collaborating with WP1 and WP2 to study current theories and best practices
* Performing a gap analysis between functionality implemented, functionality in use and latest theoretical concepts (with a focus on coordination and control in the business network) in collaboration with ICT vendors
* Organize second ICT vendor and user workshop

2015* Writing a research paper on current use and opportunities for SAAS in web shop logistics
* Designing and evaluating the agile architecture for e-commerce logistics, including (a) the services for historical geo-data analysis and visualization, (b) services for logistic inventory location and (c) services for dynamic pricing and deliveries/returns.
* Organize third ICT vendor and user workshop

2016* Complete PhD thesis, validate results and publish main result in scientific journal paper
* Organize final ICT vendor and user workshop
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| Work distribution:The work in this WP is done by the Ph.D. candidate and senior researchers. Primary supervision of the Ph.D. candidate is done by the promotor Prof. Jos van Hillegersberg and co-promotor Dr. Maria Iacob. Prof. van Hillegersberg will act as WP leader. Dr. Martijn Mes will be involved to contribute to translating the logistics concepts into agile service based ICT architectures.MSc projects are used to link the scientific content of the project to practice. Students will be active in several areas: the exploration of the field (via case studies in e-commerce companies), the gathering and analysis of data (e.g. marketing surveys, transaction data) and the actual implementation of results in companies (also through case studies at e-commerce companies). Each year 3-4 students will write their Master thesis on a topic from this WP. Students will be selected early January by the research team from the existing MSc students in Industrial Engineering and Business Information Systems at University of Twente.  |
| Expected results/deliverables/milestones:* Insight into current practices, ICT packaged software and its benefits and limitations and the gap with state of the art architectures and theories
* A proof of concept agile architecture for logistic business network coordination including the pluggable service components described
* An evaluation of the architecture and future roadmap. Elements of the architecture will be further developed by ICT vendors or by independent service providers that can be launced in the Dianlog incubator
* PhD thesis and at least three journal papers on the topic of WP3.
* 10-15 MSc theses.
* 3 scientific papers.
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| Activity 4: Valorization |
| Description:In this WP we focus on the valorization of findings from WP 1, WP2 and WP3. The objective of the CATeLOG project is to further professionalise the e-commerce sector. This is facilitated by scientific and business developments regarding consumer preferences, business models and concepts and ICT architectures and applications. The results of the project will be translated in working solutions at participating companies and into services that may be provided by new companies. Consortium partners have stressed the relevance of a focus on applications of the scientific results. Hence, we expect good support from consortium partners. In our project we also aim to involve companies from the start using real-life experiments as this may contribute to the widespread use of our results.We envision valorization in several ways:1. Implementation of models and tools developed

The PhD students and the MSc students will be involved in not only developing the solutions and tools but also in implementing these solutions in practice at the participating companies. Testing and obtaining feedback on solutions and tools is essential for further improving the quality of solutions and tools1. Support and active encouragement of new ventures

One company has already expressed interest in exploiting the possibilities of geographical information systems in the area of consumer demand and logistics requirements. We also expect that there will be possibilities to commercialize the models and software we will develop for dynamic pricing. There are also possibilities in the area of setting up new 4C activities as well as consulting and advice on cross-chain collaboration in e-commerce.1. Demonstration projects in the near future

We will examine opportunities for setting up demonstration projects in the near future together with partner companies as well as other interested companies.ICT tools play a vital role in our project. We do have ICT capacity among partners in our consortium and we plan to organize workshops with these companies throughout the project with the aim to:* Challenge companies to implement concepts and further develop these into demonstration projects.
* Present to and discuss with project members regarding ICT tools on a regular basis (at least three times per year).

We furthermore plan to hold annual gatherings for software vendors in the e-commerce market to discuss project results.We will develop a valorization plan before the end of 2012, encompassing the activities that we will undertake in the 4 years of the project. Valorization is one of the indicators of success of our project and therefore the manager of the valorization work package will report quarterly on the progress of valorization.  |

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| Planning:* Start: end of 2013
* Completion: December 2016
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| Work distribution:Dr.ir. J.P. van den Berg (WP Leader)Prof.dr. J. Boter (representing WP1)dr.ir. S. de Leeuw (representing WP2)prof.dr. J. van Hilligersberg (representing WP3) |
| Expected results/deliverables/milestones:* Valorization plan in 2013.
* Yearly action plan (to be updated yearly for the next year).
* Progress reports every quarter.
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| Activity 5: Knowledge Dissemination |
| Active knowledge dissemination is focused on informing our stakeholders as thoroughly as possible. We intend to disseminate knowledge in the project via the following means:1. Show progress of work via social media and websites:

We will set up a facebook page, maintain a weblog and a website containing information and relevant documentation of the project and (interim) project results (responsibility: research team).1. Make results available to practitioners in the Netherlands and Europe in writing:

We will publish intermediate results in national and international professional magazines (Logistiek.nl, Supply Chain Magazine in the Netherlands but also abroad: Business Logistics in Belgium, Logistik Heute in Germany or via the European Logistics Association ELA). We will publish on a weblog connected to the CATeLOG website. We also intend to develop at least one white paper per work package per year that is focused on practitioners. We will also publish results in periodicals of branch organizations such as thuiswinkel.org (responsibility: research team).1. Organize practitioner-oriented seminars and workshops:

We will organize a seminar for practitioners at least once per year where we will present work in progress with interested organizations. We will furthermore invite consortium partners to progress meetings every quarter to facilitate and discuss knowledge dissemination, to identify progress and to indicate opportunities (responsibility: research team and consortium partners). 1. Make results available in academic journals and proceedings:

Researchers will publish results in journals and present results at both operations management and marketing conferences (responsibility: research team).1. Share results with institutes (or instances) in the Netherlands and abroad that represent e-commerce companies, such as the international variant of Thuiswinkel.org (which is currently being set up) and EMOTA (European Multi-channel and online trade association; responsibility: research team and consortium partners).
2. Perform an annual benchmark study:

Part of WP1 is to set up an annual benchmark study, which will be used to identify best practices in e-commerce; results will be made available to participants and other interested parties (responsibility: research team and consortium partners).1. Develop teaching materials:

We aim at developing Harvard Business type case studies and other teaching materials towards the second half of the project. We envision that a first draft of these case studies can be made by MSc students together with their supervisors, as part of their MSc thesis. We also aim at developing written course documentation on e-commerce logistics for Dutch and international higher professional education (responsibility: research team)We will develop a knowledge dissemination plan before the end of 2012, encompassing the activities that we will undertake in the 4 years of the project, with a focus on the coming year. This plan will be revised at least once a year. |
| Planning:* Start: September 2012
* Completion: December 2016
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| Work distribution:* prof.dr. J. Boter (WP leader and representing WP1)
* dr.ir. S. de Leeuw (representing WP2)
* prof.dr. J. van Hilligersberg (representing WP3)
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| Expected results/deliverables/milestones:* Knowledge dissemination plan before the end of 2012
* Action plan for year 1 (to be updated yearly for the next year)
* Progress reports every quarter
* Annual workshop with interested (partner and non-partner) companies and institutes as well as quarterly meetings with partner companies and institutes
* White papers and trade journal articles
* Benchmark results
* Educational materials, particularly for HBO, but also including academic teaching cases.
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Planning

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| Below we provide an overview of the overall project plan of CATeLOG. Details of the project plan can be found in the individual activity descriptions above. |

1. **Consortium and Project Organization**

Research Team

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| Short CVs of the scientific researchers are included as Annex. |
| **Partner’s name** | **Role and input** | **Specific competence** |
| **VU University** | **Coordinator, project management, input in WP1, WP2, WP4, WP5** | **Marketing and logistics** |
| Dr.ir. S. de Leeuw  | Project coordinator, WP2 leader | Operations management & logistics |
| Prof.dr. J. Boter | WP5 leader, WP1 & WP2 | Marketing |
| Dr. S. Bhulai | WP2 | Operations research |
| Dr.ir. J.P. van den Berg | WP1 leader & WP4 leader | E-commerce logistics |
| Prof.dr. H. Van Herk | WP1 & WP2 | Marketing |
| PhD student | WP1 | E-commerce logistics |
| PhD student | WP2 | E-commerce logistics |
| Research associate | WP1 & WP2 | Marketing |
| **University of Twente** | **Input in WP3, WP4, WP5** | **ICT and supply chain** |
| Prof.dr. J. van Hillegersberg | WP3 leader | ICT for supply chain |
| Dr. M. Mes | WP3 | Transportation Planning & ICT |
| Dr. M. Iacob | WP3 | ICT architecture |
| PhD student | WP3 | ICT architecture for logistic networks |
| **Companies** | **Input in WP1, WP2, WP3, WP4** |  |
| Mr. J. Peters | Blokker | Multi-channel retail |
| Mr. D. Groeneweg | Centric IT Solutions | ICT systems and architectures, particularly assortment related |
| Mr. R. de Jong | Cool Cat | Multi-channel retail |
| Mr. A. Groenendal | De Bijenkorf | Multi-channel retail |
| Mr. T. Cieraad | E-ways | 3PL Fulfilment |
| Mr. H. van Mil | Geodan BV | Geographical information systems |
| Mr. M.L.G. Gelissen | Nic Oud | 3PL Fulfilment |
| Mr. B. van der Krogt | PostNL | Parcel delivery, particularly in relation to customer service and assortment planning |
| Mr. A.H. van de Scheur | VDS Fulfilment | 3PL Fulfilment |
| Mr. B. Hoogewind | WDM Nederland BV | Consumer data (for WP1 and 2) |
| Mr. F. Jantze | WICS | ICT systems and architectures |
| **Organizations** | **Input in WP5** |  |
| Mr. N. van Essen | vLm community e-commerce  | Knowledge dissemination |
| Mr. J. van Hek | LogiXperience | Knowledge dissemination |

Project organization

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| The project is coordinated by VU University and supervised by a project board. We have based our project organization on Prince II project management principles. We defined the following structure for the project:The project board consists of two representatives of the participants (to represent the user perspective), a representative from Dinalog (to represent the business perspective, i.e. the extent to which goals are met). Furthermore the project board consists of a scientific member representing science (prof.dr. W.E.H. Dullaert). The project manager reports to the project board. We intend to hire a research associate to support the marketing reseach in the first 2 years of the project in WP1 and WP2. Part of the work of this research associate may also involve writing teaching cases.Details of the organizational roles described above are further described below

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| Organization | Team lead | Members |
| Project Board | Prof.Dr. W.E.H. Dullaert | Representative company 1Representative company 2Representative UTRepresentative Dinalog |
| Project manager | Dr.Ir. S. de Leeuw | Vacancy (project support) |
| WP1 | Dr.ir. J.P. van den Berg | Prof.dr. J. BoterProf.dr. H. van HerkVacancy (PhD student)Vacancy (research associate) |
| WP2 | Dr.ir. S. de Leeuw | Dr. S. BhulaiProf.dr. J. BoterProf.dr. H. van HerkVacancy (PhD student)Vacancy (research associate) |
| WP3 | Prof.dr. J. van Hillegersberg | Dr. M. MesDr. M. IacobVacancy (PhD student) |
| WP4 | Dr.ir. J.P. van den Berg | Prof.dr. J. BoterDr.ir. S. de LeeuwProf.dr. J. van Hillegersberg |
| WP5 | Prof.dr. J. Boter | Dr.ir. S. de LeeuwProf.dr. J. van Hillegersberg |

The teams in the three work packages meet at least every quarter to discuss progress and achievements and to exchange information. This information is then used for the project board meetings that are planned shortly after the project meetings. |

1. **Evaluation and Monitoring**

Evaluation

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| We will monitor and evaluate the progress of this project within the university in line with regular evaluation processes, in work group meeting and in the project board. We will submit a yearly progress report to Dinalog.Each PhD project follows the evaluation process that is standard at universities. The postdoc is evaluated each year. For each work packages we organize a meeting every quarter where we discuss progress of each of the projects and the extent to which the results will be achieved, as well as issues such as delays or changes in plans. This quarterly meeting also ensures that relevant information is shared, in particular with respect to empirical data for case studies and tools that can be implemented. The progress information from this meeting is one of the inputs for the project board meeting. Consortium partners are also invited for these progress meetings to check the extent to which project progress and deliverables keep being aligned with the interested of the consortium.As indicated under ‘organization’ above we will set up a project board with representatives from the companies and universities involved, and we will invite a director from Dinalog. The project board meets 4 times a year shortly after the quarterly project meetings. The key role of the project board is to ensure that the Dinalog objectives are met and to discuss proposed changes in schedule and plan.In each work package, the work package leader and the PhD student involved are responsible for developing a project plan that includes milestones. Prince II project management principles will be used as much as possible for developing and monitoring the project plan. For each work package we plan to set up four key indicators to monitor and evaluate progress: a financial indicator, a schedule adherence indicator, an achievement indicator and a valorization indicator. The financial indicator identifies the extent to which the financial budget and resources budget are met. The schedule adherence indicator identifies to which extent the milestones defined in the project are actually met and whether delays are expected in meeting future deadlines. The achievement indicator identifies to which extent the deliverables identified in the work package project plan are achieved and to which extent the business effects of the deliverables (revenue, efficiency, new venture creation) are achieved. The valorization indicator focuses on identifying opportunities for generating new business. These opportunities are then discussed with the steering group (see part E below as well). Every quarter, the work package project leader writes a brief report with a description of the three indicators incorporated, which will be used by the overall project leader in the project board. Every progress report will contain a section with input from the consortium partners on progress to evaluate expected added value for practice from the perspective of consortium partners. |

1. **Valorization and Implementation Strategy**

Valorization and knowledge dissemination

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| Project ValorizationValorization is a separate work package. The progress of valorization is captured for WP1/2/3 by making it an explicit evaluation/monitoring indicator for these work packages (as described above). We expect that there are several opportunities for generating new business based on this project.One of the consortium partners has for example expressed interest in commercializing a geographic information tool that maps logistics needs. Based on the deliverables defined above we expect that at least 3 such new venture initiatives can be started. Where applicable we will make use of Dinalog incubator possibilities as much as possible.Valorization is further described in WP4 (see above).Knowledge DisseminationWe intend to disseminate our knowledge via several media. We will set up a facebook page and a web page where those interested can follow the endeavours of the project. We will organize events, such as a yearly e-commerce logistics event where practitioners and academics can meet. We have quarterly project team meetings where both researchers and companies meet to discuss progress but also exchange knowledge. We will furthermore develop written materials for academic purposes and for educational purposes, both focused at practitioners and at students.Knowledge dissemination is further described in WP5. |

Implementation

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| Implementation pertains to applying and using models, concepts and tools developed in the project. First and foremost, PhD students and their supervisors are involved in implementation. In the first projects that will be performed the emphasis will be put on analyzing the current situation. Once methods and tools have been developed, PhD students will test and apply their findings in practice. Implementation of project results will also take place via MSc projects. Student projects will focus on specific situations of companies, probably dealing with a variety of marketing, logistics control and information issues. In these projects we will identify issues and apply knowledge developed in the project and receive feedback on what works and what does not. Field-testing is essential to developing workable solutions and facilitates their adoption. We have broad experience in our research team with applied research and collaboration with industry. We furthermore have a strong consortium of best in class companies at our disposal to help with implementation issues. We will perform projects with our consortium partners as a start but we expect to extend this to other partners as well. Consortium partner companies have priority and preferential treatment but the test of certain concepts and tools may require a broader application than just the consortium partners. The first projects with companies will be exploratory in nature. Only in year 2 and onwards we expect to be able to start testing and implementing ideas in practice. For that reason we will develop a detailed implementation plan towards the end of 2013. |

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**Annex Short Researcher CV’s**

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| **Jeroen van den Berg** |
| **Short CV**Jeroen van den Berg is director of Jeroen van den Berg Consulting. He is expert in e-commerce and warehouse management. In addition to his work as a consultant, he is active as trainer, author, researcher and public speaker. He holds a part-time position at the VU University. Jeroen van den Berg is the author of the book *Highly Competitive Warehouse Management* (2012). In this book, he has developed a multi-disciplinary approach for establishing best-in-class warehouse management. The approach considers the whole of strategy, organization, processes, control, behavioral change, information systems and collaboration in the supply chain. The approach is successfully used by various companies.In 1996, Jeroen van den Berg earned a PhD degree from the University of Twente with his thesis “Planning and Control of Warehousing Systems”. He holds an MSc in Applied Mathematics from the same university.  |
| **5 recent publications and projects**1. J.P. van den Berg, *Highly Competitive Warehouse Management*, Management Outlook, Buren, The Netherlands, 2012.
2. S. de Leeuw and J.P. van den Berg, Improving operational performance by influencing shopfloor behavior via performance management practices, *Journal of Operations Management*, 29, pp. 224-235, 2011.
3. J.P. van den Berg, *Integral Warehouse Management,* Management Outlook, Utrecht, The Netherlands, 2007.
4. J.P. van den Berg, F. Boumans, H. Kapelle, D. Kooij-IJkema, H Leenaars, E. Peet & W. Stel, *Best Practices in Logistieke Prestatie-indicatoren*, Vereniging Logistiek Management, 2006.
5. Various consulting projects on logistics for e-commerce companies, including Wehkamp.nl, E-ways, VDS Fulfilment, Nic Oud and Micromedia.
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| **Sandjai Bhulai** |
| **Short CV**Sandjai Bhulai is an associate professor in Applied Probability (Stochastic Operations Research) at VU University Amsterdam. He is co-founder of the Amsterdam Center of Business Analytics, which aims at developing, disseminating and exploiting business analytics knowledge and applications by bringing together businesses and scientific research. Sandjai graduated in 1998 with an M.Sc. degree in both “Mathematics” and “Business Mathematics and Informatics” at VU University Amsterdam. He carried out his Ph.D. research on “Markov decision processes: the control of high-dimensional systems” at the same university. In the academic year 2002-2003, he was a postdoctoral researcher at Lucent Technologies, Bell Laboratories (USA) as NWO Talent Stipend fellow. Sandjai’s primary research interests are in the general area of stochastic modelling and optimization, in particular, the theory and applications of Markov decision processes. His favorite application areas include telecommunication networks, call centers, logistics and health care. He is currently involved in the control of time-varying systems, partial information models, dynamic programming value functions, approximate dynamic programming, and reinforcement learning. His passion for research is also reflected in his teaching for which he received the “Excellence in Teaching Award” for best lecturer of both the faculty and the university in 2006/2007.Education: VU University Amsterdam, Mathematics (M.Sc., 1998) and Business Mathematics and Informatics (M.Sc., 1998); VU University Amsterdam, The control of high-dimensional systems using Markov decision processes (Ph.D., 2002). |
| **5 recent publications**1. R. Meijer and S. Bhulai (2012). “Optimal pricing in retail: a Cox regression approach”. *Proceedings of the Colloquium on European Retail Research*, May 2012. Nominated for Best Paper Award.
2. P.M. Koeleman, S. Bhulai, and M. van Meersbergen (2012). “Optimal patient and personnel scheduling policies for care-at-home service facilities”. *European Journal of Operational Research*, 219(3):557-563. Special issue on Operations Research in Healthcare.
3. S. Bhulai, G.J. Hoekstra, J.W. Bosman, and R.D. van der Mei (2012). “Dynamic traffic splitting to parallel wireless networks with partial information: a Bayesian approach”. *Performance Evaluation*, 69(1):41-52.
4. R. Yang, S. Bhulai, and R.D. van der Mei (2011). “Optimal resource allocation for multi-queue systems with a shared server pool”. *Queueing Systems*, 68(2):133-163.
5. Roubos and S. Bhulai. “Approximate Dynamic Programming techniques for the control of time-varying queueing systems applied to call centers with abandonments and retrials”. *Probability in the Engineering and Informational Sciences*, 24:27-45.
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| **Jaap Boter** |
| **Short CV**Prof. dr. Jaap Boter studied Musicology (MA) at Utrecht University. Having worked for a number of years as a consultant and lecturer of Arts Marketing at Utrecht University, he switched to the Marketing Department of the VU University Amsterdam in 2001 as assistant professor, to complete his PhD research into analyzing large scale consumer transaction data of cultural organizations, such as theater box office data, museum visiting behavior of Dutch Museum Card holders, and borrowing data of public library patrons. While GIS originally was simply included to map the customers in the data, his enthusiasm for the potential of GIS techniques grew rapidly and became an important foundation of his research. He set up a course on GeoMarketing for the MSc Marketing program and is one of the founding partners of the Geomarketing Knowledge Center, in which the departments of Marketing, Logistics and Spatial Economics join several partners from industry to carry out research on the interface of customer service, distribution & warehousing, and spatial/geographical data. Next to his work at the VU University Amsterdam, Jaap Boter also holds the Royal Booksellers Association chair on Book Trade at the University of Amsterdam; a field in which, again, his interest in culture, business economics, retail and logistics, and location, all come together. |
| **5 recent publications**1. Bijvank, Marco, Iris F.A. Vis and Jaap Boter (2012), “Network assortment planning with customer choice modeling”, Working paper.
2. De Leeuw, S., Boter, J., Jasper, D. (2012), “Consumer Do-It-Yourself repair: expectations and supply chain considerations”, Working paper VU University Amsterdam, The Netherlands: Amsterdam.
3. Wruck, Susanne, Iris F. A. Vis, and Jaap Boter (2012), “Time-restricted Batching Models and Solution Approaches for Integrated Forward and Return Product Flow Handling in Warehouses” (under review).
4. Verhagen, Tibert, Jaap Boter, and Thomas Adelaar (2010), “The Effect Of Product Type On Consumer Preferences For Website Content Elements: An Empirical Study”, *Journal of Computer-Mediated Communication*, 16, pp. 139-170.
5. Roodbergen, Kees Jan, Iris F.A. Vis and Jaap Boter (2010), “Design of Cross-Chain Internet Order Fulfillment Centers”, in: Ellis, Kimberly, et al., *Progress in Material Handling Research*. Charlotte (NC), The Material Handling Institute.
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| **Hester van Herk** |
| **Short CV**Hester van Herk is Fenna Diemer Lindeboom chair of Cross-Cultural Marketing Research and Program Director of the Bachelors of Business Administration and International Business Administration at VU University Amsterdam. Before joining VU University in 2000 she was on the Faculty of Tilburg University working on cross-cultural and international marketing research projects. Her main research interests are in the effects of cultural differences and similarities on consumer behavior in developed and emerging markets and in research methodology providing insight into differences and similarities between survey responses from consumers in different nations and cultural groups. After obtaining her MSc, she worked in business for several years. She worked as a scientific researcher at Statistics Netherlands (CBS) and as a statistical software consultant at Solvay Duphar where she developed statistical software tools. Then she specialized in marketing and worked as a marketing research consultant at ABN Amro where she ran projects to segment the banks’ consumer market. Before returning to academia, Hester worked as a methodologist at the marketing research agency MarketResponse, where she coordinated and performed large scale national and international marketing research projects. She is currently running projects on segmenting consumers in many countries worldwide in order to better predict consumer behavior. For this she uses innovative methods such as multilevel modeling, archetype analysis, and advanced latent class models.Education: Leiden University, the Netherlands, Psychology with a major in research methodology and minors in social and organizational psychology and in mathematics (MSc, 1986); Tilburg University, the Netherlands, Equivalence in a cross-national context: methodological & empirical issues in marketing research (PhD, 2000). |
| **5 recent publications**1. Van Herk, Hester and Ype H. Poortinga, “Current and historical antecedents of individual value differences across 195 regions in Europe” *(forthcoming)*
2. Van Rosmalen, Joost, Hester van Herk, and Patrick J.F. Groenen (2010), “Identifying Response Styles: A Latent-Class Bilinear Multinomial Logit Model” *Journal of Marketing Research,* 47(1), 157-172.
3. Nijssen, Edwin J. and Hester van Herk (2009), “Conjoining International Marketing and Relationship Marketing: Exploring Consumers' Cross-Border Service Relationships”, *Journal of International Marketing*, 17(1), 91-115.
4. Van Herk, H., Y.H. Poortinga and Th.M.M. Verhallen (2005), “Equivalence of Survey Data Relevance for International Marketing”, *European Journal of Marketing*, 39(3/4), 351-364.
5. Van Herk, H., Y.H. Poortinga and Th.M.M. Verhallen (2004), “Response Styles In Rating Scales: Evidence of Method Bias in Data from 6 EU Countries”, *Journal of Cross-Cultural Psychology*, 35(3), 346-360.
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| **Jos van Hillegersberg** |
| **Short CV**Jos van Hillegersberg is head of department and professor of Business Information Systems at School of Management & Governance, University of Twente. He is program director of the Business Information Technology BSc and MSc programs. Before joining the UT in 2005, he was on the faculty of the Rotterdam School of Management, Erasmus university for 15 years, working on component based software systems, IT management, global outsourcing and agent systems for supply chains. He is interested in the effects of new IT services on supply chain integration, and studies the Development and adoption of inter-organizational systems from a business and socio-technical perspective. He is currently involved in several research projects studying new ICT concepts for agile logistics business networks. He is leading the ICT workpackage in the Dinalog 4C4More project. He was project and theme leader of the nationally funded projects Transumo (transition to sustainable supply chains). As project leader of the Transumo Distributed Planning and Optimization with Multi-agent technology he initiated and conducted several research projects with the port of Rotterdam, Shell and Merba on the benefits of multi-agents for sustainable logistics. Other project he participated in are Software Mass Customization, the EU projects ECOSPACE (on future workspaces for virtual collaboration) and Myotel (on adoption of wireless sensor networks for Healthcare). He also worked for several years in business. At AEGON he was component manager for the setup of an Internet Bank. He worked at IBM on artificial intelligence and expert systems. He is currently running projects on improving collaboration in business networks using innovative ICT such as agent technology.Education: Leiden University, Computer Science (MSc, 1991); Erasmus University Rotterdam, Meta-modelling based integration of OO (PhD, 1997) |
| **5 recent publications**1. Folmer, E., P. Oude Luttighuis, and J. van Hillegersberg. 2011. “Do Semantic Standards Lack Quality? A Survey Among 34 Semantic Standards.” *Electronic Markets*: 1–13.
2. Kotlarsky, J., Oshri, I., Kumar, K. & Hillegersberg, J. van (2008). Towards agility in design in global componentbased development. *Communications of the ACM*, 51(9), 123-127.
3. Hillegersberg J. van, Boeke R, van den Heuvel W.J., (2004), Potential of Webservices to enable smart business networks, *Journal of Information Technology,* 19(4): 281-287
4. Hillegersberg, J. van, Zuidwijk, R., van Nunen, J.E.A.A., van Eijk, D., Supporting return flows in the supply chain, *Communications of the ACM*, June 2001, vol. 44, no. 6. p. 74 – 79
5. Kumar, K. and van Hillegersberg, J., ERP Experiences, *Communications of the ACM*, April 2000, vol. 43, no. 4. 23-26
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| **Maria Iacob** |
| **Short CV**Maria-Eugenia Iacob is currently assistant professor at the department of Information Systems and Change Management, at the University of Twente. Previously she worked as scientific researcher at Telematica Instituut (2000-2006). She holds a Ph.D. degree in Mathematical Analysis from the University Babes-Bolyai of Cluj-Napoca, Romania. She has done research in the areas of (enterprise) information systems architecture design and analysis, service-oriented architectures, model driven development, model transformations, e-services architectures, e-government, business process (re)engineering and management, and business modelling.Her research interest include:* Business Process Integration and Management
* Data and Process Interoperability of distributed enterprise applications, inter-organizational integration
* Enterprise Architectures: Methods, modeling and (quantitative) analysis
* Business, Goal, and Value modeling, electronic commerce and networked business
* Business Intelligence and Data Models
* Service-Orientation and Model-driven Design
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| **5 recent publications**

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| 1. Meertens, L.O., M.E. Iacob, L.J.M. Nieuwenhuis, A method for business models development, In B. Shiskov (editor*), Business Modelling and Software Design*, Volume 109 of Lecture Notes in Business Information Processing, pages 113–129. Springer Berlin Heidelberg, 2012.
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| 1. Engelsman, W., Jonkers, H. Franken, H.M. and Iacob, M.E. (2009), Architecture-driven requirements engineering. In Erik Proper, Frank Harmsen, and Jan L. G. Dietz, editors, *Advances in Enterprise Engineering II*, Volume 28 of Lecture Notes in Business Information Processing, pages 134–154. Springer Berlin Heidelberg, 2009.
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| 1. Iacob M.-E., Rothengatter D., van Hillegersberg J. (2009). A Health-care Application of Goal-driven Software Design. *Applied Medical Informatics*, 24(1-2):12-33.
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| 1. Iacob, M.E., H. Jonkers, A Model-driven Perspective on the Rule-based Specification of Services, *Enterprise Information Systems*, Volume 3, Issue August 2009 , pages 279 - 298.
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| 1. Iacob, M.E., H. Jonkers, M. Lankhorst, M. Steen, Service-oriented enterprise modelling and analysis: a case study, *International Journal of Business Process Integration and Management*, 2007 - Vol. 2, No.1 pp. 26 - 37.
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| **Sander de Leeuw** |
| **Short CV**Sander de Leeuw is an associate professor of logistics in the department of Information, Logistics & Innovation at the Faculty of Economics and Business Administration at VU University in Amsterdam. He is the coordinator of the MSc program in Transport and Supply Chain Management. Prior to joining VU University, he held positions at MIT’s Center for Technology, Policy and Industrial Development (USA), at Babson College (USA), at Eindhoven University of Technology (Netherlands) and more recently at the MIT-Zaragoza logistics program in Zaragoza (Spain). He was also employed as a management consultant at amongst others KPMG. He is a guest lecturer in the executive supply chain education program at the University of Pretoria in South Africa.Upon completing his PhD in 1996 Sander was a researcher at the International car distribution programme (ICDP), a program similar to the International Motor Vehicle Program at MIT. He then spent nearly 10 years in industry, as a management consultant in the area of logistics and supply chain management at different companies, including his own company. During this time Sander was amongst others a team leader of one of the nationally funded Connekt projects on supply chain collaboration in the chemical industry in 2003. He has held a part-time position at VU University since 2004 and a full-time position at VU University since 2008.Sander is interested in best practices research in supply chain management and is focused on empirical research methods. Sander has an MSc (1992, cum laude) and a PhD (1996) in Industrial Engineering/Management Science from Eindhoven University (the Netherlands). |
| **5 recent publications**1. Leeuw, S. de, Boter, J., Jasper, D. (2012). “Consumer Do-It-Yourself repair: expectations and supply chain considerations”, *Working paper VU University Amsterdam*, The Netherlands: Amsterdam.
2. Leeuw, S. de, and J.P. van den Berg, (2011). Improving operational performance by influencing shopfloor behavior via performance management practices, *Journal of Operations Management*, vol 29(3), pp. 224-235.
3. Leeuw, S. de, M. Holweg and G. Williams, (2011). The impact of decentralised control on firm-level inventory: evidence from the automotive industry *International Journal of Physical Distribution and Logistics Management*, vol 41(5), pp. 435-456.
4. Leeuw, S. de, and J.C. Fransoo, (2009). Drivers of close supply chain collaboration: one size fits all? *International Journal of Operations & Production Management*, 29(7), 720-739.
5. Dijk, E. van, S. de Leeuw and P. Durlinger (2007). *Voorraadbeheer in Perspectief: Zeven Invalshoeken van het Vak*, Slimstock, Deventer, 147 pp. (In Dutch).
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| **Martijn Mes** |
| **Short CV**Martijn Mes is an assistant professor within the department Industrial Engineering and Business Information Systems at the University of Twente (Enschede). He holds an MSc in Applied Mathematics (2002) and did his PhD at the School of Management and Governance, University of Twente (2008). Martijn’s main activities are (i) giving lectures for master and bachelor students, (ii) assisting graduate students, (iii) doing research and project work. Martijn provides the following courses: Simulation, Warehousing, Management of Technology, Supply Chain and Transportation Management, Stochastic Models for Operations Management, Project Process Control and Production Management, Project Production and Logistics Management. His research involves multi-agent systems (MAS), pricing and auctions in freight transport, behavioral issues in freight transport, dynamic vehicle routing problems (VRP & DVRP), AGV routing, ranking and selection problems (R&S), optimal learning, approximate dynamic programming (ADP), simulation optimization, discrete-event simulation, and simulation of logistic systems.  |
| **5 recent publications**1. Mes, M.R.K., W.B. Powell, and P.I. Frazier (2011). Hierarchical knowledge‐gradient for sequential sampling. To appear in *Journal of Machine Learning Research*.
2. Mes, M.R.K., M.C. van der Heijden, and P.C. Schuur (2011). Interaction between intelligent agent strategies for real-time transportation planning. *Central European Journal of Operations Research*, DOI: 10.1007/s10100-011-0230-7.
3. Mes, M.R.K., M.C. van der Heijden, and P.C. Schuur (2010). Lookahead strategies for dynamic pickup and delivery problems. *OR Spectrum* 32(2), pp. 395‐421.
4. Mes, M.R.K., M.C. van der Heijden, and P.C. Schuur (2009). Dynamic threshold policy for delaying and breaking commitments in transportation auctions. *Transportation Research* Part C 17(2), pp. 208‐223.
5. Mes, M.R.K., M.C. van der Heijden, and A. van Harten (2007). Comparison of agent‐based scheduling to lookahead heuristics for realtime transportation problems. *European Journal of Operational Research*, 181, pp. 59–75.
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1. Source: discussions with Thuiswinkel.org. [↑](#footnote-ref-1)