

PROJECT PLAN

Extended Single Window – Information gateway to Europe: New information and governance models in international trade & logistics

final proposal

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Project participants:

Applicant: TNO

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Research Theme Transport Hubs in Control

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Summary

This R&D project will contribute to the added value in supply chain coordination in the Netherlands by increasing supply chain reliability, reducing administrative costs for all stakeholders and improving effectiveness and efficiency of government authorities in dealing with growing logistic flows whilst still meeting various inspection and law enforcement requirements in such areas as security, health, economic, environmental and fiscal controls. The R&D will be influenced by business and government innovations like different governance models as currently supported by the Modernized Customs Code (MCC) and in its turn will drive these business and government innovations. Since coordinated border management is one part of creating an Information Gateway to Europe, seamless integration between the various regimes is also supported.

The Work Packages to conceive these objectives focus on research in:

1. auditing concepts based on technological developments (WP2). A Ph.D. thesis will describe the auditing mechanisms.
2. means of sharing information triggered by logistic events (WP3). It will result in the specification of an IT architecture for governance and information orchestration.
3. a framework describing logistic and government information requirements based on existing developments and analysis of the business models for implementing changes (WP4). On the one hand a framework for information sharing amongst stakeholders will be defined, whereas on the other hand potential business models are given.
4. a Proof of Concept to show that the abovementioned mechanisms will work in practice (WP5).

Additionally, project management (WP1) and valorization (WP6) are identified.

These results allow business to choose in coordination with government authorities a solution that best fits their abilities and needs, show government authorities which functionality they can implement within an EU and global context, and supports Port Community Systems in maximizing their benefits for the Dutch logistics industry at large. All relevant stakeholders cooperate in this project to achieve the abovementioned objectives. The innovativeness is in applying new technology like semantic web, RF-, and event driven technology to achieve the results.

The valorization and implementation strategy is according two lines:

- Knowledge valorisation at ICT and commercial service providers (a. o. customs advice offices). In this line there will be given attention to amongst others open source and COTS providers (Commercial Off The Shelf).
- Dissemination of knowledge amongst shippers and logistic service providers. This group will be subdivided into early adopters, early majority, and late majority.

Knowledge coaches will be assigned as a bridge between scientific research and its practical implementation on two subjects: RF technology and trade facilitation.

1 Orientation and Project Goals (A)

1.1 Motivation

This section lists the major issues that will be solved by these innovations, present our vision on Extended Single Window, and give the relation to the applicable Dinalog theme.

1.1.1 Major issues

This research projects develops solutions to major issues faced by international logistics industry.

Need for seamless and reliable supply chains

Businesses are increasingly operating in a global environment. The main challenge for a modern multinational corporation is to integrate sourcing, manufacturing, sales and marketing, and distribution across countries, even across continents. Businesses achieve this by optimizing their supply chains.

At the same time, government supervision and enforcement authorities, such as customs, police, and quality inspection agencies, have to perform their tasks, while being confronted with new tasks in the area of security, and with new tools and technologies that all have a promise of better data, more accurate data and real time data. The joint aim is to organize this governance function with minimum impact on supply chain planning and execution processes. Supply chains have to be reliable in the way they respond to customer requirements and unexpected disruptions like government controls harm this.

Compliance to revised European coordinated border management procedures

Revision of the EU regulations for coordinated border management in general and customs procedures in particular are progressing. On the one hand it is the objective to simplify customs procedures, whereas on the other hand security has to be safeguarded. The first phase of this revision is completed by the implementation of Regulation 1875/2005 (EG) in 2008 with, amongst others, the introduction of the Authorised Economic Operator (AEO) certificate for trusted traders. The second phase is the revision of the Customs Code to the Modernised Customs Code (MCC). It is the intention to further simplify customs procedures and allow for the implementation of new concepts for coordinated border management. Single Window, Single Authorisation for Simplified Procedures (SASP), and Self Assessment enable centralised control of goods flows in the EU. Whereas Single Window implements coordinated border management, SASP allows for handling EU customs formalities with one EU customs authority. The relation between Single Window and SASP is still under development. Self Assessment deals with the implementation of required controls in a traders system for VAT calculation with a facility offered to customs authorities for auditing an implementation.

These developments have impact on government authorities and customs in particular. With an effective use of means and personnel authorities have to control a larger volume of goods flow within an EU context where different authorities have a different focus. Based on security regulations, a shift to border management is required, which needs coordination amongst authorities from a business perspective for reliable logistics.

Need to reduce the costs of compliance to governance requirements

A number of government authorities participate in border management within ports and airports. Each of these authorities implements its particular regulations with particular IT facilities like messages. Similar data with possible different structures and technology has to

be submitted transaction-based to several government authorities to these authorities with high costs for businesses. DigiPoort is a first improvement of submitting all data via one entry to those authorities.

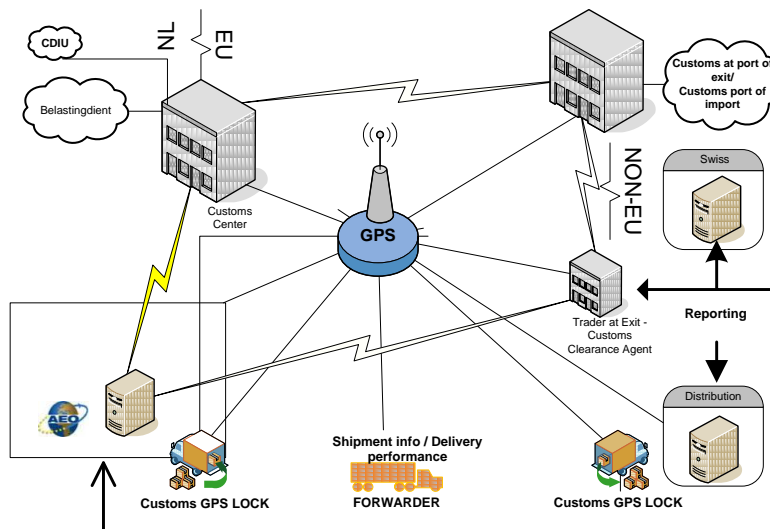
Businesses generate data within supply chains, both from a commercial view between buyer and seller and from a logistics view. This data is the basis for government authorities to meet all required regulations. Thus, business data could be re-used by government authorities. This is called the piggy-back principle. Furthermore, businesses have implemented risk management systems for resilient and reliable supply chain management. These risk management rules can be re-used by authorities to improve their particular risk management procedures.

Single Window – business perspective

The main purpose of Single Window is data re-usability by all government authorities for all types of goods movements, based on data re-use of businesses. The current definition of 'Single Window' leaves room for interpretation, which leads to different implementations, i.e. the aforementioned DigiPoort is a way of implementing Single Window.

Within the context of Single Window, two main approaches can be distinguished: interoperable government portals and Single Window implemented in business processes. The first approach, which is still a transaction based declaration approach, is supported by DigiPoort for electronic declarations. It is the objective of government authorities to extend such an approach with information re-use between authorities based on one declaration by business. It will lead to reduction of administrative burden in the sense that some 80% of the information is re-used by different government authorities. Probably, also the number of manual interventions will be reduced since information is for instance only validated once. Single Window will also increase the efficiency of border management by alignment of inspection planning of different authorities. Currently, each inspection leads to additional handling, waiting times, and thus additional costs.

In the second approach, business processes of logistic actors gather all relevant information, including physical cargo/container tracking by for instance GPS technology. This information will become available to government authorities like customs (see next figure). It also allows these authorities to track goods movements across borders. This approach based on, for instance, a data pull principle like experimented in ITAIDE allows seamless and paperless logistics. It requires federated security mechanisms and globally accepted open standards.



1.1.2 The vision of an integrated solution: Extended Single Window

The vision is to develop an integrated coordinated border management solution for ports and airports integrating with previous and subsequent procedures for reliable, secure, and cost effective logistic chains throughout the Netherlands, thus enabling an excellent logistic gateway to Europe. This coordinated border management solution is called 'Extended Single Window'. It requires efficient and reliable handling of data to generate information for effective joint supply chain planning for shippers, goods owners, transportation companies, forwarders, terminals and other logistic service providers and to use these data also to generate information for government agencies, like customs, agricultural and tax. Currently, shippers and goods owners are faced with a wide range of regulations and procedures when goods enter or exit the EU (border, agricultural, safety, import controls, statistics, and indirect taxes). Completion of declaration processes and risk analyses and planning and coordination of inspections by the various agencies before shipments are (un)loaded from an aircraft or vessel enables logistics actors (terminal operators, forwarders, transport operators) to plan and execute transportation of shipments with hinterland hubs efficiently (improving modal shift, throughput time (i.e. for perishable goods) and reducing congestion). Efficient and reliable government controls reduce administrative costs, increase reliability of the supply chain, and ultimately reduce transport costs for shippers and logistic operators.

Thus, Extended Single Window covers all regulations and procedures for coordinated border management at ports, airports and extending to hinterland hubs according the Modernized Customs Code (MCC) for both incoming and outgoing logistic flows, including integration with previous (outgoing goods for instance preceded by export) and subsequent procedures (incoming goods for instance followed by transit). Basic research in advanced information technologies is in Event Driven Architecture with a Logistic Interoperability Ontology to realize piggy-backing and data pull:

- **Information Service Bus.** Basically, each logistic operation triggers an event. Discharge of a container from a vessel and loading cargo on a truck for on-carriage are examples of events. This event is controlled by information exchange between business actors. The fact that such an event is going to happen or has taken place needs to be known to government authorities, e.g. an event is generated before a vessel actually leaves a port and information regarding that event becomes available to authorities. We will extend the current state-of-the art research by developing a model for event-trees for export and import cases. For example, the export of a container via Rotterdam triggers an event tree of various controls. If the container contains food products, then extra controls for food safety are required, next to customs controls. We will investigate how such an event tree can be automated such that: (1) all relevant data for the various controls only need to be collected once from the companies in the supply chain via a so-called event-driven Information Service Bus, and (2) how workflow management solutions can be used to optimize the planning of the various controls in the event-tree. This research contributes directly to the development of an extended single window, based on solution principles such as piggy-back and data-pull. An Information Service Bus supports functionality like publish/subscribe to events, e.g. authorities can subscribe to events upon which processes can be triggered for retrieving data required by risk management systems or coordinating inspection. One event can also trigger a tree of subsequent events of all government authorities involved.
- **Virtual Logistic Data Space.** Each actor in a supply chain re-uses information received from another actor, updates the information depending on its role in the chain and shares this changed information with other relevant actors. A virtual data space can be defined for logistics that contains all relevant information and can be

viewed by individual actors from different perspectives. The data space is virtual in the sense that events submitted to Information Service Bus allow sharing of information using various technologies like web services or declaration based messaging. The semantics of the Virtual Logistic Data Space specifies the semantics of all physical objects as shared by business actors in supply chains, e.g. semantics of containers, goods items, and trucks. The semantics is written by specified as ontology that integrates with mechanisms for information sharing amongst all actors in logistic chains thus allowing that each actor shares only relevant information with one or more other actors.

An example for import in the to-be situation

The import process of phytosanitary goods shows tight independencies between authorities and traders. The *Planteziektekundige Dienst (PD)* and *KCB* perform risks assessment on the phytosanitary declarations of fruit, plants and vegetables that are imported into the Netherlands and select parts of the flow for further inspection. The outcome of the selection process is used by importers in the selection of the next custom-procedure (import, NCTS/bonded warehouse, export). If goods are selected for inspection, traders use customs procedures NCTS/ bonded warehouse which allow them to transfer the goods to their own warehouse for inspection. If goods are not selected, an import declaration is submitted to bring goods directly into free circulation. Furthermore, a trader needs to submit the outcome of the selection and/or inspection process by KCB (the P2-code) to Customs. Before Customs approves the import declaration, Customs check the validity of the P2 code with PD/KCB.

The current process is not efficient from an administrative and logistics perspective. Although almost information is available 72 hours before a ship arrives in the port, importing companies wait with submission of the phytosanitary data until they know for sure when goods can be made available for inspection at their warehouse, even though it is not clear if they need to be inspected at all. The hesitance of the traders to provide the information earlier is caused by uncertainties in the arrival times of vessel and the availability of the container at the terminal.

The extended single window facilitates improved coordination and information sharing between authorities and traders. For example: the event 'pre-arrival of vessel' triggers customs and phytosanitary authorities to retrieve (pull) required information from the IT-systems of carriers and traders. Depending on particular risk profile parameters, they are able to retrieve the full data set for risk analysis. Traders can predefine upfront which customs procedures they want to apply depending on the outcome of the phytosanitary risk assessment (by an event-tree). Communication between authorities is also supported by events. When customs receive the event 'approval by KCB', it is no longer dependent on the provision of this information by the trader but is able to retrieve the data otherwise. The event 'import of goods', which makes import declaration data available for retrieval to customs, could be generated automatically after reception of an event 'approval by KCB' based on an event-tree specified by a trader. Depending on the trustworthiness of that trader (AEO) customs may decide to retrieve the necessary import declaration data immediately, on a monthly basis or not at all.

The main benefit of the extended single window solution in this example is the early information sharing by customs and phytosanitary authorities. Conceptually, a trader only needs to disclose information for retrieval, share the information according to predefined event-trees with authorities and other traders, and authorities can coordinate the entire risk assessment and monitoring processes triggered by events. A trader receives events of the authorities, but does not have to respond by sending additional information (in fact such an event could be a web service for additional information). This means lower administrative costs.

Advanced information technologies like Service Oriented Architecture (SOA), smart seals (RFID etc.) for tracking and tracing of movement of goods enable government agencies to access data of logistic operators when needed (data pull) with minimal reception of declarations (data push), to be initiated by an event-driven approach. The impact of these advanced information technologies on business models will be studied for feasibility of their implementation. An advanced Information Service Bus constructs a virtual logistic data space for sharing information amongst all stakeholders, i.e. logistic service providers, shippers, mainports, inland hubs and the various government agencies, using the integrated Port Community Systems (PCS) Cargonaut and Portbase as Extended Single Window via

the government gateway 'Digipoort' for coordinated border management in several airports and ports with extensions to hinterland hubs. Since the data space is 'virtual', the solution no central data base is required, but the relevant data can still reside with each actor depending on governance and logistic innovations at business level. An Event Driven Architecture and the Logistic Interoperability Ontology can operate in different ways, e.g. both a data-pull approach is supported as well as a declaration-based approach where specific data (e.g. 10+2) are provided by the company to the customs for each shipment.

1.2 Relation to Dinalog innovation themes

The aim of the program Transport Hubs in Control is to develop new concepts and control mechanisms that use the available infrastructure capacity in the mainports as efficient as possible (all modes, 24 hours a day) and reduce congestion. The level, quality and efficiency of control activities in the mainports and hinterland transportation hubs will be improved substantially, which will support the Dutch mainports in strengthening their competitive position. Besides strengthening this physical gateway to Europe, the Netherlands will also become a leading Information Gateway to Europe.

Well organized government controls are a precondition for the development and implementation of new control mechanisms. Shipments can be transshipped to hinterland hubs efficiently and shortly after their arrival when it is clear when and where can be released by authorities and inspections are coordinated. Reliable government information enables logistics operators to plan and execute transportation of shipments with a hinterland hub more efficiently, to use intermodal transport more frequently, and this will lead to a very significant reduction of traffic congestion around the mainports.

The project is closely related to the Dinalog-proposal Extended Gate that focuses on the economics and operational logistics control mechanisms to transship goods from Rotterdam to the extended Gate in Venlo. The Extended Single Window proposal focuses on the information and governance models to allow goods transshipment via the Netherlands with reliable and coordinated government inspections. The participants of the projects Extended Gate and Extended Single Window aim to strengthen the links between these projects by establishing a joint program management. The program management also seeks collaboration with other (future) Dinalog projects.

1.3 Objectives and goals

1.3.1 Overall project objective and aim

The objective of the project is to create reliable, secure, and cost effective logistic chains throughout the Netherlands supporting all applicable regulations and procedures, by embedding events for government controls in supply chains based on safeguards in processes of certified supply chain partners, re-use of transaction data by government agencies, and creating an Information Service Bus based on existing PCS's with the application of innovative IT technology. The aim is to identify how safeguards for government controls can be defined and supported by advanced IT-technologies with contribution of business and government authorities and in close cooperation with various demonstration projects (single window, AEO/system-based controls, centralized clearance). It will lead to a drastic reduction of physical inspections of goods in the mainports by coordinated planning of government authorities, reliable transport to and from hinterland hubs, and administrative cost reduction. The concepts are developed for supply chains using both the Schiphol-Venlo and Rotterdam-Venlo corridor.

1.3.2 Business objectives

The main business objective is reliable logistics for all types of goods flows by coordinated border management in the Netherlands:

- Increase of supply chain reliability and reduction of logistic costs by coordinated inspection planning of government authorities.
- Reduction of transaction costs since information is shared amongst government authorities and re-used between regimes by a government authority (e.g. re-use between export and outgoing).
- Improvement of effectiveness of government authorities to deal with a growing volume of goods flows by subscription to logistic events.
- Improvement of security by data sharing amongst relevant actors in supply chains according to a common ontology specifying semantics of logistics.
- The ability to support both a declaration based approach and system based auditing by business models for the implementation of events and the ontology.
- Improved release of goods by (seamless) integration with previous and subsequent applicable procedures implemented by for instance SASP.

At national level, a business objective is to increase competitiveness for managing logistic flows across Europe and provide value added services (see an estimate of the contribution of added value in supply chain control further on). Competitiveness relates to registered offices of shippers/consignees versus border management. It is the objective of this proposal to align shippers/consignees processes with coordinated border management processes in ports and airports. Since information is re-used by government authorities for different regimes, less information needs to be provided. Guarantees for secure transport between borders and hinterland hubs are not required and physical inspections can be performed closer to the office of a shipper/consignee. Having registered offices in the Netherlands and moving goods via the Netherlands is not obvious anymore (although recent research has indicated that the Netherlands is still one of the cheapest countries for registered offices of business). Competition of other ports and congestion for hinterland transport increases. Lowering costs, reliability of logistics, and reduction of the administrative burden are important assets for the competition of Dutch (air)ports. Furthermore, IT allows business in the Netherlands to become a global player in directing goods movements.

1.3.3 Research objectives

The research objectives are:

- Design of a smart auditing framework based on Event Driven Architecture and Service Oriented Architecture for logistics and its governance. This includes constructing a model for implementing events as safeguards in business processes to meet government regulations and procedures in line with the MCC and other applicable (EU) regulations.
- Development of a flexible and scalable Event-Driven Governance and Information Orchestration (EDGIO) model to ensure that information is available where and when needed. Such a model captures organizational and technical issues. The EDGIO model can be used in import/export situations as part of the event driven Information Service Bus (ISB).
- Construction of a Logistics Interoperability Ontology Framework as the basis for the Virtual Logistic Data Space. The ontology is used for describing semantics (1) shared amongst all actors in logistics chains and (2) supporting individual actors in their business processes and mapping their internal data to the shared concepts. Such an ontology framework may consists of components defining the semantics of individual (physical) objects and will build on international developments like the WCO data model and the UN/CEFACT Core Components. Further research is required into the fact that it is required to define different ontologies based on common components of

the framework, whereas each ontology defines a specific view on the framework, e.g. an interoperability ontology, an ontology for an enterprise import/exporting for instance electronic equipment and for an enterprise importing/exporting toys. Part of the research will also be on the potential impact on ease of development and application of ontology constructed of components with distributed maintenance.

- Proof of Concept of the Information Service Bus built on the Event Driven Architecture and the Logistic Interoperability Ontology that will have a distributed nature in its realization. From a logistic perspective, the Information Service Bus will act as a virtual logistic data space in which actors share relevant information triggered by events of their business processes. In this way, the ISB will actively support data and process integration.
- Evaluation of the feasibility of the aforementioned concepts by (1) constructing different business models and (2) improving the figures mentioned in section 1.4.3 of this proposal for the added value to supply chain coordination in the Netherlands. The business models will illustrate different implementations of the concepts with their advantages and thresholds for different logistic actors.
- Exploration of the innovation potential of the Information Service Bus and the Virtual Logistic Data Space in terms of audit process redesign and an evaluation framework based on explicit control effectiveness and costs criteria.

1.4 Expected results

1.4.1 R&D project deliverables

Project deliverables include:

- A model for event driven data sharing amongst actors in logistic chains across borders that includes events to meet applicable government regulations and re-use of relevant data amongst actors.
- The Event-Driven Governance and Information Orchestration model for coordination of actors in organizational networks.
- A framework of (ontology) components that allows (1) interoperability amongst all actors in logistic chains and (2) individual actors to execute their specific business processes. As stated before, the framework will be as much as possible based on existing models and components like the WCO data model.
- A model and a proof of concept of the Information Service Bus.
- A business model that evaluates the feasibility to meet the aforementioned business requirements and contribute to the increase of added value in supply chain control.
- Case studies in process innovation based on existing or to be developed technical solutions.
- An evaluation framework for Service-Oriented Auditing based on explicit control effectiveness and costs criteria.

1.4.2 Expected results from intended demonstrations

Enterprises and government authorities both participate in different ways in this R&D project:

- They supply input to the R&D part by for instance explaining their supply chains and IT systems.
- They provide case material that can be used during R&D to further develop the models.
- They are available for interviews and will validate the R&D results.

Furthermore, it is the intention of the enterprises to initiate demonstration projects that will both feed the R&D and will make apply the R&D results, government authorities are developing a Single Window approach that can be improved by the research, and PCS's will

have the ability to construct a durable solution for their customers in line with government procedures.

One particular demonstration project called Single Window Fit for Future is already under development. It will demonstrate (1) a system based auditing approach based on events and (2) implement alerts for exception handling in physical flows based on the same event driven architecture. Each of the intended demonstration projects has to define its expected results. Each enterprise cooperating in this R&D project will have the opportunity to apply the model to their specific case and thus (1) be sure that the model will meet their requirements and (2) use the results of the model in their business processes and IT systems. Such a case may comprise incoming into or outgoing goods from the EU.

1.4.3 Contribution to Added value in SC coordination

This section describes the expected contribution to the ambition formulated by de Commissie Laarhoven to increase the Added Value in Supply Chain coordination activities from EUR 3 billion to EUR 10 billion in 2020. The estimate described in this section follows from a combined top-down approach and bottom-up approach. The estimate is the result of a discussion between the experts in the consortium.

The top down approach takes the Laarhoven-ambition as a reference and starting point, an increase in National Added Value in Supply chain coordination from EUR 3 to 10 billion. From this 7 billion, the DIALOG strategic research agenda is assumed to contribute to realizing half of the ambition, the other half is assumed to be realized also without DIALOG. Within the DIALOG agenda, roughly one third of the contribution is covered by the theme "Hubs in Control", the other two-third is roughly related to the topics "4C" and "Service Logistics". Within the topic of Hubs in control, the specific topic addressed by this research project, "New Information and Governance models" can contribute to one third to this ambition, other topics like for instance the service models related to the reliable, fast and efficient transport between mainports and hinterland hubs can also contribute to the topic "Hubs in Control". And the valorization approach aims to contribute to 50% of the increased added value, recognizing that the valorization approach will not reach a 100% effective implementation of the concepts and bodies of thoughts developed within this project. As a result from this top-down approach, the expected contribution of this project to the Laarhoven-ambition is an increase of EUR 194 million per year in Added value of supply chain coordination.

	Now (in mln)	2020 (in mln)		Increase (in mlr)
SC Coordination added value	3.000	10.000		7.000
DIALOG			50%	3.500
Theme "Hubs in Control"			33%	1.167
Subtheme "New Information and governance models"			33%	389
Result of project valorisation			50%	194

The argumentation from the bottom up approach argues that innovations in new information and governance models for international trade & logistics provide businesses more reliable transport operations and enhanced supply chain visibility with lower transaction and transport costs. This will attract new European Distribution Centers. The availability of state-of-the-art knowledge and technology on governance models (government controls) and cooperative and efficient government agencies (coordinated by Dutch Customs) make The Netherlands an even more appealing location for European headquarters for customs and VAT departments of international companies. Also the main knowledge centers of international consulting and technology firms specialized on innovations in integrated border management (like Cap Gemini, IBM, Deloitte, KPMG, PWC etc.), already based in the Netherlands will

strengthen their position in Europe. Estimated increase in employment and added value in 2020 is expected to be:

Type of activity	Added value per employee per year (euro)	Jobs	Added value/year (euro)
Transport & Transshipment	42500	1000	42,500,000
Warehousing & Storage	41000	1000	41,000,000
VAL/VAS	48000	1000	48,000,000
Supply chain coordination	148000	1250	185,000,000
Support activities	80000	625	50,000,000
TOTAAL		4,875	366,500,000

So this approach results in an increase in added value related to supply chain coordination of EUR 185 million, which is in line with the results of the top-down approach. Additionally, another EUR 180 million added value can be realized in transport, warehousing, VAL/VAS and support activities.

1.5 Relation to government policy

Both the Dutch government and the European Commission have recognized and emphasize cost reduction and coordinated border management. The Dutch Customs strategic innovation plan focuses on innovations in Single Window, simplified procedures, self assessments and system-based control. Dutch Customs is willing to allocate strategic resources to this proposal and to collaborate with the Dinalog consortium in this proposal.

The European Commission is developing the Modernized Custom Code and has allocated considerable funding for R&D in the 6th and 7th Framework Program to develop supply chain innovations that contribute to safe, secure and efficient trade lanes (projects ITAIDE, SMART-CM, managed by partners of this proposal, and Integrity).

1.6 Orientation

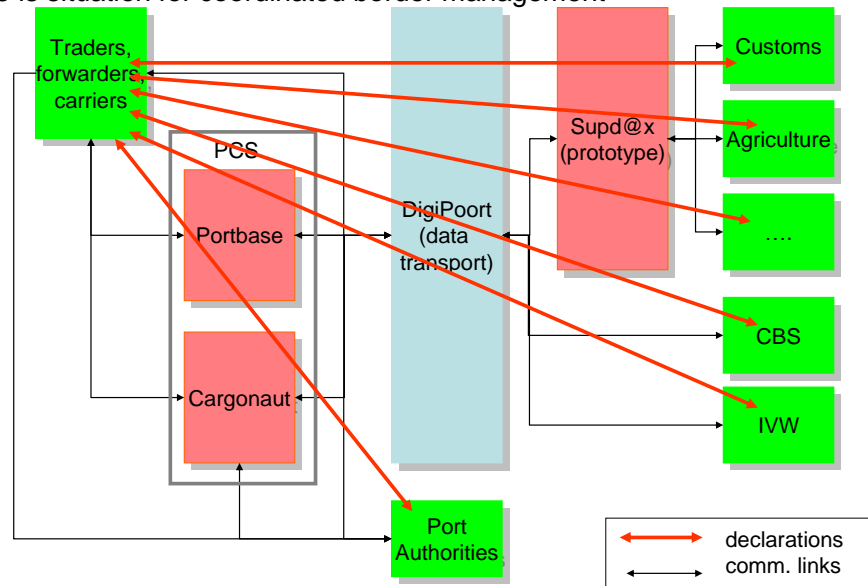
1.6.1 State of the art

The state of the art is described from three perspectives: governance and business, IT, and R&D.

- Governance and business perspective:
 - **Transaction based declarations** – Individual government authorities require declarations and accompanying documents based on their rules and regulations of individual transactions, e.g. import and export declarations, agricultural declaration and documents.
 - **Reduction of administrative burden.** Government authorities are striving to reduce the administrative burden of business actors. Therefore, they introduce the following concepts:
 - **Single Window** – A single window allows parties involved in trade and transport to lodge standardized information electronically with a single entry point (DigiPoort) to fulfill all incoming and outgoing supply chain related regulatory requirements thus allowing for coordinated border management. The current approach is still declaration based with possible coordination based on the Supd@x prototype.

- **Single Authorization for Simplified Procedures (SASP) or Central Clearance** – Central Clearance, formerly referred to as Single European Authorization and currently known as SASP in the Modernized Customs Code (MCC), indicates that a company can manage all its customs declarations for goods movements in the EU and across borders of the EU with a one customs authority of one of the member States of the EU.
 - **Authorized Economic Operator (AEO) and System-Based Auditing (SBA)** - The MCC allows the application of simplified procedures if Authorized Economic Operators perform self-assessments and take measures to reduce their risks. Self assessment is combined by a System Based Auditing in which customs audits the implementation of controls by an AEO.
 - **Information sharing** – Information is shared amongst business partners in supply chains and available for governance, based on paper and electronic documents. All individual business partners manage their information and execute their processes according to their role in supply chains.
 - **Physical security** – A number of EU projects (INTEGRITY, SMART-CM, ITAIDE) has been performed in which containers have been equipped with secure seals to ensure that the content of a container is not altered during transport and containers can be tracked.
 - **Extended Gate principle** – The Extended Gate principle basically extends a secure area from a main port to the hinterland for all types of goods movements (incoming and outgoing). All procedures and physical inspection can be handled in the hinterland. The Extended Gate principle is submitted as an R&D proposal for Dinalog.
- IT perspective:
 - **Port Community Systems** – Port Community Systems (PCS) like Cargonaut and Portbase support information transport, transformation, and Value Added Services. Some Value Added Services support information sharing between business partners, e.g. e-invoicing, but basically a PCS does not store information. Portbase is transforming its current system to one based on an Enterprise Service Bus with applications that offer the Value Added Services.
 - **Messaging** – Information is exchanged by EDI (Electronic Data Interchange) messages within a main port. Information is duplicated by all relevant business partners. Messaging with government authorities is via a central entry point, DigiPoort. The following figure shows the state of the art.

Figure – as-is situation for coordinated border management

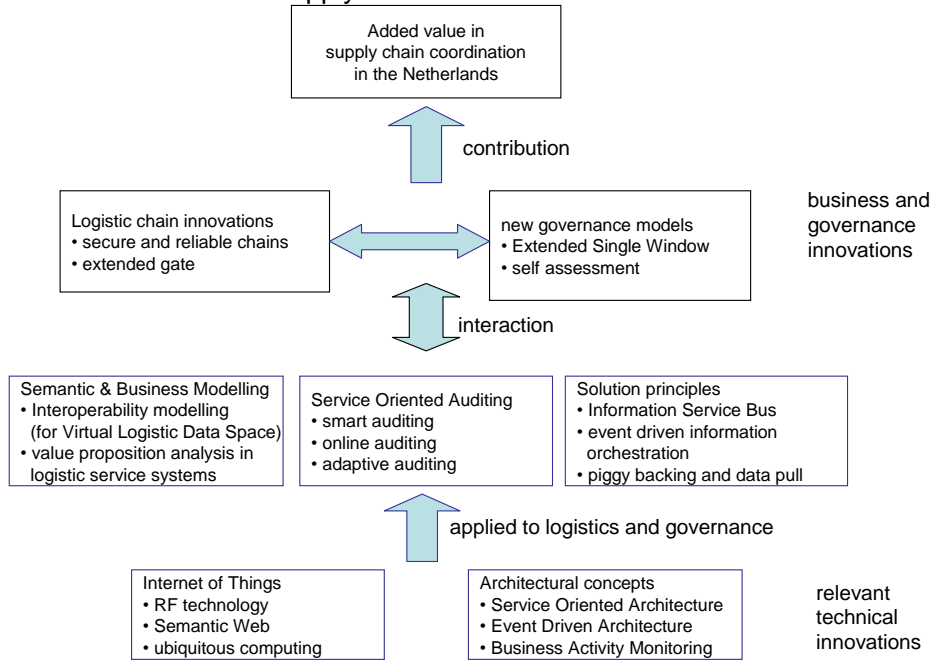


- R&D perspective:
 - **Architectural concepts**– There are several architectural concepts developed that are supported by COTS (Commercial Off The Shelf) and open source products. The best known is Service Oriented Architecture implemented by an Enterprise Service Bus. An ESB supports process orchestration and other functionality like rules engines for controlling the process orchestration. Additionally, the Event Driven Architecture (EDA) supports the notion of an event and publish and subscribe mechanisms. Additional open source software is developed for event processing and a number of COTS products also support EDA. Software modules can subscribe to certain events, whereas they themselves can publish events, e.g. an orchestration module can subscribe to an event triggering. Event processing is an effective way of implementing asynchronous communication between systems and thus actors.
 - **Internet of things** – As IPv6 will be introduced, the number of devices that can be identified by an Internet address can rapidly increase. They allow for RF technology to be implemented, which typically generates events that can be processed by an EDA. Extending the Internet in such a way also gives a rapid growth of available data. The Semantic Web with several techniques like Ontology Web Language (OWL), a W3C standard (World Wide Web Consortium), improves search, interoperability, data analysis, and business intelligence. One other aspect of the Internet of things is that one is not aware anymore where data resides or processes are executed. There is a ‘cloud’ of intelligent devices (ubiquitous computing).

1.6.2 Progress beyond the state of the art

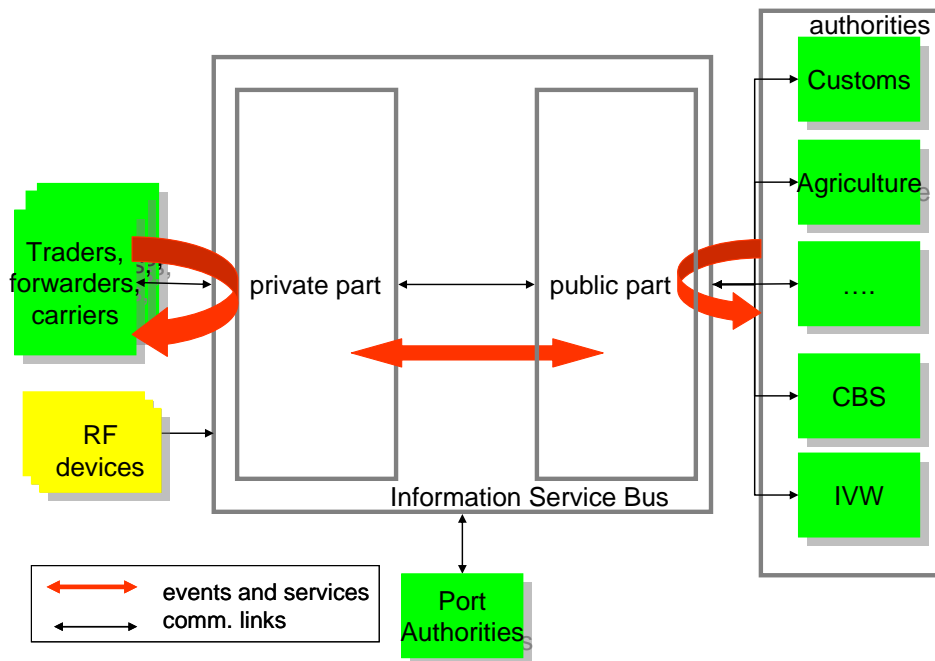
The basic innovation of this research proposal is the creation of a Virtual Logistic Data Space and a Proof of Concept of the Information Service Bus based on an Event Driven and Service Oriented Architecture combined with a Logistic Interoperability Ontology. It caters for one time submission of data in the Virtual Logistic Data Space, where data can be shared amongst all actors. Thus it allows for one time data transmission and re-use by government authorities triggered by logistic events. This basic innovation is a prerequisite for implementing the Extended Single Window and data sharing amongst traders. Its implementation may result in an Extended Single Window consisting of a private and a public part.

Figure – filling the gap between technical and business and governance innovations to contribute to added value in supply chain coordination



The previous figure shows how different technical innovations will be applied to support both the business and governance innovations. It shows that this R&D proposal is basically filling the gap between the identified technical innovations and the business and governance innovations, thus creating the following situation (see the next figure; DigiPoort will support communication between the public and private part and is a component of the public part).

Figure – to-be situation



Whereas the public part enables information sharing and process coordination of government authorities, the private part offers the same functionality to traders, and more. The additional functionality of the private part, implemented by a PCS, is hiding the individual procedures of authorities. From a traders view, certain events trigger a change in regime for a particular physical object, e.g. the object is placed under a transit regime after incoming. By implementing the Extended Single Window in addition to the Extended Gate concept, the Netherlands can act as a hub for Europe and implement the objectives indicated earlier.

An example of export in the to-be situation

Currently, a trader submits an export declaration to the ECS-system (Export Control System) to declare goods for export. When the goods arrive at the terminal in a seaport or airport, the message 'arrival at location of exit' (these locations currently refer to a customs office of exit used for presenting the relevant declaration data) is sent to customs by the terminal operator or cargo handler. When the goods are loaded onto a vessel or aircraft or cross the EU border by truck, the carrier sends the manifest of all cargo to customs. In this way, customs have a safeguard that goods have indeed been exported. Finally, the trader receives the message 'confirmation at exit' from customs. Periodically, customs checks whether all export consignments have indeed been left the EU. If not, the trader has to prove that shipments have left the EU, which means that it has to request a certified document from customs of the country of import declaring that goods have indeed been imported. This is a costly procedure as proof of export is already available in the chain.

With the Extended Single Window this procedure can be simplified and made more efficient. Traders that are AEO or certified by System Based Auditing can use alternative means to prove that goods have been exported. Besides the events 'arrive at location of exit' and 'departed from location of exit', the actors in the chain can also provide events 'arrive at location of entry' triggered by the transport operator, 'arrived at place of destination' triggered by the consignee, 'transport paid' triggered by the trader. These events indicate that certain locations have been passed and final destination as mentioned for the consignment is reached. When these events are received, customs can decide to request additional information from these actors to check if indeed all details about the consignment are correct. Similarly, a shipper could limit its export declaration to information about the goods, cargo and transport order IDs and the actors that are part of the supply chain. Based on this information customs can define an event geography that indicates which services in the supply chain it has to subscribe to monitor a specific consignment. Customs could also decide not to subscribe to these events itself, but request the information from the traders system afterwards.

In this approach, customs is enabled to monitor each consignment in a flexible way. Events allow customs to define what information they want to retrieve for individual consignments or consignments of a specific trader. The amount of information that is collected depends on the risks and the quality and reliability of the data. Companies with AEO or certified by System Based Auditing can provide limited information. Companies can use tracking and tracing information based on RF technology that is already present in the supply chain to trigger events that help to indicate that a shipment has been exported. Customs need to indicate which events and related data provide sufficient. These events may be different across supply chains. Although customs is able to receive more events, the export and consignment data remains identical in the chain and can be re-used for several procedures according to the piggy-backing principle).

The R&D component of this proposal consists of:

- **Complex Event Processing and services** (Ghelsasi 2009). Events are the means to exchange references to information. These events have a particular semantics for business processes. Events have to contain sufficient information for subscription mechanisms, e.g. commodity codes in combination with an indication of incoming cargo may trigger specific risk analysis procedures. These events can trigger services for information retrieval in case the information is required by processes. One of the challenges within this particular area is to handle stateful events, thus combining event processing with BPM (Business Process Monitoring) for transaction with a long duration. There are also particular research questions regarding events resulting in event trees spanning more than one system or actor to realize the Extended Single Window. Furthermore, there are no standards for sharing 'event' specification amongst all actors involved and configure IT systems.

- **Event choreography.** Exchange of events between actors has to adhere to predefined sequences for constructing stateful events. Choreography defines a structured set of event sequencing. The underlying logistic processes are (1) resource allocation by business actors to execute a particular logistic activity and (2) risk analysis by government authorities.
- **Logistic Interoperability Ontology Framework.** Information sharing needs to be based on a common semantics of that information. Semantic models consisting of components need to be specified describing the basic objects for transport (e.g. goods items and containers) and different views on these objects (e.g. a customs, a transport, an agricultural, and the view of individual enterprises). Each component of the framework can be maintained by a separate authority or organization, e.g. customs maintains all relevant customs views and events. By constructing components, it should be possible to construct an ontology for each view.
Current ontology development basically focuses on the development of components. These components, which are ontology, can be used to construct ontology. There is no research yet how different views (e.g. interoperability and individual actors like customs, agriculture, and traders) can be combined into a stable ontology framework. The only reference available is to the ontology framework of NASA for its internal information semantics. One of the challenges will be to construct such a framework in the setting of service systems.
- **Virtual Logistic Data Space.** Information is always only managed by its source and references to that data are distributed via events. Each actor has its relevant data, exchanges references to that data to other actors that add their data to those references. These concepts are based on the principles of the semantic web. For instance, all relevant information for incoming cargo by sea is stored in a manifest. Reference to individual consignments in a manifest will be distributed to other actors that perform on-carriage. These references are also relevant for government authorities.
- **Information Service Bus.** Technically, events are exchanged by an Event Service Bus. Processes may subscribe to certain events initiated by specific actors, e.g. a risk analysis module is triggered by an event indicating incoming cargo. Individual events can trigger orchestration of web services (SOA – Service Oriented Architecture), e.g. the reception of an event indicating incoming goods with a reference to those goods, may trigger a web service for retrieval of the information of those goods. All events are published to a logical event space. This event space can be implemented by a PCS. A monitoring service subscribes to specific events.

These innovations are driven by and enable business and governance Innovations. All government authorities share information via the public part of the Information Service Bus that integrates via events with the private part. Traders and authorities coordinate their processes and share information via the information service bus. The public part acts as a Single Point Of Contact for all government procedures via a governance module. The following functionality is for research:

- Definition of those events that are relevant to individual actors participating in and governing supply chains.
- Monitoring events that are exchanged between all actors involved in supply chains. The public part subscribes to specific events published by traders in the private part; these events have to be defined by government authorities in business rules.
- Implementation of business rules. On the one hand, these business rules define the mandatory events published by business actors and propose corrective actions; on the other hand they function as decisions rules and define event trees to involve authorities in goods flows. From the context of a trader, the public part of the Information Service Bus offers one business service with by one event (including updates of that event

according to an event choreography) that is decomposed into individual business service with their specific events.

- Storing shared information. The Information Service Bus only stores the information that is shared amongst authorities (public part) and traders (private part), or relevant references to that information. The information or reference to information is basically fed by events published on the Information Service Bus. The public and private part of the Information Service Bus may contain duplicate information for traders and authorities respectively. Each government authority manages its own information internally and has its particular risk analysis environment. These risk analysis environments are also triggered by subscription to events.
- Process coordination. Risk analysis results of individual authorities can lead to coordinated physical inspections.
- Integrating with other regimes. One regime will be followed or preceded by another, e.g. an incoming regime can for instance be followed by a transit or import regime and an outgoing regime can be preceded by an export regime. From a business perspective, a change in customs regime is indicated by an event that relates to the relevant part of the information already present in the governance module and possibly adding additional information (e.g. detailed commodity code). Whereas the next or previous regime can be implemented by another governance model, e.g. SASP or Central Clearance, events and relevant data ensure the integration with those regimes. As such, the public part integrates with SASP and acts as a Single Point Of Contact for all relevant logistic events in goods movements.
- Business Intelligence is implemented as a special service that is able to handle all types of searches within the information present in a governance module.

An example for Centralized Clearance (SASP) / System Based Auditing in the to-be situation

Centralized Clearance allows traders to submit all customs declarations in the country in which their main customs department is located, although the goods are physically entering the EU in another member state. This is expected to increase the number of declarations that need to be processed by Dutch Customs in case they are the Centralized Clearance authority. The combination of System Based Auditing and the Extended Single Window–concept allows customs to offer more efficient monitoring and control procedures to companies that have integrated the necessary safeguards into their processes and systems. These companies do not need to submit complete declarations for each customs procedure change for particular goods. They only submit events that indicate a change and which fit in a predefined event-tree agreed with customs. Using the data pull-concept customs can retrieve the data (when needed). For instance, a trader transfers goods from a port using NCTS, stores the goods in its bonded warehouse, uses the goods in production, and finally exports and imports parts of the consumer product from/into the EU. In the current situation, a full declaration is needed indicating the completion of a customs procedure and a full declaration is required to indicate the start of the next customs procedure. In the Extended Single Window-concept, the trader only reports the change in the customs procedure of the goods, not the full declarations.

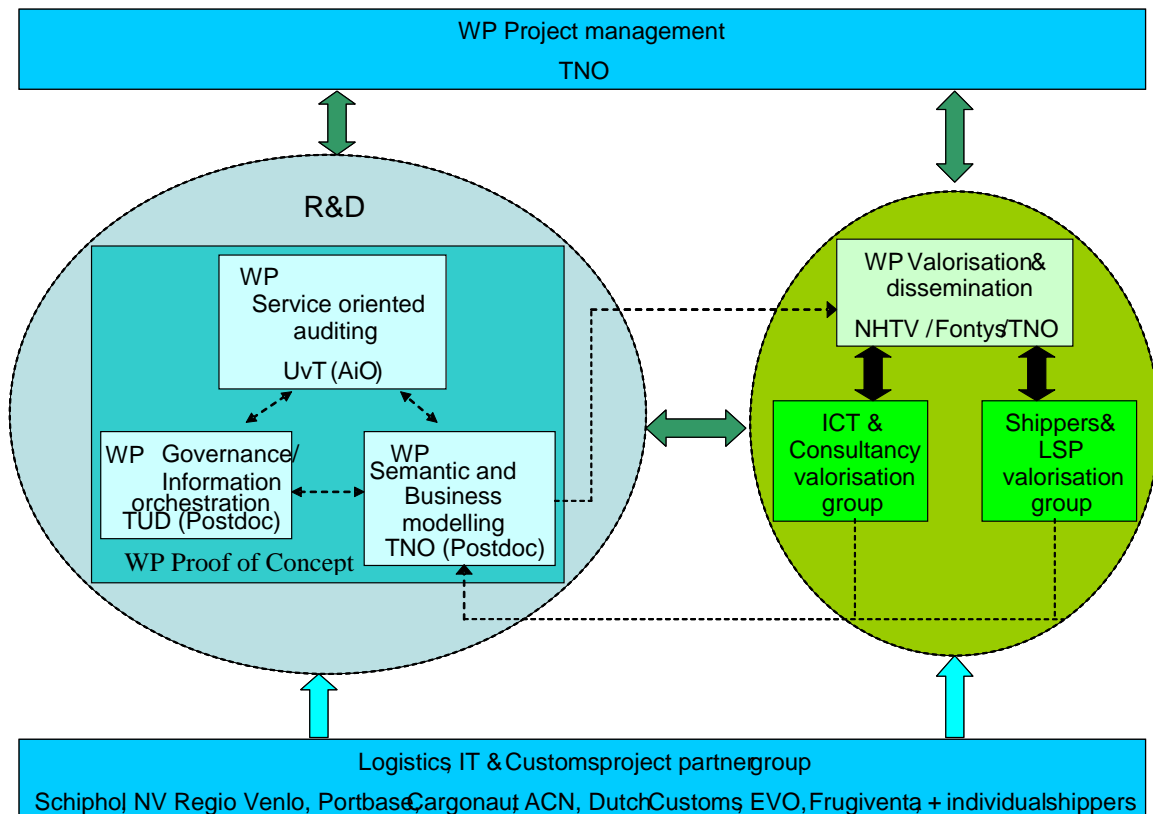
2 Activities and Work Packages (B)

2.1 WP overview

The project structure includes the following 5 Work Packages:

1. Project management
2. R&D: Service Oriented Auditing
3. R&D: Governance and Information Orchestration
4. R&D: Semantics and business modeling
5. R&D: Proof of Concept
6. Valorisation and Dissemination

The figure below conceptualizes the link between the different WP's and the main role of the partners in these Work Packages.



A description of the Work Packages is presented in the following sections. The R&D work package descriptions include an elaboration according to the NOW-guidelines for AiO and Post-doc descriptions.

2.1.1 WP1 - Project management

Objectives

The objective of this work package is:

1. The overall legal, contractual, ethical, financial and administrative management
2. Maintaining communication with DINALOG and with each partner

Tasks and activities

- a) Administrative project management (Task leader: TNO)
- Project planning, monitoring and control (TNO)
 - Formulation of more detailed project plan on task/partner level incl. detailed budgeting and scheduling (TNO).
 - Keep track of the progress, costs and budget situation and create an early-warning system (TNO)
 - Set-up and maintenance of online project documentation archive and project procedures manual (TNO)
 - Web-based monitoring of the project's progress in terms of deliverables, milestones, task completion and resource use (TNO).
 - Preparation, organization, administration, minutes and follow up of Project Management meetings (TNO)
 - Day-to-day administrative management and tuning in with the DINALOG scientific staff (TNO)
 - Keeping track of payment procedures partner (TNO)

b) Quality control (Task leader: TNO)

The project coordinator (TNO) is responsible for Scientific Quality Assurance and Risk management throughout the project. This task involves the monitoring of the technical quality. In case needed corrective actions will be taken including possible work reallocation. Monitoring of quality assurance and risks will be done on the basis of quarterly reports prepared by the WP leaders, that includes a milestone review template prepared by TNO and on the basis of the review of the Deliverables. Corrective actions will be prepared by the project coordinator as input for the Executive Board, consisting of the WP leaders.

A Quality Assurance Plan and a Risk Management plan will be developed to guarantee the Quality of the results and to safeguard the progress of the project. First versions will be delivered at Month 4 of the project and with updates every 6 months which will be discussed in the Executive Board meetings.

Reporting

- Compilation of progress reports, including financial issues
- Collection of individual partner administrative documents and statements of expenditures and transmission to DINALOG (TNO)
- Quality Assurance Plan and a Risk Management plan (TNO)
- Preparation of any document connected with the project from the consortium to DINALOG and conversely (TNO)
- Production of the final evaluation report (TNO in close cooperation with each project partner).

2.1.2 WP2 - Service-Oriented Auditing (SOAu)

Abstract

To improve the efficiency as well as the effectiveness of governance mechanisms in international trade and logistics, innovative forms of auditing and auditing process redesign are required that make optimal use of new technology. Service-oriented architectures provide a solid foundation for such innovations that meet heavy constraints on scalability and adaptivity. They may help to realize the idea of Continuous Online Auditing. Combined with knowledge technology, they can implement forms of smart auditing and global decision services. This ESW WP will explore the innovation potential of Service-Oriented Auditing and provide an evaluation framework based on explicit control effectiveness and costs criteria.

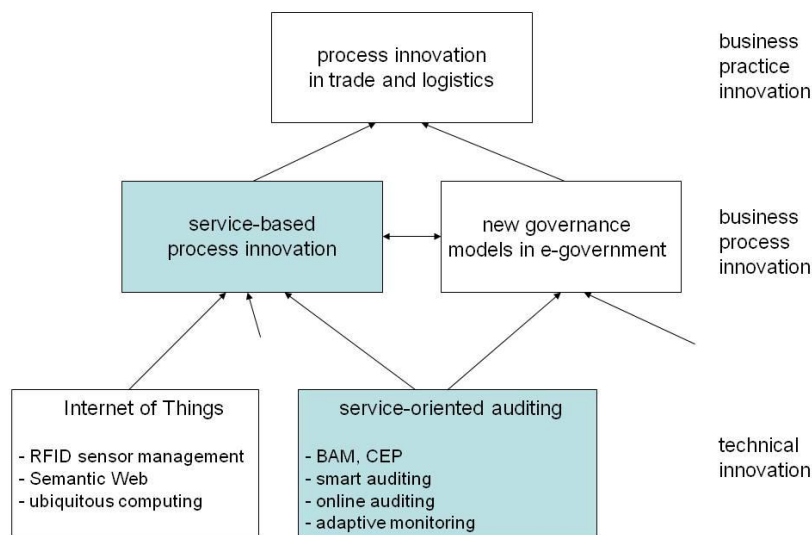
Description of the proposed research

a. Research topic

Service-Oriented Architecture (Papazoglou, 2007; Papazoglou & Van den Heuvel, 2007) is not just a change in architectural style of information systems but also provides new opportunities for innovating and redesigning business processes (Vom Brocke et al, 2009). This is particularly the case for business processes that span multiple organizations (Heck & Vervest, 2007). The domain of international transport/ e-logistics is a good example (Fenton, 2005; Kim et al, 2008). Adherence to SOA standards makes it easy for services to communicate independently from their physical location and without requiring detailed information about the software itself. The communication platform to implement this is usually called Enterprise Service Bus (ESB). As the ESB may cross organizational boundaries, the terms Global Service Bus or Information Service Bus are also used.

The administrative regulations of international trade and transport are still not harmonized across countries and government organizations. This lack of harmonization leads to administrative burdens for international logistic service providers and their customers and thus extra costs. To reduce this burden, EU customs authorities have developed the concept of single point of contact (Single Window implemented in the Netherlands by DigiPoort). Other initiatives include process alignment between various government organizations involved in logistics; the Authorised Economic Operator as a form of horizontal supervision and Single Authorisation for Simplified Procedures.

The above-mentioned initiatives do not yet make optimal use of new technology. Service Orientation is the emerging IT standard whose global openness, design for agility, dynamic orchestration and single-source approach (to mention a few key features) offer new opportunities in trade and logistics.



The figure shows the context of the proposed research. The ultimate objective is process innovation in trade and logistics, like an Extended Single Window. To support this innovation, the research aims to explore process innovation (at the concept level): service-based process innovation in the transport domain, new governance models in the administrative domain, and especially the interplay between these two (cf. Baida et al, 2007). The innovations should include but also go beyond more efficient data distribution and take the

form of a redesign of processes. In this context, the focus will be on audit process redesign, but this may have an impact on the business processes. When the business process has been designed rigorously (and as a result, the company being in control), the audit processes can be “piggy-backed” to it. If not, reengineering of the business process may be necessary.

The process innovations that we foresee draw on already existing and still to be developed technical innovations that we group together under the label “service-oriented auditing”. There are other technical innovations on which the project will draw, in particular in the area of the Internet of Things (Salomie et al 2008; Thoelen et al 2008), but only for their application. For instance, ADiWA <http://www.adiwa.net/> (2009-..) is a German project coordinated by SAP to bridge the gap between the internet of things (e.g. RFID tags) and dynamic business processes (in logistics and other domains) by means of a service layer. Modeling Complex Events is viewed as one of the pillars.

Service-Oriented Auditing (SOAu) is still to be developed. To delineate it, we first describe its background: BAM and CEP.

Business Activity Monitoring (BAM)

Business Activity Monitoring (BAM) is the term for the activity of reading events, aggregating and interpreting these data and producing information for the business. BAM differs from traditional data warehousing and business intelligence in the real-time aspect. With Business Intelligence, a manager or analyst performs complex queries offline, typically on historical data collected in a data mart. In BAM, the events on which the monitoring is based are part and parcel of the runtime process. BAM can be seen as a major application area of the scientific domain Complex Event Processing

Complex Event Processing (CEP)

Complex event processing, or CEP, is an event processing concept that deals with the task of processing multiple events with the goal of identifying the meaningful events within the event cloud. CEP employs techniques such as detection of complex patterns of many events, event correlation and abstraction, event hierarchies, and relationships between events such as causality, membership, and timing, and event-driven processes. CEP is to discover information contained in the events happening across all the layers in an organization and then analyze its impact from the macro level as "complex event" and then take subsequent action plan in real time.

Big IT vendors such as IBM, Microsoft, Oracle, Tibco, and Cordys (Netherlands) offer BAM functionality in combination with service deployment platforms. However, there are still many research challenges:

- *Managing the business logic.* The interpretation steps made during the monitoring process are warranted by business rules. These business rules (the policies they capture) change over time, and therefore need to be managed properly. This management is complicated by the fundamental gap that exists between the execution level addressed by the IT and the policy level on which the business formulates its requirements.
- *Interoperability.* When data from different data spaces have to be combined, interoperability is needed, both on the syntactic and the semantic level.
- *Proactive monitoring.* Currently, virtually all monitoring is reactive monitoring. However, there is a growing demand for pro-active or predictive monitoring.
- *Smart auditing.* The intelligent use of domain knowledge can often simplify or optimize heavy data search processes (Feelders & Daniels, 2001; Graco et al, 2007). Current BAM/CEP tools do not make use of audit knowledge. See below.
- *Adaptive monitoring.* Monitoring can be a complex task that uses a configuration of

numerous hardware and software resources. The question is not only how it can be done but also how to optimize this task (in terms of time, costs on the one hand and the effectiveness in terms of risk management and control on the others), and how to cope with failures. The aim of adaptive monitoring is to allow dynamic configuration of the monitoring task according to certain performance goals.

- *Online auditing.* Online (continuous) auditing means that the auditor does not inspect the organization physically, but rather inspects databases remotely. This format has certain limitations, but also new possibilities, in particular (a) the possibility to run complex queries and (b) the possibility to cross-check with other databases (public databases or business partner databases) and (c) to do this on a real-time continuous basis (Kogan et al, 1999). Online auditing should be non-intrusive, i.e., not interrupt normal operations, and obey transparent security requirements. Online auditing is closely related to the idea of “Piggy-Backing” where auditor and auditee agree to use the same business data flow for both internal and external audit purposes.

We define Service-oriented Auditing (SOAu) as: applying SOA concepts and SOA technology to the field of auditing and providing the following functions:

- Global decision services built on CEP and interoperable business rule technology
- Adaptive monitoring built on well-founded cost and effectiveness metrics and compliance-based service composition
- Online auditing on the basis of global web service standards
- Smart auditing making optimal use of BI techniques such as machine learning, model-based reasoning and heuristic search

SOAu is service-oriented in two ways: it is about auditing of web services and service interactions and it is auditing by web service.

SOAu can give a new impulse to Continuous Online Auditing that started at the end of the 90's to draw on Embedded Audit Modules. Embedded Audit Modules (EAMs) are software applications embedded in host systems or linked to host systems in order to externally monitor such systems. EAMs continuously monitor flows of transactions, identify transactions that match certain pre-determined integrity constraints and, in the event of a constraint violation, alert the auditor and copy the transaction data to a file. The adoption of EAMs has been rather low so far (Debreceeny et al, 2005). As already argued by (Murthy & Groomer, 2004), web service technology can make the implementation much simpler, and also broaden the application from single enterprise ERP systems to supply chains, and from single databases to event logs and business process audit trails.

The goal of Business Process Mining is to extract process-related information from event logs. Substantial progress on this topic has been made over the past few years, especially in the context of ProM (Van der Aalst et al, 2007). Process mining can be used for log-based auditing that allows auditors to go beyond a “reasonable assurance” based solely on checking control procedures and some samples of factual data. It becomes possible now to check all events run-time, to see if the operations are within the boundaries of “de jure” models. Note that for efficiency reasons such a complete check was abandoned in the ‘70s by auditors to be replaced by so-called System-Based Auditing that focused on the internal control measures rather than the transactions. It seems that nowadays a smart combination of both approaches is becoming feasible, but what a “smart combination” is, is still a question.

One challenge in process mining is that a log-based auditing should accept the stochastic nature of business processes (Van der Aalst, 2010). Another challenge is the representation of the “de jure” models or norms. Lee has demonstrated the applicability of audit patterns

(Lee et al, 2001). In the COMPAS (Holmes et al, 2010) project¹, a Compliance Request Language (CRL) has been developed for the formal specification of compliance requirements that stem from legislative and regulatory bodies. Earlier relevant work that we also want to consider is (Elsas, 1997) that draws on the (for auditors familiar) value cycle approach.

b. Approach

Research context

The Extended Single Window project (ESW-Dialog) in international trade and logistics

Research objective

The objective is to develop solutions for service-oriented auditing and explore their potential of process innovation

Research tasks

- explore possibilities of reengineering logistic processes and government procedures in business cases
- develop solutions for service-oriented auditing
- develop an SOAu evaluation framework based on control effectiveness and costs metrics and apply this on the solutions found
- evaluate the value of these solutions in terms of innovation potential in business cases

The research objective explicitly includes the continuous consolidation and dissemination of results so that they become accessible and ready-to-use for the project partners as well as future researchers.

Research methods

The project uses a combination of formal and empirical research methods in order to arrive at rigorous results. The overall perspective is design research (Hevner et al, 2004) in which artifacts are developed that solve certain action problems. Validation includes the formal description of the artifacts, verifying to what extent requirements are met, and evaluating the solution in terms of effectiveness and performance. The evaluation may range from purely formal analysis to elaborate field studies of the proposed solutions in context.

For an optimal alignment with the overall project planning, the research will be executed in three phases. In phase 1, business cases are described and analyzed in close collaboration with the business partners. On the basis of the analysis, innovation potentials will be identified. These potentials will be validated with the business parties in bilateral meetings and interactive workshops (depending on the specificity of the case). In the second phase, solutions for SOAu will be developed, the requirements being elicited from the earlier described case studies and, if necessary, additional interviews and workshops. In the third phase, the SoAu solutions will be evaluated formally and empirically – the latter again in interaction with the business partners.

¹ COMPAS <http://www.compas-ict.eu/> (FP7, 2008-2011) is a European project in which ERISS is involved to “design and implement novel models, languages, and an architectural framework to ensure dynamic and on-going compliance of software services to business regulations”. COMPAS takes a single organization perspective.

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d. Activities and time plan

The following activities and their planning are identified (any conference papers or other scientific contributions are not listed in the table as deliverables; the following table lists deliverables that can serve as input to the other WPs;):

WP	Resp.	Activities	begin	end	Deliverables	
WP2	UvT	SOAu				
		WP2.1	State of the art on SOAu	1	6	State of the art report
		WP2.2	Case description	4	12	Case descriptions
		WP2.3	Ph.D. Courses	1	12	-
		WP2.4	Cases for existing/new SOAu	13	18	Case descriptions
		WP2.5	SOA online auditing framework	13	18	Service Oriented framework for online auditing
		WP2.6	Cases for existing/new CEP	19	24	Case descriptions
		WP2.7	CEP smart auditing framework	19	24	CEP framework for smart auditing
		WP2.8	SOAu evaluation framework	37	48	SOAu framework
		WP2.7	Innovation potential	37	48	-
WP2.8	Dissertation	37	48	dissertation		

e. Output

Expected scientific output and dissemination of results

- First year: state-of-the-art survey; workshop papers (e.g. the yearly VMBO workshop on Value Modeling and Business Ontologies, yearly BPM conference, yearly i-semantics conference)
- Second year: workshop and high-quality conference papers (e.g. CAiSE, ECIS, ICIS)
- Third year: same as second year, including journal paper (e.g. DSS, DKE)
- Fourth year: same as third year, dissertation

Dissemination of results to practitioners: see above.

2.1.3 WP3 – Governance and Information Orchestration

Abstract

In the current climate businesses expect governments to operate as an integrated organization and providing a single window to businesses. By minimizing the number of interactions, changing control mechanisms, introducing the Authorized Economic Operator (AEO) and central clearance of information exchange processes the transaction costs between businesses and governments can be reduced and accordingly the administrative burden will be lowered. These developments require that governments and private parties collaborate in networks and that there is effective coordination of the interactions. Yet, there is little work on how loosely organized networks can be structured and orchestrated effectively. Orchestration is viewed as the ability to coordinate the information flows aimed at ensuring that the information is available when needed. Designing and improving information orchestration across a network of agencies involves addressing many challenges outside the control of a single agency. This research is aimed at designing a flexible and scalable Event-Driven Governance and Information Orchestration (EDGIO) model to ensure that information is available where and when needed. Such a model captures organizational and technical issues. The EDGIO model can be used in import/export situations as part of the event driven Information Service Bus (ISB). An ISB facilitates the exchange of data between the involved parties. The developed model accommodates the autonomy of organizations and the decentralized structure of public administration, while at the same time enabling the creation and control of cross-organizational processes.

Description of the proposed research

a. Research topic

Businesses expect a single window allowing them to lodge standardized information electronically with a single entry point to fulfill all import, export and transit-related regulatory requirements. Data should be submitted only once and re-used by all relevant government authorities. The creation of a common virtual data space for supply chains and piggy backing (reuse of existing data stored in existing business systems) requires mechanisms to effectively collect, access, process and distribute information. Another development is that transaction-based control is changed to more system-based control. The basic claim is that by optimizing the information exchange processes between businesses and government the transaction costs between them can be reduced and accordingly the administrative burden is lowered. In addition this should result in better control, compliance and less fraud.

The developments impact the way the organizations structure their activities and coordinate their information flows. The integration of activities and joining up extends to greater collaboration and integration between agencies (Kamal, Weerakkody, & Jones, 2009). Traditional command and control mechanisms are substituted by complicated relationships managing the interactions among business and (semi-)autonomous government agencies. These developments result in the need for joined-up government, which refers to “consistency between the organizational arrangements of programs, policies, or agencies, which may enable them to collaborate” (Perri 6, 2004, p. 106). As a consequence, collaborative, inter-organizational networks have become a common way to deliver public services (Provan, 1993).

Previous e-government research has shown that when cooperating in networks, public agencies must not only manage their own internal operations, but they must also arrange and manage the multi-organizational network. Fountain (2001) argues that cross-agency processes require substantial changes to public institutions enabling an enactment of technology. Within public administrations many different more or less autonomous agencies exist at the different levels (ranging from local to central authorities), each responsible for a certain set of tasks. As part of their historical heritage, agencies often are part of different hierarchies that are governed in isolation of each other. Working in networks needs to rely on networking between stakeholders, goodwill, mutual trust and softer forms of governance mechanisms like service level agreements, instead of hierarchical control.

These developments require that governments and businesses collaborate in networks. Yet, there is little research on how loosely organized networks can be structured and orchestrated effectively (Milward & Provan, 2003). Information orchestration is viewed as the ability to coordinate the information flows aimed at ensuring that the information is available in the supply chain when and where needed. Information orchestration takes place within the governance structure which cannot be neglected. Designing and improving information orchestration across a network of agencies involves addressing many challenges outside the control of a single agency and needs to consider both technical and organizational aspects. An event-driven governance and information orchestration model (EDGIO) coordinates both the storage and exchange of information and on the accompanying governance mechanisms guiding these information flows.

This research will develop a flexible and scalable Event-Driven Governance and Information Orchestration (EDGIO) model to ensure that correct and right information is available where and when needed for cross-border trade.

Orchestration models are social and technological constructs and in-depth insight is necessary in the context to understand the specific sensitivities and needs.

From a technology point of view information orchestration and interoperability among the organizations is facilitated by an information service bus (ISB). An information service bus facilitates the exchange of data between the involved parties. Currently, service-oriented architectures (SOAs) and web services are the main technologies that are used to facilitate the interactions between agencies. Each organization in the network can make its system accessible by means of web services and by invoking these services a process can be created. One of the advantages of web services is that they allow for the decoupling of service interfaces from considerations related to service implementation and platform selection (Ferris & Farrell, 2003). This enables dynamic service binding and increases cross-language and cross-platform interoperability (Feenstra, Janssen, & Wagenaar, 2007; Park, 2006; Ralyté, Jeusfeld, Backlund, Kühn, & Arni-Bloch, 2008). Interoperability is the ability of a system, service or product to work with other systems, services or products without special effort on the part of the client (Ralyté et al., 2008). Another advantage of web services is that they can be composed. Composing services rather than accessing a single service provides service providers and application developers the opportunity to develop value-added services by combining existing web services (Yang & Papazoglou, 2004). Web-service orchestration coordinates the sequence of web-service invocations (Zhao and Cheng, 2005). Where web service orchestration focuses on the creation of pre-defined arrangements it can be criticized for its limited flexibility. Therefore we focus in this research specifically on the development of event-driven mechanisms as a data dissemination mechanism in the context of supply chain logistics. The orchestration will be based on event-based service oriented model and used as the mechanism for managing the interactions among individual organizations (Sheng, Benatallah, & Maamar, 2008). Events can be triggered by physical activities (for example a vessel arriving in a port) or activities (for example start of a random control). Yet this mechanism alone is not sufficient, as from a governance view organizations should react to the events. The event should trigger government agencies to plan their controls, in particular among each other (e.g. customs, veteran, hazardous materials etc), and identify one unique data set, which is required for all these controls from the importer or exporter of the goods. In turn events should trigger importers or exporters to know what is expected from them, make additional information available by granting access to the parts of the information pool and reusing as much as possible available business data from their own enterprise information systems (piggy backing), take decisions, create new events and take appropriate measures. The processing of these events, and the corresponding exchange of these data should be enabled by the information service bus. In essence, the decoupling of information needed for trading is changing as the traditional request-response model is changing to more complicated models in which the information decoupling point is shifting and might be located differently for certain types of information. In this way they are employing the information that is available from various organizations in the network.

In prior research, an event-driven orchestration model was developed within single organizations (Overbeek, Klievink, & Janssen, 2009). We will extend this research to develop an analysis of inter-organizational event trees for export and import cases. For example, the export of a container via Rotterdam triggers an event tree of various controls. If the container contains food products, then extra controls for food safety are required, next to customs controls. We will investigate how such an event tree can be automated such that: (1) all relevant data for the various controls only need to be collected once from the companies in the supply chain via the event-driven Information Service Bus, and (2) how workflow management solutions can be used to optimize the planning of the various controls in the event-tree. This research contributes directly to the development of an extended single window, based on solution principles such as piggy-back and data-pull. This research also links directly to the service-oriented audit research. Factors complicating the information orchestration including privacy restrictions which do not allow to share information, granting access, decoupling of information, information push and pull, the need to include new partners and change of partners in the network. Organizations store duplicates of information

available and such a network required basic registries in which vital information is managed and maintained based on the principle of information stewardships (having information ownership allocated to a single responsible entity who is responsible for the quality and control and maintenance (e.g. Dawes, 2010)). In addition the network is not static and will evolve and change overtime. This requires flexibility, which is a multidimensional aspect and include robustness, modifiability, new capability and partnering flexibility (C. Tan & Sia, 2006). Such a distributed approach poses new challenges to orchestrate the activities. This requires flexibility but at the same time clear control and governance mechanisms to ensure that events are delivered and processed in time. Both technology and governance aspects play an important role in an information orchestration arrangements.

This research proposal will be conducted in close collaboration with the other partners in the consortium. These developments need to be supported and enabled by the ISB requiring a combination of new governance mechanisms, information orchestration, semantic technologies and controls. ISBs are enabled by service-oriented paradigm and related technology protocols which provides the foundations. On top of this layer semantic interoperability is necessary to ensure information exchange. Information orchestration of the information and ensuring that the right information is available to ensure the smooth functioning of the interactions which is facilitated by governance mechanisms. Finally, this shift enables new types of controls which are related to type of information orchestration.

b. Approach

To ensure the rigor of our research, we aim to analyze (understand the specific requirement), interpret (e.g. the types of actor-network relationships on the interdependencies manifested in the networks), model (e.g. event tree modeling, workflow modeling, information flow and process modeling), design (orchestration model) and evaluate (impacts among businesses and government). In this research, we follow a design approach as described in (Hevner, March, Park, & Ram, 2004). We follow the design science paradigm where the knowledge and understanding of a problem domain and its solution are achieved in building and applying the designed artifact. The effects of applying this artifact are determined using a workshop and via a final case study. In this research, we follow the design-oriented research steps by (e.g. Verschuren & Hartog, 2005).

Phase 1: understanding

The need to understand the “critical dimensions of the problem inevitably implies that target groups most closely related to the problem provide the interpretation of the problems, rather than the researcher” (Ven & Delbecq, 1972, p. 341 p. 341). We will conduct multiple case studies using semi-structured interviews. The analysis process is iterative and interpretive in nature, focusing on a rich data set. The case studies will be selected based on covering a variety of different situations. In the case studies the requirements on the orchestration model will be elicited which will include technical and organizational aspects.

Phase 2: Developing orchestration model

The preceding steps are retrospective, viz. analyzing and understanding what has happened. Based on theory and the insights and experiences from practice an EDGIO having high-levels of adaptability and scalability will be developed. The modeling of such an EDGIO will be the core of these activities and should ensure specificity and ability to communicate the results. An iterative and interactive process will be employed having high user involvement to ensure that the design meets the requirements posed from practice. The EDGIO should foster the variety of stakeholders involved and provide alternatives. Yet it should contribute to the availability of correct and right information where and when needed. The EDGIO model will be an extension of the event-driven service-oriented architecture (EDSOA) such as proposed in (Overbeek et al., 2009; Y. H. Tan, Hofman, Gordijn, & Hulstijn, in press). More specifically, the modeling of event trees, workflows, information

flows and processes will be an important aspect during phase 2. The conceptual modeling aspects of the ISB links directly to the modeling aspects of the service-oriented auditing research.

Phase 3: Evaluation workshop

The resulting EDGIO model will be tested by involving practitioners. In this phase we want to conduct case study research with in-depth interviews with experts from the participating companies. The expert interviews are focused on eliciting knowledge of how existing processes can be redesigned to novel processes that support an event-driven service-oriented paradigm.

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d. Activities and time plan

The following activities and their planning are identified (begin and end of each activity is given in months after starting date; EDGIO: Event Driven Governance and Information Orchestration; ISB: Information Service Bus):

WP	Resp.	Activities		begin	end	Deliverables
WP3	TUD	Governance and Information Orchestration				
		WP3.1	Case description	1	9	Cases
		WP3.2	Draft version of EDGIO	4	12	Report with the first draft EDGIO
		WP3.3	Testing EDGIO draft with ISB	13	15	
		WP3.4	Second version EDGIO	16	24	Report with second draft EDGIO
		WP3.5	Validate 2nd EDGIO with ISB	25	27	
		WP3.6	Case studies with EDGIO	28	36	Case study report EDGIO
		WP3.7	Final version EDGIO	37	40	Final version EDGIO
		WP3.8	Disseminate results	41	44	
		WP3.9	Write final report	45	48	Final report

e. Expected scientific output and dissemination of results

This study is motivated by the need to better understand and improve orchestration by analyzing it from multidimensional views. Innovations in this project are:

- Model of an event-driven service-oriented governance and information orchestration (EDGIO) model to increase interoperability between existing and future services and systems in a network of service providers. The developed model accommodates the autonomy of organizations and the decentralized structure of public administration and has high levels of adaptability and scalability to ensure further sustainability, which contributes to the extended single window.
- Requirements and constraint on EDGIO models
- Governance mechanisms facilitating information orchestration models
- Conceptual models that specify requirements for information orchestration in networks
- Evaluate results of EDGIO models which can be used for further research direction.

The aim is to have at least 1 journal and 2 conference publications each year. Both the research field of information systems and e-government will be targeted.

To disseminate the results (and gain feedback) to practitioners and the organizations involved a number of workshops will be held. One workshop is scheduled to take place at the Delft University of Technology in September 2011. This coincides with the international IFIP EGOV conference in which both researchers and practitioners will participate. The aims of the workshops are threefold: to engaging the users and to generate feedback, to evaluate the model and on on-going findings; and providing a forum for discussions, and sharing of experiences.

2.1.4 WP4 – Semantics and business modelling

Abstract

The focus is on the development of a method for modelling complex service systems with many actors by describing both their semantics and their associated value propositions. The semantics focuses on the development of a virtual logistic data space and its practical application in terms by business. The virtual logistic data space for logistics is an ontology framework specifying all semantic concepts, their associations and possible assertions. It is (1) the basis for (global) interoperability to cover all aspects of logistic chains and (2) the basis for system development. The framework will consist of different components. Each of these components can be maintained by a separate organization and overall maintenance becomes distributed. The framework builds upon developments by the World Customs Organization, UN/Cefact, and other relevant developments, but is basically a semantic representation of all objects and activities performed by actors in logistic chains that add value in those chains.

Value propositions are distinguished at several architectural levels, e.g. on business level between actors in logistic chains and on the level of intermediaries (PCS's like PortBase and Cargonaut) providing Value Added Services. Single Window and Single Authority for Simplified Procedures are examples of value propositions offered by government authorities

and customs respectively. Value propositions are supported by IT, e.g. events exchanged within a single semantic space according to predefined patterns. These value propositions have a European dimension. Analysis of various service systems consisting of different constellations of value propositions needs to be done to identify the potential advantages and disadvantages of each model. Each service system is part of a larger, global service system for international trade and transport.

Description of the proposed research

a. Research topic

Over the past decades, services have become the most important part of economies (Heineke, 2007). Basically, the service economy refers to the service sector, which includes logistics. It leads to more sophisticated forms of cooperation, or what is called value co-creation (Spohrer, 2009). From an economic perspective, these systems are described as service systems. Research in this particular area is called service science (Spohrer, 2009). *Service* is the key concept to support value propositions of actors in an organizational network, since this concept only specifies (part of) the behaviour of an actor that is externally visible to other actors. 'Service' as such should not only constitute value propositions, but also requires governance mechanisms for uncertainty reduction (Spohrer, 2009). The service concept abstracts from internal resources of a service provider to meet customer requirements. A service provider can autonomously allocate its internal resources meeting a customer requirement and outsourcing part of the required service. A service should also refer to policies and performance metrics. A *policy* refers to conditions and assumptions under which value can actually be exchanged, e.g. conditions from a governance perspective. *Metrics* of a service refer to aspects like availability and performance and the basis for Service Level Agreements (Spohrer, 2009). To support a value proposition, interaction behaviour for actual value exchanges, interaction semantics, reachability (technical communication protocols, etc.), and non-functional properties need to be specified.

Governance comprises not only issues like open standards and security, but also services for discovery of value propositions with their related IT services, for example, auditing actors in a service system for applying controls according to agreed governance mechanisms, etc. *Open standards* and their semantics need to be globally accepted to implement a service system at a global scale. Trade and transport are examples of global service systems that require open standards. Most probably, semantics differs for each actor in such a (global) service system and additional mediation functionality is required. Standards and their semantics have to be available to all actors, either for free or at reduced (administrative) costs. *Security* is a second aspect of governance. In a setting of a (global) network of organizations, a federated security mechanism must be offered since not all actors will use the same security provider. One must be able to validate the identity of actors in an open environment like the Internet, where each actor can choose its preferred identity provider. A mechanism where these identity providers can be trusted needs to assure that identity of actors can be validated. *Service discovery* of business and IT services is a third aspect of governance. Although standards have been developed for IT service discovery (e.g. (Fensel, 2008)), discovering services is still complicated, because commercial issues are at stake. Careful consideration needs to be given on how to structure service discovery results. There are best practices that show how to offer the results, e.g. the airline booking systems, see (Petzinger 1995). *Auditing*, a fourth aspect of governance, could be implemented by periodic or behavioural auditing, e.g. behavioural auditing might be supported by monitoring and analysing the actual behaviour of a service system based on, for instance, process monitoring (Aalst et al. 2007). Behavioural auditing adds trust to service systems, since it will immediately detect flaws in the system. Auditing firms could be actors that play an important role in auditing service system. Finally, one of the most important aspects of governance is the *fair distribution of co-created value* between all actors in a service system. A fair win-win

situation must be created, otherwise partners of the service system will drop out, and the service system will not be sustainable.

Architectural aspects of service systems are related to concepts such as 'business process', 'business service', 'resource allocation', and 'transaction protocols' as the basis for *IT services*. These concepts allow distinguishing services from a business and IT perspective. Business transaction can be applied for actual value exchanges. It allows business and IT services alignment. *Business services* are the publication of a value proposition by a service provider. Value propositions can be expressed in different ways that need to be recognized by both customers and a service provider, e.g. a joint goal like the transportation of cargo. Different approaches like (Spohrer 2009) and (Fensel et al. 2008) use different terminology and define these terms loosely, or not at all. For instance, (Spohrer 2009) mentions business goals, whereas (Fensel et al. 2008) introduces the concepts of 'goal' and 'capability', meaning that a goal denotes a customer requirement and a capability the offering by a service provider. These two concepts, goal and capability, can be applied to both business and IT services. Since a joint business goal is the basis for service discovery or mediation between a goal and a capability (Fensel et al. 2008), these concepts have to be defined unambiguously. Basically, a *value proposition* not only encompasses a business activity that can be performed by a service provider, but also prices, conditions and IT services with their non-functional requirements for actual value exchange. An example of a business activity is 'transport' that is supported by a business process supporting various value propositions like express transport (individual cargo items that have a maximum weight and are transported by air) or container transport. To be able to perform a particular business activity, resources may have to be allocated. A service provider has to allocate resources (Spohrer 2009), e.g. a production line for beer production, to produce value for a customer. A customer should only be aware that a service provider is committed to a value exchange for a particular service. Each actor of a service system should implement a coordination mechanism over resources that are under its control.

Resource allocation to meet customer requirements is based on negotiation between that customer and a service provider and relates to a value proposition. A *negotiation mechanism* comprises various aspects of a value proposition, e.g. costs, duration, start and ending time, and places or stages. During negotiation, both actors try to reach an agreement resulting in a contract as a commitment for actual value exchange. (Dietz 2006) defines negotiation as a coordination act with an intention and a proposition. Coordination acts are supported by a transaction protocol. A basic protocol consists of 'request', 'promise', 'state' and 'accept', needs to be implemented by IT services, and can be decomposed in different phases: information or service discovery phase, negotiation phase which can lead to a contract, delivery phase in which value is actually exchanged based on the result of the negotiation phase, and a cancellation phase required for cancelling a contract and its agreed value exchange. A negotiation may lead to a commitment for value exchange of a service provider based on an existing service, which implies that that provider is actually willing to allocate resources. After a customer has accepted that proposition, resources have to be allocated according to the proposition. Support of a transaction protocol by IT services allows us to transform value propositions directly into IT services. This modelling approach still needs to be extended with rules for internal orchestration. (Hofman 1994) already introduced a set of rules based on the coordination of distributed resources.

(Osterwald 2004) presents a business model ontology encompassing a number of aspects mentioned above. Capabilities are for instance linked to resources and products have value propositions. (Hruby 2006) presents an accounting perspective based on the exchange of resources. These concepts are relevant from an interoperability perspective, i.e. logistic service providers offer their resources (vessels, airplanes, trucks, etc.) as capabilities in the context of a value proposition. Based on these concepts it seems feasible to construct an enterprise interoperability ontology (Hofman 2010). Furthermore, according to an

architectural approach (Lankhorst 2005), services can be distinguished at several levels. Intermediaries like PortBase and Cargonaut may offer IT services to support the business services between actors in logistic chains.

Modelling needs to be done at two levels. Firstly, business modelling needs to comprise the value propositions and exchanges of each actor involved in logistic chains based on changes induced by the introduction of the Extended Single Window concept and improve the estimate of the added value for supply chain control for the Netherlands. The Extended Single Window concept may lead to different services offered by government authorities or, applying the pull concept, a set of governance services offered by logistic service providers or intermediaries to government authorities (also known as System Based Auditing or SOAu, see before). As logistics has a global nature, the Single Authorization for Simplified Procedures (SASP, also known as Central Clearance) will be considered. The second modelling aspect is the construction of a logistics interoperability ontology framework. Such framework specifies the semantics for logistics based on concepts introduced above, e.g. resources, value propositions, business activities, and business transactions (Hofman 2010). Such an ontology framework can be constructed in analogy to the approach taken by the NASA (the NASA has constructed a similar framework for their information requirements). The framework needs to be applied for sharing information and has to support different views of individual actors on this information, e.g. customs requires different information than a stevedore or first line operator at an airport. In this context, consideration must be given in constructing core building blocks like a customs and dangerous goods view on logistics according to specific guidelines. Each of these views can be maintained by different organizations, thus leading to distributed management of open standards. A logistics interoperability ontology is based on these building blocks. Additionally, each actor must be able to construct its internal view based on these building blocks. This internal view can be used for mediation with the interoperability logistics.

b. Approach

Research objective

The objective is to develop a methodology for modeling service systems, their value propositions, semantics, and interoperability.

Research tasks

- Analyse existing methods, tools, and requirements (both from a semantic and business perspective)
- Explore concepts of service systems and their interoperability
- Apply these concepts to logistics and construct a logistic interoperability ontology
- Investigate the relation with the Information Service Bus
- Analyze the different constellations of value propositions

Research methods

The project uses a formal research methods in order to arrive at rigorous results. The overall perspective is design research (Hevner et al, 2004) in which artifacts are developed that solve certain problems. Validation includes the formal description of the artifacts, verifying to what extent requirements are met, and evaluating the solution in terms of effectiveness and performance.

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d. Activities and time plan

The following activities and their planning are identified (begin and end of each activity is given in months after starting date):

WP	Resp.	Activities		begin	end	Deliverables
WP4	TNO	Semantic and Business Modelling				
		WP4.1	Data structure analysis	1	3	State of the art interoperability
		WP4.2	Business model analysis	4	6	State of the art business model
		WP4.3	Ontology framework req.	4	6	Framework requirements
		WP4.4	Business model req.	7	9	business model requirements
		WP4.5	Framework guidelines	4	12	Framework guidelines
		WP4.6	Draft ontology framework	9	18	Draft ontology framework
		WP4.7	Refine framework	13	48	Refined ontology framework
		WP4.8	Business model development	9	36	Business models
		WP4.9	Coordinate	1	48	-
		WP4.10	Innovation aspects			Added value to SC coordination

e. Expected scientific output and dissemination of results

The expected scientific output will be:

- State of the art survey reports on semantic web technology (ontology, etc.), tooling, frameworks, and current business models.
- Requirements for ontology framework and business modelling.
- Ontology framework guidelines and fit-gap analysis for tooling
- Logistic Interoperability Ontology Framework in several stages (e.g. first draft, concept, and a possible refined model with input from cases and international standardization meetings)
- Business Models of the to-be situation
- Improved estimates of added value

2.1.5 WP5 - Proof of Concept

Abstract

The objective of this Work Package is to develop a Proof of Concept (PoC) for the technical feasibility of the concepts for both air- and sea-cargo. The Proof of Concept will lack certain functionality for its practical applicability; aspects like scalability and performance will also be

considered in the PoC. As such, the PoC is a basis for further development of a joint platform for air- and sea-cargo.

Description of the proposed research

a. Research topic

This work package does not have a scientific nature but is intended to construct a Proof of Concept. As currently foreseen, such a Proof of Concept has to show that an Information Service Bus can be realized constructing a virtual logistic data space. The Information Service Bus will consist of two components, namely a private and a public part. The private part will integrate the information of all transportation modalities. Both parts will act as Integrated processes that can publish and subscribe events for the functionality they support on behalf of the actors. The other Work Packages have to show which components are required, but at least an Enterprise Service Bus with Complex Event Processing facilities supporting stateful events needs to be in place. It must be shown how the public and private part can not only share data and events, but also how they need to be configured, e.g. how can an event tree be published by the public part to the private part (if different at all) and what is the structure of the event choreography. This also includes aspects such as authorization and security.

b. Approach

Close collaboration with the other Work Packages is required. The architecture for an event-driven Service Oriented Architecture environment delivered by WP3 is the basis for developing the Proof of Concept. The specification of the activities, the planning, and deliverables of this WP will contain detailed information concerning the realization of the PoC. Furthermore, it is the intention to produce more than one version of the PoC. After initial selection of the tools based on first thoughts concerning the architecture, the guidelines for developing the Logistics Ontology Framework, and the auditing, an initial version of the PoC will be produced to get (1) acquainted with the available tools and (2) the concepts of the approach. Furthermore, there will be a yearly update of the PoC resulting in 3 releases of the PoC. The final release will include the SOAu framework, since this is the one that will be delivered by WP2 in the last year.

c. Literature references

Not relevant.

d. Scientific setting

Not relevant

e. output

Four versions of the PoC will be produced:

- Initial version, first year: getting acquainted with the tools and the concepts.
- Second version, second year: first support of the architecture and the ontology framework.
- Third version, third year: refinement of the second version by supporting updates of the architecture and the ontology framework.
- Fourth version, final year: including support of (parts of) the SOAu framework.

f. Societal & Scientific Relevance

The PoC development will be led as a joint effort of both Portbase and Cargonaut. Since Portbase is in the process of renewing their infrastructure, the PoC will most probably be constructed as an extension or a Value Added Service on that infrastructure. Furthermore, Cargonaut is currently implementing a similar approach in close cooperation with Dutch

Customs at Schiphol Airport. Since the PoC will show which extra functionality can be realized in the near future for both parties, they are strongly committed to realize the PoC. Therefore, they will not only commit their contribution in kind to this R&D project, but will also internally commit resources for the realization of the PoC.

2.1.6 WP6 - Valorisation

See chapter 5 for details.

2.2 Planning

The following figure gives an overview of the planning (the planning is given per quarter; planning of WP6 – valorization – is given in chapter 5):

WP	Resp.	Activities	Quarter																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
WP1	TNO	Project Management	[Active]																
WP2	UvT	SOAu	[Active]																
		WP2.1	State of the art on SOAu	[Active]															
		WP2.2	Case description	[Active]															
		WP2.3	Ph.D. Courses	[Active]															
		WP2.4	Cases for existing/new SOAu	[Active]															
		WP2.5	SOA online auditing framework	[Active]															
		WP2.6	Cases for existing/new CEP	[Active]															
		WP2.7	CEP smart auditing framework	[Active]															
		WP2.8	SOAu evaluation framework	[Active]															
		WP2.8	Innovation potential Dissertation	[Active]															
WP3	TUD	Governance and Information Orchestration	[Active]																
		WP3.1	Case description	[Active]															
		WP3.2	Draft version of EDGIO	[Active]															
		WP3.3	Testing EDGIO draft with ISB	[Active]															
		WP3.4	Second version EDGIO	[Active]															
		WP3.5	Validate 2nd EDGIO with ISB	[Active]															
		WP3.6	Case studies with EDGIO	[Active]															
		WP3.7	Final version EDGIO	[Active]															
		WP3.8	Disseminate results	[Active]															
		WP3.9	Write final report	[Active]															
WP4	TNO	Semantic and Business Modelling	[Active]																
		WP4.1	Data structure analysis	[Active]															
		WP4.2	Business model analysis	[Active]															
		WP4.3	Ontology framework req.	[Active]															
		WP4.4	Business model req.	[Active]															
		WP4.5	Framework guidelines	[Active]															
		WP4.6	Draft ontology framework	[Active]															
		WP4.7	Refine framework	[Active]															
		WP4.8	Business model development	[Active]															
		WP4.9	Coordinate	[Active]															
		WP4.10	Innovation aspects	[Active]															
WP5	Portbase	Proof of Concept	[Active]																
		WP5.1	Tool selection	[Active]															
		WP5.2	First draft configuration	[Active]															
		WP5.3	Construction of the PoC	[Active]															
		WP5.4	Validation of the PoC	[Active]															

The following dependencies are identified between the Work Packages:

Depending activity	Required input	Input produced by
WP5.1 tools	Initial draft architecture	WP3.2, WP4.1-6
WP5.1 tools	Ontology Framework guidelines	WP4.5
WP5.3	Draft architecture	WP3.2, 3.4, and 3.7, WP4.1-6.
WP5.3	First draft Ontology Framework	WP4.6
WP5.3	SOAu Framework	WP2.4-6

The final PoC as the result of WP5.3 will be based on the latest versions of the architecture produced by WP3.7, the Logistic Ontology Framework, and the SOAu Framework.

3 Consortium and Project organization (C)

3.1 Research Team

Name partner	WP	Role and input	Specific competence
Prof. L. Hagdorn (TNO)	WP1	Overall project management	Project management skills, domain knowledge, research experience
Ir. G. Zomer (TNO)	WP1/WP4	Overall coordination, business modeling, joint WP4 leader	Experience in managing (large) research projects, domain knowledge
Dr. H. Weigand (UvT)	WP2	WP2 leader	Research experience in SOA, auditing, experience in (large) research projects
To be fulfilled	WP2	aio	
Prof. Y. Tan (TUD)	WP3	WP3 leader	General experience with (large and international) scientific research projects, domain knowledge
Dr. M. Janssen (TUD)	WP3	WP3 senior researcher	Research experience in event driven orchestration
Dr. S. Overbeek (TUD)	WP3	WP3 postdoc	Research experience in event driven orchestration
Ir. B. Klievink (TUD)	WP3	WP3 postdoc	Research experience in event driven orchestration
Dr. ir. W.J. Hofman (TNO)	WP4	Semantic modeling, joint WP4 leader	IT experience and interoperability experience combined with domain knowledge
P. Swaak (Portbase)	WP5	Joint WP5 leader	Domain knowledge, IT experience within the domain, commitment of internal resources of Portbase
A. Hoitink (Cargonaut)	WP5	Joint WP5 leader	Domain knowledge, IT experience within the domain, commitment of internal resources of Cargonaut
H. Bethem (Fontys)	WP6	Joint WP6 leader	Domain knowledge, research experience
L. Kemps (NHTV)	WP6	Joint WP6 leader	Domain knowledge, research experience

Note that the aio position will be fulfilled as soon as the request for this R&D proposal is granted. Furthermore, the WP5 leaders will compose a team as soon as the work package starts.

3.2 Project organization

The project organization is concise. The project includes 5 work packages, each with a responsible WP leader.

WP1 Project coordination is the responsibility of TNO. Prof L. Hagdorn acts as project director, G. Zomer acts as project coordinator.

The three R&D work packages are managed by three WP leaders. These are:

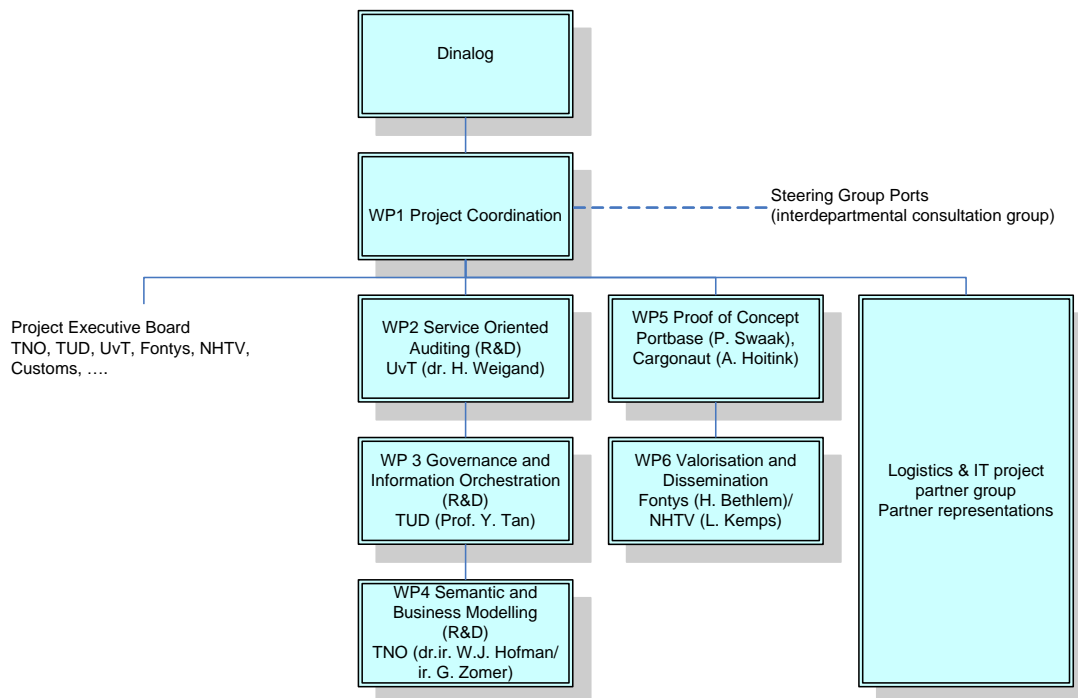
- WP2 Service Oriented Auditing: Dr. H. Weigand (UvT)
- WP3: Governance and Information Orchestration: Prof Y. Tan (TUD)
- WP4: Semantic and business modelling: Dr. W.J. Hofman/Ir. G. Zomer (TNO)
- WP5: Proof of Concept: P.Swaak/A. Hoitink (PortBase/Cargonaut)

The last WP is WP6 Valorisation and dissemination. This is a joint responsibility of Fontys, NHTV and TNO. The responsible WP leader is H.Bethlem/L. Kemps.

The Executive Board assures that the final results in terms of added value to supply chain coordination will be reached. If necessary, the Executive Board will take corrective actions to safeguard that the results of the Work Packages contribute to this added value. The WP leaders with the addition of customs and traders representatives form the project executive board, chaired by the project director.

The group of logistics, customs and IT project partners includes Schiphol NV, NV Regio Venlo, Portbase, Cargonaut, ACN, Dutch Customs, EVO, Frugiventa and a series of individual shippers. This group provides input to the R&D work packages and validates the R&D results. Moreover, they contribute to the realization of the valorization objectives, particularly the realization of demonstration projects.

The diagram below gives a representation of the project organization. It shows the coordination between the project and the interdepartmental consultation group 'Steering Group Ports' in which a number of participants of this proposal is also represented. This coordination can be used as a means to safeguard that the results of this project will also be implemented.



4 Evaluation and monitoring (D)

4.1 Evaluation

The final evaluation of this R&D project consists of the added value to supply chain coordination in the Netherlands. The calculation of this added value is a specific activity in Work Package 4, namely WP4.10. The result will be a better estimate of the figure given in section 1.4.3 of this proposal. Project Management will also produce the final evaluation report, which will not only contain the estimated figures for the added value, but also more qualitative innovation aspects based on for instance the scientific impact. If possible, these qualitative aspects will be underpinned with quantitative figures of potential impact and foreseen actions. These latter qualitative and quantitative innovation aspects are produced by the relevant activities of Work Packages 2 and 3.

Furthermore, the following evaluation indicators are used during the project:

- Cooperation between within the project team, with the executive board, the Steering Group Ports, etc. (number of meetings, number of company visits, number of joint papers, number of student internships, etc.).
- Scientific impact (number of publications, number of presentations).
- Dissemination (number of presentations, number of participants per presentation, media presence, meetings with dissemination panels, etc.).
- Innovation achieved (total of savings achieved by actual innovations in the context of the ESW project).
- Innovation potential achieved (projected savings from innovation concepts developed).
- Participant satisfaction (survey).

4.2 Monitoring

The WP leaders will submit a quarterly progress report with the achievements and forecast for the next quarter. This progress report will be based on the aforementioned metrics and include:

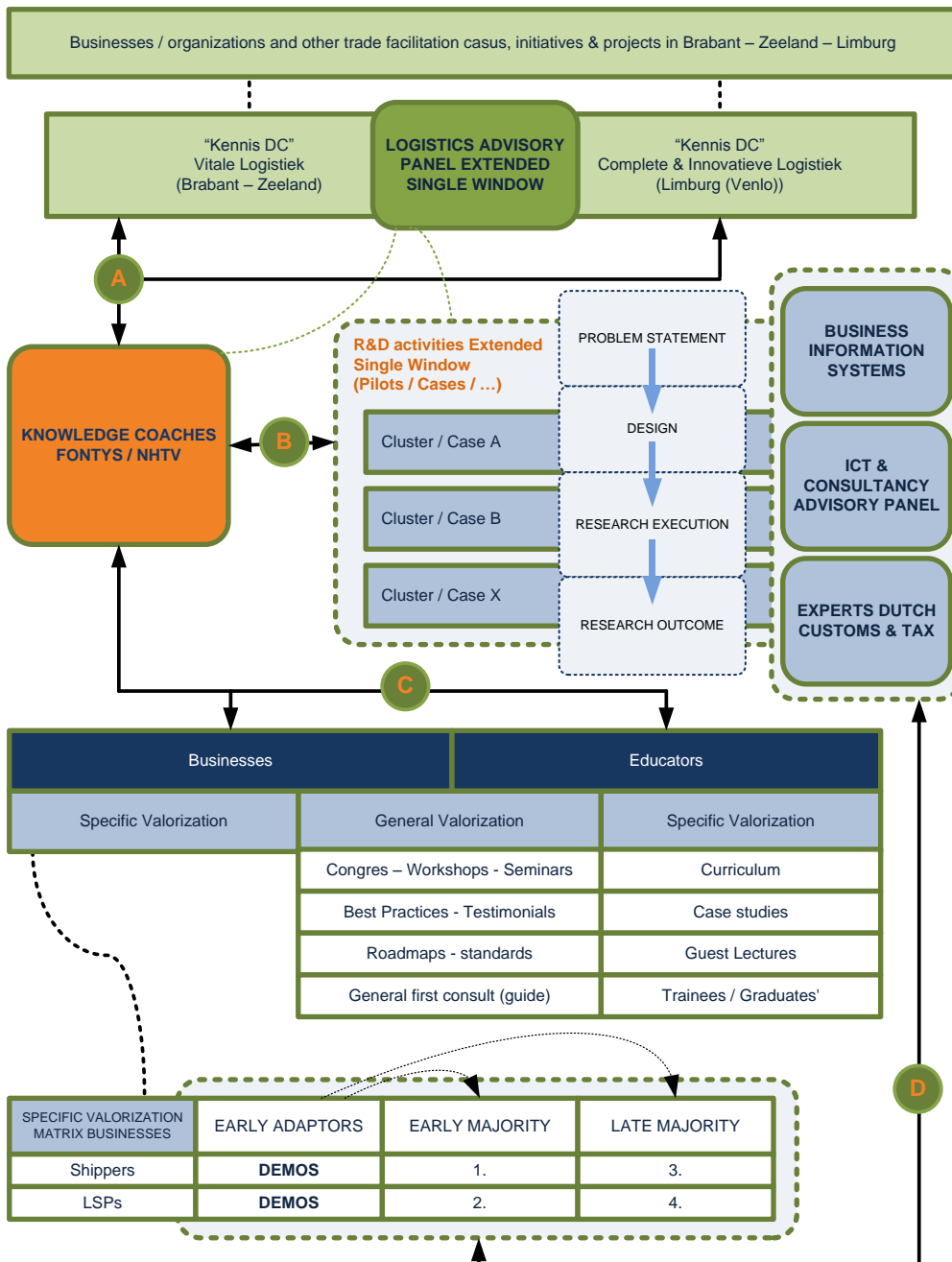
- Actions that have been taken.
- Deliverables that have been produced, including their status.
- Milestones that have been reached.
- Bottlenecks and (proposed) solutions.
- Actions and potential risk for the coming period.
- Financial overview and forecast.

Based on these quarterly reports, Project Management will take corrective actions. Furthermore, Project Management will use these quarterly reports to submit a quarterly report to Dinalog and the Executive Board. Based on this input, the Executive Board will propose corrective action.

5 Valorization and implementation strategy (E)

5.1 Valorization and knowledge dissemination

Valorisation and dissemination of knowledge are important aims for Dinalog. In Extended Single Window the following model is used for this:



Starting point:

Valorisation and dissemination of knowledge take place from the start of the project and grow along during the development. That is why the parties that are active in the actual dissemination of knowledge are actively involved in the project right from the start.

Valorisation (= economic returns from the project) takes place, if:

- The developed logistics and supervision concepts are applied in the logistic chain and lead to *higher logistic performance and cost savings* for shippers and logistic service providers and carriers. To be able to achieve this, these shippers and logistic service providers must get an insight into the advantages and possibilities of these innovative logistics and supervision concepts. A secondary effect takes place if the Netherlands becomes more attractive as a place of business for logistic and customs activities and as a result employment opportunities grow.
- The developed logistics and supervision concepts, changing roles and the supporting ICT-infrastructure, have been incorporated into *the ICT-systems within the chain and within businesses*. ICT-businesses and (commercial) service providers such as consultants and (customs)-carriers can offer ICT-solutions for this. The developed logistics and supervision concepts can also be marketed internationally by the ICT-businesses, consultancies and international customs-carriers. Dutch ICT-businesses and consultancy businesses already take up a strong position in Europe in this field of operations.
- The developed logistics and supervision concepts are incorporated into the educational programmes of the various academies, both at HBO (Higher Vocational Education) and WO (University) level. We do not only think of logistics academies here, but also of academies in the fields of (business) economics and ICT.
- The developed logistics and supervision concepts facilitate the application of new directional concepts, such as the extended gate concept. The development of new directional concepts takes place in other (Dinalog-) projects and is incorporated in this valorisation plan.

5.2 Implementation

Two action lines for valorisation and dissemination of knowledge are deployed:

- Knowledge valorisation at ICT and commercial service providers (a. o. customs advice offices)
- Dissemination of knowledge among shippers and logistic service providers.

Knowledge valorisation at ICT and commercial service providers:

- Target group: ICT-businesses (IBM, SAP, Cordys, Capgemini, MIC, Minihouse, Softpak, etc...), tax/customs-consultants (Deloitte, KPMG, etc...) and (customs) carriers, such as Gaston Schul, Verhoex etc.). These businesses develop the supporting systems and services that are used by shippers and logistic service providers to apply the developed supervision concepts in practice. The step that must be taken is that the ICT-businesses, consultants and carriers are going to integrate the supervision concepts and ICT-architecture into their systems and services.

- Track 1: Taking part in R&D cases / projects: Integration is boosted if in the R&D project the applicability of the solutions is directly looked at in cooperation with Customs and port community systems. So the R&D project must provide an insight into some applications that can be realized quickly. Subsequently, the results can be tested immediately in demonstration projects. These demonstration projects are developed parallel to the R&D project, so interaction with the market can be set up quickly.
- Track 2: ICT & Consultancy panel. For a good interaction with the providers, during the project, an ICT & Consultancy Panel is set up. The panel is open to all providers. There are periodic meetings to discuss results and points for discussion (for instance, 2 or 3 times a year) and to feed the project with the dynamics from the field. The participating businesses can orientate themselves in good time on the application of knowledge to be developed. Feedback can be provided from demonstration projects in which some ICT and consultancy businesses will take part.
- Track 3: Open source: To make the threshold to accessibility of results for businesses as low as possible all software to be developed (within the DIALOG project) is open source. This will also be a requirement for demonstration projects that are financed via DIALOG.
- In the driver's seat: TNO
- Activities:
 - Track 1:
 - ICT coordination within R&D Project and between R&D project and demonstrators
 - Track 2:
 - 8 meetings of 1 or 2 mornings/afternoons
 - Preparation with regard to content of meetings – from R&D budget
 - Organising (logistic preparation) of the meeting – 20 days from knowledge dissemination budget
 - Track 3: setting up and coordinating open source policy.

Dissemination of knowledge to shippers and logistic service providers:

- Aimed at informing shippers and logistic service providers about the possibilities of reducing the impact of the supervision of speedy dispatch of import/export goods and of decreasing the administrative costs of supervision.
- The HBOs can play a bridge function in translating the scientific knowledge into practical tools and information for businesses not taking part in the Dialog-project research. In this the concept Knowledge DCs (Vital Logistics + Complete & Innovative Logistics) can be used, that is being developed jointly by the HBOs. A logistic knowledge DC has the following tasks:
 - (1) accessible window for knowledge and innovation for MKB (Small and Medium Sized) businesses in the region
 - (2) setting up practical applications of new scientific insights
 - (3) identifying and translating the needs of businesses in the region
 - (4) creating a network in which businesses and knowledge institutes find each other
 - (5) speeding up innovation on to the market
 - (6) speeding up knowledge on to the market

In the Brabant region Vitale Logistiek/NHTV has in the meantime started developing a Knowledge DC for Brabant. Around three themes (Performance

measurement, trade facilitation and clustering flows of goods) Vitale Logistiek/NHTV has in the meantime set up a network of 250 businesses. In the Limburg/region of Venlo, NV region Venlo & Fontys with Complete & Innovatieve Logistiek (CIL) have in the meantime started developing Knowledge DCs. Around the themes of ICT (RFID), sensing/diagnostics, Value Added Logistics, junction direction, fiscal logistics coordination and agro-logistics-coordination, CIL with Fontys, has in the meantime set up a network of 200 businesses and knowledge institutes. The Kennisakkoord Logistiek/HBO consultation has stated that it will further develop the concept of Knowledge DCs and at the same time do their best for the dissemination of knowledge and valorisation of Dialog projects.

In the R&D project extended single windows, as a central axis in the role of valorisation and dissemination of knowledge, a knowledge coach is deployed.

- Knowledge coach; a knowledge coach is a lector or HBO-lecturer who serves as a switch-point between scientific research and the application of knowledge in the practical field. The knowledge coach on the one hand has the task to translate scientific research into practical handles for the business community and educational institutes, and on the other hand introduce questions/needs that are connected to the application of knowledge from (non-participating) businesses and projects through the Knowledge DCs. To be able to fulfil this bridge function the knowledge coach will regularly take part in project meetings to be well-informed during the project. The knowledge coach guides the knowledge dissemination activities on his subject in the regions concerned (so not only his own region).

Knowledge coaching knows 4 main routes (also see the figure on page 1) that have to be controlled, coordinated and maintained:

Route	Description
A	Open up possibly interested businesses & organisations, knowledge, experience and results from other projects and initiatives via the knowledge DCs.
B	Bring parties, knowledge / expertise, standards, etc from the knowledge CDs into Extended Single Windows and vice versa.
C	Well-aimed actions of dissemination of knowledge and valorisation within Extended Single Window in 3 main lines and actively bring back experience and results to R&D projects and knowledge DCs.
D	Take care of clever made-to-measure dissemination of knowledge and experience and linking of directly involved ICT, commercial service providers and customs in the direction of the practical field through the valorisation matrix described.

The knowledge coaches guard and coordinate all routes and the information, knowledge and techniques that flow along those routes. The routes always operate 2 ways!

It is proposed to deploy two knowledge coaches in the Extended Single Window project:

- Knowledge coach '*RFID, ICT and coordination*' from Venlo. This Knowledge coach focuses on making applicable or seeing to it that the ICT concepts developed link well with the logistic and fiscal systems and processes that are now being deployed by logistic parties.

- Knowledge coach ‘ *Trade facilitation*’ from NHTV. This knowledge coach focuses on the economic and organizational incorporation of the concepts within (logistic) businesses / the supply chain.

The two subjects ‘RFID, ICT and coordination and ‘Trade facilitation’ can be distinguished, but it is difficult to keep them apart. Therefore it is essential that both coaches are attuned well for the further working out of specific questions for their field of operation or pilots.

- Logistics advisory panel; the knowledge coach organises around himself a sounding board of four to six businesses that are at the front of developments, but have different characteristics from the businesses taking part in the R&D research. The knowledge coach uses the logistics advisory panel to make a choice what questions or results need further elaboration in the Knowledge DC and what questions need further elaboration to be able to make the step to the practical field.
- Specific dissemination via regional network. Particular attention is paid to specific valorisation / dissemination in the direction of the business world. This is done on the basis of the following matrix (also see the figure on the first page):

SPECIFIC VALORIZATION MATRIX BUSINESSES	EARLY ADAPTORS	EARLY MAJORITY	LATE MAJORITY
Shippers	DEMO's	1.	3.
LSP's	DEMO's	2.	4.

The early adaptors are:

- Big shippers (active throughout Europe or the world);
- Top service providers with their own customs facilities (active throughout Europe or the world).

The early majority is:

- Medium-sized shippers (active throughout Europe or the world);
- Sub-top service providers with their own customs facilities or that make use of a customs forwarding office (active throughout Europe or the world).

The late majority is:

- MKB field of operation shippers (active throughout Europe or the world);
- MKB field of operation service providers that make use of a customs forwarding office (active throughout Europe or the world).

DEMOs

The early adaptors will especially be serviced through DEMO projects that will be developed and offered adjacent to the R&D project Extended Single Window. The early adaptors have hooked up via the networks and “development” organisations involved in the knowledge DCs. All knowledge and experience from the R&D project will be brought into the DEMO projects. All knowledge and experience from the DEMOs will again be brought in for valorisation and dissemination of knowledge in the blocks / categories 1,2,3 and 4.

1 & 2

The early majority will also be recruited via the knowledge DCs and generic dissemination of knowledge. This group will especially be served by the commercial service providers involved in the R&D project. Because in the R&D project and in the DEMO projects standardization has been aimed at and as a result “easy accessibility”, the costs for use or implementation of ICT and other services will be low for the field of operation. After all, there is no need for the commercial service providers to re-invent the wheel.

3 & 4

The late majority will again be recruited through the knowledge DCs and generic dissemination of knowledge. This group will (in the first line) be served especially from the field of education and then specifically through case studies, work placements and final projects. The knowledge, roadmaps and standards have, at this stage, been developed out so well that students should be able to help a business on its way in the first line, after which the businesses themselves can continue (either with or without the (light) support of commercial service providers).

- Generic dissemination of knowledge via the regional network. Every HBO/region has a network of businesses interested in this through ongoing research. In Brabant and in Noord-Limburg NHTV/Vitale Logistiek and Fontys/Compleet in Innovatieve Logistiek have respectively built up a network of 400 businesses, approximately 45 of which are directly interested in the subject of Extended Single Window/Trade facilitation. The HBOs deploy this network as follows:
 - Congress, seminars and workshops (target : 50 active businesses)
 - Best practices and testimonials are on the one hand meant to “recruit” businesses to become active in Trade Facilitation and Fiscal and Logistic coordination services or to deploy these services actively in operational management and on the other hand are meant to “recruit” businesses for the region / the Netherlands (establishment of logistic operations and services in the Netherlands);
 - Roadmaps and standards;
 - Direct short-term advice to businesses → short “guiding” discussions to determine the right route for the business concerned (target: 25 per region)

NHTV and Fontys will also make the developed seminars and workshops available for meetings outside their own regions. In cooperation with EVO, TLN and ACN meetings in other places in the Netherlands are also organised.

- Specific dissemination of knowledge for educational institutes; the results of the research are also incorporated into the curriculum.
 - Teaching material on Trade facilitation & the role of the region;
 - Lectures on ‘Customs & Trade’ and on ‘ICT in the fiscal and logistic chain’;
 - Case studies from the R&D project are transformed into educational cases;
 - Work placement and final project assignments (target: 10 projects per region).

- In the driver's seat:
 - NHTV – Economic and organizational aspects
 - Fontys (Transport Academy) – RFID and ICT and coordination
 - Activities /Deployment:
 - Knowledge coach: 40 days per coach (10 per year)
 - Network activities:
 - 6 sessions (2 per year), 2.5 days per session
 - 10 final projects, acquisition 1 day per project and 40 hours of supervision per project
 - 25 consultancy courses (: 1 day per course =25 days)
 - Departments
 - Developing teaching material: 5 days per course/4 courses
 - Developing 4 educational cases: 20 days (5 days per case)

Annex. Relevant partners and CVs

University of Tilburg

The project will be executed in the context of the ERISS institute in Tilburg, in collaboration with TUD (Yao-Hua Tan) and the other DIALOG project partners. The European Research Institute in Service Science (ERISS) undertakes innovative, interdisciplinary services research. It focuses on real-world challenges that demand the use of multiple conceptual, methodological and substantive approaches. ERISS is scientific coordinator of the European Network of Excellence in Service Engineering Scube, and involved in several European projects, including COMPAS (Compliance). In addition, it has projects funded by the Dutch Science Foundation NWO, including VALUE-IT that focuses on service-oriented design and adaptation.

ERISS is regarded a top institute on service engineering that has close connections with companies such as IBM and top universities in Europe and USA. ERISS director *Michael P. Papazoglou* holds the chair of Computer Science at the University of Tilburg. He is also an honorary professor at the University of Trento in Italy. Prior to this he was full Professor and head of School of Information Systems at the Queensland Univ. of Technology (QUT) in Brisbane Australia (1991-1996). Mike is Co-Editor in Charge of the monograph subline of Lecture Notes in Computer Science (LNCS) dedicated to Service Science with Springer-Verlag and Co-Editor in charge of the MIT book series on Information Systems. He has founded the International Conference on Cooperative Information Systems (CoopIS), and more recently the high-impact International Conference in Service Oriented Computing (ICSOC), which is now supported by the EU FP-7 Programme. His most two recent books are "e-Business: Organizational and Technical Foundations" published by J. Wiley in 2006, and "Principles and Foundations of Web Services", published by Prentice-Hall in 2008.

Dr. Hans Weigand is Associate Professor at the Dept of Information Management at which he teaches various Computer Science subjects including Databases and IT Infrastructure as well as E-business, and a research fellow of ERISS. His research domain is Information Systems on which he has published numerous conference and journal articles. He is especially interested in IT-enabled business processes, where technical and organizational aspects interact. Since some years, he is investigating service modeling (in collaboration with KTH Stockholm) and adaptive service-oriented architectures. His research is partly financed by NWO and is performed in collaboration with industry, sometimes in the form of EC-funded projects. Hans Weigand is a board member of the research school SIKS and of BENAIS, the BENELUX chapter of the AIS.

Tilburg University is a member of the accredited Dutch national research school SIKS on Information Systems and AI. SIKS provides an extensive program of graduate courses. Currently, more than 200 Ph.D. students are enrolled via the member universities.

Main publications of applicant(s):

Weigand, H., Johannesson, P., Andersson, B., Bergholtz, M., Value-based Service Modeling and Design: Toward a Unified View of Services. In: van Eck, P.A.T. and Gordijn, J. and Wieringa, R.J., eds. Proc. CAISE 2009, Springer, LNCS 5565, pp. 410-424

S.J.B.A. Hoppenbrouwers, H. Weigand, and E.A.J.A. Rouwette: Setting Rules of Play for Collaborative Modelling. Int. Journal of e- Collaboration (IJeC), 5(4), 2009, pp. 37-52.

Silva, P. A., and Weigand, H. 2009. Challenges in Predictive Self-Adaptation of Service Bundles. In: Proc. of the 2009 IEEE/WIC/ACM Int. Joint Conference on Web intelligence and intelligent Agent Technology - Volume 03 (Sept 15 - 18, 2009). IEEE Computer Society, Washington, DC, 457-461.

Hiel, M., Weigand, H., & Heuvel, W.J.A.M. van den (2008). An adaptive service oriented architecture. International Journal of Interoperability in Business Information Systems, 2(3), 37-51.

Moor, A. de, & Weigand, H. (2007). Formalizing the evolution of virtual communities. *Information Systems*, 32(2), 223-247.

Technical University of Delft

The project will be executed in the context of the section of ICT, Faculty of Technology, Policy and Management at Delft University of Technology, in close collaboration with TNO and the ERISS institute in Tilburg the other DINALOG project partners. The objective of Dinalog is to develop an integrated solution for the challenges described above, to create reliable, secure, and cost effective logistic chains throughout the Netherlands, thus enabling an excellent logistic gateway to Europe. At the heart of this is the advanced Information Service Bus (ISB) for data exchange between all parties of the supply chain. From a semiotic perspective, the ISB facilitates interoperability at the network level, the research of TNO facilitates the semantic level, whilst this research looks at the pragmatic level.

Founded in 1842, Delft University of Technology is the oldest, largest, and most comprehensive university of Technology in the Netherlands. The University collaborates with a wide network of (inter)national educational, industrial, and government partners. TUDELFT tries to discover research problems in society, usually with a technical or engineering component. The Faculty of Technology, Policy and Management (TPM) within TUDELFT is concerned with complex technological systems which function within a socio-economic context. The faculty develops interdisciplinary theories, methods and tools in this field. The faculty includes sections in the field of policy analyses, policy management, systems engineering, simulation and gaming, philosophy (ethics and value sensitive design) and ICT related to e-government. The section of ICT is concerned with the embedding of ICT in social life and a special focus is on e-customs and e-governments.

Prof.dr. *Yao-Hua Tan* is the chair of the ICT section. He was also Reynolds visiting professor at the Wharton Business School of the University of Pennsylvania. His research interests are virtual relationship building in business-to-business electronic commerce; the role of trust as facilitator for company participation in electronic commerce; ICT-enabled electronic negotiation and contracting; use of artificial intelligence techniques to enable automation of business procedures in international trade. He has numerous publications in this research field.

Dr. *Marijn Janssen* is Director of the interdisciplinary Systems Engineering, Policy Analyses and Management Master programme, manages a Toptech executive programme and is an Associate Professor within the Information and Communication Technology section He conducted and/or managed a number of projects and is an associate editor of the *International Journal of EGovernment (IJEGR)*, *Electronic Journal of eGovernment (EJEG)*, *International Journal of E-business Research (IJEER)* and *Government Information Quarterly (GIQ)*, co-chair of the e-government infrastructure and interoperability minitrack at the HICCS conference, e-government track chair at AMCIS2010 and conference chair of IFIP EGOV2010. He is winner of 7 best paper awards and published over 160 conference papers, book chapters, and journals and was ranked as one of the leading researchers in e-government in a survey (2009). More information: www.tbm.tudelft.nl/marijn.

Dr. *Sietse Overbeek* is a researcher at the ICT group of the Faculty of Technology, Policy and Management at Delft University of Technology. His research interests in the field of conceptual modelling of (web) information systems and service-oriented computing at Delft University of Technology. Sietse has (co-)authored several journal papers, conference publications, and book chapters and is a member of multiple international program committees related to conferences on (service-oriented) systems analysis and design. Sietse received his Ph.D. from the same university in April 2009. He is a member of the ACM. For more information, see: www.sietseoverbeek.nl

Bram Klievink (a.j.klievink@tudelft.nl) is a researcher at the ICT group of the Faculty of Technology, Policy and Management at Delft University of Technology. He holds a MSc degree in political science as well as a degree in business information systems. He is currently working on a PhD research, focused on coordination mechanisms for public-private service networks. Furthermore, he participated in research projects on integrated, demand-driven e-government and on multi-channel management in government. He is also a board member of the Dutch Alliance for Vital Governance, a strategic research alliance for collaboration and knowledge transfer between government organisations and research institutes in the Netherlands.

Main publications of applicant(s):

1. Baida, Z., Liu, J., and Tan, Y.H., Towards a Methodology for Designing e-Government Control Procedures. In M.A. Wimmer, J. Scholl, & A. Gronlund (Eds.), *Electronic Government, 6th International Conference, EGOV 2007, Lecture Notes in Computer Science (LNCS 4656)*, pp. 56-67, Berlin Heidelberg: Springer Verlag, 2007.
2. Baida, Z., Rukanova, B., Liu, J., Tan, Y.H., Preserving Control in Trade Procedure Redesign - The Beer Living Lab, *Electronic Markets, The International Journal*, Vol. 18, No. 1, 2008.
3. J. Ramon Gil-Garcia, Soon Ae Chun, and Marijn Janssen (2009). Government Information Sharing and Integration: Combining the social and technical. *Information Polity*, Vol. 14, No. 1-2, pp. 1-10.
4. Henriksen, H., Rukanova, B., Tan, Y.H., Pacta Sunt Servanda But Where is the Agreement? The Complicated Case of eCustoms. In: *Electronic Government, 7th International Conference, EGOV 2008, Lecture Notes in Computer Science*. Berlin Heidelberg: Springer Verlag, 2008.
5. Hulstijn, J., Liu, J., Tan, Y.H., Delegation of Control in Administrative Procedures, Book chapter of R. van der Meyden and L van der Torre (Eds.) *Proceedings of the Ninth International Conference on Deontic Logic in Computer Science (DEON'08)*, LNCS 5076, Springer Verlag, 2008.
6. Marijn Janssen, Soon Ae Chun and J. Ramon Gil-Garcia (2009). Building the Next Generation of Digital Government Infrastructures. *Government Information Quarterly*, Vol. 26, No. 2 pp. 233-237.
7. Janssen, M. & Joha, A. (2006). Motives for Establishing Shared Service Centers in Public Administrations. *International Journal of Information Management (ISSN: 0268-4012)*, Vol. 26, No. 2, pp. 102-116.
8. Janssen, M. & Joha, A. (2008). Emerging Shared Service Organizations and the Service-Oriented Enterprise: Critical Management Issues. *Strategic Outsourcing. An International Journal*, Vol. 1, no. 1, pp. 35-49 (*Highly Commended Award Winner at the Literati Network Awards for Excellence 2009*).
9. Janssen, Marijn, Kuk, George & Wagenaar, René W. (2008). A Survey of Web-based Business Models for e-Government in the Netherlands. *Government Information Quarterly*, Vol. 25, No. 2, pp. 202-220.
10. Janssen, M. & Verbraeck, A. (2008). The Strengths and Weaknesses of Internet-Based Matching Mechanisms for the Transport Market. *Transportation Research Part E (TRE), Logistics and transportation review*, Vol. 44, No. 3 pp. 475-490.
11. B. Klievink & M. Janssen (2009). Realizing Joined-up Government. Dynamic Capabilities and Stage Models for Transformation. *Government Information Quarterly*, Vol. 26, No. 2, pp. 275-284.
12. Overbeek, S.J., Janssen, M.F.W.H.A., and Bommel, P. van (2009). Integrating markets to bridge supply and demand for knowledge intensive tasks. In Di Noia, T. and Buccafurri, F., editors, *E-Commerce and Web Technologies: 10th International Conference, EC-Web 2009 Linz, Austria, August 31 - September 4, 2009, Proceedings*, volume 5692 of *Lecture Notes in Computer Science*, pages 193-204. Springer, Berlin.
13. Overbeek, S.J., Bommel, P. van, and Proper, H.A. (2009). Embedding knowledge exchange and cognitive matchmaking in a dichotomy of markets. *Expert Systems with Applications*, 36(10):12236-12255.
14. Overbeek, S.J., Janssen, M.F.W.H.A., and Bommel, P. van (2009). Modeling and Describing an Ontological Knowledge Framework for Integrated Public Service Delivery. In: Dickson K.W. Chiu, Patrick C. K. Hung, & Ho-fung Leung (eds.) *Handbook of Research on Service Intelligence and Service Science: technologies and Challenges*.

15. S.J. Overbeek, B. Klievink & M. Janssen (2009). "A Flexible, Event-Driven, Service-Oriented Architecture for Orchestrating Service Delivery," *IEEE Intelligent Systems*, vol. 24, no. 5, pp. 31-41.
16. Tan, Y.H., Hofman, W., Gordijn, J., Hulstijn, J., A Framework for the Design of Service Systems, in: Haluk Demirkan, James C. Spohrer, Vikas Krishna (eds.), *Service Systems Implementation*, Lecture notes in Computer Science, Springer Verlag, in press.

TNO

The Netherlands Organisation for Applied Scientific Research (TNO) is the third largest research & technology organisation in Europe. Established in 1932, TNO's public mission has been laid down in a special law: to support industry and society in general in transforming knowledge into products and processes of economic and societal value. TNO is fully independent. In 2008, TNO's turnover amounted to EUR 600 million. TNO's 4700 employees are active in the following five core areas:

- TNO Defence, Security and Safety
- TNO Information and Communication Technology
- TNO Science and Industry
- TNO Built Environment and Geosciences
- TNO Quality of Life

TNO participated in 184 FP6 projects. In the Preparatory Actions for Security Research TNO participated in 11 projects. TNO performs project management of SMART-CM for security in container transport. In cooperation with TUDelft and Erasmus University Rotterdam, TNO submitted a proposal for a large scale implementation projects with respect to security, Cassandra, that is positively received by the EC. It is most probable to start this year (a formal letter for the contract has not yet been received, but the proposal is on the list for granting a contract). Of TNO's public tasks, one is related to the technological and scientific needs of the Ministry of Defence. As a non-governmental body, TNO Defence, Security and Safety runs the majority of the national defence R&D programme. An important pay-off is the availability of know-how and expertise that is of value to public safety.

TNO Information and Communication Technology is the partner of government and businesses for innovation in information and communication technology. There is experience in multimedia mining, innovation management, interoperability and integration, IT architecture, and developing innovative solutions in the Internet and telecommunication provider area. TNO ICT participated amongst others in EU FP6 ITAIDE and is going to contribute to Cassandra. Relevant internal projects of TNO ICT are in the development of concepts for business collaboration and business service discovery based on search technology. Interoperability and integration between organisations is one of the core activities within TNO ICT.

The business unit Mobility & Logistics of **TNO Built Environment and Geosciences** develops, models and evaluates strategic innovations in mobility and infrastructure, intelligent transportation systems and logistics networks thus improving the quality and efficiency of traffic and transport systems and optimize supply chains.

The business unit monitoring systems of TNO Science and Industry develops open sensor networks for the public sector. They focus on heterogeneous information systems combining different sensor types (e.g. vision and acoustics) for identifying large scale phenomena. Application areas include traffic and transport systems, environmental monitoring systems, as well as applications the area of public safety.

Prof Lorike Hagdorn. Her specialization lies in the field of strategy formulation and implementation within network and chain alliances in both the profit and non-profit sector as area of competence. Lorike has considerable experience in the setting up of chain alliances, including many national and international Supply Chain restructuring projects for companies such as Rank Xerox, Shell, Vopak, Dow Chemical, Unilever and Frans Maas. She gained this experience with BSO, later Origin, now Atos Origin, with Berenschot, with her own consultancy, HMS, as a partner of Boer&Croon Strategy and Management Group and currently at TNO, where she focuses on innovation in logistics networks to contribute to the competitive advantage of individual companies and mainports. She also translates this knowledge and experience of chain alliances in the industrial sector into other sectors, including energy, banking, government and healthcare. Lorike continually combines this with scientific research formerly at the Business Administration faculty of the Erasmus University in Rotterdam, where she obtained her doctoral degree 1996 and currently at the Vrije Universiteit Amsterdam as a professor in Transportation, Distribution and Logistics with special focus on chains and networks.

She combines a vigorous and analytical method with precise communication towards the colleagues, clients and the stakeholders and staff involved. In addition, she gives all with lots of energy, enthusiasm and involvement. The high quality of process and content managed by her contribute greatly to the successful implementation of the proposed changes.

Gerwin Zomer holds a MSc in Industrial Engineering and Management at the University Twente (the Netherlands). In 2007 he joined TNO Mobility & Logistics as a senior logistics and transport consultant. Before he worked several years as consultant in redesign of business processes and ERP implementation processes in several trade and production companies. As from 2000 he is involved in European research project in transport logistics and ICT and has built experience in managing large European projects. Gerwin also advised the Commission on a number of relevant Evaluations and Impact Assessments of EC policy initiatives, like the Marco Polo Programme evaluation, Logistics Action Plan, the European RFID policy, a new ITS Deployment Programme and on Interoperability of Electronic Fee Collection. He is work package leader in the currently running FP7 project SMART-CM on container integrity and visibility and will become the project manager of the EU project Cassandra.

Wout Hofman holds a PhD in information technology on the development of a conceptual model for a software system to support customer driven business process orchestration in transport and logistics (TU/e and EUR). He has a broad experience in interoperability between organisation and systems. Amongst others Wout has worked for the EC (DG Taxud – interoperability design of the Transit system and DG JAI – Architecture of Schengen II) as an IT architect and has written the initial specification of the Rotterdam port system as part of his project management task in the EDO project (EDO: Electronisch Dossier Overheid, a cooperation of the Dutch ports and customs to construct a Port Community System for sharing information and coordinating processes amongst all actors). He supported Dutch Customs in the development of Sagitta Binnenbrengen (IT system and interfaces for incoming cargo), initiated the development of commercial software for customs declaration (BTMS Douane, all Dutch customs procedures, <http://www.beurtvaartadres.nl/Pages/douanezaken.aspx>), and has been an advisor for development of the Belgium version of this system (Transbel). Wout has a long experience in interoperability in transport and ports dating back to 1986, in international EDI standardization and national standardization for all transport modes. His first book on EDI, the Dutch EDI handbook, appeared in 1989.

Main publications of the participant(s):

Hofman W.J., Enterprise Interoperability Ontology, ICSOFT, 2010 (in review).

Hofman W.J., Staalduinen M. van, Public Service Experience, eGov2010 (in review).

Tan Y., Hofman W.J., Gordijn J., Hulstijn J., A framework for the design of Service Systems, to appear in 'Service Science', Springer-Verlag, 2010.

Hofman W.J., Tan Y., Requirements for modelling knowledge intensive services systems based on the Beer Living Lab, International Journal for Services Technology and Management, 2010 (to appear)

Hofman W.J. Tan Y., Modelling Service Systems, VMBO workshop, VU, 2009.

NHTV

The Academy for Urban Development, Logistics and Mobility of NHTV offers bachelor study programs on logistics (Bachelor of Business Administration and a Bachelor of Engineering) among other study programs. These study programs focus on international case studies and subjects within the logistics management branch. The programs are fully taught in Dutch as well as in English.

The Academy for Urban Development, Logistics and Mobility also offers a knowledge and expertise centre on the different disciplines of the Academy (among them Logistics). This centre is called AIC (Advies- en InnovatieCentrum). The AIC aims for development, distribution and valorisation of knowledge. In that way knowledge can be used for industry and education institutes. The AIC is connected to the Knowledge Platform Vitale Logistiek (www.vitalelogistiek.nl) in which NHTV participates. Within Vitale Logistiek we operate with consultants, lecturers and students in business related projects and research. Some major projects of Vitale Logistiek are directed by NHTV. For instance one can mention the project Safefficient. This project obtains for a better economic position of the region by strengthening the direction function of companies within logistical chains. This position can be developed by improving the so called support functions like customs and money transfers. For instance can be mentioned the realisation of green lanes. Multinationals and chain partners like Mars and Kuehne + Nagel (and many others) participate in this project.

From NHTV different people can participate in the work package Valorisation of the project. For this project **Jan Willem Proper** will participate. Jan Willem Proper is the lector Transport and Logistics of NHTV and is a specialist in Supply Chain Management. Furthermore we can participate with lecturers like **Rob Happé** (specialist on logistics and customs) and **Frans de Jong** (specialist on intermodal transport chains).

Fontys

Fontys University of Applied Science is based in south part of the Netherlands (Tilburg-Eindhoven-Venlo) and provides more than 200 higher professional education programmes, following the international Bachelor-master structure. At the Fontys University Research is one of the three primary processes. The other ones are Education and Services/Consultancy. Research is always focused on practice, and is ever aimed at improving professional practice. Fontys aims to be the connecting link between professional areas and knowledge areas. As a institute of knowledge, Fontys also aims to contribute to development and innovation in professional practice via both the creation of knowledge and the circulation of knowledge. Therby, research demands hail directly from companies and organisations operating in the region.

Fontys covers several knowledge areas. One of these areas is that of Logistics and Supply Chain Management. This knowledge area is allocated to Fontys Hogeschool Techniek & Logistiek located in Venlo. This department is also known in the Netherlands with his original name "Vervoersacademie". Connected to this department is a Lectorate Supply Chain Management which will be responsible for the Fontys activities within the project Extended Single Window. A lectorate is a unit of Fontys that revolves around a specific subject and is headed by a lector, who is a expert in that subject. A lector occupies a chair at an Fontys

University and is the centre of a network called “kenniskring”, a knowledge network. He conducts applied research in a specific area of expertise and maintains contacts within relevant branches of business or industry. Fontys University counts 38 lectorates.

From Fontys **Henk Betlem** will participate in the work package Valorisation. He is part-time lector Supply Chain Management. It will be a joint effort with one of the teachers but the name is not yet known. Henk Betlem(1945) is a well experienced person studied business engineering and logistics. He worked in management and staff functions in industry, travelling industry and business consultancy.

PortBase

Portbase is the neutral and reliable ‘spider in the web’ for all logistics information in the ports of Rotterdam and Amsterdam. Via Portbase’s port-wide Port Community System, companies can benefit from a multitude of intelligent services. This package guarantees the efficient and simple exchange of information, both between companies and between the public and private sector. This enables all the participants to optimise their logistics processes, thereby improving their own competitive position and that of the ports.

Portbase was created by a merger between Rotterdam’s Port infolink and Amsterdam’s PortNET. The new organisation was set up in 2009 by the Port of Rotterdam Authority and Port of Amsterdam and enjoys the wide support of the port business community. Its aim is to develop a national Port Community System within the foreseeable future. Portbase also wants to play a key role in European port-related logistics networks.

Portbase currently offers 25 different information services to around 1300 clients in every port sector. Every month, more than two million electronic messages are sent via the Port Community System. Portbase’s head office is in Rotterdam, and there is also a branch in Amsterdam. In total, Portbase has a staff of just over 70. Portbase belongs to and serves the port community and is a non-profit organisation.

Paul Swaak, director Strategy & Business Development at Portbase, finished the Nautical Academy in 1981, and sailed for 6 years as nautical officer with Nedlloyd. He followed contingencies studies such as Logistics, Business Administration and Strategic Planning in the years till 1995. Paul worked for various companies, including consultancy before he started his own company in 1993. He led various projects in the field of (air)port and transport logistics before he joined Boer&Croon as an associate Interim Manager. As Interim Manager he occupied various MD positions in various sectors.

He was asked as Operations Director for Geest North Sea Line in 1995, and as member of the board he navigated the company through acquisition by Samskip and following mergers with Seawheel ltd and (part of) Delphis. He acted as COO and Director Strategic Development of the new Samskip MCL (the leading European Multimodal Container Logistic company) till February 2009. As from March 2009 he developed the new strategy for Portbase and as per 1-1-2010 he now acts as Director Strategy and Business Development.

Marten van der Velde, Strategy & Business Development Manager at Portbase, studied Information Science in Groningen. From 2001 until 2003 Marten has worked for the Ministry of Transport (AVV) for the STIS, COMPRIS and MaRNIS projects, where he had a supporting role for the overall management of these projects.

In 2003 Marten joined Port infolink in the role of Project Bureau officer (staff function). In this function he was responsible for, amongst others, the set-up of standard development processes, project management standards and project- and financial administration. Since 2007, Marten was Project manager at Port infolink, in which he was responsible for the development of several of Port infolink’s services and internal projects. As of 2009 Marten is

Strategy & Business Development Manager at Portbase, and is a.o. responsible for defining the company's strategy and all of the European projects in which Portbase operates.

Cargonaut

Cargonaut is a dynamic and innovative IT provider at Schiphol Airport where it develops, implements and operates the Port Community System for airfreight. Its goal is to create supply chain solutions by means of electronic information exchange between airline companies, forwarding agents, ground handlers, truckers and shippers, as well as customs and other government institutions. The company has supported logistics processes with products and services, including software and consultancy, for over 20 years.

Mr. **Arno Hoitink** has a large experience in building, implementing and the operation of IT-systems. Since 1985 he is working for Cargonaut B.V. in several functions in which he obtained knowledge of logistics in the transportation business in general and more specific in air cargo logistics. On a national and international level (IATA) he has been actively involved in process innovation in the air cargo industry and in the promotion and introduction of electronic information exchange between logistics companies. Under his management Cargonaut B.V. has successfully evolved from a technical oriented IT-company into a market-oriented company.

Arno Hoitink is also a member of the Board of Directors of Smartloxs B.V. which is owned for 55% by Cargonaut B.V. Smartloxs B.V. is a company that provides smartcard solutions for access and security in the transportation industry.

ACN, Arrow, Dohler, EVO, Frugiventa, Herbalife, NV Regio Venlo, OCE, Schiphol NV, FloraHolland, Havenbedrijf Rotterdam, Havenbedrijf Amsterdam

These partners contribute cash and in kind to the project and will contribute actively as prominent business partners to the R&D work packages and the realisation of the project ambitions.

Gaston Schul, Mattel

These partners contribute only in kind to the project and will contribute actively as less prominent business partners to the R&D work packages and the realisation of the project ambitions.

Dutch Customs Authority

Dutch Customs Authority has the intention to contribute actively to the project, but could not commit themselves to the administrative requirements required for project partners.