D2.3 Requirements Analysis Report

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Short Summary

This document lists the high-level requirements that have been collected from ADVENTURE's stakeholders, coupled with explanations on the methods that have been applied while collecting and structuring them. These requirements will be considered within the further development steps of the ADVENTURE approach. Further, first mockups for graphical user interfaces shall be considered as conceptual sketches for the development of the ADVENTURE dashboard.

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Executive Summary

The purpose of this deliverable is to collect the requirements of ADVENTURE's stakeholders in order to maximize future exploitation possibilities. The findings of this deliverable are crucial for all future deliverables and the framework and tools created for ADVENTURE. The document starts by defining the term requirement and explaining the methods that have been applied while collecting and categorizing the requirements. The core part of this deliverable is a structured listing and explanation of the requirements that have been collected. Subsequently, the document concludes with a description of how the requirements will be monitored and, if necessary, adapted during the course of the project.

1 Introduction

ADVENTURE – ADaptive Virtual ENTerprise manufacTURing Environment – is a project funded in the Seventh Framework Programme by the European Commission. ADVENTURE creates a framework that enhances the collaboration between suppliers, manufacturers and customers for industrial products and services. Section 1 sets the scene for the report defining aims and objectives.

1.1 ADVENTURE Project Aims

The framework proposed by ADVENTURE provides mechanisms and tools that facilitate the creation and operation of manufacturing processes in a modular way. ADVENTURE combines the power of individual factories to achieve complex manufacturing processes. It provides tools for partner-finding, process creation, process optimization, information exchange as well as real-time monitoring combined with the tracking of goods and linking them to Cloud services.

There have already been several research projects that address the combination of different independent manufacturers to so-called virtual factories. Most of these research projects focus primarily on the business-side in general and on aspects like partner-finding and factory-building processes in special. However no proven tools or technologies exist in the market that provide the creation of virtual factories applying end-to-end integrated Information and Communication Technology (ICT). ADVENTURE is aiming to provide such tools and processes that will help to facilitate information exchange between factories and move beyond the boundaries of the individual enterprises involved. The collaborative manufacturing process will be optimised by enabling the integration of factory selection, forecasting, monitoring, and collaboration during runtime.

ADVENTURE builds on concepts and methods of Service-oriented Computing and benefits from the advancements in this field. The monitoring and governance of the collaborative processes will be supported by technologies from the Internet of Things such as wireless sensors. Existing tools and services that can be integrated will be considered during the development of the platform for ADVENTURE.

The increased degree of flexibility provided through ADVENTURE will benefit SMEs especially as it helps them to react quickly to changes and to participate in larger, cross-organizational manufacturing processes. Furthermore, ADVENTURE will help manufacturers in assessing the environmental friendliness of actual manufacturing processes and resulting products and services. Other objectives of ADVENTURE include research in areas such as service-based manufacturing processes, adaptive process management, process compliance, and end-to-end-integration of ICT solutions.

1.2 Deliverable Purpose, Scope and Context

This deliverable enumerates requirements as collected from the case companies ABB, AZEV and Control2K, and thus provides a refined view on the needs and challenges they face in their respective market sector. This document further provides a series of mock-ups created by these case companies in order to highlight

functionalities which they deem most important. For sure not all of these requirements can be considered and finally implemented within the final ADVENTURE prototype. This is based on the fact that the case companies decided to describe and list requirements as complete as possible referring to their on-going projects and processes. But it is clear, that only some part of that is covered by the ADVENTURE STREP with dedicated RTD innovations in particular RTD areas.

1.3 Document Status

This document is listed in the DOW as 'public' as the requirements allow for in-depth insight into how and why aspects of ADVENTURE contribute to the overall concepts.

1.4 Target Audience

Though, this deliverable is to be used by all participating project members. It will be a foundation (and blueprint) for the further derivation of technical requirements, as well for allowing case companies to track the implementation progress.

1.5 Glossary

A definition of general, common terms and roles related to the realization of ADVENTURE as well as a list of abbreviations is available in the supplementary document "Supplement: Abbreviations and General Terms" which is provided in addition to this deliverable.

Further information can be found at: http://www.fp7-adventure.eu

1.6 Document Structure

This deliverable is broken down into the following sections:

Section 1 provides an introduction for this deliverable outlining the scope, audience and the structure of the deliverable

Section 2 sets the scene describing why, how and what types of requirements have been collected.

Section 3 presents a detailed overview of the collected requirements, sorted by importance and ADVENTURE lifecycle (which will roughly correspond to components in the currently elaborated architecture). The section consists of two parts: strategic and functional requirements collected from the case companies, as well as high level technical (non-functional) requirements derived from the functional requirements.

Section 4 gives a brief overview of how we plan to ensure a continuous refinement and monitoring of the collected requirements in order to ensure the comprehensiveness and usefulness of ADVENTURE prototypes.

Section 5 concludes the document by describing how the requirements will influence subsequent steps, leading to prototypes that will implement the ADVENTURE vision.

2 Requirements Scope

2.1 Requirements Definition

In order to systematically acquire requirements we differentiate between:

- Strategic requirements, which represent business application goals and needs of the user partners.
- Functional requirements, which are derived from strategic requirements by collaboration between the academic partners and the case companies.
- Technical requirements, which represent non-functional requirements derived from the functional requirements.

This approach is roughly in line with standard requirements engineering processes[1]. As we only elaborate high-level requirements as a preparation for work in future deliverables and work packages, the granularity of the requirements is different from the granularity typically found in software engineering.

2.2 Type and Categorization of Requirements

All the collected requirements are categorized in terms of strategic, functional and technical level of details. The strategic requirements describe the expectation from user's and customer's perspectives, while the functional requirements explain what has to be done to fulfil the expectations. The technical requirements can be defined as a translation of the customers' expectation into quantifiable terms and their objective is to define how to respond to the customers' requirements.

The requirements are analysed for the purpose of defining them in a clear, complete and consistent manner. They were checked for ambiguity and apparent conflicts were resolved. All the collected data was also analysed with the goal to securitize and to prioritize them based on their inherent importance (although some in priority 3 are out of scope for ADVENTURE). The data set was prioritized according to specified numbers such as '1' for essential, while '2' and '3' are 'important' respectively 'nice to have'. The requirements were also categorized with respect to their point of view such as Supplier, Customer and Adventure.

2.3 Data Collection Method

The specified requirements data from each case company were collected through face-to-face interviews, both formal and informal meetings between the research partners and the case companies key personnel's. A set of questionnaires were also supplied to the key personnel of the case companies with the objective to elaborate the requirements. Three research partners were responsible to collect and securitize the requirements from the three case companies. For instance, the University of Vaasa was assigned to ABB, INSEC Porto to Azevedos and the University of Vienna to Control 2K. The Technical University of Darmstadt was responsible for generic requirements (operational processes) for the ADVENTURE framework.

[1] K. J. Lyytinen, Design Requirements Engineering: A Ten-Year Perspective: Design Requirements Workshop, Cleveland, OH, USA, June 3-6, 2007, Revised and Invited Papers. Springer, 2009.

Initially, the collected data set was stored in an excel sheet which was then transferred to the word document for further refinement. After the collection of all the data, it was cross checked in order to avoid overlapping requirements within the three case companies. Individual requirement lists as collected initially from each of the case companies were finally merged into a single excel sheet in order to synchronize them.

2.4 Requirements Elicitation

The collected requirements were analysed in terms of problems regarding the scope, problems concerning the understanding, and problems of volatility. In order to tackle problems concerning the scope, the requirements are specified based on the customers/users overall objectives, whereas, to tackle problems concerning the understanding, the functional requirements are stated more precisely.

In the requirements elicitation process, the three user companies (ABB, Azevedos and Control2K) prioritized the requirements according to their importance. The requirements are also grouped concerning their scope based on the life cycle phases Join, Search, Plug and Play.

2.5 Identification of Business Needs

As elaborated by Lyytinen et. al. (see Requirements Definition), the identification of business needs is a critical step towards the collection of business requirements and specifications. In order to assess the economic and technical feasibility of an implementation it is always recommended to collect and synchronize the specific requirements. It is necessary to identify the key peoples who will help to specify the key requirements and understand their organizational bias. One or more requirements elicitation methods (such as interviews, focus group or team meetings) are needed in order to define the requirements from different points of views.

The creation of usage scenarios or use cases helps customers/users to better identify key requirements. The identification of business needs usually follows specific guidelines and steps:

- Identify the actual problem, opportunity or challenge.
- Identify the current business measure(s).
- Identify the goal measure(s) with the view to show that the problem has been addressed properly.
- Identify the ‘as-is’ cause(s) of the identified problem.
- Investigate the ‘as-to-be’ scenario(s) for problem tackling process.
- Define the business ‘whats’ that must be delivered to meet the goal measure(s).
- Specify the possible solution(s) how to satisfy the real business requirements.

3 Requirements

This chapter contains lists of collected requirements. All requirements are sorted first by their priority and then by their corresponding lifecycle phase. Furthermore the requirements sometimes contain references between each other: Sx denote strategic requirements, Fx functional requirements, and Tx technical requirements. Furthermore the following concepts and abbreviations are used:

- **Lifecycle (abbr. LC):** Describes the lifecycle phase that benefits from the fulfilment of a requirement (for details about lifecycles see D2.1)
- **Point of View (abbr. PoV):** The user role that benefits from the requirement. The point of view “Adventure” means that both user roles, supplier and customer, may benefit from the fulfilment of a specific requirement.
- **Priority (abbr. Pri.):**
  - 1 = essential
  - 2 = important
  - 3 = nice to have
  - 4 = out of scope for ADVENTURE

The high level functional requirements are assigned to one or more strategic requirements. For functional requirements we also include assignments to tasks from the DOW that may be affected by a particular requirement.

3.1 UI mock-ups – Virtual Factory Drilldown

The purpose of the UI mock-ups is to provide a testbed for discussion and mutual understanding between the different groups of partners in ADVENTURE. They focus on the dashboard, which will contain all functionality provided to the users via a graphical user interface. The dashboard will consist of two main views: the Join and Search Portal, and the Plug and Play Dashboard.

Remark: the visualization of the UI provided in this section does not necessarily represent how prototypes may actually look like. Contrary, the aim is to sketch the needed functionality and to get a rough idea about required GUI elements. This Subsection contains references to Subsection 3.3 in the form Fx, where x is the ID of the functional requirement.

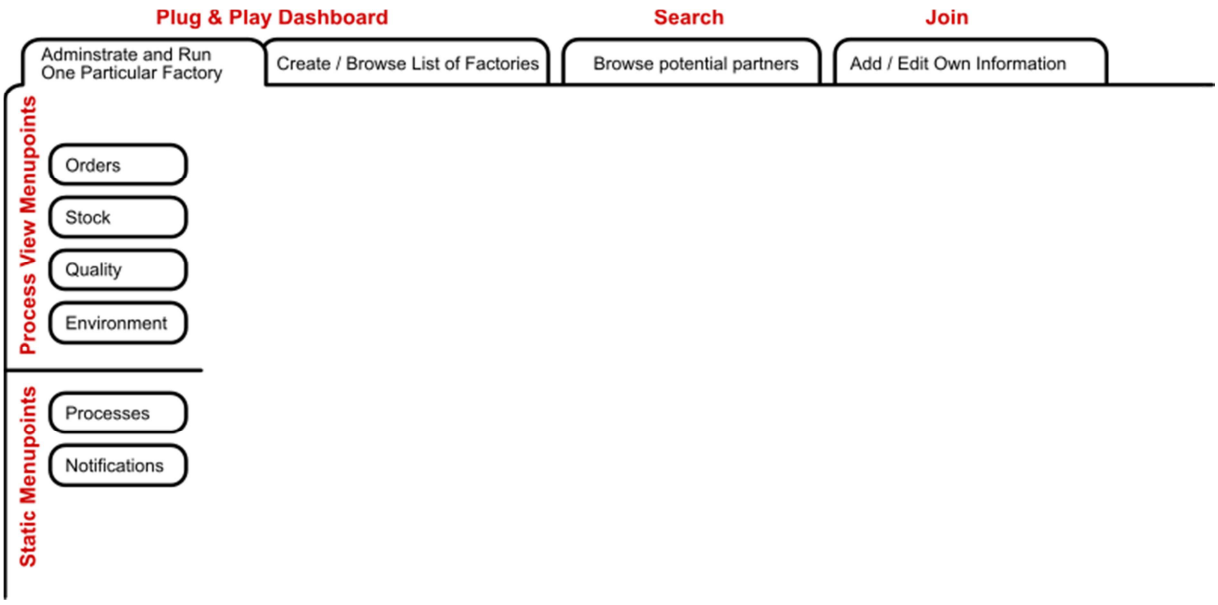

Figure 1 (T): Portal Usage & Dashboard

Figure 1 is intended to show a minimal set of elements that will be required from an ADVENTURE User Interface (UI), in order to incorporate all the events as envisioned by the ADVENTURE consortium. The red terms above the tabs describe the separate main UI parts, concurring with the lifecycle phases:

- Plug&Play Dashbord: Contains all the functionality for maintaining and operating virtual factories.
  - Create / Browse List of Factories: provide a list of factories associated with a particular ADVENTURE Broker (see Glossary). Creating a new virtual factory, may be a button found above or below the list, creating an empty factory, which can then be filled with processes and partners in “Administrate and Run One Particular Factory”.
  - Administrate an Run One Particular Factory: Will contain all functionality that is necessary to configure and operate a virtual factory.
- Search – Browse Potential Partners: this tab will allow all ADVENTURE members (active and passive) to browse through a repository of partners and to search for certain criteria and to inspect details. This tab is intended to work independently of existing factories. Its function is to provide yellow pages that can be used to plan new business ideas and contact potential partners.
- Join – Add Edit Own Information: ADVENTURE members (active and passive) are intended to enter information about their business. While passive members will just add contact and product information, active members will also add technical information, i.e. web service endpoints and processes that describe how they plan to interface with partners in virtual factories.

Figure 1 furthermore shows an active “Administrate and Run One Particular Factory” tab. As stated above this tab will allow ADVENURE brokers to configure and operate a virtual factory. The mockup shows the two basic concepts that will be untilized to allow for flexible configuration and operation:

- Static Menupoints: The menupoints “Processes” and “Notifications” will exist for all virtual factories (even if unconfigured or ‘empty’). “Processes” will allow

the ADVENRURE broker to define/model interactions (process models) between factory partners. Possible interactions may include:

- Reading the stock level from a particual partner (e.g. process with only one step).
- Aggregating the stock level from all partners (multi step process with transformations to compensate for different data formats)
- An order process that incorporates the involvment of several partners in a long-running process.

"Notifications" on the other hand will allow an ADVENTURE broker to keep track and configure all possible notifications that may arise from the execution of above mentioned processes.

- Process View Menupoints: They represent bookmarks and lead to particular processes mentioned above. This allows an ADVENTURE broker to promote important processes to be menupoints thus allowing for fast access. Each menupoint leads to details regarding the execution of the process:
  - For the above mentioned "reading stock level" process the result will be a list incorporating all information returned by said process.
  - For the above mentioned "order" process, the result will be a cockpit to track the execution of orders.

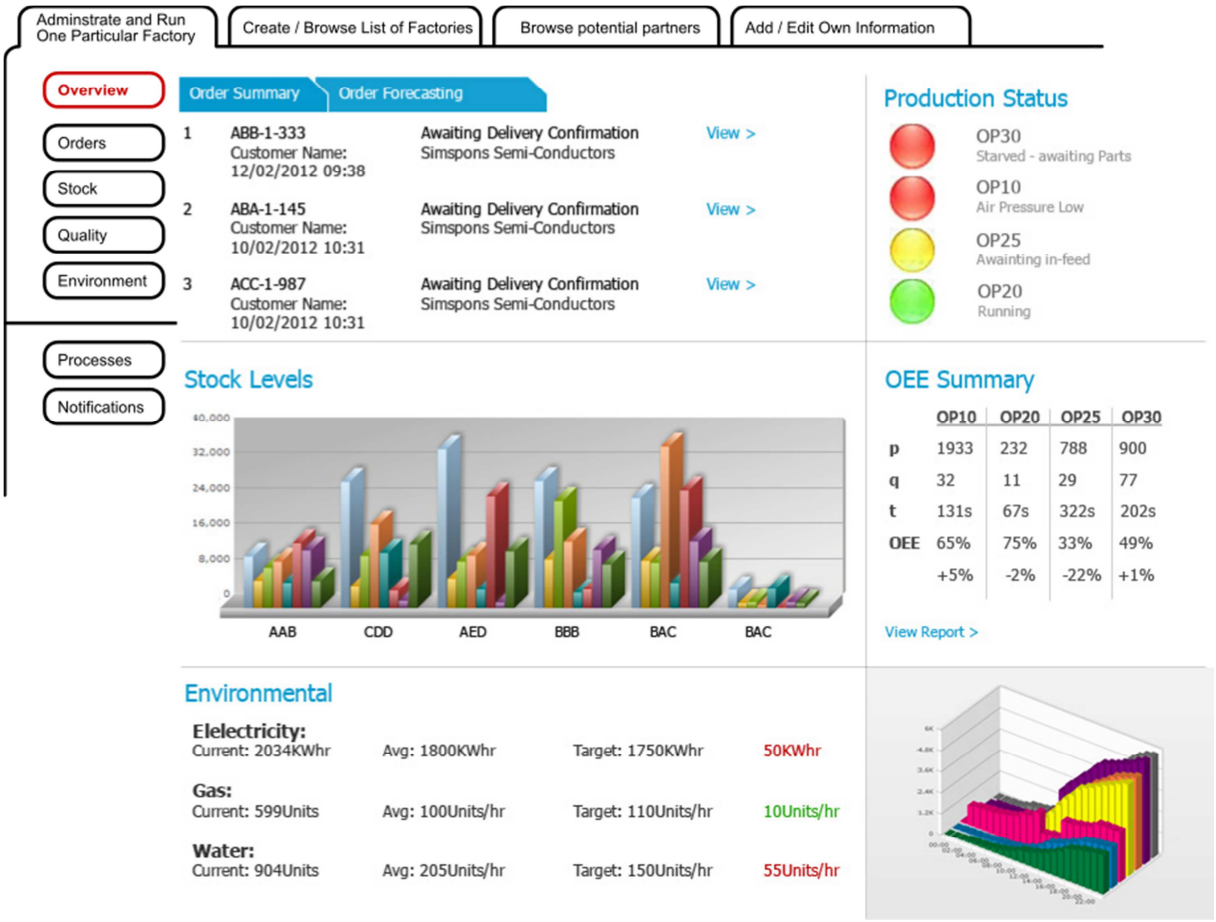

Figure 2 (L0): Overview

Figure 2 shows an overview page as described by F72. Such a page may be assembled by an ADVENTURE broker in order to provide a quick overview of the factory. The grid layout provides for 6 containers that may hold the visualization, results or status of processes, similar to an iGoogle (http://www.google.com/ig) home screen.

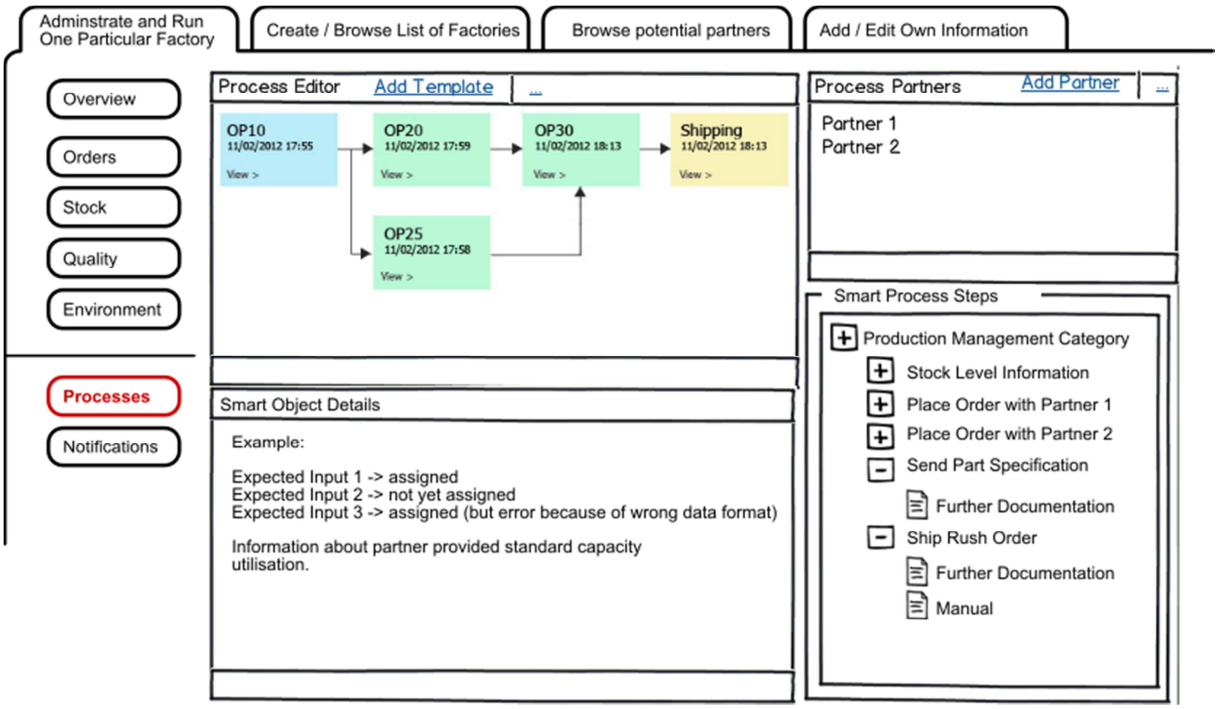

Figure 3 (L1-1): Create / Edit / Manage Processes

Figure 3 shows the creation of a process as specified in requirements F11, F12, F16, F30, F55, F56, F57, F58, F60, F61, F79. The following elements can be seen:

- A graphical process editor (upper left)
- A means to configure all details of a process step (lower left)
- A list of partners involved in the process (upper right)
- The compound list of process steps provided by the partners (lower right)

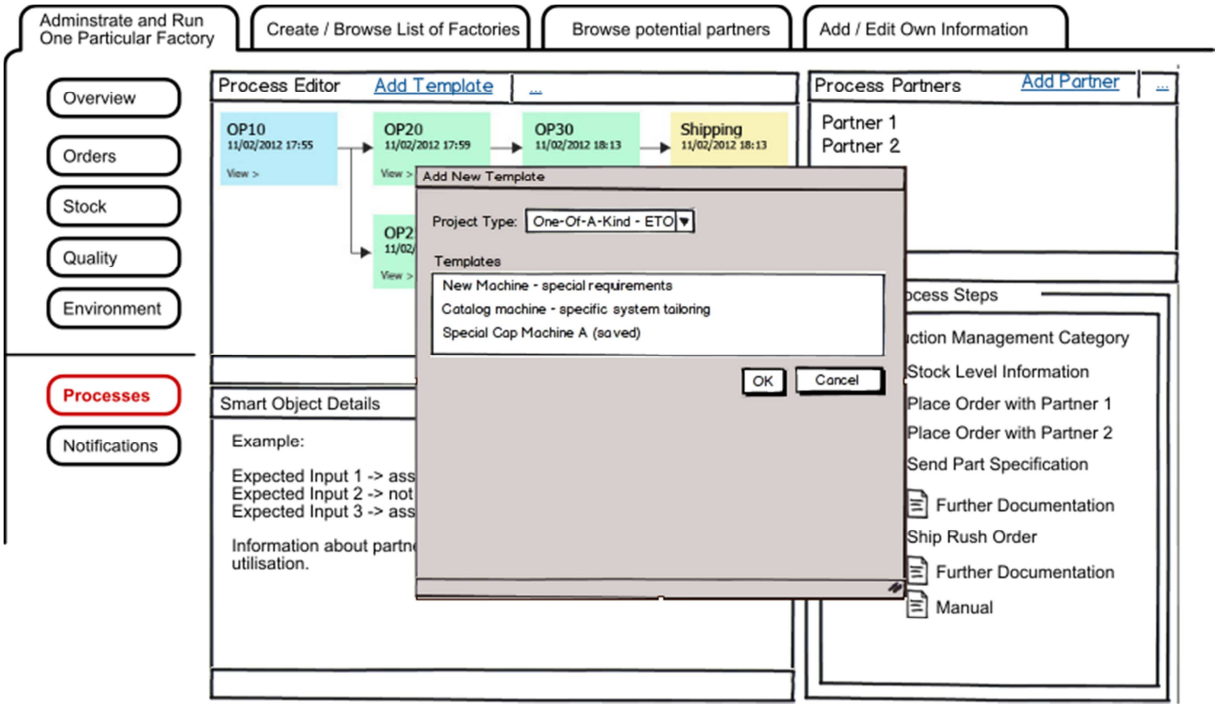

Figure 4 (L1-2): Add Template

Figure 4 shows the creation of a new template as described in F44, F56, F57. Templates are standard processes that may be tailored to fit specific cases.

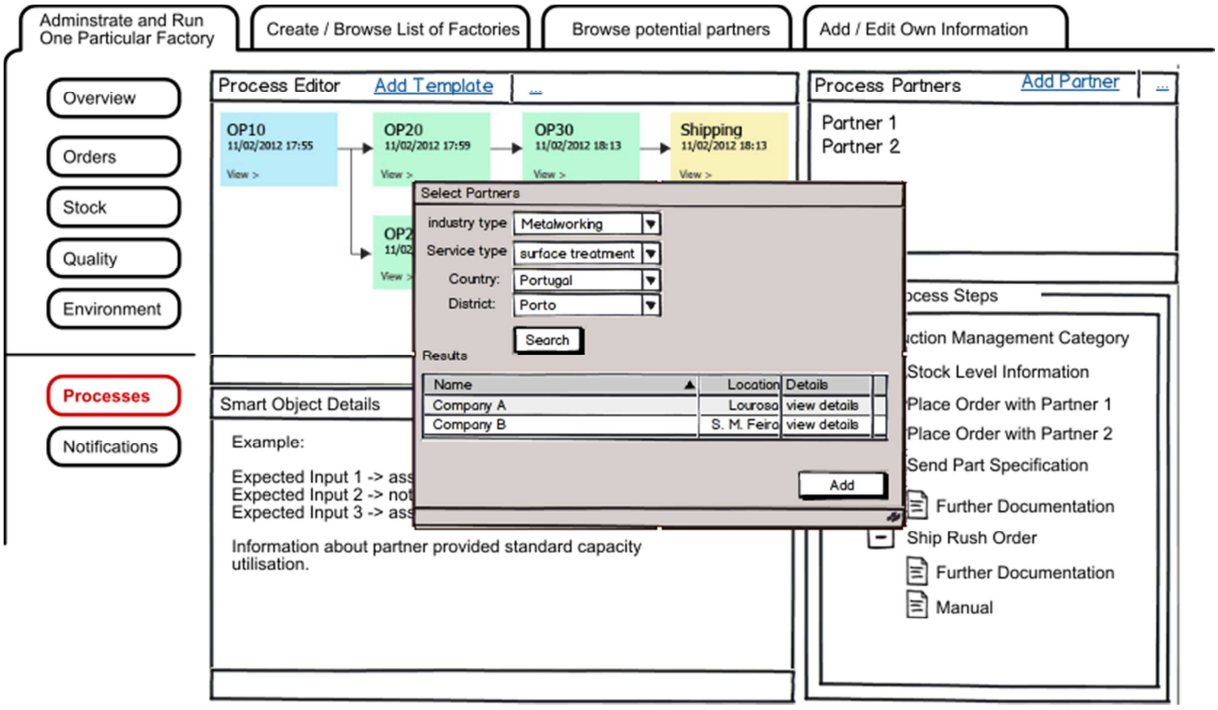

Figure 5 (L1-3): Add Partner (New Smart Objects)

Figure 5 shows how to add partners to a process, as described in F3, F11, F38, F59, F64, F66, F67. Added partners will then appear in the partner list (upper right) and contribute to the list of process steps (lower right).

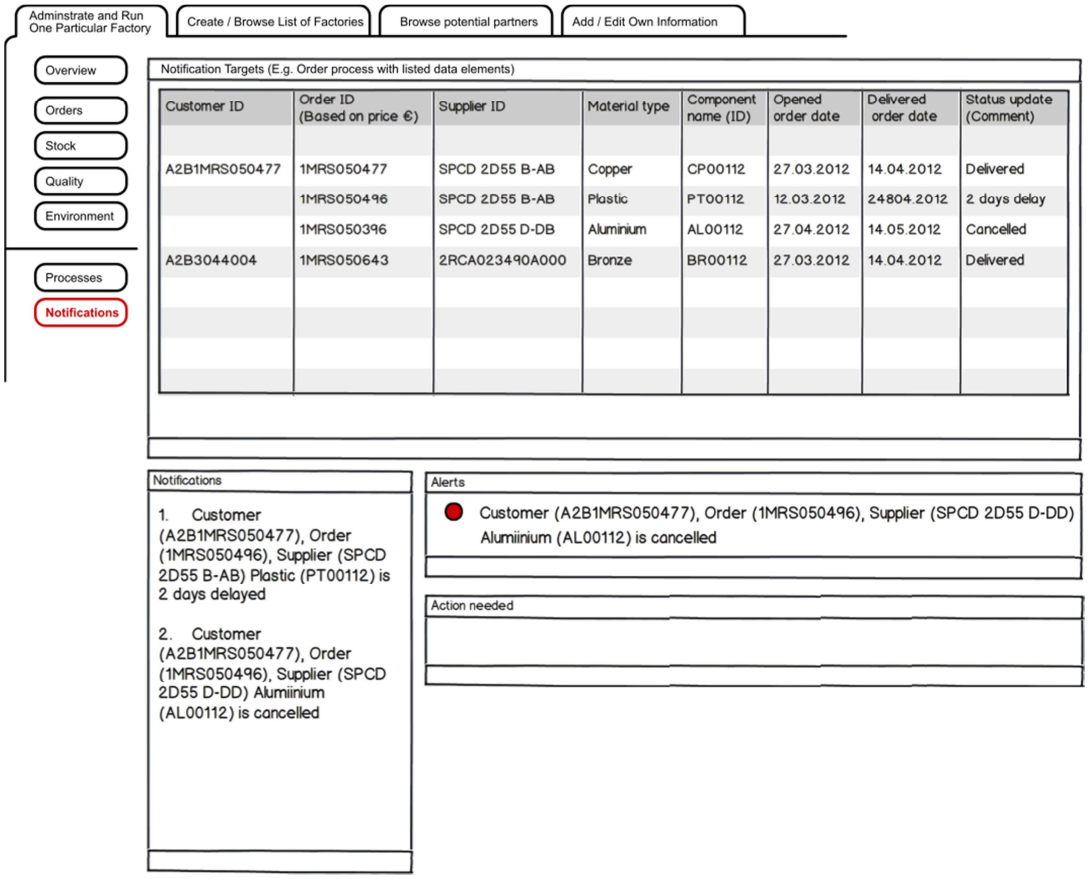

Figure 6 (L1-4): Notifications

Figure 6 shows the means to manage notifications resulting from running processes as described in F6, F39, F42, F43, F71. The mock-up shows a list of notification targets, as well as the action notifications, alerts and list actions to be executed directly in the Dashboard.

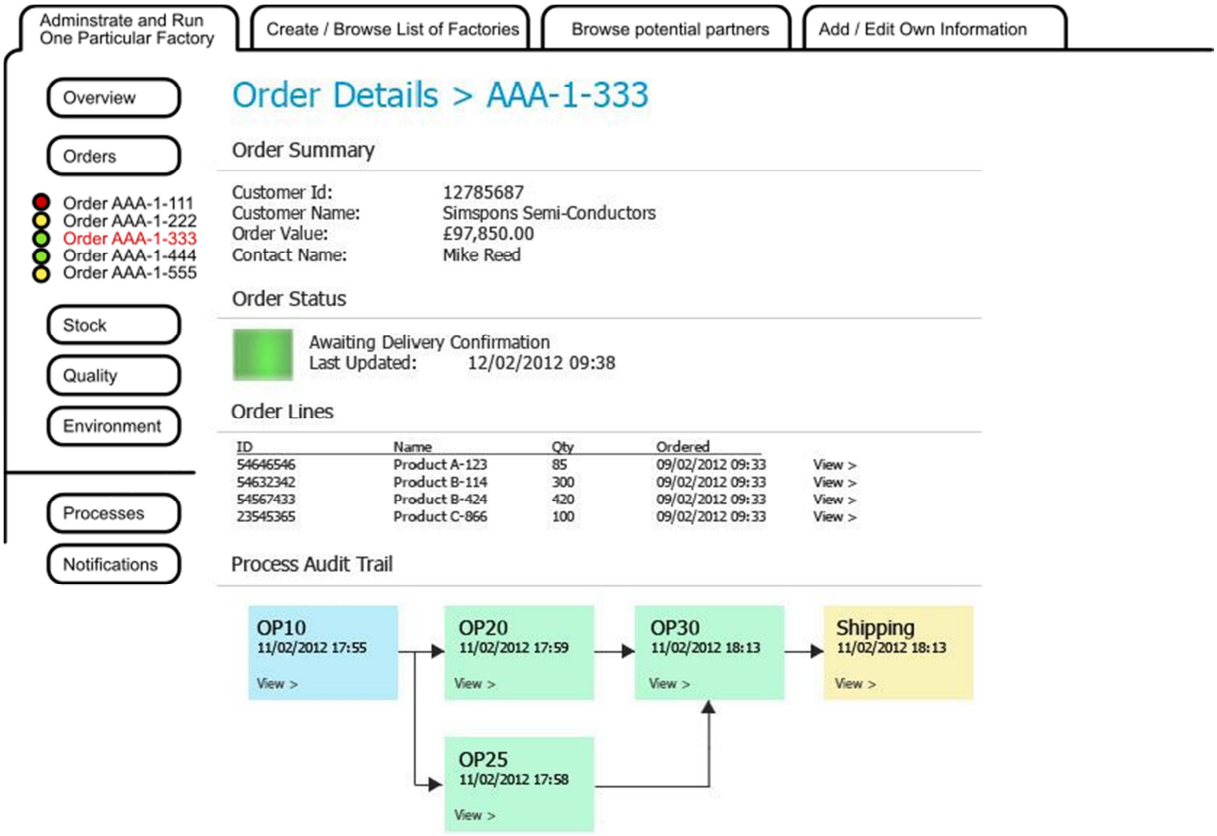

Figure 7 (L2-1): Orders

Figure 7 shows the detailed view of a running order process as described in F27, F37 and F46. The details represent information accumulated by process steps so far. Drilldown to a more detailed view may be possible.

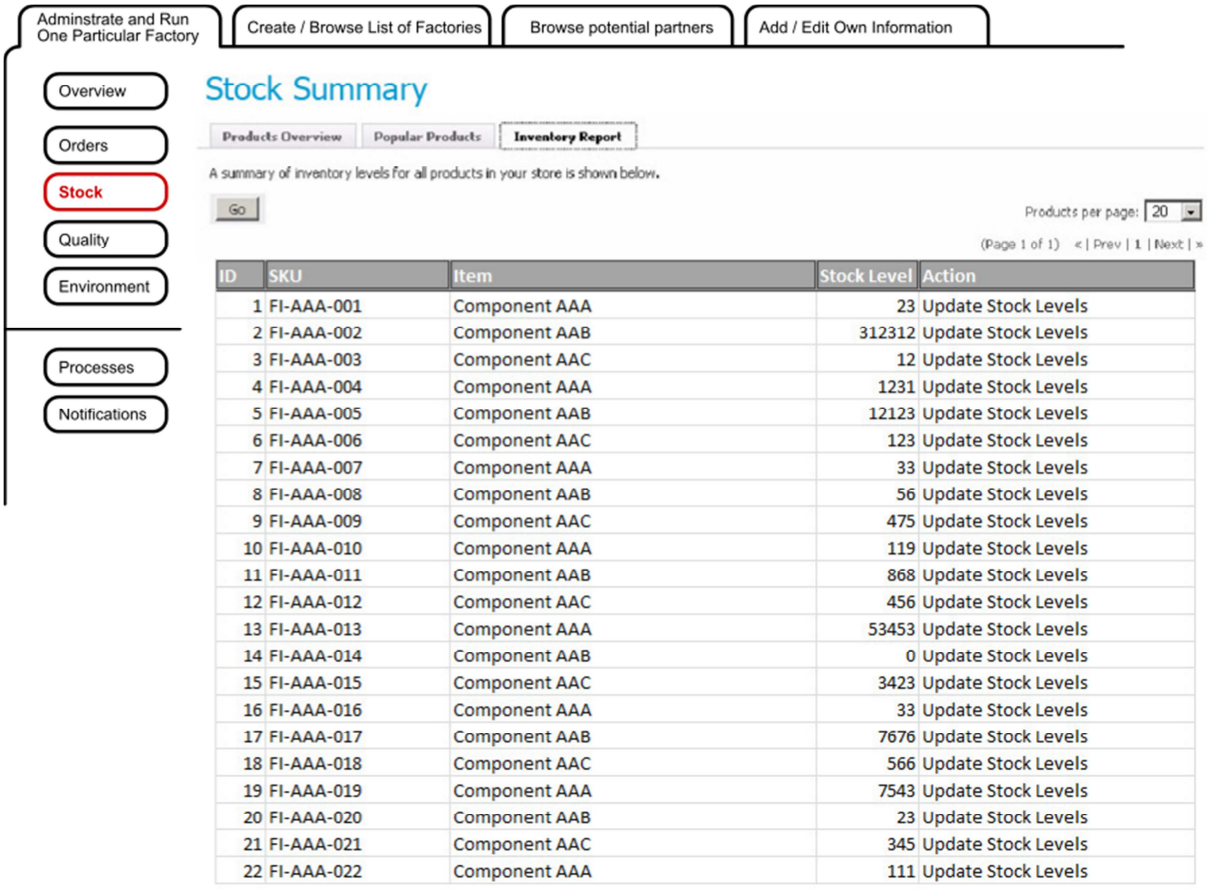

Figure 8 (L2-2): Stock Management

Figure 8 shows all the results as returned by a “stock level” information gathering process. This mock-up is related to F35 and F36. All values in the list are gathered in one process, and automatically formatted as a list.

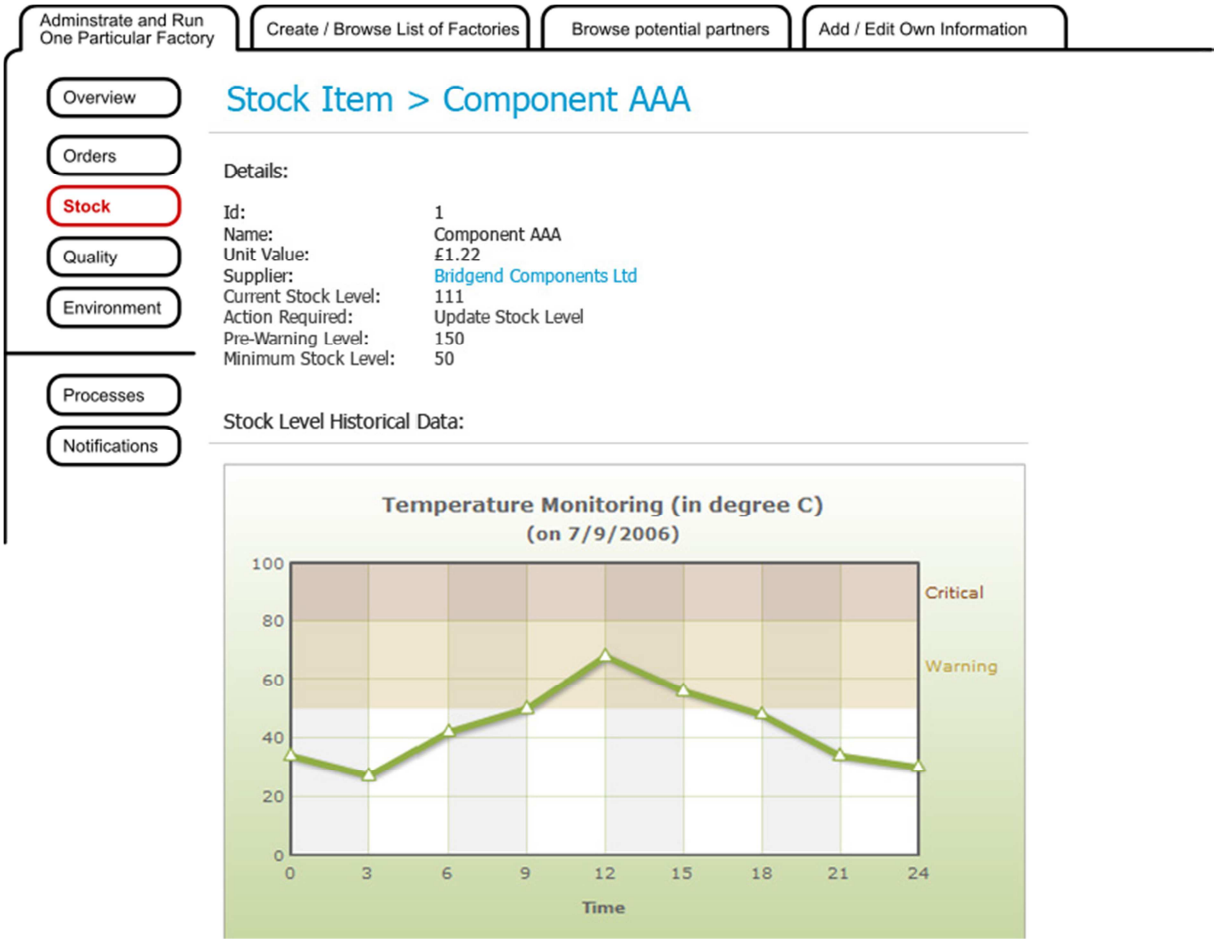

Figure 9 (L2-3): Stock Item Details

Figure 9 shows a possible visualization as described in F26, F28, F28, F83. Visualizations are envisioned to contain arbitrary data elements occurring in processes. For example temperature values from past runs of a process (available through the ADVENTURE cloud storage) will allow for trend graphs.

3.2 Strategic Requirements

S3	**Lifecycle:** SEARCH, JOIN, PLAY	**Priority:** 1
Information Gathering - Allow potential customers to fetch information about standard operation procedures regarding contracts.		
Motivation: Potential customers should be able to decide if a business opportunity is feasible.		

S5	**Lifecycle:** PLAY, PLUG	**Priority:** 1
Interoperability - Data provided by the supplier should be available to standard systems of the customers.		
Motivation: The supplier is not interested in providing connectors for each and every system out there.		

S6	**Lifecycle:** PLUG, PLAY	**Priority:** 1

Flexibility - Third party providers should offer connectors to customer's standard software and/or file formats.
Motivation: Independent service providers should provide all kinds of data translation, transformation and aggregation plugins, for ERP/MES systems as well as for other partner specific systems. Working with different file formats or versions of file formats should also be handled through this plugin system.

S7	**Lifecycle:** PLAY	**Priority:** 1
Visualization - Data streams should be visualized through dashboard. Visualization should be interactive.		
Motivation: As sensor data or production data is passing through the ADVENTURE layer from company to company, it should be possible to drill down into details, access past information.		

S8	**Lifecycle:** PLAY	**Priority:** 1
Planability - Enable ATP ("available to promise") or CTP ("capable to promise") computations.		
Motivation: Users need to ensure for both the availability of materials and production capacities to each of the customer orders.		

S9	**Lifecycle:** PLAY, PLUG	**Priority:** 1
Adaptation - Adapt processes and advertise process updates.		
Motivation: Adapt processes and advertise process updates occurs, e.g., when a per-agreed delivery deadline cannot be met by the particular supplier. In general: when unforeseen events occur, the decisions about process adaptation must be human based, however, the system should give hints. Regarding adaptation and advertising: It is in the best interest of a partner to have as few as possible versions of its software out in the wild. Less versions mean less administration effort. For mandatory updates a standardized way of informing customers of the impact and potential changes is mandatory.		

S10	**Lifecycle:** PLAY, PLUG	**Priority:** 1
Monitoring - Monitor all important aspects of a virtual factory.		
Motivation: Features to monitor and control the buffer level in each key component of suppliers. Examples: (1) Customers want to know the state of all active processes (for AZEV: Machines being produced). (2) Customers want real time information about status of the smart process. More generic: partners involved in a given task, should share a collaboration environment with order data monitoring, documents needed to execute the service associated, events log and performance indicators.		

S11	**Lifecycle:** PLAY	**Priority:** 1
Forecast - Provide forecasts to customers.		
Motivation: System needs to be able to efficiently forecast orders to the customers in a regular basis. This information system will support suppliers to plan their respective production processes. Suppliers should, e.g., provide their customers with forecasts concerning probable delivery dates.		

S12	**Lifecycle:** PLUG, PLAY	**Priority:** 1
Process Design - Allow the creation of smart processes, including Design - On-the-fly work planning. Processes that are executed before partners are added to a virtual factory are to be provided during		

the JOIN phase. We will call them PLUG processes. Processes that constitute the Virtual Factory are designed during the PLUG phase.
Motivation: Suppliers should be able to start new virtual factories and create smart processes. For the AZEV case: A tool to design the engineering and/or manufacturing process for each of its new one-of-a-kind products that can be integrated with services finding and assignment, simulation based on services data, process and task data monitoring and documentation. This model is initially an abstract model and can be based on a process template stored in the cloud based repository. Regarding Flexibility: The smart process for a specific one-of-a-kind (special requirements) production can be changed on the fly, once the process is not totally predictable.

S13	**Lifecycle:** SEARCH, PLUG, PLAY	**Priority:** 1
Partner Finding - Service or partner finding and assignment to each process step.		
Motivation: Find suitable partners to execute a set of activities by providing engineering or manufacturing services.		

S15	**Lifecycle:** PLAY	**Priority:** 1
Flexible Execution - Handling of non-prescriptive processes.		
Motivation: The Smart Process may not completely be known by users a priori, i.e. when execution starts, because the process involves engineering activities that will detail the subsequent phases and activities of the process. Therefore, the Smart Process should be re-designed on-the-fly.		

S16	**Lifecycle:** PLAY	**Priority:** 1
Notification - Alerts and Notifications.		
Motivation: Show alerts and notifications related to Smart Processes on the dashboard. E.g., a supplier needs to actively control handling of customer order processes. Customer need to be notified immediately if there are any changes during the customer order execution period.		

S18	**Lifecycle:** PLUG	**Priority:** 1
Security - Security.		
Motivation: There are quite number of drawings, specifications, lists, that users need to share with partners in order to execute a service. These documents are usually sent by email without any control. It should be possible to attach it to a Smart Process task so that only the partners assigned to it will have access.		

S2	**Lifecycle:** SEARCH	**Priority:** 2
Advertising - Pro-actively identify potential customers.		
Motivation: Allowing sending marketing material to potential customers and inviting them to events.		

S4	**Lifecycle:** PLUG, SEARCH, JOIN	**Priority:** 2
Simulation - Fetch relevant information from customers.		
Motivation: When a customer decides to evaluate (simulate) the behaviour of a partner it should be able to access all necessary information, and also provide all necessary information.		

S14	**Lifecycle:** PLAY, PLUG	**Priority:** 2
Optimization - Process optimization.		
Motivation: This includes two scenarios: (1) Risk Estimation (minimize risk of delivery failure of any of the involved subsystems): Based on available data from partners' services, users should be able to choose the best set of partners in order to mitigate the risks of the process considering time, cost, environment footprint, etc. (2) Performance assessment and optimization: Metrics in order to evaluate the process performance as well as partner performance considering time, cost, environment footprint, etc.. Achieve the best performance in terms of time and requirements compliance.		

S17	**Lifecycle:** PLAY	**Priority:** 2
User Interface - Desktop and mobile interface.		
Motivation: The mobile application will help technicians by providing means to read and write information on the machine record.		

S19	**Lifecycle:** PLAY, PLUG	**Priority:** 2
Messaging - Standardize communication between partners.		
Motivation: Improve communication in order to create strong relationships between partners.		

S1	**Lifecycle:** SEARCH, PLUG	**Priority:** 3
Environment - Assessment of environmental impact for virtual factories.		
Motivation: Free suppliers and partners of the burden to argumentation about its environmental impact. There should be a clear set of inputs to automatically calculate environmental impact variables.		

S20	**Lifecycle:** PLAY, PLUG	**Priority:** 3
Document Management - Document management functionalities integrated with Smart Processes and its activities.		
Motivation: Given that virtual factories include engineering and design activities, a set of technical documents is produced (namely specifications of parts and manufacturing operations).		

3.3 High Level Functional Requirements

The requirements in this section are structured according to the topics derived from the strategic requirements defined in section 3.2. Although some requirements are associated with more than one strategic requirement, the requirements are shown only once, under the topic that is deemed most important.

3.3.1 Adaptation

F14	**Pri:** 1	**LC:** PLAY: ADAPTION & OPTIMIZATION	**PoV:** SUPPLIER
Title:		Show if a potential change in your process (inside and outside of ADVENTURE) affects the client process.	
Motivation:		Whenever an activity is no longer available or amended, or not used it should not	

	have an effect on the operation of the customer's software.
Example:	A supplier changes the output data format of a process step "read product quality indicators". As this step is used by 3 (out of 6) virtual factories that the supplier has a business relationship to, these dependencies are shown. Further steps may include ensuring proper transformation from the new to the old format, or bilateral negations in order to change the virtual factory processes.
How to test it:	As a supplier, simulate the effects of a process change to the customers' process.
Strategic Req.:	S9, S5
Task Assignment:	T5.2: simulate a change in process T6.2: monitor process T6.3: integrate rendered UI for end-users in role

F31	**Pri:** 1	**LC:** PLAY	**PoV:** SUPPLIER
Title:		Changing suppliers should be possible during process execution, in case of any the delivery risk. This implies the possibility to re-optimize the process. (see also F41).	
Motivation:		In case of any delivery risk, an existing, alternative supplier should be involved in the current process.	
Example:		In case of delivery risk of supplier A, the broker should be able to exchange supplier A for supplier B.	
How to test it:		Exchange supplier A for supplier B during process execution.	
Strategic Req.:		S9, S16	
Task Assignment:		T4.1: maintain partner services descriptions T4.2: search for suitable supplier T5.1: change process activity bindings T6.1: apply changes to process instance T6.3: integrate UI	

F41	**Pri:** 1	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		The system must issue alerts (alert page) in case of unexpected situations that can arise during the production process: delays in tasks and their reasons (problem on a partner machine, shipping delays, goods damage, etc.).	
Motivation:		Support problems solving during the manufacturing process. E.g., if the supplier is not able to deliver as promised to the customer, the customer should receive alerts.	
Example:		Imagine that during the surface treatment, AZEV' partner has problems in their facilities and will not be able to deliver the treated parts. An alert will be shown on ADVENTURE dashboard immediately so that AZEV can react to this unforeseeable event.	
How to test it:		The alert is shown in ADVENTURE dashboard.	
Strategic Req.:		S9, S16	
Task Assignment:		T6.2: continuous monitoring and active notification T6.3: integrate in UI	

F46	**Pri:** 2	**LC:** PLAY: ADAPTION	**PoV:** CUSTOMER

Title:	When a partner changes (See change F47 - automatic is not considered) it should be possible to do simulations taking into account the current data of process execution and data that are available for new potential partners. This is an extension of F43 since in this case the partner is being injected midway in to the process.
Motivation:	Support problems solving during the manufacturing.
Example:	Imagine that a smart process is running, developing a new machine. Unexpectedly, the Automation system supplier is no longer available to supply and a new one has to be introduced. As we are introducing a new partner on-the-fly, we run a simulation in order to obtain the process changes (lead time, cost, etc.).
How to test it:	AZEV is able to run a new on-the-fly simulation after a partner change. The new simulation results are shown.
Strategic Req.:	S9
Task Assignment:	T4.1: maintain data T4.2: provide data T5.2: simulate T6.2: provide process monitored data (i.e. already stored)

F42	**Pri:** 3	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Extending alerts (F41) to include email/SMS/Mobile.	
Motivation:		Make alerts more flexible.	
Example:		Receive Alert about failed process by SMS.	
How to test it:		Receive Alert about failed process by SMS.	
Strategic Req.:		S9, S16	
Task Assignment:		T6.2: continuous monitoring and active notification	

3.3.2 Advertising

F10	**Pri:** 1	**LC:** SEARCH	**PoV:** CUSTOMER
Title:		Create a browsable catalogue of ADVENTURE partners.	
Motivation:		Enable users to look for new business opportunities.	
Example:		Browse the catalogue for potential partners.	
How to test it:		Search for potential partners by browsing the catalogue.	
Strategic Req.:		S2	
Task Assignment:		T4.1: storing the catalogue T4.2: allow searching for partners T6.3: visualize the catalogue	

F70	**Pri:** 1	**LC:** JOIN: PROVISION	**PoV:** SUPPLIER
Title:		Supplier side: Describe/specify offered manufacturing capabilities as services utilizing semantic annotation.	
Motivation:		As ADVENTURE aims at enabling and enhancing automated partner finding, it is necessary that suppliers describe their (manufacturing) capabilities, which they	

	want to offer, as services. In order to enable automated processing of their service descriptions, semantic annotations linking to ontologies are indispensable.
Example:	As ADVENTURE aims at enabling and enhancing automated partner finding, it is necessary that suppliers describe their (manufacturing) capabilities, which they want to offer, as services. In order to enable automated processing of their service descriptions, semantic annotations linking to ontologies are indispensable.
How to test it:	Create a service description for a manufacturing capability with semantic annotations.
Strategic Req.:	S2, S3
Task Assignment:	T4.1: maintain descriptions T4.2: describe services T6.3: integrate UI

F71	**Pri:** 1	**LC:** SEARCH	**PoV:** CUSTOMER
Title:		Customer side: Describe/specify required manufacturing capabilities as services utilizing semantic annotation.	
Motivation:		As ADVENTURE aims at enabling and enhancing automated partner finding, it is necessary that customers describe required (manufacturing) capabilities, which they need and want to use, as services. In order to enable automated processing of service descriptions, semantic annotations linking to ontologies are indispensable.	
Example:		Factory X requires certain cork stoppers as a pre-product. It creates a "machine readable" service description that represents the capability of producing these specific cork stoppers. Factory X therefore uses semantic annotations which link to respective ontologies.	
How to test it:		Create a service description for a manufacturing capability with semantic annotations.	
Strategic Req.:		S2, S1, S13	
Task Assignment:		T4.1: maintain descriptions T4.2: describe services T6.3: integrate UI	

F11	**Pri:** 2	**LC:** SEARCH	**PoV:** CUSTOMER / SUPPLIER
Title:		Enable a supplier to identify customers that initiated PLUG processes (even if not successful) with this supplier.	
Motivation:		Allow a customer to check the record of a potential supplier (WARNING: under some circumstances this may not be desired). Allow a supplier to keep track of all past business relationships.	
Example:		Browse the history of business relationships for partners in the dashboard.	
How to test it:		Search for a customer that initiated a PLUG process.	
Strategic Req.:		S2	
Task Assignment:		T4.1: maintain relationships history data T4.2: provide relationships history T6.3: integrate rendered UI to end-users in role	

F9	Pri: 3	LC: SEARCH	PoV: CUSTOMER
Title:		Allow Customers to express interest in the company's products (for further contact). (relates to F10).	
Motivation:		Passive ADVENTURE members should be able to be contacted by partners browsing through a list of potential partners.	
Example:		Browse the catalogue for potential partners aiming at initiating communication about possible future collaborations.	
How to test it:		Contact a potential partner.	
Strategic Req.:		S2	
Task Assignment:		T4.1: storing the catalogue T4.2: allow searching for partners T6.3: visualize the catalogue	

F83	Pri: 3	LC: SEARCH	PoV: SUPPLIER
Title:		Allow potential customers to identify former customers.	
Motivation:		Let potential customers see successful projects.	
Example:		Successful projects of supplier A.	
How to test it:		As a customer, browse list of successful projects of a specific supplier.	
Strategic Req.:		S2	
Task Assignment:		T4.1: maintain partnerships log T4.2: search for previous partisanships	

3.3.3 Document Management

F53	Pri: 2	LC: PLUG: SMART PROCESS DESIGN	PoV: CUSTOMER
Title:		The system should enable the association of documents (specifications, drawings, manuals, etc.) to each of the activities of the collaborative process in order to share the vital information between the partners involved in each activity; This is not about content management or document flow, but simply being able to connect a document to a specific process step definition in the library.	
Motivation:		Partners involved in a given task, should share a collaboration environment with order data monitoring, documents needed to execute the service associated, events log and performance indicators.	
Example:		When AZEV decides to outsource a task, a set of specifications, drawings and other files has to be shared with partners so they can quote the service. Then all the documentation related to this service has to be centralized and associated to the service task. It will act like a knowledge base for this task.	
How to test it:		AZEV is able to create folders and attach documents and emails in the scope of a given task or process. AZEV is able to define permissions to the folders (e.g. all participating partners can red, only AZEV (broker) can write) in the process designer shown in Mock-up L1-1.	
Strategic Req.:		S20	
Task Assignment:		T4.1: store documents and their links to process steps T5.1: assign documents to steps in the process	

F54	Pri: 2	LC: PLUG: SMART PROCESS DESIGN	PoV: CUSTOMER
Title:		The documents connected with process steps (or possibly the steps themselves) in the process step library should have access rights.	
Motivation:		The system must be highly usable in order to make it user friendly, otherwise, there is the risk of partners to not use it.	
Example:		When AZEV decides to outsource a task, a set of specifications, drawings and other files has to be shared with partners so they can quote the service. Then all the documentation related to this service has to be centralized and associated to the service task. It will act like a knowledge base for this task.	
How to test it:		AZEV is able to create folders and attach documents and emails in the scope of a given task or process. AZEV is able to define permissions to the folders (e.g. all participating partners can red, only AZEV (broker) can write).	
Strategic Req.:		S20	
Task Assignment:		T4.1: authorized access to documents T6.3: access rights dashboard	

F67	Pri: 3	LC: PLUG / PLAY	PoV: CUSTOMER
Title:		it should be possible to have version control of the documents associated to each smart process activity.	
Motivation:		Avoid wrong information sharing between partners.	
Example:		Best Automation is developing an automation system for a machine, meanwhile, some functional requirements have changed and there are some adaptation is automation system specification. Then, AZEV attaches a new version of the automation system specification to the task and Best Automation is notified, the document version is controlled automatically by the system.	
How to test it:		AZEV attaches a new version of the automation system specification to the task and then Best Automation is notified.	
Strategic Req.:		S20	
Task Assignment:		T4.1: provide versioning	

F68	Pri: 4	LC: PLUG / PLAY	PoV: CUSTOMER
Title:		Collaborate on a document through a process.	
Motivation:		Collaborative document editing with change control.	
Example:		AZEV is collaborating with an engineer partner on automation system specification and they are both working on the same document. But when AZEV opens the document, other partner cannot edit it (controlled through the process).	
How to test it:		Collaborate on a document together with a partner.	
Strategic Req.:		S20	
Task Assignment:		T4.1: storing and serving document T6.3: providing dashboard function to collaborate	

F69	Pri: 4	LC: PLUG / PLAY	PoV: CUSTOMER

Title:	Document Validation Process â€“ e.g. approval of documents.
Motivation:	In engineering activities, it is helpful to have collaborative validation workflow, i.e., the revision and approval may be done by different partners.
Example:	Partner develops series of specs for new machine. AZEV needs to validate each document (or parts of) to prove the work.
How to test it:	Make a process editor for a document approval process.
Strategic Req.:	S20
Task Assignment:	T5.1: provide for design of processes T6.1: execute processes

3.3.4 Environment

F81	**Pri:** 3	**LC:** PLUG: SIMULATION	**PoV:** ADVENTURE
Title:		A means to assess the environmental impact of contracts with potential partners. I.e. Process steps that are in a category environment, and allow fetching of information about hazardous material (Mock-up L1-1).	
Motivation:		Allow customers to find out about hazardous materials used by the partner, and compare them to regulations in particular goal countries.	
Example:		Hazardous materials used by partners.	
How to test it:		Browse potential partners and provided information regarding the environmental impact, inspect results.	
Strategic Req.:		S1	
Task Assignment:		T5.2: drill down the partner supply chain to assess the overall environment impact	

F82	**Pri:** 3	**LC:** SEARCH	**PoV:** ADVENTURE
Title:		A means to compare potential partners regarding the environmental impact of a contract. I.e. fetch information for various partner for comparison in a table.	
Motivation:		Allow customers to minimize the environmental footprint, or reducing their carbon dioxide output.	
Example:		Would engaging in a cooperation with supplier A have a lower environmental impact than a potential cooperation with supplier B?.	
How to test it:		Execute ADVENTURE's functionality to compare potential partners regarding environmental impacts, inspect results.	
Strategic Req.:		S1	
Task Assignment:		T5.1: integrate with process editor T5.2: compare assessments T6.3: Integrate in UI	

3.3.5 Flexibility

F61	**Pri:** 1	**LC:** PLAY: EXECUTION	**PoV:** CUSTOMER
Title:		Adventure should be able to integrate with legacy systems such as MES and ERP.	

Motivation:	Update legacy systems databases automatically.
Example:	AZEV creates a smart process and there are some tasks that will be performed by AZEV itself, so ADVENTURE will have to send production orders to AZEV Manufacturing Execution System.
How to test it:	for each internal order, a production order is created in AZEV MES.
Strategic Req.:	S6
Task Assignment:	T4.4: gateways will do it as appropriate

3.3.6 Forecast

F25	**Pri:** 1	**LC:** PLUG: FORECAST, PLAY: EXECUTION	**PoV:** CUSTOMER
Title:		Supplier forecast data giving information on processes such as stock control.	
Motivation:		Suppliers may supply forecast data (through separate smart process step) based information from further down the supply chain. This forecast data can be either considered while designing a process or while dynamically selecting a partner at runtime.	
Example:		Stock level forecast.	
How to test it:		Perform a forecast.	
Strategic Req.:		S11	
Task Assignment:		T5.2: do forecast	

F26	**Pri:** 2	**LC:** JOIN: PROVISION	**PoV:** CUSTOMER
Title:		Comparing forecast (done by the supplier) with prediction data (done by customer) to assess accuracy of the forecast.	
Motivation:		Passive (statistical) calculation of expected variable behaviour. Stark deviations from data provided by suppliers may be used for decision / exception handling.	
Example:		Use historic data to compare with forecasts to assess the level of accuracy.	
How to test it:		Predict data, perform a forecast, and compare the results.	
Strategic Req.:		S11	
Task Assignment:		T4.1: query process log T5.2: perform forecast T6.3: compare forecast with historic data	

F32	**Pri:** 3	**LC:** PLAY	**PoV:** CUSTOMER
Title:		Notify partners about intended orders and processes with estimated definitions of product type, quantity and delivery date.	
Motivation:		A partner would like to be notified about planned/intended orders from its customers in order to optimize deployment of own resources.	
Example:		Supplier A wants to be notified by its customer B about envisaged, upcoming orders. Supplier C of Supplier A would also like to be similarly notified by Supplier A.	
How to test it:		Notify a supplier about upcoming order of a customer.	

Strategic Req.:	S11
Task Assignment:	T4.4: deliver upcoming order T6.3: integrate in UI

3.3.7 Information Gathering

F3	**Pri:** 1	**LC:** PLUG	**PoV:** CUSTOMER
Title:		Allow Customers to add/enter data required by the PLUG process through the dashboard.	
Motivation:		When a customer adds a partner to a virtual factory via dashboard, the PLUG process of this partner may require data from the customer. This data may either be collected automatically from the customers systems, based on resources that he allows access to by PLUG processes. Or they may be added manually. This case is dealing with the manual input.	
Example:		The plug process consists of steps that ask for contact persons, desired capacity. The customer is required to enter data through a form shown in the dashboard.	
How to test it:		Define a process step, initiate a PLUG, check if all steps can be connected to required smart process steps. Check if a form is shown.	
Strategic Req.:		S3	
Task Assignment:		T4.1: storage for entered data T4.2: provides data to ADVENTURE T5.1: the process engine supports human tasks to accomplish manual steps in process T6.3: the input to human tasks is rendered in the dashboard UI	

F84	**Pri:** 4	**LC:** SEARCH	**PoV:** SUPPLIER
Title:		Potential customers should be able to fetch information about additional required subcontractors.	
Motivation:		Potential customers should be able to select (and possible contract) companies that C2K is also comfortable working with.	
Example:		C2K proposes a set of additional suppliers and or software service providers (e.g. TIE) upon PLUG.	
How to test it:		Fetch information on subcontractors.	
Strategic Req.:		S3	
Task Assignment:		T4.2: removed	

3.3.8 Interoperability

F15	**Pri:** 1	**LC:** PLAY: EXECUTION	**PoV:** SUPPLIER/ CUSTOMER
Title:		Securely validate and transmit data to customer.	
Motivation:		Create secure connection to supplier / customer and ensure identity of the sender.	
Example:		A has received data which was transmitted and validated securely.	

How to test it:	Validate received data.
Strategic Req.:	S5, S18
Task Assignment:	T4.4: secure communication/messaging

F16	**Pri:** 1	**LC:** PLAY: EXECUTION	**PoV:** SUPPLIER / CUSTOMER
Title:		Buffer data in case partner is not available.	
Motivation:		Buffer partner data when services are offline so that the service should not be interrupted.	
Example:		In case where real data is transmitted constantly and there is a loss of connection, messages will be kept and delivered when the respective partner gets online again.	
How to test it:		Switch a partner off and send him data.	
Strategic Req.:		S5	
Task Assignment:		T4.4: delayed messaging	

F24	**Pri:** 1	**LC:** PLAY: EXECUTION, PLUG: SMART PROCESS DESIGN	**PoV:** SUPPLIER
Title:		Rule's based message/alert/notification generation.	
Motivation:		In order to deliver data to customers systems (e.g. ERP systems) it is necessary to generate messages after a) fetching data from suppliers or b) reacting to data pushes from suppliers. E.g. it should be possible to configure alarms for each critical and non-critical activities concerning lead time, due dates.	
Example:		(1) Whenever 5 orders are finished, a message is sent to a customer's ERP system. (2) AZEV configures an alarm for 2 days before surface treatment due date. If this activity is below 80% then an alarm will be triggered.	
How to test it:		Add notification rule through Dashboard, check if rule triggers.	
Strategic Req.:		S5	
Task Assignment:		T4.1: maintain monitoring data T6.2: rules apply monitoring data	

F27	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CLIENT
Title:		Connectors from legacy software to ADVENTURE.	
Motivation:		Legacy software such as IndustreWeb is to be wrapped behind a gateway to behave the ADVENTURE way (abstraction for sync/async call, list of smart process steps, delivery of visualization along with process step results, ...).	
Example:		Connecting very old computer systems, e.g., old PLC system.	
How to test it:		Connect legacy software A to ADVENTURE.	
Strategic Req.:		S5, S6	
Task Assignment:		T4.4: provide and register gateways T7.2: use case specific connectors	

F17	**Pri:** 3	**LC:** PLAY: ADAPTION & OPTIMIZATION	**PoV:** SUPPLIER

Title:	Update data formats if necessary. (see also F8).
Motivation:	Updates of software may require changes to data formats. These changes have to be communicated to ADVENTURE resulting in a potential notification to customers. The ADVENTURE broker can include new software modules (e.g. SmartBridge) to provide a transformation.
Example:	A new version of word has a new file format. A ERP system has a new protocol for notifications.
How to test it:	Change data format.
Strategic Req.:	S5
Task Assignment:	T4.2: find updated service definitions and affected processes T4.4: takes care of message/format transformations

F18	**Pri:** 3	**LC:** PLAY: ADAPTION & OPTIMIZATION	**PoV:** SUPPLIER
Title:		Validate data against agreed schema.	
Motivation:		Check for potential changes in expected data formats. As customers or suppliers both may change data formats unnoticed, there has to be a passive safeguard mechanism to detect incompatibilities.	
Example:		A new version of word has a new file format. A ERP system has a new protocol for notifications.	
How to test it:		As a customer, change data format. As a supplier, validate data against agreed schema.	
Strategic Req.:		S5	
Task Assignment:		T6.1: prevent failures due to invalid data format.	

F19	**Pri:** 3	**LC:** PLAY: ADAPTION & OPTIMIZATION	**PoV:** SUPPLIER
Title:		Manage several data formats and transformations between them.	
Motivation:		In order to keep supporting customers that rely on old data formats, transformations carried out by ADVENTURE might be handy.	
Example:		Include TIE SmartBridge or attach own transformation plugins to handle data flow transformation between different pieces of software included in a process. This can also be a script task in a process that changes a date format.	
How to test it:		Transform from one data format to another one in the process editor. Either include a step (e.g. SmartBridge) or a script task.	
Strategic Req.:		S5	
Task Assignment:		T4.4: takes care of data transformations	

3.3.9 Messaging

F65	**Pri:** 2	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Configurable dashboard - it should be possible to manage the ADVENTURE modules like components in iGoogle, for instance.	
Motivation:		Maximum user friendliness of Dashboard.	

Example:	AZEV will add components for important processes like process monitoring , messages, in one single Dashboard (see Mock-up L0). For level 2 dashboard it will be the activity workflow monitor, content management, associated partners, and monitoring.
How to test it:	AZEV is able to add and configure widgets in the dashboard.
Strategic Req.:	S19
Task Assignment:	T6.3: manage modular and configurable UI

3.3.10 Monitoring

F1	**Pri:** 1	**LC:** JOIN: PROVISION	**PoV:** SUPPLIER & CUSTOMER
Title:		During the PLUG process, partner information needs to be available through the dashboard. This can be static information, e.g., profile information, and dynamic information, e.g., current capacities.	
Motivation:		In order to be able to find suitable partners and to decide about its trustworthiness, information about that partner is required.	
Example:		Contact persons, available capacities, subcontractors, max/mean throughput of the machines.	
How to test it:		Check if a partner provides a smart process step that makes machine information available. Invoke the step. Inspect the results.	
Strategic Req.:		S10	
Task Assignment:		T4.1: store the data T4.2: provisioning of data T4.4: data is routed through the messaging component T6.3: will be accessed via the Dashboard	

F4	**Pri:** 1	**LC:** PLUG	**PoV:** CUSTOMER
Title:		Allow Customers to monitor the progress of the PLUG process in the dashboard.	
Motivation:		At the end of the PLUG process a partner is part of a virtual factory. Establishing it, it consists of a series of steps. These steps could possibly take some time on behalf of either the supplier, so the customer may want to monitor progress.	
Example:		See if a supplier entered data or finished steps that are necessary to join a specific virtual factory.	
How to test it:		Start a PLUG process, monitor its progress.	
Strategic Req.:		S10	
Task Assignment:		T6.1: will provide input to T6.2 T6.2: will handle process state monitoring T6.3: the monitoring is rendered in dashboard UI	

F30	**Pri:** 1	**LC:** PLAY	**PoV:** CUSTOMER
Title:		The broker should be able to see on the Dashboard the stock levels at own factory, in transit, and at suppliers for any material.	
Motivation:		In order to get an overview about "all" stock levels, which include also stock in transit and at supplier's, the system should provide real time information and	

	status update of those stock levels via the Dashboard. This would enable an optimized selection of suppliers, if needed.
Example:	Suppliers and/or manufacturers need to monitor the exact number of stock level (restricted stock, unrestricted stock, stocks in transit, etc.) on real-time environment as shown in Mock-up L2-2.
How to test it:	Access and show stock levels of 5 different materials.
Strategic Req.:	S10
Task Assignment:	T4.4: deliver inventory data via gateways T6.2: monitor stock level T6.3: integrate into UI

F37	**Pri:** 1	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		The system must allow monitoring of process steps, providing status information of the activities in each of the partners (not started, late in x hours, in production, in testing, in packaging, in shipping, finished, % conducted) via the Dashboard. This information would come from F36 but maybe a subset of information (e.g. not all events - only important ones - e.g. started, errors etc.).	
Motivation:		This is done manually today and sometimes the information arrives too late to act. With real time monitoring of the process steps, operations can be improved. The process steps should be monitored while running, compared to a log that only concludes of START and END events.	
Example:		AZEV access ADVENTURE and for a given task, they can view if it is running or stopped and the percentage of execution as shown in Mock-up L2-1.	
How to test it:		AZEV access ADVENTURE and for a given task, it is possible to view if it is running or stopped and the percentage of execution.	
Strategic Req.:		S10	
Task Assignment:		T4.4: routes event information stored in cloud to Process Execution Engine T6.2: monitor process activities status T6.3 Display status	

F38	**Pri:** 1	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		The system shall present the status of all process steps in a graphic manner. (e.g., by colour in each task in the process, including status information and notes related to it). This builds of F37 to provide further UI improvements.	
Motivation:		Make data available easier.	
Example:		In the global smart process view for a machine development, all the activities are colored according to their status On mouse over, some details (due date, start date, partner, execution percentage, etc. are shown).	
How to test it:		In the global smart process view for a machine development, all the activities are colored according to their status On mouse over, some details (due date, start date, partner, execution percentage, etc. are shown).	
Strategic Req.:		S10	
Task Assignment:		T6.2: provide UI for process statuses T6.3 Dashboard	

F73	**Pri:** 1	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER

Title:	Process monitoring data from smart objects is gathered.
Motivation:	Enhances supply chain visibility significantly; allows for early event detection and on time countermeasures and process adaptation.
Example:	Sensors gather temperature data.
How to test it:	Use prototype sensors and expose them to certain temperatures or via simulation.
Strategic Req.:	S10, S5, S16
Task Assignment:	T4.1: maintain monitoring data T4.3: provide monitoring and aggregation of data T6.2: process monitoring data for consumption

F75	**Pri:** 1	**LC:** PLAY: MONITORING	**PoV:** ADVENTURE
Title:		Communication with smart objects, which monitor data which may be used in a process is enabled. They are connected through ADVENTURE enabling gateways as per other legacy systems.	
Motivation:		Gathered data is made available to the user so that he/she can profit from the enhanced supply chain visibility to react early on events and adapt his/her processes.	
Example:		Sensors might communicate between each other and thus transport information to a central system.	
How to test it:		Communication between prototypical sensor nodes or via simulation.	
Strategic Req.:		S10, S5, S16	
Task Assignment:		T4.3: provides interface to ADVENUTRE to integrate smart objects as IT providers	

F76	**Pri:** 1	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Process monitoring data from smart objects is stored in ADVENTURE's data repository.	
Motivation:		Gathered data is made available to the user so that he/she can profit from the enhanced supply chain visibility to react early on events and adapt his/her processes.	
Example:		Critical temperature events are stored in the repository as shown in Mock-up L2-3.	
How to test it:		Enable communication between prototypical sensor nodes and ADVENTURE data repository.	
Strategic Req.:		S10, S5, S16	
Task Assignment:		T4.1: maintains monitoring data from smart objects T4.3: stores monitoring data in T4.1	

F36	**Pri:** 2	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		During the runtime phase all events must be recorded, including start and end of tasks time, alarms (e.g. machine failed) and e.g. partner suddenly not available or delayed two days. All these events come from the factories/partners.	
Motivation:		In order to mitigate future risks, It is helpful if we have traceability of the smart process execution.	

Example:	When "TECHNOLOGICAL" starts the surface treatment activity, it is recorded in ADVENTURE and AZEV is able to follow the activity running.
How to test it:	AZEV is able to see the status log of all smart process activities.
Strategic Req.:	S10
Task Assignment:	T4.1: storage of events etc. T4.4: transferring event information to storage (from monitor to storage) T6.2: logs all process events

F59	**Pri:** 2	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		All active processes should be viewable in the Dashboard.	
Motivation:		Users should be able to know the state of all active processes (Machines being produced).	
Example:		AZEV participates on 6 virtual factories, In the dashboard there, for example a GANTT chart that enables AZEV to globally monitor all the processes.	
How to test it:		AZEV is able to view the state of all active virtual factories.	
Strategic Req.:		S10	
Task Assignment:		T4.1: maintain process data T4.4: provide process data T6.2: monitor process state T6.3: integrate UI into dashboard	

F66	**Pri:** 2	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Process monitoring should support SMART objects with single or multiple sensors.	
Motivation:		Require the processing of multiple sensors.	
Example:		SMART objects can range from a machine of multiple functionality with multiple sensors providing feedback to a single device with one output parameter and Adventure should not only focus on simple sensors.	
How to test it:		Run a process which response to a multi sensor device.	
Strategic Req.:		S10	
Task Assignment:		T4.3: SMART Object integration for integration of multiple sensors T6.2: Process Monitoring	

F74	**Pri:** 4	**LC:** PLAY: MONITORING	**PoV:** ADVENTURE
Title:		Process monitoring data from smart objects is locally per-processed.	
Motivation:		Provides focus on only relevant events; leading to efficient behaviour and preventing an information overload at the user's side.	
Example:		Sensors decide locally whether a temperature is too high.	
How to test it:		Use prototype sensors or simulations working on gathered/provided temperature data.	
Strategic Req.:		S10, S5, S16	
Task Assignment:		T4.3: pre-process monitoring data (aggregation, filtering) locally when possible	

3.3.11 Notification

F33	Pri: 2	LC: PLAY	PoV: SUPPLIER
Title:	The system must issue alerts (alert page) in case stock levels cross agreed thresholds (relates to F41).		
Motivation:	In order to avoid too high AND too low stock levels and to optimize the selection of suppliers, it is necessary to see the real-time stock levels on the Dashboard.		
Example:	If a stock level crosses an agreed threshold, e.g., the stock level is too low, an alert is provided.		
How to test it:	Check whether an alert is issued when stock level is too low or too high.		
Strategic Req.:	S16		
Task Assignment:	T4.4: route the alert T6.2: real-time monitoring T6.3: show the alert		

F62	Pri: 2	LC: PLAY: MONITORING	PoV: CUSTOMER
Title:	Within the process design it must be possible to specify dependent tasks with parameters such that when executed (or not executed) - for example, so an alert can be sent when a process is executed - See also F63.		
Motivation:	Show alerts and notifications related to smart processes on the dashboard.		
Example:	AZEV configures an alarm for 2 days before surface treatment due date. If this activity is below 80% then an alarm will be triggered as shown in Mock-up L1-4.		
How to test it:	If this activity is below 80% 2 days before due date, the alarm is triggered and shown in the ADVENTURE dashboard.		
Strategic Req.:	S16, S10		
Task Assignment:	T4.1: maintain process dependency data T4.2: provide process dependency data T5.1: enter of dependency data T6.3: integrate UI		

F63	Pri: 2	LC: PLAY: MONITORING	PoV: CUSTOMER
Title:	Within the Process Execution Engine, if there are rules specified from a designed process which are broken, then an alert must be generated.		
Motivation:	For early warning of good and bad issues connected with a process.		
Example:	A process step is not operated quickly enough.		
How to test it:	Define a rule, break it, and ensure an alert is generated.		
Strategic Req.:	S16		
Task Assignment:	T4.1: provide process dependency data T4.2: provide process dependency data T5.2: monitor real world vs. dependency data T6.3: integrate UI		

F85	Pri: 3	LC: PLAY: MONITORING	PoV: CUSTOMER
Title:	Implement instant messaging for partners collaborating in a virtual factory		

	integrated into the ADVENTURE system.
Motivation:	Allow partners to collaborate via chat with each to speed up communication.
Example:	Skype.
How to test it:	Send message to ADVENTURE partner, find out if he receives it.
Strategic Req.:	S16
Task Assignment:	T4.4 Instant Messaging functionality T6.3 Dashboard visualization of instant messaging

3.3.12 Optimization

F48	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		Define threshold value in order to have reference to the monitoring and the simulation components/functionalities on when to extract information.	
Motivation:		Achieve the best performance in terms of time and requirements compliance.	
Example:		This can be realized using the process designer shown in Mock-up L1-1. Example: Assign minimum and maximum due date for each process step and for the whole process.	
How to test it:		Set threshold value to X.	
Strategic Req.:		S14	
Task Assignment:		T5.1: process Designer to enter thresh values against process steps T6.2: process Monitor to reference parameters	

F80	**Pri:** 1	**LC:** PLUG: OPTIMIZATION	**PoV:** CUSTOMER
Title:		Show/propose optimized composition of services for a specific smart process.	
Motivation:		Having modelled a smart process and specified restrictions and objectives, the ADVENTURE broker wants to know, which partner services among alternative ones he should select.	
Example:		Having modelled a smart process for a coffee service comprising one process step for providing spoons and one process step for providing cups, the ADVENTURE broker specifies that the coffee service requires to be delivered within 3 days and at the lowest possible price. With this input, the ADVENTURE broker wants to know, which partner service for providing the spoons and which partner service for providing the cups he should select in order to satisfy his constraint with respect to the 3 day delivery time frame and in order to produce the coffee service at lowest cost.	
How to test it:		Specify restrictions and an objective for a smart process and find a composition of (manufacturing) service that satisfy the constraints and maximize/minimize the objective.	
Strategic Req.:		S14	
Task Assignment:		T4.1: maintain partner services descriptions T4.2: provide for matching services T5.1: integrate in process editor T5.3: optimize process against KPIs T6.3: integrate UI	

F44	Pri: 2	LC: PLUG: SIMULATION	PoV: CUSTOMER
Title:		At the end of a simulation a simulation report has to be displayed and saved. This should include details about the configuration parameters, goals etc.	
Motivation:		In order to compare the various scenarios. An example report may include the following columns: process due date range, activity due date range, process bottlenecks and the set of alternatives that minimize the lead time and maximize the requirements compliance.	
Example:		AZEV designs a new smart process and assigns services to some activities that have to be outsourced. Based on services data, ADVENTURE is able to perform evaluations and suggest the best set of partners to AZEV. However, user may choose other partners/services manually.	
How to test it:		AZEV is able to select a smart process simulation and compare the results of various simulations in order to choose the best one.	
Strategic Req.:		S14, S10	
Task Assignment:		T4.1: manages simulation reports T5.2: visualize the simulation report T6.3: visualize in dashboard	

3.3.13 Partner Finding

F72	Pri: 1	LC: SEARCH	PoV: CUSTOMER
Title:		Search/browse/query the data repository to find appropriate services (as offered by real factories) by entering a semantic description of services which needs to be exchanged.	
Motivation:		In case an ADVENTURE broker wants to exchange a partner for another partner, the ADVENTURE broker should be able to query the data repository, where offered (manufacturing) capabilities are stored, and search for appropriate partners by entering the services previously provided by that partner the ADVENTURE broker wants to exchange.	
Example:		If for instance during the Play phase, supplier X cannot deliver due to an event the required number or quality of cork stoppers, which was necessary to produce a "filling machine", it is necessary to exchange supplier X for an alternative supplier. For this, an ADVENTURE broker should be able to query the data repository, where offered (manufacturing) capabilities are stored, and search for suppliers which probably could replace supplier X by entering descriptions of the services, which are cork stoppers in this example, which had been previously provided by supplier X. As all this is happening during the Play phase, the "search-and-find" lookup should be enhanced by automated propositions of best fitting alternative suppliers.	
How to test it:		Find appropriate services by utilizing a service, for which alternative candidates should be found.	
Strategic Req.:		S13, S1, S2, S3, S4	
Task Assignment:		T4.1: maintain descriptions T4.2: browse services T6.3: integrate UI	

F78	Pri: 1	LC: PLUG: ADAPTION & OPTIMIZATION	PoV: CUSTOMER
Title:		Show non-functional properties (e.g. default (typical) cost, delivery time, carbon	

	footprint) of discovered services.
Motivation:	In addition to the manufacturing capabilities and products a certain partner factory is able to provide, the ADVENTURE broker requires information regarding non-functional aspects as cost and delivery time.
Example:	The ADVENTURE broker searches for partner factories that provide cork stoppers. In addition to the ability to provide appropriate cork stoppers, the ADVENTURE broker also wants to know, how long it takes the partner factories to deliver the respective cork stoppers and at which price they provide them.
How to test it:	Display non-functional service properties.
Strategic Req.:	S13, S9, S14
Task Assignment:	T4.1: maintain partner services descriptions T4.2: provide NFP services details T6.3: integrate UI

F52	**Pri:** 2	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		In the smart process design, the system must search and fetch potential partners on specific criteria (For example; Market sector; services type, Location, ...). Then it should be possible to drill down each partner in order to access more detailed information like Name, know-how, related services, technology used, ADVENTURE's trust index, etc.;.	
Motivation:		Find suitable partners to execute a set of activities by providing engineering or manufacturing services.	
Example:		AZEV need to develop a control system using a specific programming language. Thus, AZEV needs to find skilled partners to perform the task as shown in Mock-up L1-3.	
How to test it:		AZEV is able to search partners by Location, Market sector, Type of services provided and so on. Then it is possible to view partner and services details.	
Strategic Req.:		S13	
Task Assignment:		T4.1: maintain partner data T4.2: provide searchable data T5.1: process designer to trigger 4.2 to find and extract information (comparison etc. is done in 4.2) T6.3: integrate in UI	

F57	**Pri:** 2	**LC:** SEARCH	**PoV:** CUSTOMER
Title:		The system should provide descriptions, photos, catalogues, attached to every partner. These documents are sent when a potential client asks for details about their activities, capabilities.	
Motivation:		Find suitable partners to execute a set of activities by provide engineering or manufacturing services.	
Example:		AZEV finds some partners that provided the same service, for example, PLC programming, but they need to know a lot more details like, types of technology used (OMRON, SCHNEIDER, SIEMENS), reference projects, reference clients, certifications, photos, catalogues, and so on. Because all the info is attached to service, It's easy for AZEV to choose the most suitable partner to do the job.	
How to test it:		AZEV is able to view services details and partner info. Na automation company will provide: types of technology used (OMRON, SCHNEIDER, SIEMENS), reference projects, reference clients, certifications, photos, catalogues, and so	

	on.
Strategic Req.:	S13
Task Assignment:	T4.1: maintain partner services descriptions T4.2: browse partner services descriptions and access accompanying documents T6.3: dashboard to provide assignment, maintenance and viewing facility

F56	**Pri:** 3	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		The system should permit the assignment of a set of preferential partners/suppliers for each outsourced activity (per partner). E.g. a group of preferred partners.	
Motivation:		Manually suggest suitable partners to execute a set of activities by provide engineering or manufacturing services.	
Example:		AZEV creates a task for mechanical part binding During services search, the system suggest a list of preferred partners based on historic data (previous partnerships, location or best suited services) as shown in Mock-up L1-3.	
How to test it:		During process design, the system suggests a list of partners for a specific outsourced service task.	
Strategic Req.:		S13	
Task Assignment:		T4.1: maintain (preferred) partner services descriptions T4.2: provide preferred partner services T5.1: allow partners to be assigned to particular steps	

F58	**Pri:** 3	**LC:** SEARCH	**PoV:** CUSTOMER
Title:		When searching for partners, partners in past or active collaborations should be rated higher.	
Motivation:		Find suitable partners to execute a set of activities by provide engineering or manufacturing services.	
Example:		Over time, AZEV collaborates with several partners in several virtual factories. AZEV builds a list of preferred partners by adding them to "favourites Folder". This way when AZEV needs some service, the first partners to be searched by the system will be those included in the favourites list as shown in Mock-up L1-3.	
How to test it:		AZEV is able to add a partner to a "Favourite Partners List" and then consult this list filtering it by industry type, location and type of service provided.	
Strategic Req.:		S13	
Task Assignment:		T4.2: provide for searching partners with regards to previous partnerships (ranked higher in search hits) T6.3: dashboard to allow entering of search parameters and visualization of results	

3.3.14 Planability

F28	**Pri:** 1	**LC:** PLAY	**PoV:** CUSTOMER
Title:		Enable the broker to compute ATP ("available to promise") or CTP ("capable to promise") based on available resources, i.e., availability of material and capacity within the factory and also the availability of materials from suppliers.	

Motivation:	This computation will enable the broker factory to promise a delivery date to the customer which is based on factual information. E.g., in case of changed business environment (rush order, increased order volume, changed delivery date, etc.) both manufacturer/supplier like to simulate their capacities/capabilities based on such changed environments.
Example:	A customer approaches ABB and asks for delivery of a certain type of product. For this, ABB has promise a delivery date. This promised delivery date would consider the existing orders, capacities, and the available materials including those coming from suppliers.
How to test it:	Simulate several orders with varying products, delivery date and quantities.
Strategic Req.:	S8
Task Assignment:	T4.4: deliver ATP via gateways T5.2: simulate the order T6.3: integrate into UI

F29	**Pri:** 1	**LC:** PLAY	**PoV:** CUSTOMER
Title:		Enable the broker to gather dynamic, real-time information about, e.g., material stock position, capacity position, etc. (see also F28: this information will support the computation of ATP/CTP).	
Motivation:		Such dynamic, real-time information is required to for performing simulations, forecasting, and optimizations.	
Example:		A broker would like to get real-time information on factory A.	
How to test it:		Fetch information from factory X.	
Strategic Req.:		S8, S10	
Task Assignment:		T4.4: deliver ATP via gateways T5.2: simulate the order T6.3: integrate into UI	

3.3.15 Process Design

F2	**Pri:** 1	**LC:** PLUG	**PoV:** CUSTOMER
Title:		The Plug process is automatically started whenever a broker adds a new partner.	
Motivation:		The PLUG process allows a supplier to make a decision if the supplier wants to enter a business relationship. The PLUG process has access to customer information (F1), can prepare a suppliers facility for a business relationship.	
Example:		Add partner to virtual factory as shown in Mock-up L1-3.	
How to test it:		When adding a partner, the PLUG process should be executed.	
Strategic Req.:		S12	
Task Assignment:		T4.1: static data provided by T4.2 is managed in cloud storage T4.2: the customer services provisioning dynamic data as well as static profile data need to be allocated in profile T4.4: a communication with backend systems will be needed to fetch dynamic data via gateways, inter-component messaging T6.1: the data will be collected in a process orchestrated by the process engine T6.3: the UI for PLUG process management is in the dashboard.	

F7	Pri: 1	LC: PLUG: SMART PROCESS DESIGN	PoV: SUPPLIER
Title:		Allow semantic annotations for each process step.	
Motivation:		Enable to find matching partners. Without semantic annotation, we would basically have a "key word" search. With semantic annotations, we can find appropriated partners automatically.	
Example:		A process step is associated to a call to a service interface. The name of the called service operation has to be assigned to semantic concepts in order to make it possible to find other operations from other partners that do the same. (e.g. "query items in stock" vs. "query parts in stock"). This will be possible with the process designer shown in Mock-up L1-1.	
How to test it:		Add a new supplier to a process (as shown in Mock-up L1-3). Delete the old supplier. Process should still work without manual adaptation.	
Strategic Req.:		S12	
Task Assignment:		T4.2: discover matching partners T5.1: the process definition allows for annotations T6.3: the process designer is integrated in dashboard	

F8	Pri: 1	LC: PLUG: SMART PROCESS DESIGN	PoV: SUPPLIER
Title:		Abstraction, i.e., mapping and transformation, of partner interfaces.	
Motivation:		Allow of easy mapping of the semantic dimension of a process step. Inside a particular market certain terminologies may be common, supplier should be supported to express or map their prerequisites in these terms. Certain elements may require 1:1 mapping.	
Example:		Mapping data format X of partner Y to ISO.	
How to test it:		Map data format X to Y.	
Strategic Req.:		S12	
Task Assignment:		T.4.1: Data that needs to map is stored T4.2: gets the data from the storage T4.4: data transformation service T7.2: implementing a wrapper for use case specific mappings	

F12	Pri: 1	LC: PLUG: SMART PROCESS DESIGN	PoV: CUSTOMER
Title:		Show smart process steps that can be included in the Process Designer. Each process step has to have defined input and output.	
Motivation:		IndustreWeb is an aggregator of Smart Object data. Each smart object (i.e. all aspects like current readings, mean readings, historic readings) is to be exposed through one smart process step that can then be used to provide data to customer processes.	
Example:		Mean readings, current readings, current throughput, etc. Those smart process steps can be accessed through the process designer shown in Mock-up L1-1.	
How to test it:		Join a virtual factory as a customer, see if process activities are available to be included.	
Strategic Req.:		S12	
Task Assignment:		T4.1: maintain service descriptions T4.2: discover services T5.1: bind services in process editor	

	T6.2: integrate rendered UI for end-users in role

F13	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN, SEARCH	**PoV:** CUSTOMER
Title:		Show the suppliers (service providers) that have completed the PLUG process and are ready for selection by a broker. (see also F5 and Mock-up L1-3).	
Motivation:		Suppliers should be exchangeable with other suppliers without changing smart processes. How is this expected to work? (1) For all processes enumerate all steps that that a supplier is involved in. (2) Search and list suppliers that can provide the same process steps. This of course relies on the assumption that the process steps have been associated semantically annotated.	
Example:		Supplier B has completed the PLUG process and is found by the broker.	
How to test it:		List partners that have similar functionality.	
Strategic Req.:		S12	
Task Assignment:		T4.1: maintain service descriptions T4.2: discover services T5.1: annotate process, bind services T6.3: integrate rendered UI for end-users in role	

F49	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		Ability to search and reuse the existing templates processes and best practices (patterns) which are in the repository and then to take these and modify (See F50) .	
Motivation:		Develop a tool to design the engineering and/or manufacturing process for new one-of-a-kind products that can be integrated with services finding and assignment, simulation based on services data, process and task data monitoring and documentation. This model is initially an abstract model and can be based on a process template stored in the cloud based repository.	
Example:		AZEV receives a new customer order for a machine with very special requirements. As AZEV really wants to see costumers satisfied, AZEV will start the design of a new project aiming developing a new solution for the costumer. AZEV knows that at least the engineering phase, the mechanical parts production phase and the electrical and automation system development will be needed as well as integrated tests and commissioning This is a standard procedure for machine tool industry. As shown in Mock-up L1-2, a template can be used. But the specific tasks inside this big phases are not known at glance, so the smart process has to be designed on-the-fly. For instance, maybe AZEV will need to develop a new feed systems or the automation system has real time requirements. In that cases, new services tasks will be added to the smart process (see Mock-up L1-1).	
How to test it:		AZEV is able to edit the smart process on-the-fly, adding new tasks.	
Strategic Req.:		S12	
Task Assignment:		T4.1: maintain process templates T4.2: provide process templates T5.1: browse process templates	

F50	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		The system should allow tailoring the standard processes or design new manufacturing processes using a graphical interface and a standard notation.	

Motivation:	Develop a tool to design the engineering and/or manufacturing process for new one-of-a-kind products that can be integrated with services finding and assignment, simulation based on services data, process and task data monitoring and documentation. This model is initially an abstract model and can be based on a process template stored in the cloud based repository.
Example:	AZEV receives a new customer order for a machine with very special requirements. As AZEV really wants to see costumers satisfied, AZEV will start the design of a new project aiming developing a new solution for the costumer. AZEV knows that at least the engineering phase, the mechanical parts production phase and the electrical and automation system development will be needed as well as integrated tests and commissioning This is a standard procedure for machine tool industry. As shown in Mock-up L1-2, a template can be used. But the specific tasks inside this big phases are not known at glance, so the smart process has to be tailored on-the-fly. For instance, maybe AZEV will need to develop a new feed systems or the automation system has real time requirements. In that cases, new services tasks will be added to the smart process (see Mock-up L1-1).
How to test it:	AZEV is able to select a template from the process repository and edit the smart process on-the-fly. It's possible to add tasks and assign services on-the-fly (i.e., during process execution).
Strategic Req.:	S12
Task Assignment:	T4.1: maintain process templates T4.2: provide process templates T5.1: browse for and edit template processes

F51	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		It should be possible to design a new manufacturing process from scratch. .	
Motivation:		Develop a tool to design the engineering and/or manufacturing process for each of its new one-of-a-kind products that can be integrated with services finding and assignment, simulation based on services data, process and task data monitoring and documentation. This model is initially an abstract model.	
Example:		AZEV receives a new customer order for a machine with very special requirements. As AZEV really wants to see costumers satisfied, AZEV will start the design of a new project aiming developing a new solution for the costumer. This time AZEV wants to design it from scratch (see Mock-up L1-1).	
How to test it:		AZEV is able to design a new process from a blank page using a standard process modelling notation.	
Strategic Req.:		S12	
Task Assignment:		T5.1: design process in editor	

F77	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		Show services appropriate for realizing certain process steps. Initiated manually to query the Adventure system.	
Motivation:		In order to see, which alternative partner services would be suitable, the ADVENTURE broker requires this information to be displayed via the ADVENTURE dashboard.	
Example:		The ADVENTURE broker wants to see, which potential partner services would be suitable for satisfying his demand for cork stoppers.	

How to test it:	Perform a search for appropriate services and display them.
Strategic Req.:	S12, S2, S3
Task Assignment:	T4.1: maintain partner services descriptions T4.2: provide for matching services T6.3: integrate UI

F79	**Pri:** 1	**LC:** PLUG: ADAPTION & OPTIMIZATION	**PoV:** CUSTOMER
Title:		Describe/specify restrictions/conditions/objective(s) (at design time) on non-functional properties for (whole) smart process so that designed processes can be further optimized.	
Motivation:		Having modelled a smart process utilizing the ADVENTURE Smart Process Designer, the ADVENTURE broker searches for appropriate partner services and assigns the respective partner services to each step of the process. But, in fact, the ADVENTURE broker requires that the designed process satisfies certain restrictions with respect to non-functional properties. In addition, the ADVENTURE broker is not searching for arbitrary partner services providing appropriate per-products, but for partner services where the arising cost (for all these services) are minimal.	
Example:		The ADVENTURE broker has modelled a certain smart process utilizing the ADVENTURE Smart Process Designer, which aims at producing a coffee service. For this coffee service, spoons and cups are required. Thus, the broker is searching for appropriate partner services that can produce spoons and for appropriate partner services that can produce cups. But, in fact, the ADVENTURE broker is only interested in combinations of those partner services that can provide the coffee service within a delivery frame of 3 days. In addition, the ADVENTURE broker thereby aims at finding those partner services, which provide the coffee service cheapest.	
How to test it:		Set a restriction of 3 days for delivery time of coffee service and search for and assign services to process steps such that this the delivery time constraint (3 days) is satisfied. Set an objective, as e.g., minimum cost, and search for and assign services to process steps such that the aggregated cost for executing the whole workflow maximizes/minimizes the objective, i.e., minimize total cost.	
Strategic Req.:		S12, S9, S14, S15	
Task Assignment:		T5.1: provide for description of process constraints/requirements T5.3: restrictions for optimization T6.3: integrate UI	

F5	**Pri:** 2	**LC:** JOIN: PROVISION	**PoV:** SUPPLIER
Title:		Define the PLUG process, i.e., prerequisites of a supplier, in order to enable a broker initiating a collaboration with this supplier.	
Motivation:		Allow suppliers to define processes that should be executed whenever a business relationship is established. This can include access to the supplier's backend for checking if currently enough resources are available.	
Example:		Users can define static prerequisites (e.g. "pay me in GBP") or dynamic requisites that are checked during execution time (e.g. "enough raw materials need to be available to select me as a partner").	
How to test it:		As a supplier, define prerequisites that have to be fulfilled before joining virtual factories. Try joining a virtual factory when the requirements are not fulfilled. Use the process editor shown dashboard L1-1, for modifying a PLUG process.	

Strategic Req.:	S12
Task Assignment:	T4.1: store provided data T4.2: will manage the data provisioning T5.1: to design the process (i.e., the PLUG process in this case) T6.3: the process designer and access to tools will be via dashboard

F6	**Pri:** 2	**LC:** JOIN: PROVISION	**PoV:** SUPPLIER
Title:		Provide information about min/max duration of the steps of the PLUG process.	
Motivation:		Allow customers to calculate / assess the duration of integrating a supplier into own production processes.	
Example:		For each step a supplier stipulates min/max duration. When a customer adds a partner it is supposed to see how long it will take until a partner becomes operative within the virtual factory.	
How to test it:		As a supplier, stipulate how long it takes to plug into a virtual factory (min/max times). As a customer, see if this information becomes available.	
Strategic Req.:		S12	
Task Assignment:		T4.1: store provided data T4.2: provide information about supplier T6.3: the process designer and access to tools will be via dashboard	

F34	**Pri:** 2	**LC:** GENERAL	**PoV:** CUSTOMER
Title:		Ability to save settings (virtual factories processes and partners) for future use.	
Motivation:		Save time to develop a similar product, using a collaborative process.	
Example:		AZEV designs the smart process with all activities needed to develop a new machine, then AZEV assign partners to each outsourced activity and select the best ones to provide the services required. After the process design, AZEV saves the configuration (as can be seen in Mock-up L1-2). if in future AZEV needs to develop another machine, the process is stored and ready to run.	
How to test it:		AZEV is able to save the smart process definition as a template for future use.	
Strategic Req.:		S12, S13	
Task Assignment:		T4.1: save processes/partners into cloud storage format T4.2: discovered stored processes/partners T6.3: dashboard interface to trigger storage and retrieval of processes	

3.3.16 Simulation

F43	**Pri:** 1	**LC:** PLUG: SIMULATION	**PoV:** CUSTOMER
Title:		After designing a smart process (e.g. during PLUG phase) then the following results should be stored: the configuration (the goal goals/metrics can be defined, partner information can be connected to, partner assignments, non-functional requirements (costs delivery times)). This should then enabled compare and find best configuration. Reports are generated via F44. Comparison is also a separate requirement.	
Motivation:		In order to compare the various configuration.	
Example:		AZEV designs a smart process and defines some metrics (activity duration, min and max cost, and assigns partners to the tasks to be outsourced). After a	

	simulation run, ADVENTURE produces a report with the details for the entire process: Total cost, lead time, risk identification, cost per task, critical tasks, bottleneck identification, etc..) This simulation result is stored. Then AZEV do a what if analysis and changes some process parameters and or partners and runs another simulation. New simulation results will be stored in order to compare both scenarios.
How to test it:	AZEV is able to select a smart process simulation and see the results.
Strategic Req.:	S4
Task Assignment:	T4.1: manages process variants and related simulations T5.2: performing forecast, saving, comparing, generating report, collecting configuration information T6.3: dashboard - additional visualization

F45	**Pri:** 2	**LC:** PLUG: OPTIMIZATION	**PoV:** CUSTOMER
Title:		After a process simulation, the ADVENTURE simulation component should be able to do "what-if" analysis supported by specific changes on the smart process.	
Motivation:		This is helpful to achieve higher performance for the smart process.	
Example:		AZEV designs a smart process and defines some metrics (activity duration, min and max cost, and assigns partners to the tasks to be outsourced). After a simulation run, ADVENTURE produces a report with the details for the entire process: Total cost, lead time, risk identification, cost per task, critical tasks, bottleneck identification, etc.) This simulation result is stored. Then AZEV do a what if analysis and changes some process parameters and or partners and runs another simulation. New simulation results will be stored in order to compare both scenarios.	
How to test it:		AZEV is able to edit the smart process to make some specific changes(add/remove tasks, change partners/services, change due dates) and run a new simulation.	
Strategic Req.:		S4	
Task Assignment:		T5.2: simulate what-if scenarios T6.3: dashboard visualization	

F47	**Pri:** 2	**LC:** PLUG: SIMULATION	**PoV:** CUSTOMER
Title:		It should be possible to manually change the partners associated with each activity and run new simulations;.	
Motivation:		Enable human decision for the process.	
Example:		A partner goes bankrupt and AZEV would like to introduce a new partner.	
How to test it:		AZEV is able to edit the smart process to change partners/services and run a new simulations.	
Strategic Req.:		S4	
Task Assignment:		T4.1: maintain data T4.2: provide data T5.1: change activity bindings T5.2: simulate	

F39	**Pri:** 3	**LC:** PLAY: FORECASTING	**PoV:** CUSTOMER
Title:		Collect forecast from customer side (i.e. more like recognizing trends) Note: This	

	is not the same as process related forecasting and hence lower priority. Main requirement from ABB but e.g. AZEV could find it useful.
Motivation:	If the cork stoppers manufacturers are connected to ADVENTURE and their costumer orders data is available, AZEV will have a forecast for its production.
Example:	If the cork stoppers manufacturers are connected to ADVENTURE and their costumer orders data is available, AZEV will have a forecast for its production.
How to test it:	AZEV is able to select one or a set of cork transformation industry companies which are registered in ADVENTURE and view their sales trends.
Strategic Req.:	S4
Task Assignment:	T5.2: provide forecasts (with T4.4)

F40	**Pri:** 3	**LC:** PLAY: FORECASTING	**PoV:** CUSTOMER
Title:		View the sales trends and equipment investment trends for a set of selected companies. (see also F39).	
Motivation:		This can help with future forecasting.	
Example:		Select a set of cork transformation industry companies filtered by location and see the sales trends and equipment investment trends.	
How to test it:		Forecast information can be visualized.	
Strategic Req.:		S4	
Task Assignment:		T5.2: perform the forecast T6.3: dashboard visualizes	

F60	**Pri:** 3	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		The system shall provide information on past collaboration of partners with a party, so that that party can reutilizes these partners (e.g. fetch a participation log from every ADVENTURE members).	
Motivation:		Reutilization of past experience.	
Example:		Using a partner who had previous delivered well.	
How to test it:		Ability to view past partner information.	
Strategic Req.:		S4	
Task Assignment:		T4.1: maintain partner data T4.4: provide partner data T6.3: provide partner collaboration UI	

F35	**Pri:** 4	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Save content (e.g. delivery dates) from information exchanged in process so that information can be extracted (e.g. lead times).	
Motivation:		Content information can be used to make process decision and process design decisions.	
Example:		E.g. saving of lead time in reality (vs. projected in process objects).	
How to test it:		Ability to retrieve data.	
Strategic Req.:		S4	

Task Assignment:	T4.1: store information T4.4: message exchange

3.3.17 User Interface

F55	**Pri:** 1	**LC:** PLUG: SMART PROCESS DESIGN	**PoV:** CUSTOMER
Title:		The system must be user friendly.	
Motivation:		The system must be highly usable in order to make it user friendly, otherwise, there is the risk of partners and AZEV do not use it.	
Example:		Easy to use navigation.	
How to test it:		Full assessment with users.	
Strategic Req.:		S17	
Task Assignment:		T6.3: all tasks with UI	

F64	**Pri:** 4	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Adventure Dashboard, or parts of it, should be available in a mobile environment.	
Motivation:		The mobile application will help technicians by provide means to read and write information on the machine record. This will avoid the amount of documents and calls that is done today during technical assistance to know parts that were introduced, previous upgrades, specific software changes, etc. With the mobile application the machine file is updated on-line during the assistance service.	
Example:		Viewing a profile screen on a iPhone.	
How to test it:		Run Adventure Dashboard in mobile environment.	
Strategic Req.:		S17	
Task Assignment:		T6.3: manage modular and configurable UI	

3.3.18 Visualization

F21	**Pri:** 2	**LC:** PLAY: MONITORING	**PoV:** CUSTOMER
Title:		Clear visual representation of historic data.	
Motivation:		Customers want to look at past trends of data. This information should come strictly from the ADVENTURE cloud storage. Visualization can come directly from supplier (including aggregated supplier side data) or from the ADVENTURE level. ADVENTURE level visualization (which may be supplied through third party extension services) will access historic data from past invocations of a particular process or process step.	
Example:		Development of stock level over time as shown in Mock-up L2-3.	
How to test it:		Select a smart process step that delivers some data, drill down to show a graph that shows the development of the value.	
Strategic Req.:		S7	
Task Assignment:		T4.1: read monitored data T6.3: integrates UI	

F22	Pri: 2	LC: PLAY: MONITORING	PoV: SUPPLIER
Title:		Explore and display data granularity through dashboard.	
Motivation:		Dashboard should act like a data-warehouse interface that allows for drilldown into data.	
Example:		At Mock-up L2-1, it should be possible to drill down further into process steps, the data they require and return, and the temporal development of these steps. Connections to other related processes like aggregation of partner stock levels could be utilized to do so.	
How to test it:		Drill down the dashboard.	
Strategic Req.:		S7	
Task Assignment:		T4.1: stores data T6.3: integrates UI	

F23	Pri: 3	LC: PLAY: EXECUTION	PoV: SUPPLIER
Title:		Presentation of interactive graphs / tables for data visualization are needed.	
Motivation:		Allow to interact with the visualization, shift ranges and show/hide data points.	
Example:		Clickable visualization of multiple data values. Visualization is intended to be pulled in from suppliers, or from ADVENTURE level services provided by software service suppliers (similar to TIE SmartBridge), see Mock-up L2-3.	
How to test it:		Show/Hide data points in Mock-up L2-3, to compare temperature to throughput.	
Strategic Req.:		S7	
Task Assignment:		T4.1: provides stored data T6.3: visualizes data	

F20	Pri: 4	LC: PLAY: MONITORING	PoV: SUPPLIER
Title:		Define a policy if and how long to store data that is transmitted through ADVENTURE.	
Motivation:		Policies may come from customer. In order to maximize the usefulness of forecasting algorithms, which sometimes tend to smooth result if too much data is available, it will be necessary to specify for how long data is to be keep, and thus available for forecasting.	
Example:		Data transmitted through ADVENTURE must be stored at least 2 months.	
How to test it:		Transmit data through Adventure, see how long it is stored.	
Strategic Req.:		S7	
Task Assignment:		T4.1: maintain configured data retention and archiving policy and apply T4.4: message exchange	

3.4 Technical Requirements

The technical requirements which will represent the basis for the ADVENTURE prototypes consist of two main parts:

- UI-Related mock-ups as presented in Subsection 3.1, which show how user facing functionality may be arranged, navigated and used.
- Requirements which describe the underlying concepts of ADVENTURE will be further elaborated in the research and implementation centric work packages.

The granularity for both parts in this document will be coarse: the presented mock-ups served as a basis for the discussion necessary functional requirements, and by no means represent UI drafts. Also, the requirements concerning underlying functionality will not deal with concrete frameworks and protocols to be used, but enumerate high level requirements that will help make implementation related decisions.

Beside requirements that concern the features offered by the user interfaces, there are also requirements that cover underlying, technical aspects. These requirements can be categorized as follows:

3.4.1 Flexible data gathering

T6	Real-time: data should be gathered with a low latency and in an asynchronous manner.
T5	Asynchronous: if necessary, the system should wait for data.
T4	Synchronous: pull data.

3.4.2 Intermediate cloud data store

T7	All factory floor data should be stored in a cloud storage that is assigned to the respective virtual factory instance.
T8	The stored data should be reproducible and reliable and enable forecasting and simulation functionalities.

3.4.3 Modular Architecture

T13	Process engine: • Should feature standard events for the whole process lifecycle. • Users should be able to stop, start or restart the process engine from outside during runtime. • It should be possible to modify process positions, process descriptions and process states (i.e. data elements) while the process engine is stopped. • Extensions to the process engine should only be possible through SOAP/REST services utilizing the aforementioned interfaces in order to avoid lock-in.
T14	Software Service providers: The technical interfaces of partners deliver specific data formats. Thus, third party service providers should be able to supply modules to translate such data into different formats. Such a transformation could be implemented by the design of a three-step process with the reception of data/events, the data transformation and the pushing of the transformed data to a partner as process steps.

3.4.4 Modular User Interface

T11	Partner specific visualizations should be available through partner-specific technical interfaces. As an example, IndustreWeb delivers additional visualizations that are not offered by ERP systems.

T9	The process editor needs to have a clear technical interface regarding file formats, should receive a list of available activities and their properties (input, output) from the cloud and should save versions of the process model to the cloud.
T10	There should be standard visualization mechanisms (like simple graphs) build into the ADVENTURE dashboard for arbitrary data. Additionally, there should be visualization mechanisms from third party service providers available as plugins.
T12	Important processes should be promoted so that they are immediately accessible (see the first four menu points of the UI mock-ups).

3.4.5 Process driven data exchange between partners

T3	Monitoring: The status of long macro-flows (like order processes) should be monitored.
T2	Micro-flows: The results of short running processes (like the querying of all suppliers for their stock levels) should be saved.
T1	Macro-flows: Every interaction between two partners should have a process at the factory level: fetch data from one partner, wait for data from the other partner, push data to the third partner.

4 Monitoring Requirements

4.1 Requirements Representation and Accuracy

From the beginning, the use case companies' various requirements are collected with special care in order to avoid any mistakes. An objective was that all requirements should fully represent the case company's wishes and desires. The collected lists were double checked in order to avoid repetitions or overlaps. The most important objectives of the collected requirements were (i) to come to an agreement with case companies' stakeholders, (ii) to provide a foundation for communication with technology service providers that will implement tools that fulfil these requirements, (iii) to provide input for the next project phase, and (iv) to describe how the customer/business needs will be met by the provided solution.

4.2 Requirements Reliability

The requirements specifications are the foundation upon which the entire software system is build, and this specifies the functionalities that must be developed in the final delivered software solutions. Therefore, a requirement verification and validation is needed to assure that the specified functionalities representing the requirements has indeed been delivered within the expected standard. The approach was taken to get the requirement right at the first time - complete, concise and clear.

During the requirements collection process, each of the requirements was analysed in terms of its origin and viability. Several iterations were conducted between the case companies and the corresponding research partners during the requirements collection process. The objective of these iterations was to ensure requirements reliability and to validate them with the case companies' expectations and wishes.

4.3 Representative Requirements Monitoring

The requirements list as collected from the three user companies needs to be monitored continuously in order to keep it up to date with the current situation. Deviations from the scope and target of the requirements are closely monitored during the collection period.

5 Conclusion

The requirements collection and analysis is a crucial step towards the further development steps in ADVENTURE and the more fine-grained specifications. This deliverable aims to provide a comprehensive list of requirements which have been collected by the involved use case companies and RTD partners of the ADVENTURE approach. In the following course of the project, the most relevant requirements – in the sense of the overall project (cf. DOW) – will be selected and implemented. Hereby, the list of requirements is structured into strategic, functional and technical requirements. Further, this document provides a first impression of the envisioned user-interfaces in the form of mock-ups being used as basis for the development of the graphical user interface in the ADVENTURE dashboard. Altogether, this document builds the basis for the RTD work and relating deliverables of Work Package 3, like the architecture definition and the functional and technical specifications.