D7.1.2 Use Case Specification

Authors: ABB(lead), UVA, AZEV, INESC, TANET, TUDA

Delivery Date:	Due Date:	Dissemination Level:
2012-04-04	2012-02-29	PUBLIC

This document provides an initial specification of the use cases for the ADVENTURE concepts and solutions. Therefore, it describes the current situation, the current challenges, and the current solutions employed at the ADVENTURE use case partners, deducing from these the application fields for ADVENTURE's results.

Document History	
Draft Version	V0.1, TUDA, January 20th, 2012 V0.2, UVA, January 27th, 2012 V0.21, ABB, February 5th, 2012 V0.3, INESC, February 12th, 2012 V0.31 AZEV, February 18th, 2012 V0.4, TANET, February 29nd, 2012 V0.5, TUDA, March 10th, 2012 V0.6, TANET, March 12th, 2012 V0.7, INESC, March 13th, 2012 V0.8, UVA, March 14th, 2012 V0.9, TUDA, March 15th, 2012 V0.91, TUDA, March 16th, 2012 V0.92, UVA, March 22nd, 2012 V0.93, TUDA, March 28th, 2012 V0.94, TUDA, March 30th, 2012 V0.95, ASC, April 2nd, 2012 V0.96, INESC, April 3rd, 2012 V0.97, UVA, April 4th, 2012 V0.98, TUDA, April 4th, 2012 V0.99, TUDA, April 4th, 2012 V1.0, TUDA, April 4th, 2012
Contributions	UVA - AHM Shamsuzzoha ABB - Indrajit Jadhav INESC - Filipe Ferreira AZEV - Tiago Gomes TANET - Gash Bhullar - Simon Osborne - Denise Bowen TUDA - Ulrich Lampe - Dieter Schuller - Sebastian Zöller
Internal Review 1	Sven Abels, Ascora
Internal Review 2	Filipe Ferreira, INESC
Final Version	April 4th, 2012

Table of Contents

List of Figures

List of Tables

Executive Summary

This ADVENTURE deliverable, D7.1.2, presents an initial specification of the use cases, which the ADVENTURE concepts and solutions should address. As input for the use case specification the user interviews and their results (described in deliverable 7.1.1) and the identification of a common approach have been used. Based on these inputs, the relevant current situation has been acquired for each user partner within ADVENTURE, ABB, Azevedos, and Control2K (member of TANet), the challenges in this context have been identified and the currently employed approaches to address these challenges with their drawbacks have been described. This led to the identification of a specific field of application for the concepts and solutions of ADVENTURE.

This deliverable provides only an initial use case description. Thus within deliverable 7.1.3, due at month 18, a final use case specification will be prepared, for which this deliverable will provide one of the basic inputs.

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. Within this deliverable preliminary use case descriptions are provided based on a depiction of the current status at the Use Case Partners, the challenges, they have to face and the currently employed solutions to address these challenges.

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, providing 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 provides an initial specification of the use cases, which should be targeted by the concepts and solutions developed within ADVENTURE. In this context, the deliverable surveys the current situation at the Use Case Partners and the current challenges, which have to be addressed as well as the current solutions employed to address these challenges and their drawbacks. Based on this representation of the

manufacturing industry, the application potential for ADVENTURE methods, concepts, and solutions is identified and thus corresponding use cases deduced.

Major inputs for this deliverable are the outcomes of the conducted user interviews (described in deliverable 7.1.1) and the Project Vision Consensus Document (deliverable 2.1) as well as the Target Market Sector Descriptor (deliverable 2.2) and the initial Description of Work (DOW). Additionally, a meeting among the use case partners has been set up in order to get a common approach from the user partners.

As this deliverable provides only an initial use case description, it will be used as input for the final use case specification due at month 18 with deliverable 7.1.3.

1.3 Document Status

This document is listed in the DOW as 'public' primarily because its contents is not only interesting and relevant for the project partners, but can provide input and basic ideas for researchers and other persons active in the field of virtual factories in which specific application contexts appropriate solutions are required and will be applied.

1.4 Target Audience

This deliverable is to be used by all participating project members to achieve a project-wide understanding of the application scenarios, where the ADVENTURE results should be used and tested. Thus, this deliverable will provide a first milestone to further shape the project partners' visions towards common (application) goals for ADVENTURE. Nevertheless, as mentioned, the deliverable might proof valuable for researchers and other persons working in the area of virtual factories not within the project, as well.

1.5 Abbreviations and General Terms

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 provides a short wrap-up of the major findings from the user interviews (described in deliverable 7.1.1) as they provided one of the main sources for the development of the use cases, described in this deliverable.

Section 3 describes the chosen method to create a common approach in the context of use case identification.

Section 4 provides an individual use case specification for each Use Case Partner within the ADVENTURE project. Based on the current situation for the Use Case Partners and the challenges in this context, currently employed solutions at the Use Case Partners are described with their shortcomings. From these, the application potential for the aimed at ADVENTURE solutions are derived and thus corresponding use cases for these solutions determined.

Section 5 provides a wrap-up of this deliverable in form of a conclusion.

2 User Interviews

As stated previously, this deliverable is also based on the outcomes of the user interviews which have been conducted at the very beginning of the ADVENTURE project. Referring to D7.1.1, a summary of the key elements of these interviews is provided in the following paragraphs.

According to the interview, all of the regarded industry partners – ABB, Azevedos and Control 2K – have a wide range of standard software, such as Microsoft Office, as well as proprietary and legacy software in use today.

ADVENTURE is generally seen as a complement to these existing systems, rather than a substitute. Thus, ADVENTURE is expected to provide additional or extended capabilities, which cannot be delivered by the existing ICT infrastructure.

First, this concerns the monitoring of supply chains, e.g., with respect to delivery times or buffers. ADVENTURE is expected to provide online or *real-time* monitoring capabilities and thus provide a more timely and accurate reporting than the existing systems, which operate in an offline manner, i.e., based on historic and thus less reliable data. In addition, ADVENTURE is expected to facilitate the automatic aggregation of data, thus providing all relevant information concerning the supply chain in one common place. Based on its monitoring capabilities, ADVENTURE should also facilitate the timely notification about business-relevant events.

Second, the industry partners anticipate benefits due to ADVENTURE's forecasting capabilities. Specifically, this concerns the ability to predict potential problems in the upstream supply chain, such as insufficient buffer levels or production capacities, in advance, and thus facilitate proactive – rather than simply reactive – responses to these problems, such as process adaptations or optimizations.

Third, major improvements are expected with respect to the exchange of data. In this respect, ADVENTURE is seen as an instrument for the structured and efficient exchange of various types of information across corporate boundaries through a unified channel. Thus, the expectation is that ADVENTURE will improve the interaction with business partners across the supply chain.

Based on the conducted user interviews, preliminary use case specifications will be provided in the following section.

3 Adapting a common approach

One of the critical steps to forming a use case specification for the project was to get a common approach from the user partners. Although there are many aspects to manufacturing as there are in any sector, there are also similarities with those in the business. For example, all manufacturers:

- Have Customers and Suppliers
- Follow processes and link items such as stock control to order processes
- Look to reduce waste
- Require document control and integration to multiple systems

So, in order to rationalise the requirements of each user partner and formulate the user cases for ADVENTURE, it was important for the user partners to first understand each other's business operations. By doing this, different aspects of each business could be covered in ADVENTURE avoiding duplication and this in turn would determine the scope of the project.

A meeting was set up for all users to express their requirements and a good start point was to visualise the types of User screens that ADVENTURE would use to present the required information. It was decided that various levels should be defined to give the level of detail the user would require. The following terminology was adopted:

Top Level – L0

This would present an overview of the critical information required by each user and ideally show the full capability and areas covered by ADVENTURE.

Level – L1

Drilling down from the main screen, more information would be presented depending on the section that was chosen from L0.

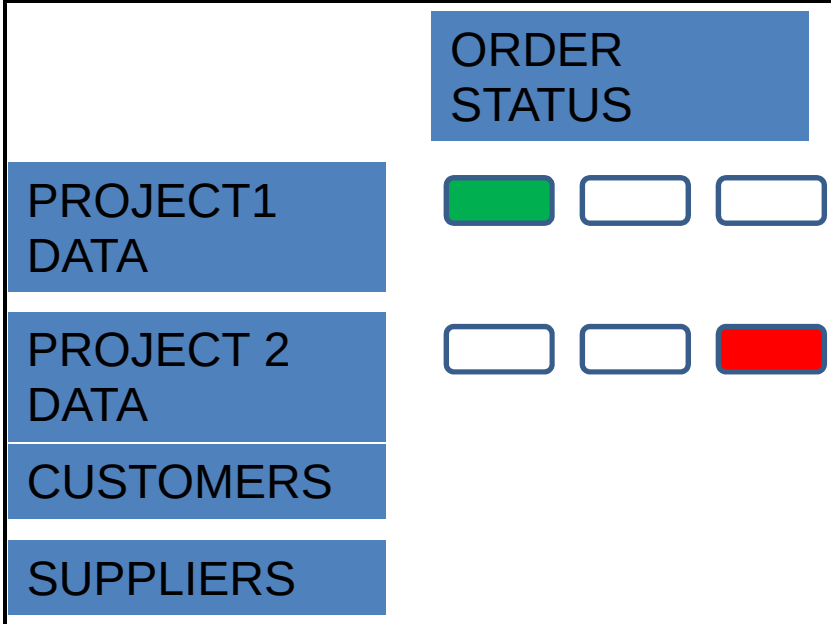
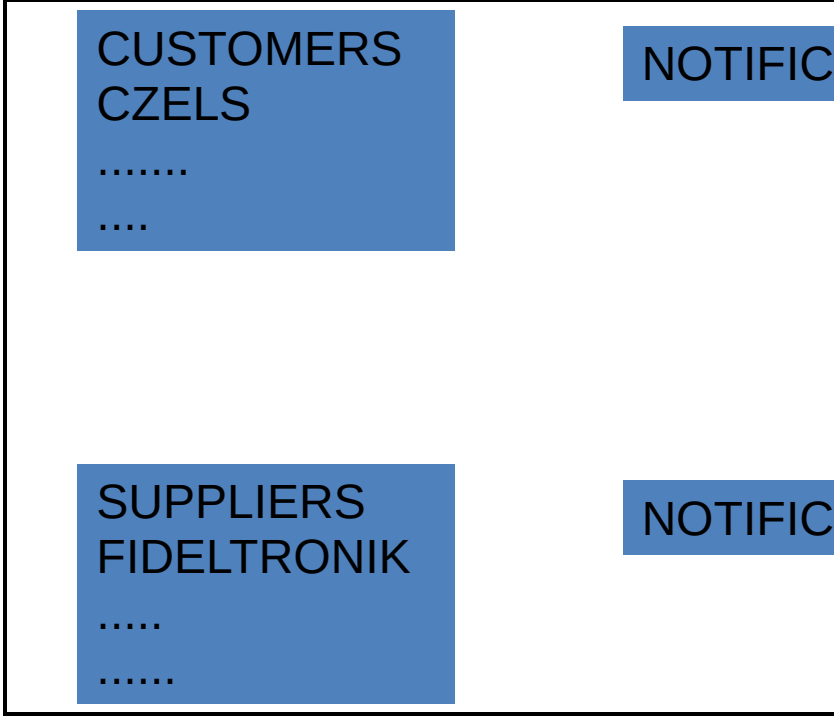
Level L2, L3, L4, etc.

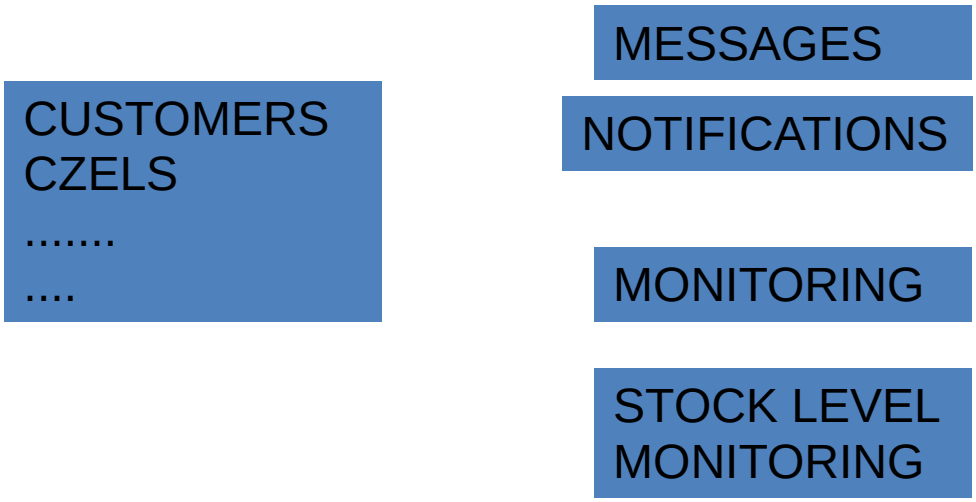
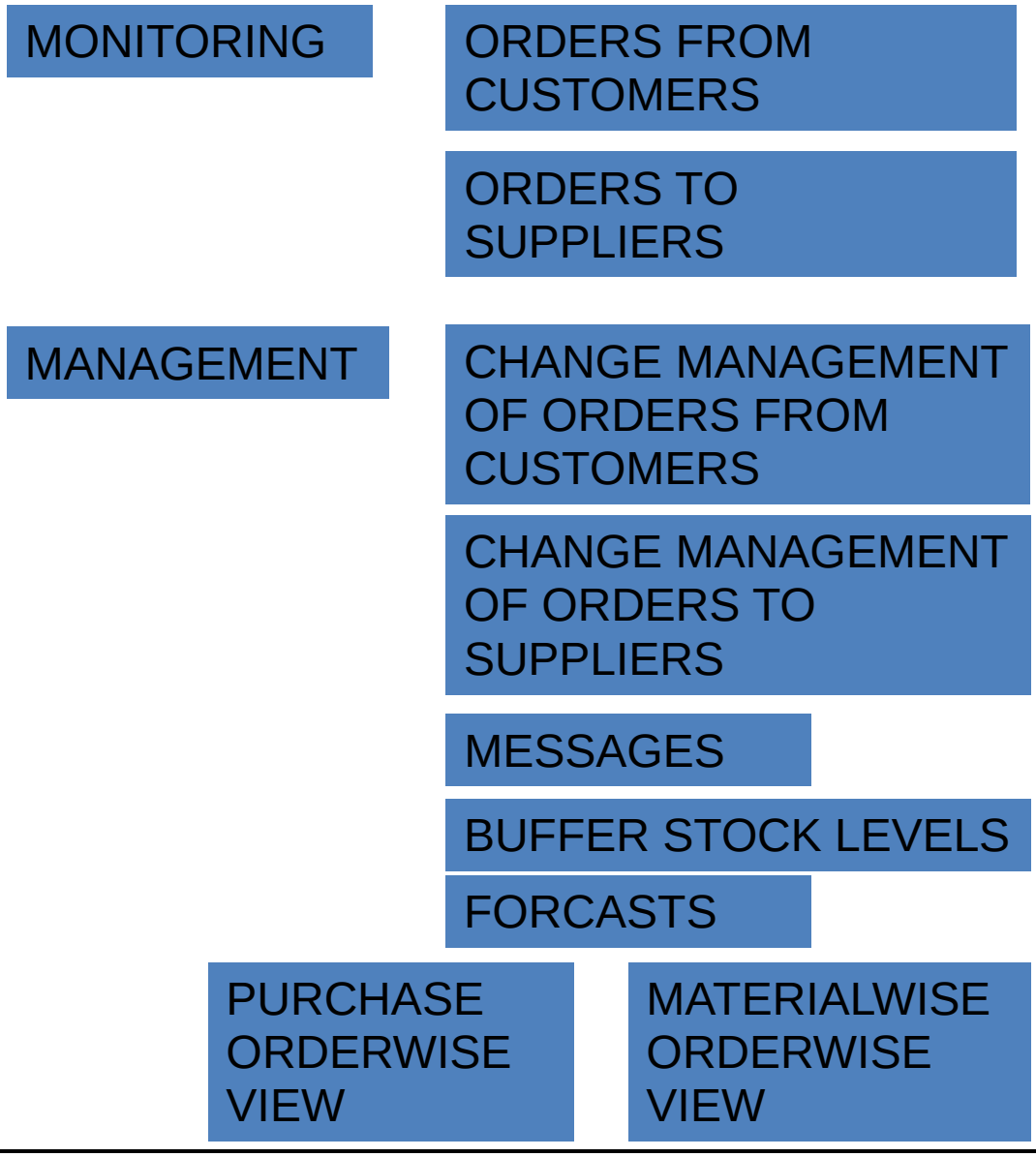
More focused information on the topic area chosen with greater granularity as the level number increases.

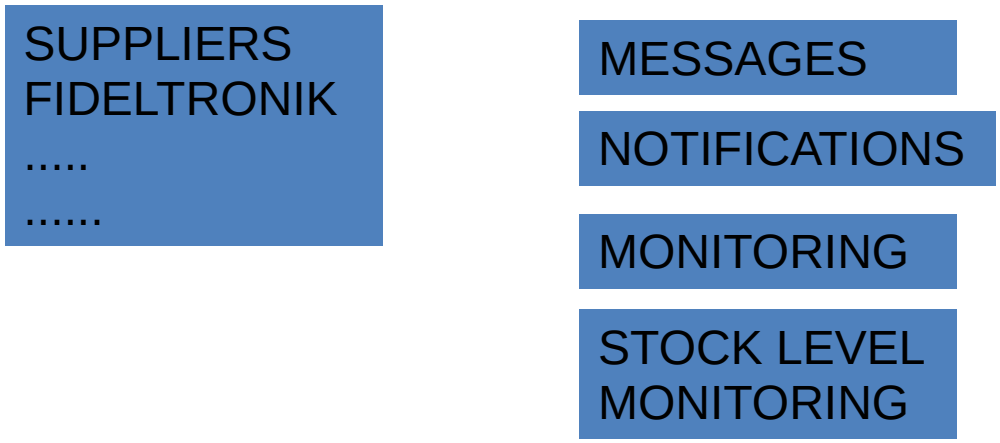
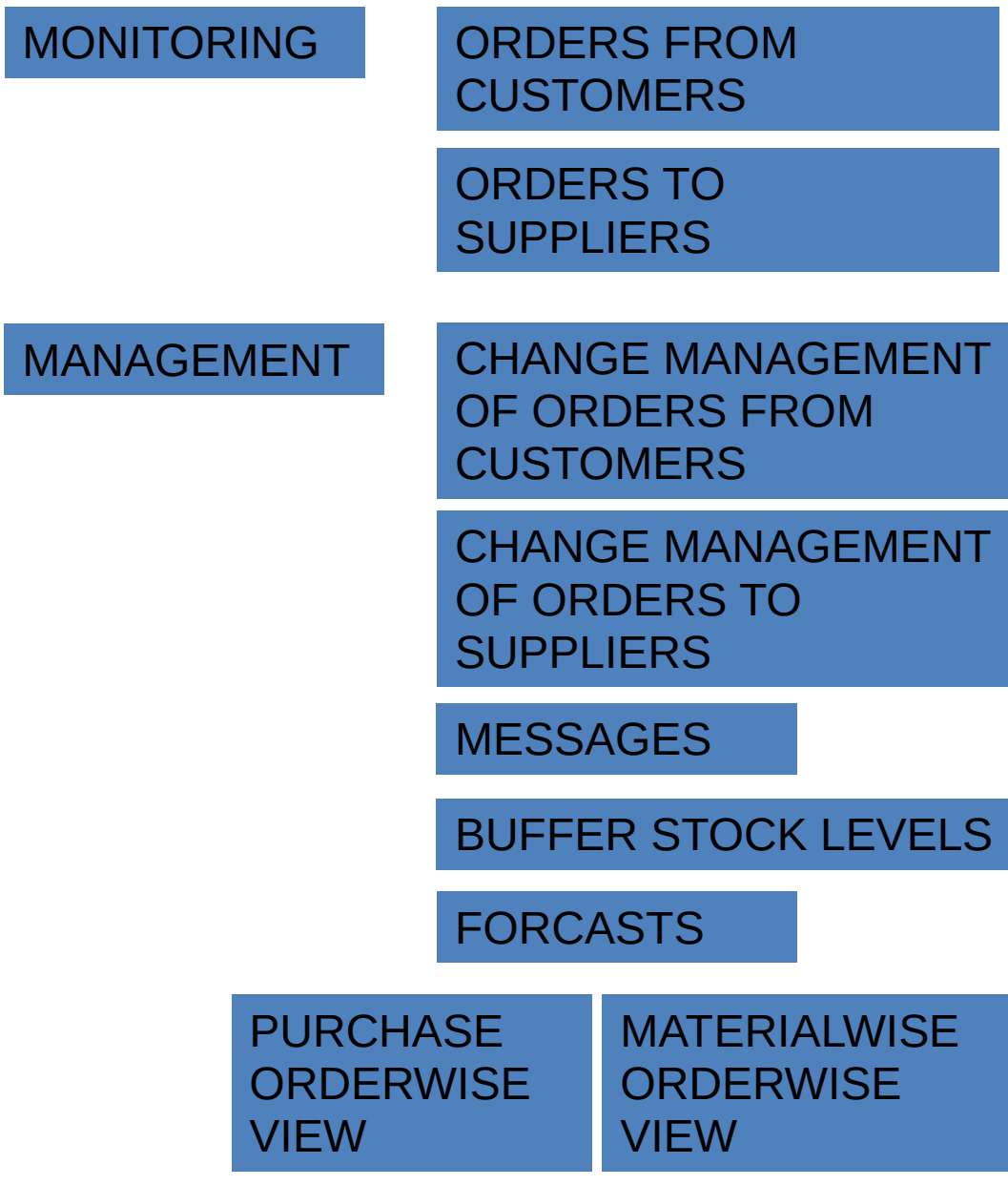
The following table depicts the initial rough sketches, developed throughout the above mentioned meeting, for possible screens which render the typical information that each of the users require at the different levels. It was important to focus on ABB and Azevedos as these partners are manufacturers whilst Control 2K being a service provider would interlink with the other two users to provide the type of data they require. The level format is used in each of the use cases.

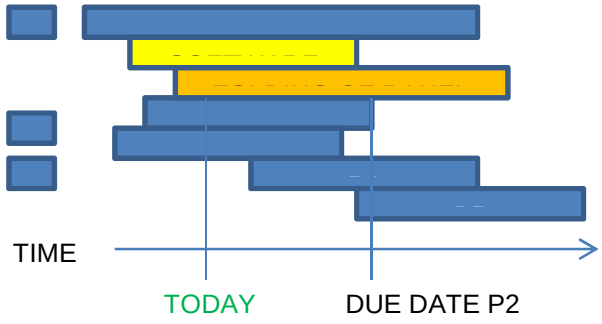
Important Note:

The consortium members also decided to analyse the customer supplier relationship between ABB and one of its suppliers FIDELTRONIK and to provide the types of information such as "buffer stock" using ADVENTURE and thereby amending its original use case.

Initial Rough Screen Mock-Ups to Capture Users' Main Information Needs	Level of Detail
	L0 - Dashboard
	L1 - ABB Screen

Initial Rough Screen Mock-Ups to Capture Users' Main Information Needs	Level of Detail
	L2 - ABB Screen - Customer View
	L3 - ABB Screen Customer View

Initial Rough Screen Mock-Ups to Capture Users' Main Information Needs	Level of Detail
	L2 - ABB Screen – Supplier View
	L3 - ABB Screen Supplier View

Initial Rough Screen Mock-Ups to Capture Users' Main Information Needs	Level of Detail
SUPPLIERS FIDELTRONIK .... MESSAGES NOTIFICATIONS MONITORING STOCK LEVEL MONITORING MATERIALWISE SUPPLIERS FIDELTRONIK	L1 - ABB SUPPLIER Screen - FIDELTRONIK
CUSTOMER ORDERS (PROJECTS) MILESTONES SUPPLIER STATUS (PROJECTS)  MATERIAL SUPPLIERS SERVICE SUPPLIERS	L1 - AZEVEDOS Screen - PORTFOLIO

Initial Rough Screen Mock-Ups to Capture Users' Main Information Needs	Level of Detail
PROCESS DESIGN AND PLANNING MAIN ACTIVITIES DEFINITION PARTNER FINDING PROCESS TEMPLATE REPOSITORY MANUAL ADAPTIVE PROCESS PROCESS DOCUMENTS ASSIGNING ENGINEERING DATA SHARED DOCUMENTS WITH SUPPLIERS DOCUMENTATION OVERVIEW – MASTER LIST MANAGEMENT MONITORING MESSAGES CHANGE MANAGEMENT OF ORDERS TO SUPPLIERS ORDERS TO SUPPLIERS	L2.1 - AZEVEDOS Screen – PROCESS LEVEL

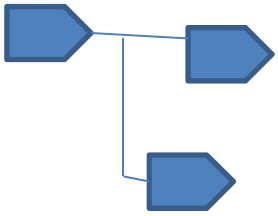
Initial Rough Screen Mock-Ups to Capture Users' Main Information Needs	Level of Detail
PROJECTWISE ORDERS SUPPLIERWISE ORDERS 	L2.2 - AZEVEDOS Screen – SUPPLIER LEVEL
WORKFLOW MONITORING ACTIVITY STATUS PARTNER ASSIGNED DOCUMENT MANAGENT MESSAGES RELATED TO THE ACTIVITY PERFORMANCE ASSESSMENT	L3 - AZEVEDOS Screen – ACTIVITY LEVEL

Table 1: Initial Ideas for ADVENTURE screens

The above depicted initial rough screen sketches show key information areas from a user perspective. They have been used as starting point to detail and, for example combined with a deeper insight in the different processes at the application partners, to determine the viability and relevance of the screens themselves and the key information

areas to the ADVENTURE project by the technical and research partners. Furthermore, they provide an important input for the user requirements document deliverable 2.3. Of course, as this sketches are only preliminary, rough sketches to illustrate the different information needs (on different levels) of the use case partners, they are only used as initial discussion documents and the final look and feel, e.g., of the ADVENTURE dashboard will clearly be different.

4 Use Case Specification

The approach in this section is to take each use case companies requirements and format them into the following structure.

Each of the users has addressed the following issues:

- Scenarios/ realistic situations
- Challenges/problems
- Current solution to the challenges/problems (without ADVENTURE)
- Usage of ADVENTURE
    - Which part/aspect/component of ADVENTURE is used
    - In which circumstances
    - How the users' "real world processes" would incorporate ADVENTURE

Most of the data is derived from D2.1 and D2.2 but with a focus on how ADVENTURE functionality can be shaped to cover the user requirements.

Again it is important to iterate that the initial documents in the WP7 constitute a "wish-list" and as the work package progresses, it is expected that much of the requirements could either be enhanced as the technology partners develop the ADVENTURE platform or could be modified to keep within the scope and timeframe of the project.

Regarding the components which are focused by each of the use case companies, we refer to Figure 1 and state explicitly in sections 4.1.5, 4.2.5, 4.3.5 which components will be used most likely by which use case company in order to indicate that each of the ADVENTURE components is actually needed and will be utilized by the use case companies. Whereas, for exchanging, storing, visualizing data and information, the Data Exchange and Messaging platform, the Cloud-based Data Storage and the Dashboard will be utilized by all the three use case companies.

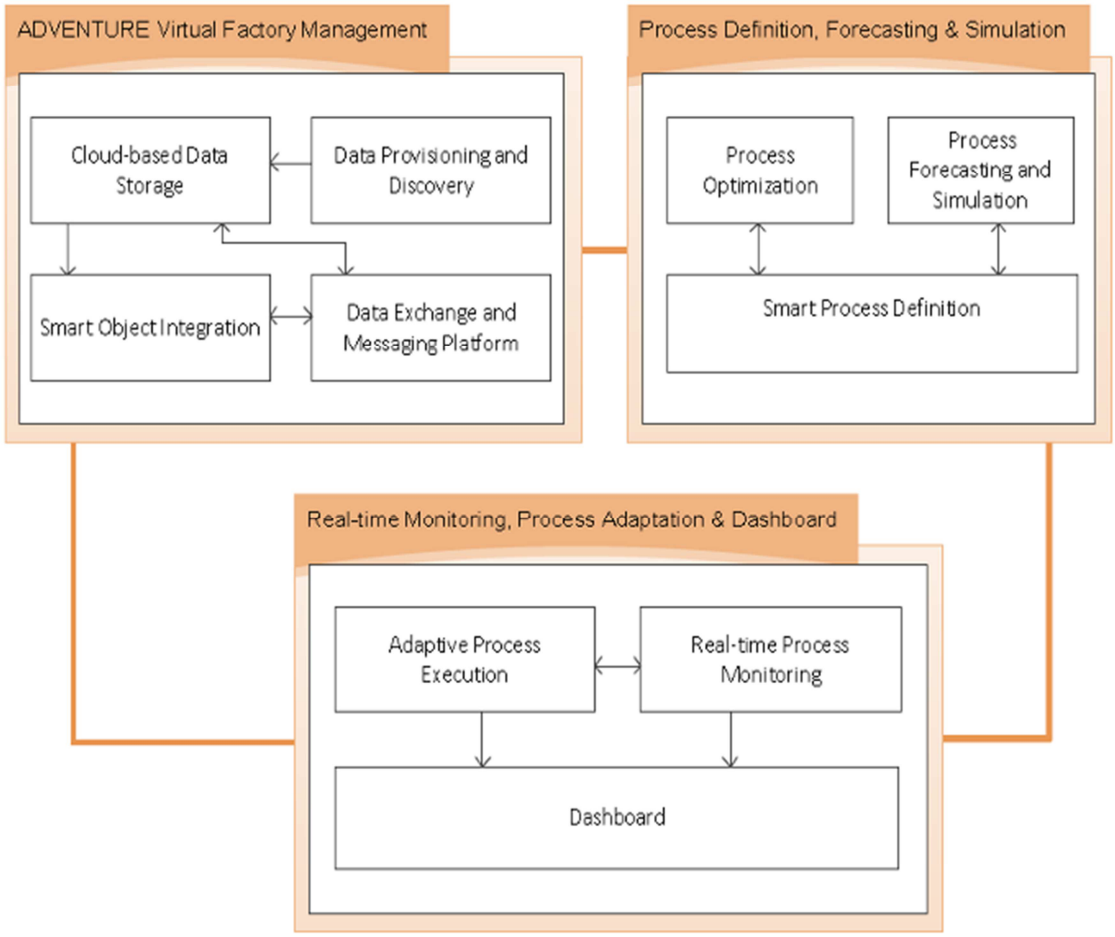


Figure 1: ADVENTURE components

4.1 Use Case Specification - ABB

4.1.1 Scenario/present situation

At present ABB's FI-DA (Finland-Distribution Automation) adopts a manufacturing system, where most of the components or modules are supplied by global suppliers. DA products secure power distribution by offering solutions for the application/protection areas of feeder protection, motor protection, transformer protection, line differential protection for feeders, arc protection, feeder automation for recloser protection and control, generator protection, voltage protection and automatic voltage regulation and capacitor bank protection. It provides Medium Voltage Networks solutions with the objectives to improve personal safety, network reliability and protection performance of utility substations, marine and industrial power systems. Only the core manufacturing processes are carried out within the premises of ABB's FI-DA. The non-core activities are outsourced to vendors such as PCBA's (Printed Circuit Board Assembly) to Electronic Manufacturing Service (EMS) providers, pressed metal parts and plastic moulded parts from global suppliers, transformers used in relays are from global suppliers, control and relay panels from ABB switchgear factories or external panel

builders, etc. These outsourcing activities are done with the objective to better utilization of resources for core business.

The products of ABB's FI-DA such as IEDs (Intelligent Electronic Devices), software solutions and communication devices serve the needs of power network reliability and protection performance of sub-stations. Figure 2 displays an example of a FI-DA's product with its corresponding functionalities.

Figure 2: Example of a DA product (IED/relay)

The DA's product family as highlighted in Figure 3 comprise different product models from the period of 1965 to 2009. From Figure 3, it is seen that different products within the product family implement to an extended fields such as protection of power, micro-processor based multi-function IED, integration of protection and control, feeder protection, communication gateways, etc.

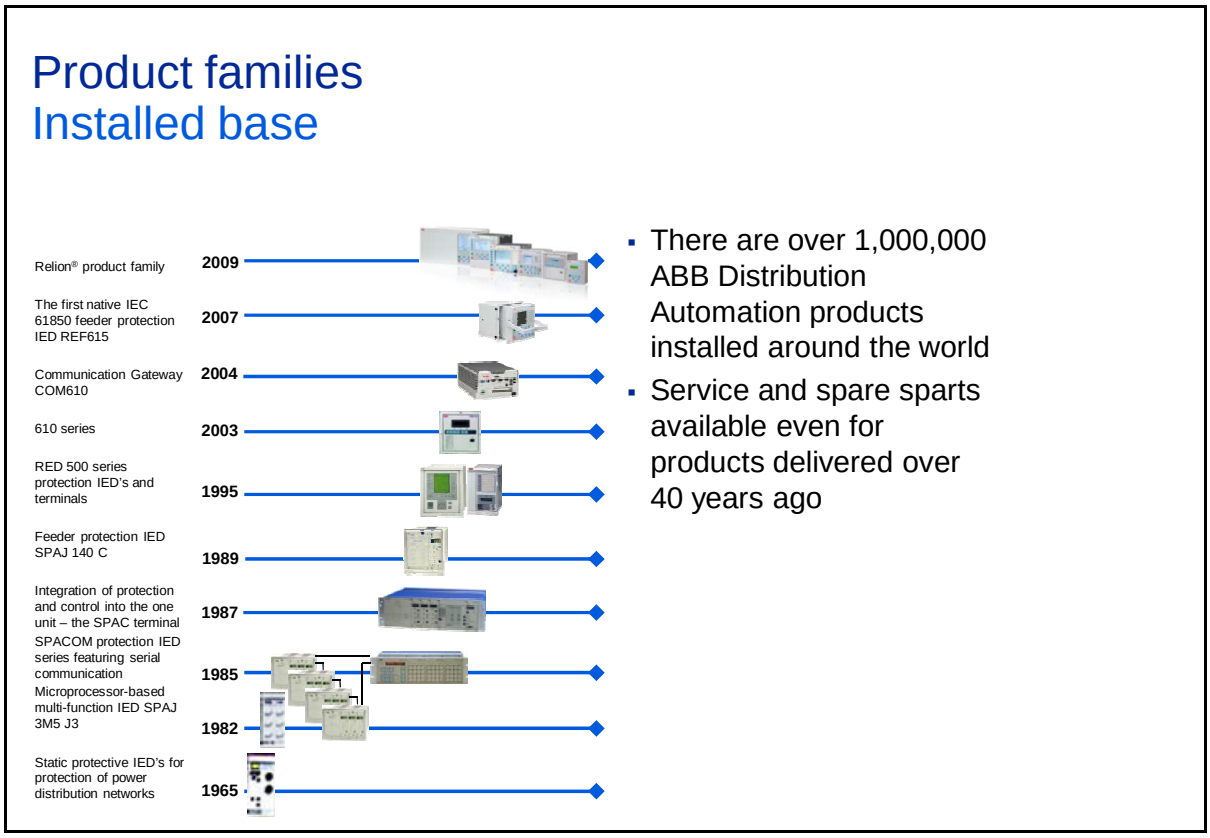


Figure 3: Display of DA's product family from 1965-2009

As displayed in Figure 3, each of the product family (e.g. Relion product family) of FI-DA factory at Vaasa, Finland has its own product lines with different product series. For instance, Relion product family has its product lines with Relion 610, 615, 620 and 630 series as presented in Figure 4, it is also observed that there are other product lines such as SACO, SPACOM, REF and RBX started from the year 1986 to date. The DA factory adopts MTO (Make-to-Order)[1] production, where the production process starts immediately after receiving a confirmed customer order. The average delivery time from booking an order to deliver an order is 2 weeks and the OTD (on time delivery) rate is approximately 91% according to the year 2011 statistics.

[1] Make-to-Order (MTO) production scenarios typically allow customers to purchase products that are customized according to their specifications.

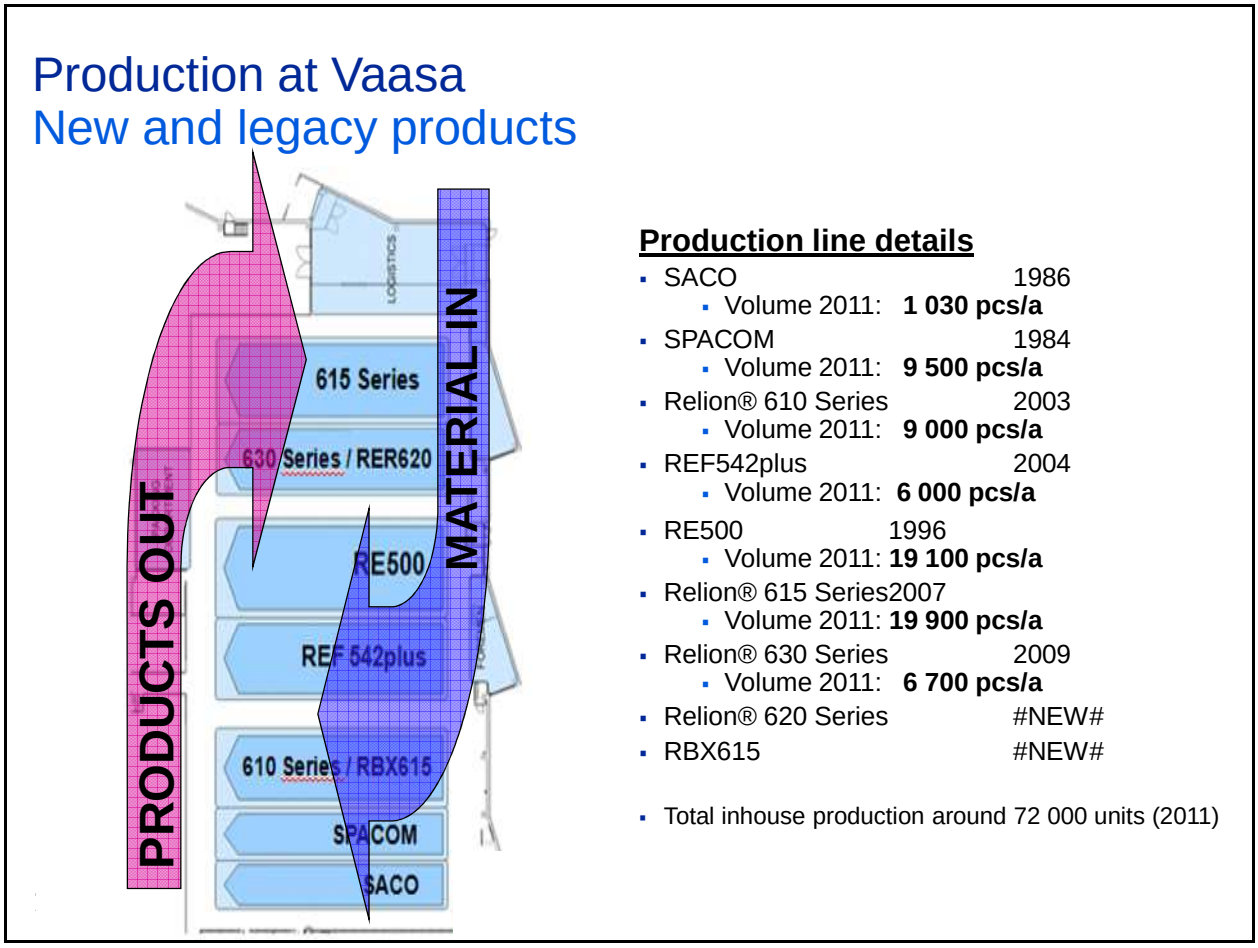


Figure 4: FI- DA's production lines during the period of 1986 to 2011

Different product types (commonly known as production lines) in the ABB's Vaasa factory are depicted in Figure 4, where the yearly sales volumes for year 2010 and 2011 are also presented for young and old products. Along with FI-DA factory at Vaasa, currently, ABB is operating other three independent DA factories globally with the objective to serve various market segments (Figure 5). For instance, ABB's DA factory in USA serves the USA market only, while a DA factory at China serves the Chinese market, a DA factory at India serves the Indian and middle-east market. The FI-DA factory at the Vaasa serves the rest of the world.

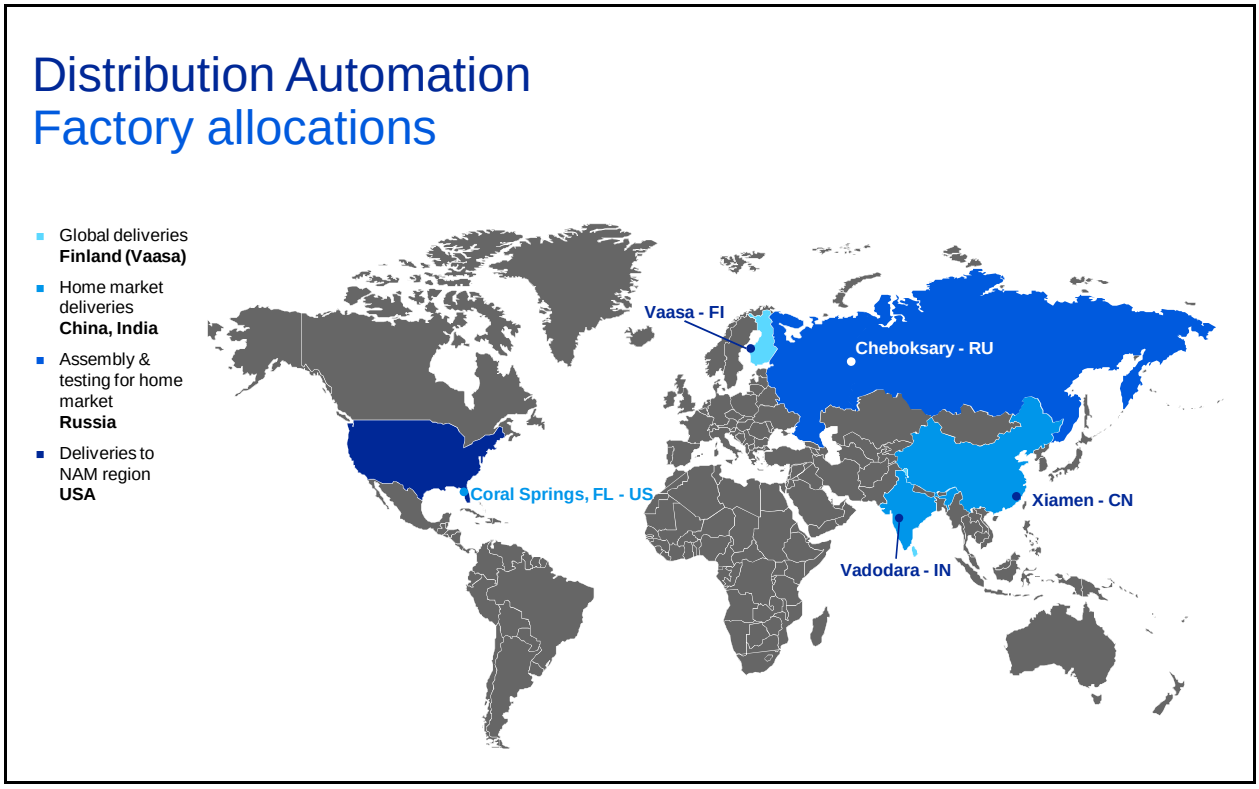


Figure 5: FI- DA's global presence

The MTO process at ABB's Vaasa site usually has to cope and adapt to a variety of requirements. These requirements change individually over time according to the current customer demands, which usually have different demands in terms of, e.g., product type, product variant, and product quantity, which have to be sufficiently considered. Accordingly, reallocations of resources and process adaptations are normal to guarantee an optimal process, both for the customers and for ABB. Here, current stock levels and interdependencies between orders have to be explicitly considered based on current status data. Today, this implies, for example, in a situation where a customer changes specifications on short notice or in a situation, where orders are incoming on short notice and should be sufficiently served, and a lot of time-consuming and possibly error-prone manual work. Nevertheless, it can be stated that, even against this background, the application of the above described outsourcing approach with its focus on core-competencies has basically been successful. But, with the present economic situation and particularly against the described background of fast-changing requirements, specifications and orders on short notice, ABB's FI-DA has to look for further possibilities to enhance cost and management efficiency. A basic option could be reusing the methods that worked well in the "older world" i.e., integrated factories[2] are one possible option to be investigated. However, re-building or expanding

[2] An integrated factory can be defined as the manufacturing environment where all the necessary parts/components of an end product are manufactured and assembled in-house and there outsourcing activities are completely absent.

backwards and forwards may not be economically viable and physical integration by mergers and acquisitions is also no longer feasible due to failure to adequately and formally develop the relationship, inadequate or misaligned valuations, and culture clashes. In such a situation a promising option is to integrate factories by realizing a Virtual Factory[3], as intended within ADVENTURE.

4.1.2 Challenges

Due to growing number of customer orders, inherent complexities, and fast changing requirements and incoming orders, ABB DA is facing several challenges from many of its existing operational activities. In order to make smooth the demand fulfilment and enhance process efficiency the following challenges have to be addressed and a significant support for the corresponding activities has to be provided:

(i) Currently, ABB is suffering to have the forecasting information from customer side related to the incoming order, which is needed for pre-scheduling or preplanning the operational processes. On the supplier side also, ABB needs sound forecast data for the delivery of outsourced items from their vendors.

(ii) The contractual agreement processes between ABB and its customers are done by the sales assistant manually, leading to a significant lacking of automatic order processing.

(iii) Another challenge that ABB is facing at present is a fast, reliable, and easy way for required process adaptations to be able to process an urgent order or managing peak demand.

(iv) Current business scenarios at ABB do not cover status update from the corresponding suppliers in terms of real-time information from the suppliers' buffer levels and delivery visibility with respect to quantity, type and delivery date of its products in most cases.

(v) From a delivery point of view, ABB needs proper monitoring and control over the complete supply chain. Inside ABB, it has its own inventory monitoring system but the integration with suppliers in the supply chain is missing. For example, there is currently no mechanism to specify the buffer level for each order line rather than the whole production line.

(vi) Rush order is currently handled by ABB DA manually, where customers can not visualize the status of their corresponding orders. Any order delay due to the shortage of components or modules has to be known well in advance for an improved order management process and to enhance customer satisfaction.

The overall relationships with suppliers and customers, where the challenges as mentioned above exist for FI-DA are highlighted in Figure 6. From Figure 6, it is seen that ABB's DA factory interacts with its customers (switchgear factory) through various tools such as ASCC (Advanced Supply Chain Collaboration), B2B (Business to

[3] Within the ADVENTURE project, a Virtual Factory is understood as a temporary or permanent alliance of ADVENTURE Members, facilitated by a broker. The Virtual Factory is managed by a distributed, integrated, computer-based system that interfaces with all systems necessary to make design and production of a product and its delivery to the customers possible. The core of a Virtual Factory is a Smart Process, which integrates reusable smaller processes and other metadata from a repository, defined by the members that take part in the Smart Process.

Business), Deliver IT, CCP (Common Configuration Platform), CCRP (Customer Complaint Resolution Protocol) and with its supplier side through ASCC, EDI (Electronic Data Interchange), Share point and Rosetta tools. All these available tools make the communication easy between the upstream and downstream sides of the DA factory, but fail to achieve the above mentioned forecast and update order status at the customer side (switchgear factory) and forecasting and checking buffer levels in the supplier side.

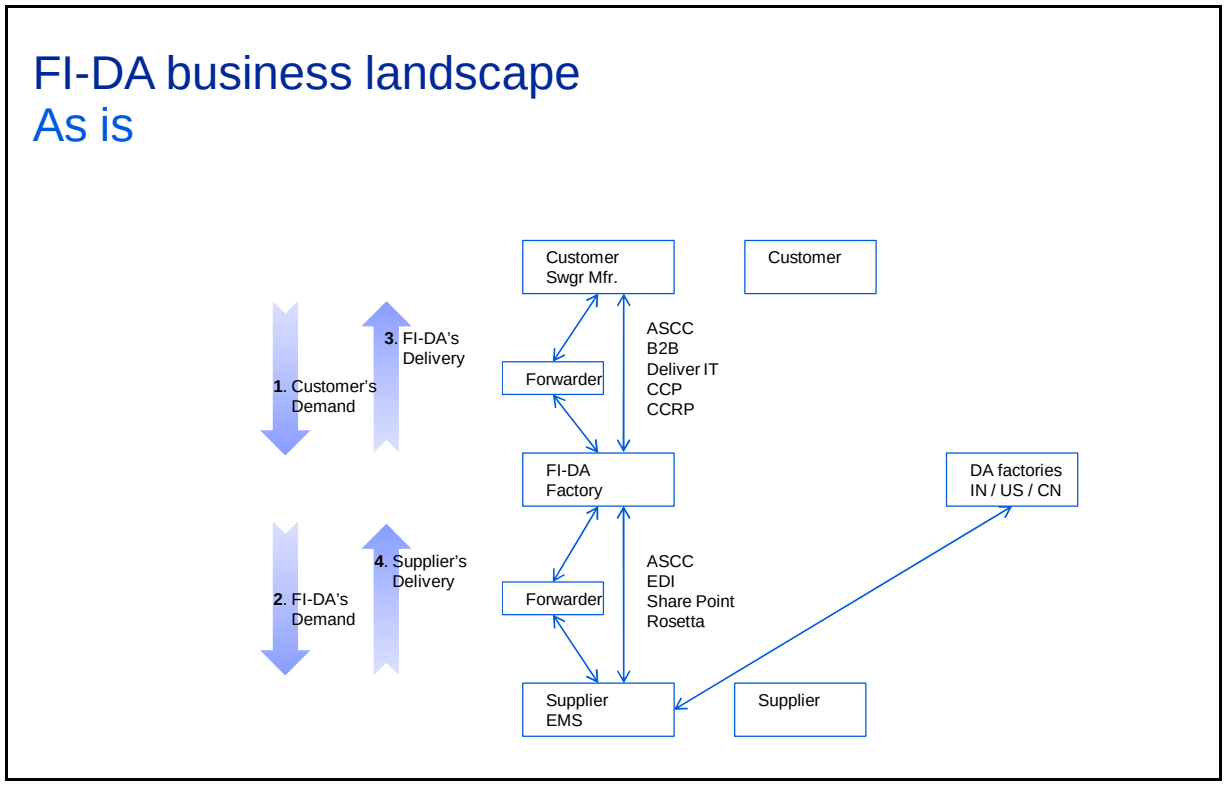


Figure 6: FI-DA's demand and delivery relationship

FI-DA's business landscape as presented in Figure 6 also highlights four remaining challenges to fulfil smoothly its demands and delivery issues as: (a) Customer's demand, (b) FI-DA's demand, (c) FI-DA's delivery, and (d) Supplier's delivery. In Customer's demand level, there is a lacking of order forecasting as necessary to prepare required planning and scheduling. In the FI-DA's demand side, the challenge is to shorten delivery time (1-2 weeks) to customers, where all the materials for production have to be available in the factory before the order is booked. In case of FI-DA's delivery concern, the challenge is to the unavailability of real-time update of the manufacturing status to the customer. For the Supplier's delivery issue, the challenge is to unavailability of online buffer status and non-visibility of pending orders from different factories, hinders capacity optimization and vendor selection.

4.1.3 Current Solutions

The current challenges in four specific sectors such as customer's demand, FI-DA's demand, FI-DA's delivery and supplier's delivery as mentioned above are tackled currently with the available technologies or software within FI-DA factory. The present solutions can specifically be defined as follows:

(i) *Customer's demand*: In the DA factory customer orders are handled currently by implementing several techniques such as CCRP (Customer Complaint Resolution Protocol), ASCC (Advanced Supply Chain Collaboration), B2B (Business to Business), and Deliver IT). These are employed for receiving the orders from certain customers and acknowledging the orders as well. An ABB internal tool named as CCP (Common Configuration Platform) is used to creating an offer by the sales personnel. All the aforementioned tools are used for helping order handling processes but do not support the collection or extraction of forecasts. Currently, demand forecasting is mostly based on basic statistical analysis or estimations or even intelligent guess.

(ii) *FI-DA's demand*: In order to handle and meet the short delivery time (between 1-2 weeks), FI-DA currently, maintained the required inventory levels on the basis of mutual agreements with its suppliers. In order to avoid delivery delay and to keep the on time delivery date as good as possible FI-DA invests substantial amount of money to build the inventory level as safe as possible. As this strategy is financially not viable against the background of the long term business objectives for ABB's DA, there exists the need to find an alternative solution to minimize the inventory level while staying flexible with the order handling process.

(iii) *FI-DA's delivery*: A fixed delivery time for each product series is followed irrespective of the material or capacity position which leads to lower OTD and higher inventories. The present solution for FI-DA to update a shipment's status of delivery is by implementing tool known as DeliverIT tool. This tool has limitation with respect to ease of use, and often the delivery delay is updated at the last moment. The resultant output from this tool is thus often not much beneficial from the customers' point of view.

(iv) *Supplier's delivery*: In order to manage the buffer stock and delivery from the suppliers, FI-DA comprises a solution that the suppliers periodically, or on request, provide an off-line update of their respective buffer level status. FI-DA uses a tool known as SharePoint which provides the necessary delivery information from the suppliers' sites through Excel sheets. Nevertheless, there is no visibility of delivery in transit, which adds to the unpredictability of the deliveries and corresponding schedule risks.

4.1.4 Application of ADVENTURE

The objective of ABB DA factory is to improve its existing processes with up-to-date solutions that might provide an increasing level of performance across its current value chain. The ADVENTURE concepts and solutions should support ABB's FI-DA as follows:

- To receive forecasts from customers and be prepared for e.g., for peak demands

- To provide forecasts that are as accurate as possible to suppliers
- To meet on time delivery (OTD) requirements
- Promise delivery dates based on ATP and CTP processes
- To avoid material shortage
- To reduce inventory
- To improve the ability to fulfil rush orders
- The ability to react quickly, e.g., through ADVENTURE's plug and play factory concept in case of late changes in orders or insufficient supplier performances
- To plan capacities (better utilization of capacities in advance)
- To avoid expediting costs (e.g. 'flash' mode of deliveries)
- To avoid emergency situations (early warning forecasts for special variants)
- To enable the ability to quickly adapt and optimize processes by receiving alerts from supplier's processes
- To have the ability to quickly adapt and optimize processes by receiving forecasts (decision support) from customer's processes

The possible framework where ADVENTURE might integrate with the FI-DA's business landscape can be highlighted in Figure 7.

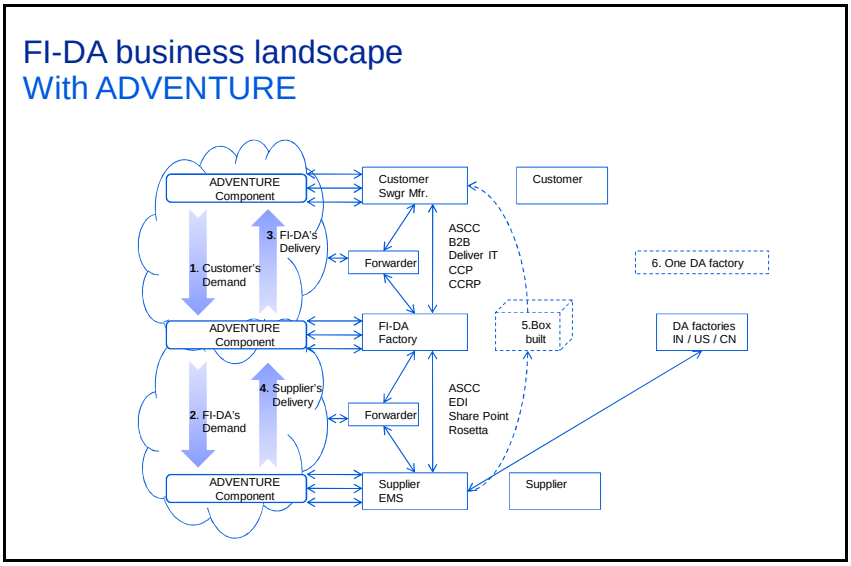


Figure 7: FI-DA's demand and delivery relationship with ADVENTURE framework

On average ABB's DA factory needs to cover approximately more than 100 orders per day, which need to be monitored closely in order to avoid any delivery delay. This monitoring level needs to be extended from ABB's production lines to the suppliers' inventory sites to provide the average delivery time within two weeks. Here, the ADVENTURE Dashboard could support ABB to monitor buffer levels all the way from internal inventory levels to the suppliers' inventory levels (including transit) dynamically. This way, a real time visibility of the entire supply chain for ABB's DA becomes possible.

Furthermore, within the monitoring process 'events' from the complete supply chain network could be identified. These events can be notified as alarms, within the total

production system. For instance, if the inventory level or stock goes beyond the predefined level or if the sales order converted to a production order, it will be considered as an event and a corresponding alarm will be triggered and displayed in the dashboard as notification or alert. Such event detection and monitoring from the ADVENTURE Dashboard could substantially support FI-DA in its daily operational activities.

The ADVENTURE concepts and solutions can additionally be used to significantly improve the forecasts in the context of order management processes. Here, ABB uses usually quarterly forecasting methods. With ADVENTURE ABB would be able to automatically get improved forecasts as soon as possible getting near to real-time data. Based on this, it would be possible to publish expectations concerning required components and modules to respective suppliers very early, enabling a re-planning and rescheduling of their production processes on time, as well.

In future, FI-DA's planning to adopt a business scenario that includes the box-built approach, where the entire manufacturing process could be outsourced to an EMS (Electronic Manufacturing Service) supplier who might deliver the complete product to FI-DA's customer directly according to the pre-specified standard and/or specification. Other business scenario could be of peer-to-peer integration with other DA factories, where assets and resources could be put to use optimally, to meet the delivery requirements of any customer, anywhere in the world.

All in all, in a usual MTO process at ABB's FI-DA site at Vaasa, the application of the ADVENTURE innovations will provide several substantial advantages, for example: First of all, FI-DA will be enabled to effectively compare different manufacturing capabilities of its existing partners and select the best fitting partner for meeting the varying delivery requirements. Secondly, interdependencies and (possibly negative) influences of different orders can be identified in an easy way and the consequences can be minimized. Thirdly, with the ADVENTURE Real-time Process Monitoring component a new level of visibility over the whole supply chain can be reached and exploited, which not only allows ABB to adapt and react for example to events occurred by its suppliers, but ABB's DA customers, as well, as relevant information will be available in real time for all affected stakeholders. This leads as well to new levels of flexibility and scalability

The implementation possibilities of ADVENTURE in case of ABB's FI-DA can be summarised through the following dashboard mock-ups. These mock ups are categorized in different levels based on the requested information from FI-DA. Figure 8 displays the global business view (Level 0), where the components are identified as stakeholders' name (e.g. customer, supplier), notifications (e.g. SMS alerts, e-mails) and monitoring (e.g. customer order, supplier inventory level). This level of dashboard provides an overall status of the corresponding stakeholder and its related monitoring results and notifications.

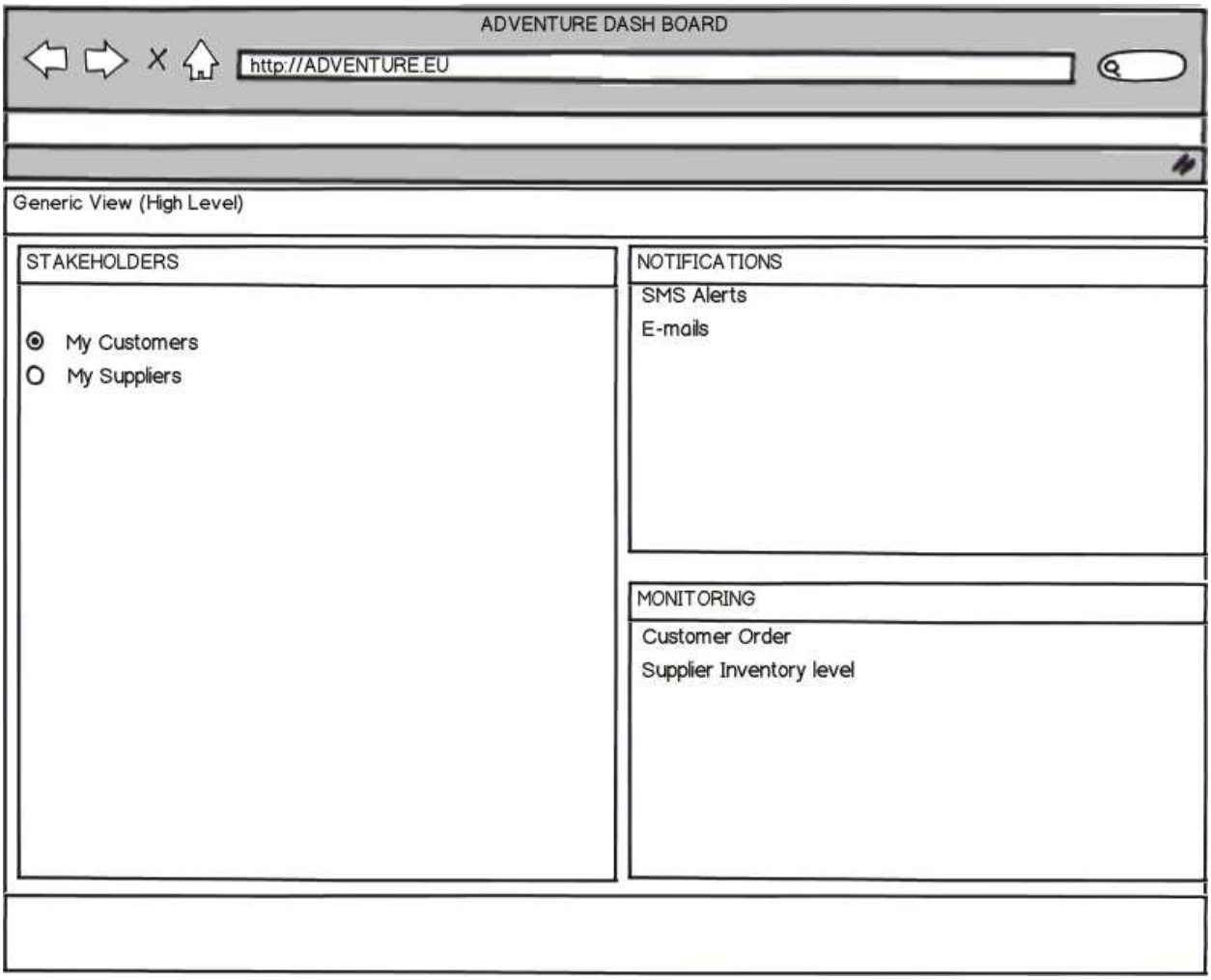


Figure 8: Global business level (L0) dashboard outline

The dashboard mock up as presented in Figure 9 displays the detailed of the customer order level (Level 1), where the status of each of the order for a particular customer is visualized. This level of the dashboard also visualizes the necessary notifications depending on the status of each customer's order. The component 'action needed' provides some useful recommendations.

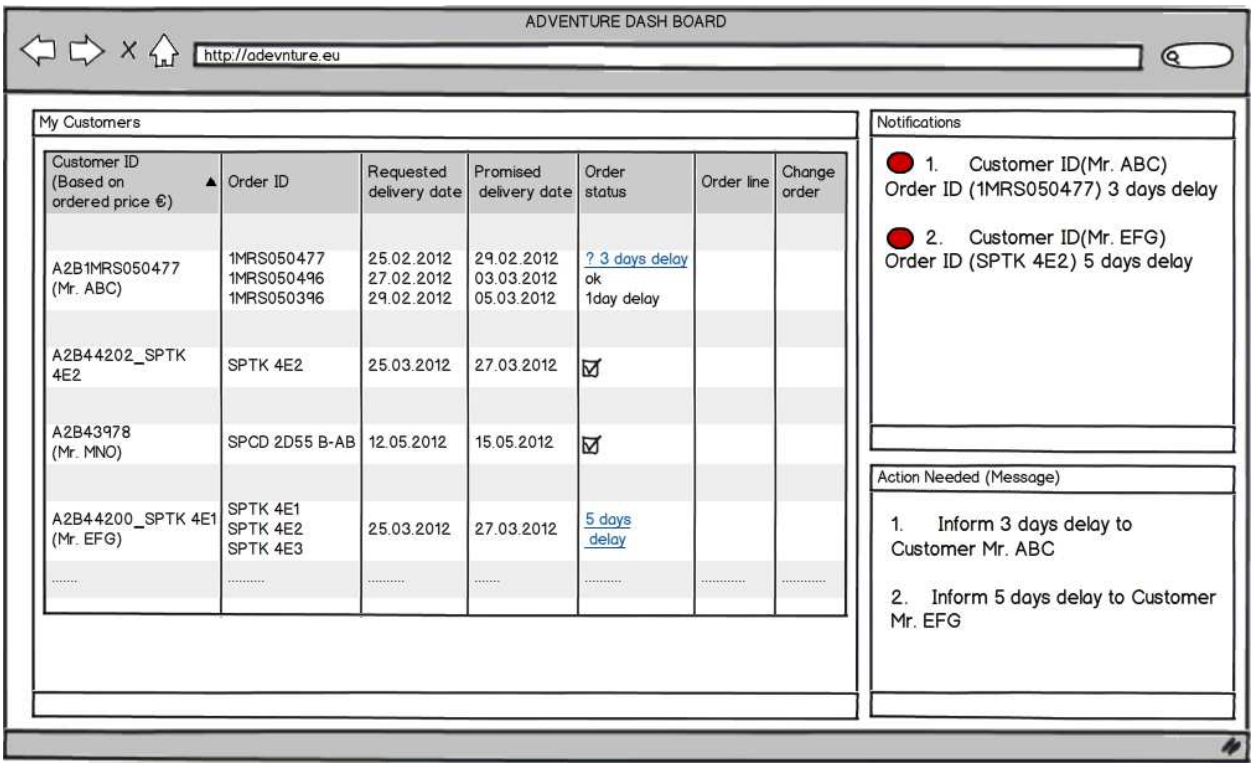


Figure 9: Customer order level (L1) dashboard outline

Figure 10 visualizes the supplier inventory level in the dashboard (level 2), where detailed status of the inventory level of each of the supplier based on corresponding customer's order is displayed. Inventory related notifications, necessary alerts and action needed components against each of the customer's order are also highlighted within this single page.

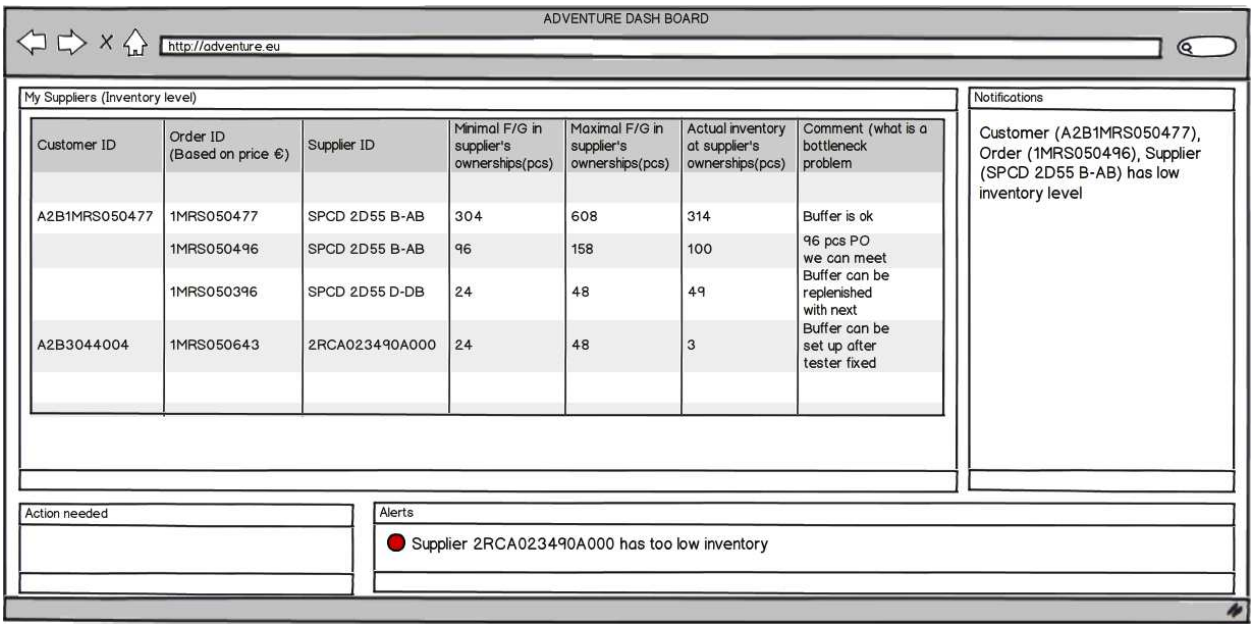


Figure 10: Supplier inventory level (L2) dashboard outline

4.1.5 Usage of ADVENTURE components

Regarding the ADVENTURE components which are focused on by ABB FI-DA, the Smart Process Definition component will be used a basic process modelling tool. In order to execute the resulting Smart Processes, the Adaptive Process Execution component will be applied. ABB FI-DA will also make use of the Process Forecasting and Simulation component for the provisioning of forecasts that are as accurate as possible to suppliers. The Real-time Process Monitoring component as well as the integration of Smart Objects will be required to meet for instance on time delivery (OTD) requirements. The Process Optimization component will be applied by ABB FI-DA to identify optimization potential in FI-DA's processes and realize such potential.

Thus, referring to Figure 1, the use case of ABB FI-DA covers in summary at least ADVENTURE's Smart Process Definition, Adaptive Process Execution, Process Forecasting and Simulation, Real-time Process Monitoring, Smart Objects Integration, and Process Optimization.

4.2 Use Case Specification Azevedos

4.2.1 Scenario/present situation

Azevedos is a leading manufacturer in the cork transformation industry. Azevedos develops, produces, sells and provides after sales assistance to a wide range of production machinery (see Figure 11) since 1964. Azevedos' products are complex (multi-part and multi-technology) convergent products: that are comprised of hundreds of different components and different technologies. Casting, bending, milling, CNC, image processing, GUI, automation systems, electric and pneumatic components are some examples of technologies and components used. Azevedos only outsources activities that are not covered by in-house competences such as bending, casting, parts'

surface treatment and on very few occasions, product engineering. Main reasons for outsourcing are the lack of competences (mainly technological) in some operations and the increase of general plant productivity by reducing delivery time to customers.

Figure 11: Azevedos' range of cork transformation automation

In fact, some products consist of 500 different components. This fact implies a huge amount of documentation (related with customer interactions, product engineering, process definition, industrialisation, quality, after sales assistance) and data (production, quality records), which must be created and also maintained. Documentation and data are spread in different physical locations at Azevedos, in different formats (paper and/or electronic) and also in different software frameworks (CAD, Microsoft Office, ERP, MES). In spite of the fact that each piece of equipment sold has a serial number, most of the time it takes a substantial amount of time to compile necessary documentation and data for equipment. This documentation can also not be accessed in a web-based manner.

In a one-of-a-kind production environment or in an engineer-to-order business model, a new business opportunity means a new project and to execute such an order involves specific combinations of different activities, like understanding the customer's requirements, conducting a rough product design, feasibility studies, engineering, rough production planning, production, commissioning and after sales support. Azevedos' processes are non-prescriptive; there is a lot of flexibility involved and many decisions are to be made by humans.

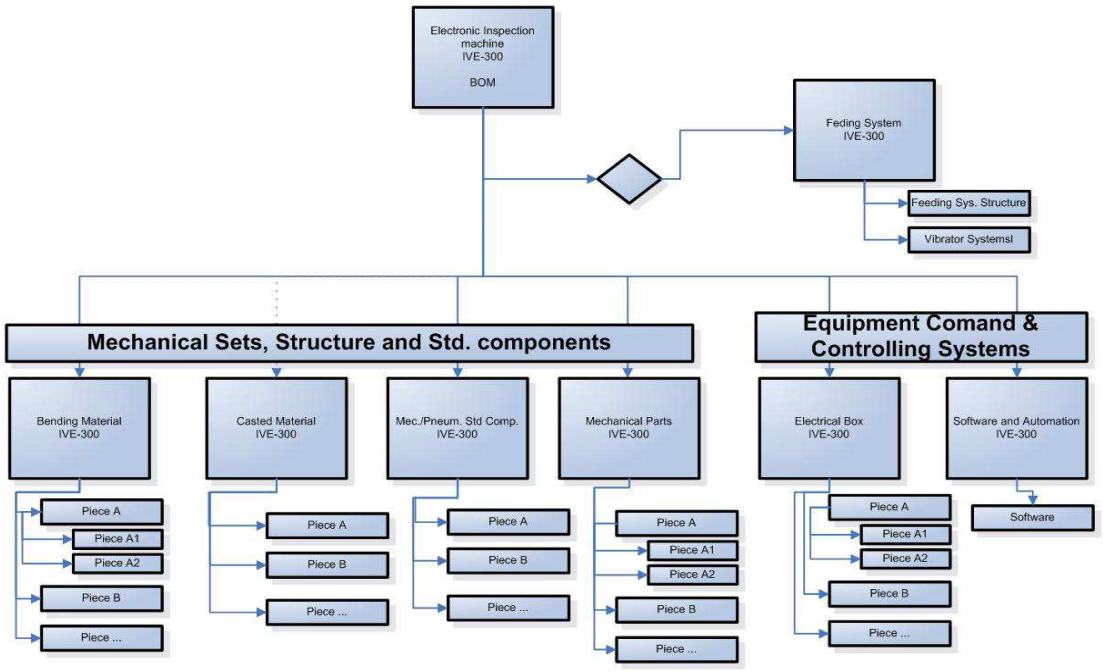


Figure 12: Infrastructure of bill of materials for internal and external orders

Azevedos in its production process has to place different orders (see Figure 12). Some of them are internal and others are external. Internal orders are executed in-house and are totally managed and controlled by legacy systems, namely by a Manufacturing Execution System. There is, however, no system that allows Azevedos to manage and control the external orders that are placed with suppliers. Currently, Azevedos can only query the status of external orders manually (by telephone or by email).

4.2.2 Challenges

The Azevedos Business Environment is characterized by Complex products, one-of-a-kind environment and multiple business partners' involvement.

For each customer order, there are specific engineering and production activities which should be managed as a whole. For each customer order, there is a mix of internal and external orders. Internal orders are managed by legacy systems, but the external orders are not. Both engineering and production activities could be outsourced (in each customer order, several activities could be outsourced).

Those business processes are non-prescriptive. Thus, there is an initial rough process design for each instance; followed by a progressive process refining based on human decision (human-based flexible and adaptive processes).

A distinctive feature of the Azevedos' virtual factories lies in the fact that they involve product design, process engineering and manufacturing tasks. All these tasks have to be managed comprehensively by the virtual factory management system.

In such an engineer-to-order virtual factory, several documents are created in execution time. For each customer order, specific documentation is generated for engineering, production, quality and after-sales activities. This documentation is spread on different

systems and supports (paper, electronic, CAD, MS-Office files). Relevant information for each customer order involves a mix of documents and data (e.g., quality and production records) See Figure 13.

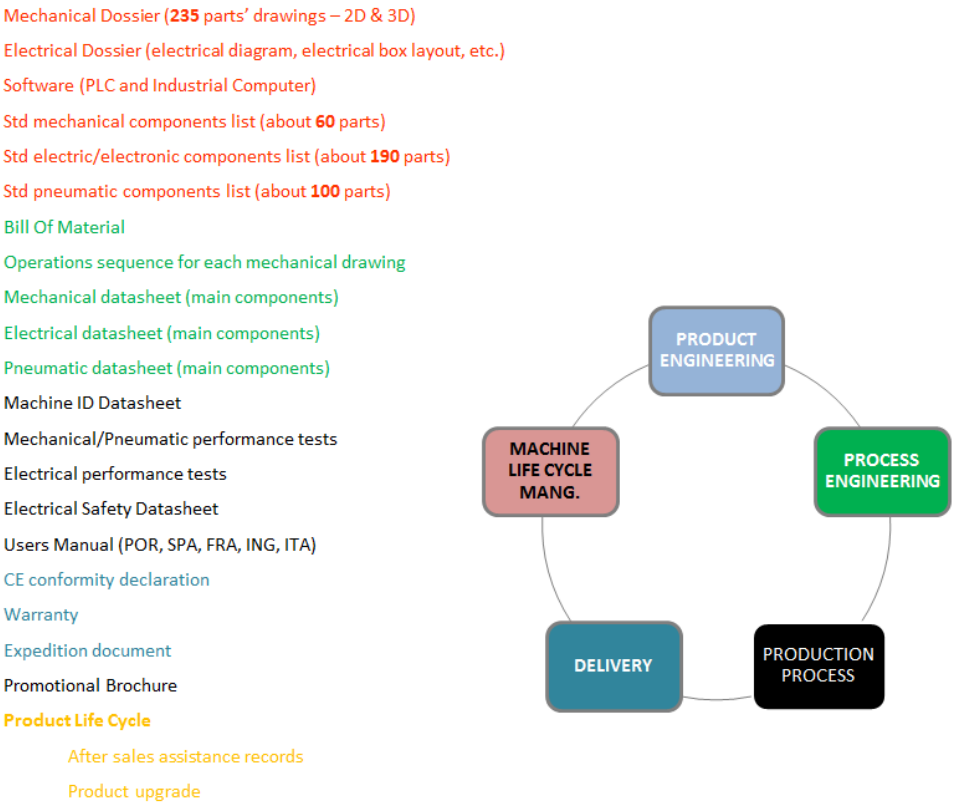


Figure 13: Relevant Information for each costumer order

4.2.3 Current Solution

Currently, there is no solution that meets the requirements for the type of environment described in Azevedos case. The collaborative manufacturing process is managed ad-hoc and although partners are chosen on the basis of the qualification process, when it is necessary to perform some task, they are bilaterally contacted. The whole process is managed manually using email exchange, phone calls and physical meetings or by skype.

Regarding the management of information associated with the manufacturing process, there is a repository of documents, organized in folders where the technical documentation (drawings, specifications, certificates, etc...) is stored but the partners have no access to it. Moreover, much of the information produced during the process is saved on the manager's desktop and each one organizes it on his own way. We can say that the information is scattered when it should be concentrated and connected by the manufacturing process flow.

In fact, there is a process where the human decision factor is very strong and where information is not correctly stored. Typically, the project manager knows the status of each task by direct contact with the responsible partners. Much information is kept in

peoples' minds and never gets to be registered. This gives rise to errors and delays in the delivery of the final product.

4.2.4 Application of ADVENTURE

The virtual factory management system should encompass both workflow management (i.e., task management) and documents management (i.e., edition, access and archive of design plans and quality records)

As stressed before, an Azevedos' virtual factory includes engineering and manufacturing tasks. Both engineering and manufacturing tasks can be performed internally or outsourced. The outsourcing is decided by the industrial manager for each particular customer order. The manager takes into account the current and future available production capacity as well as internal and partners technological capability.

The internal and external orders are managed differently: The internal orders are managed by the legacy management systems (i.e., ERP and MES). Azevedos expects to use ADVENTURE to manage the external orders.

Once the virtual factory process involves design activities, the virtual factory processes cannot be fully designed a priori (as it will happen in a conventional process management system). The design of the virtual factory takes as input a process template that depends on the product family.

The template just provides a rough process model and it will suffer several changes all along the virtual factory lifecycle: The model will be progressively refined and specialized as far as engineering defines the product and the manufacturing process. The model will also change in execution time in order to react to events such as order delays or quality test failures.

Each virtual factory (customer order) includes a specific arrangement of internal and external orders. Its management will always involve a mix of automatic and human based decisions. For example, the dispatching of internal orders for the legacy systems can be performed automatically. On the other hand, assignment (or re-assignment) of orders to suppliers or process re-planning will always be human decisions. The lifecycle of each supplier order involves a complex set of Negotiating tasks, Contracting tasks, Design or Manufacturing tasks, Expediting and in bound tasks and Test and verification tasks.

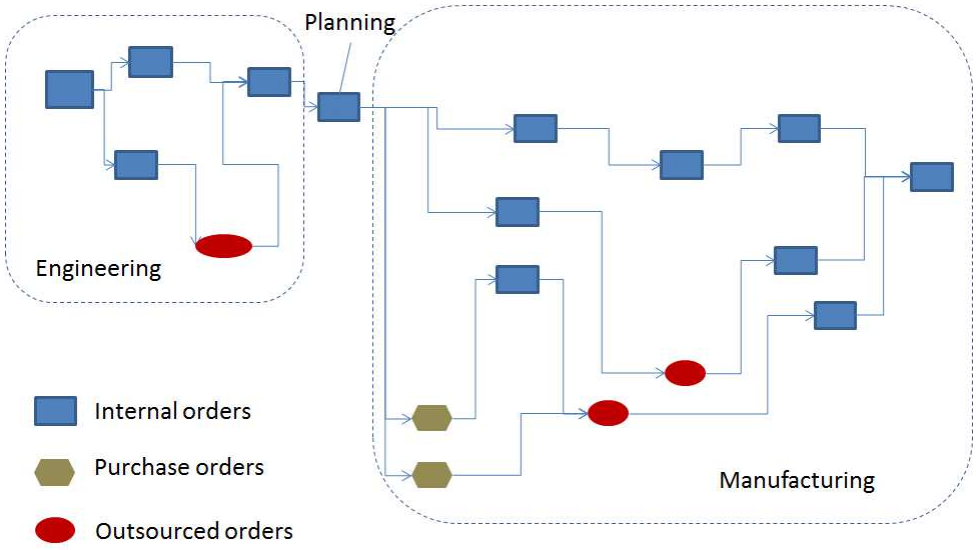


Figure 14: Process planning with interactions with order processes

Therefore, each supplier order should be managed as a sub-process of the main VF process as illustrated in Figure 15.

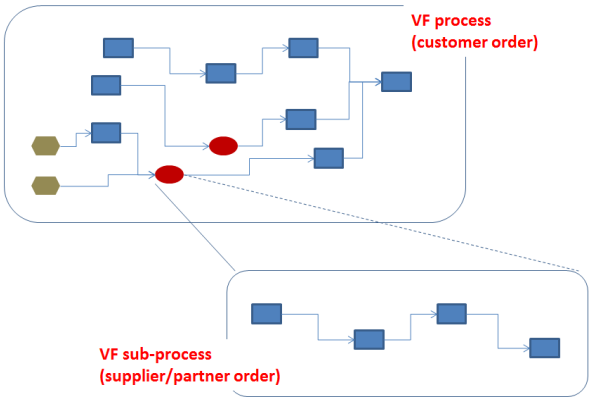


Figure 15: Supplier order as a sub process

According to the needs analysis in Section 1, we believe that to manage effectively its virtual factories, Azevedos' needs a combination of features from:

- Workflow management systems
- Project management systems
- Document management systems
- Collaboration management systems

To achieve this, Azevedos propose a 3 level dashboard for the virtual factory management system:

Global business level (Global management of the customer orders)

This dashboard level which is illustrated in Figure 16 should include the global view of all customer orders (i.e., smart processes) and its status, a summary of pending activities, a list of alerts regarding all active manufacturing processes and the last messages exchanged between network partners. Also, partner finding functionalities should be available at this level.

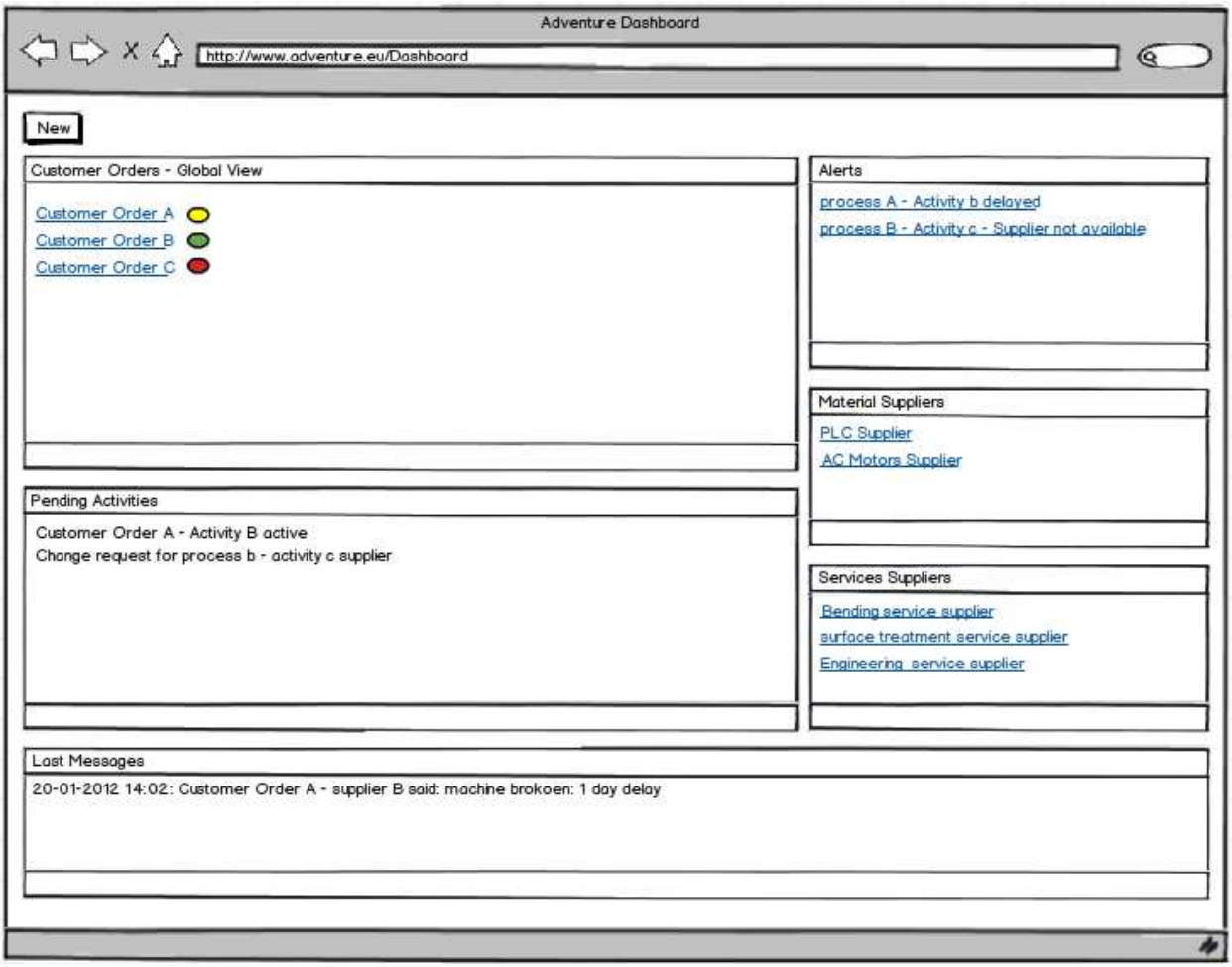


Figure 16: Global business level (L0) dashboard outline

Customer order level (Management of a customer order instance)

By clicking in one specific customer order in Level 0, the dashboard is switched to level 1, which is illustrated in Figure 17 and all the information related to the specific customer order is presented in one single page.

The process editor component allow user to design the manufacturing process graphically, the partner finding will be used to search and assign suitable partners to execute required services in the scope of this process. The information Management component will show all the documents related to this process and it will have configurable access permissions. Process real time monitoring and instant messages components will allow partners to collaboratively follow the process in real time. If some unforeseen event rises, an alert will then show up in the alerts list.

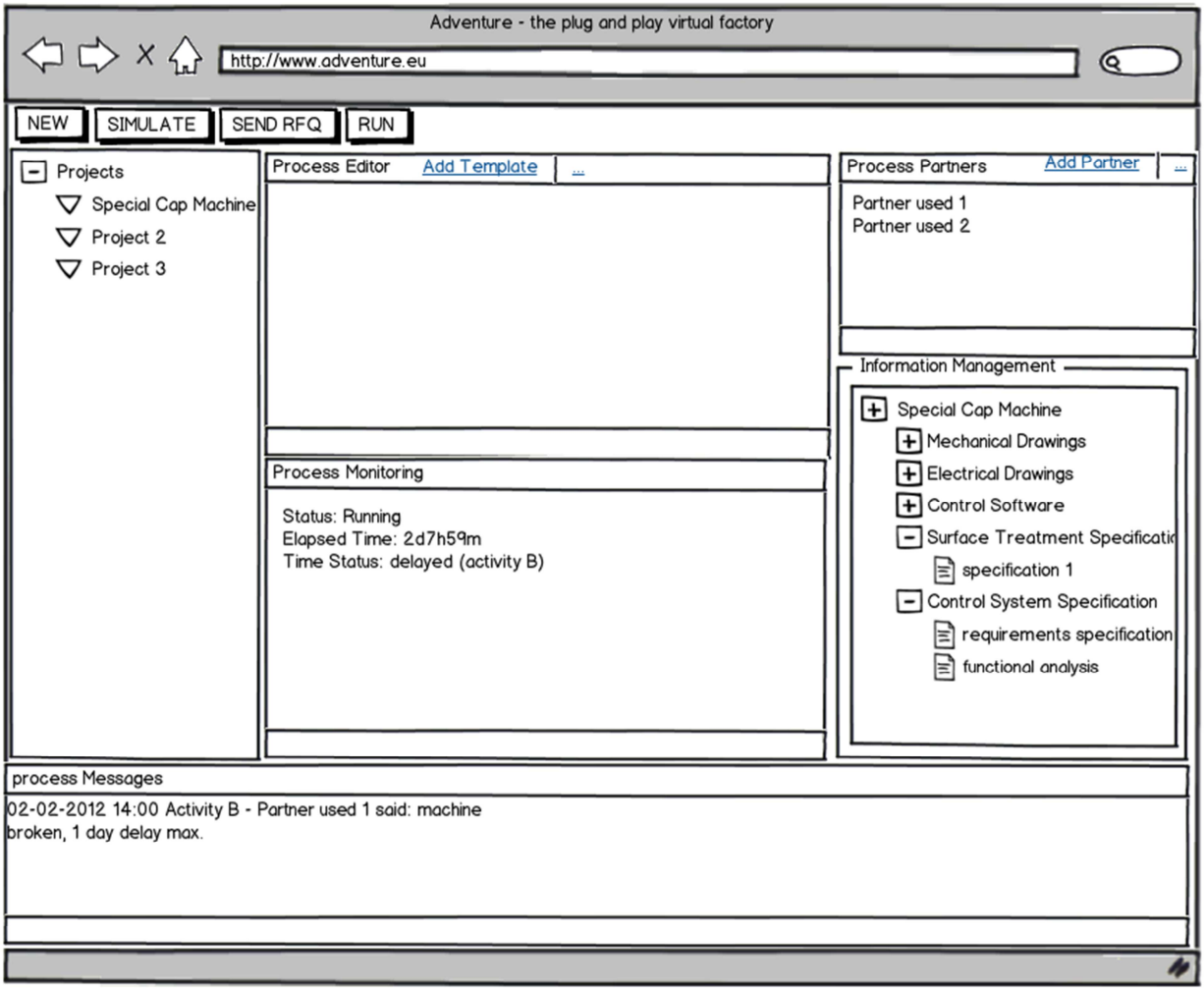


Figure 17: Customer order level (L1) dashboard outline

Supplier order level (Management of a supplier order instance)

By clicking in one specific task, all the information related to this specific task is presented in one single page, as illustrated in.

The task workflow monitoring component allows users to follow the order status, partner finding functionalities will be used to search suitable partners to execute the required task service. These partners can be assigned to the process task. The information container will show all the documents related to this task and will have configurable access permissions. Only partners associated to this task should have controlled access to this information. Task real time monitoring and messages will allow partners to follow the task in real time. If some unforeseen event rises, an alert will show up.

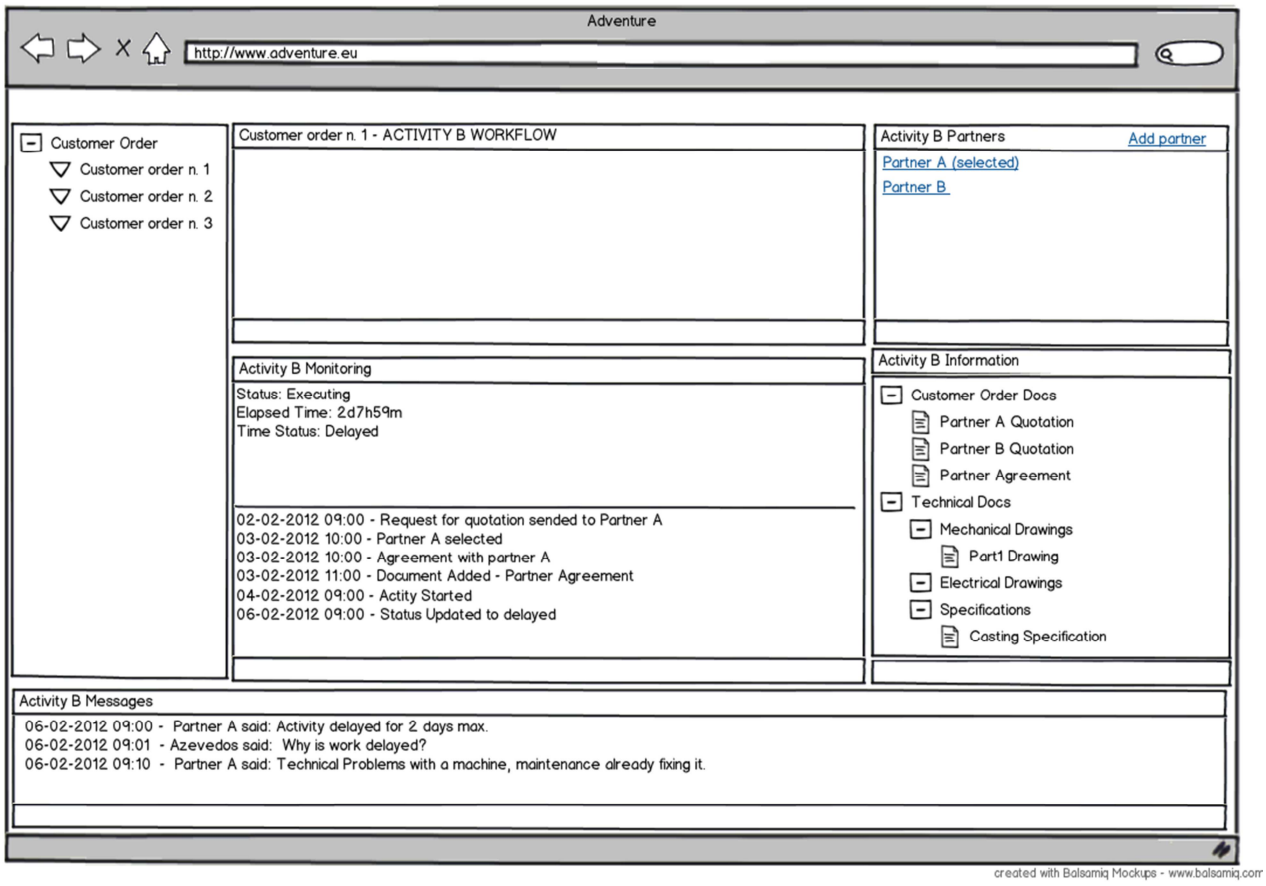


Figure 18: Supplier order level (L2) dashboard outline

4.2.5 Usage of ADVENTURE components

For modelling and executing Smart Processes, Azevedos will utilize the ADVENTURE Smart Process Definition component and Adaptive Process Execution component. In order to find and assign potential partners to the steps of the Smart Process, the Data Provisioning and Discovery component will be utilized. In order to get an optimized proposition of which partner should be assigned to which process step, Azevedos

makes use of the Optimization component. For status monitoring and event detection, the Real-time Process Monitoring component as well as Smart Objects will be deployed. Thus, referring to Figure 1, the use case of Azevedos covers in summary at least ADVENTURE's Smart Process Definition, Adaptive Process Execution, Data Provisioning and Discovery, Process Optimization, Real-time Process Monitoring, and Smart Objects Integration.

4.3 Use Case Specification Control 2K

4.3.1 Scenario/present situation

Control 2K Limited (as a lead partner of TANet) is a service provider to the manufacturing domain. It provides software solutions that allow manufacturers to monitor their processes and therefore apply process improvement techniques to achieve greater efficiency. In addition, manufacturers utilise this valuable data to help integrate with their suppliers and customers via the exchange of production related data. To achieve this Control 2K uses its own "Industreweb" software platform which is implemented as either a stand-alone installation or as an integrated part of their customers' existing systems.

These types of systems are wide spread in all sectors but taking manufacturing as a specific target area, the process of integration is further compounded by the linkage into Enterprise Resource Planning, Materials Resource Planning and Manufacturing Enterprise Systems (MES). Most businesses will have elements of order processing, financial transactions and dispatching processes. The processing of an order like any business requires an order number and the normal process of financial clearance as highlighted in the other examples within this document.

The scope of business for Control 2K is very large as the range of services that can be provided to manufacturers is vast. The current approach adopted by the company is to solve individual problems that manufactures have. The main areas addressed with current products are:

- **Energy Monitoring** - With the rising costs of energy bills in both industrial and domestic environments, the reduction of waste and energy saving are a constant hot topic. Very few service providers can provide this information in real time while presenting the information to company personnel in clear concise displays and easy to understand reports that pinpoint exactly where the businesses are wasting energy and money
- **Supply-Chain Integration** – All customers and suppliers strive for better communications and want the flexibility to monitor and keep track of goods throughout the manufacturing and delivery processes. This tracking may be required in real time, anywhere in the world. The benefits in time reduction and reduction of miscommunication is vital for any organisation
- **Error Proofing** - Most Error Proofing systems rely on paper processes that can be time consuming, unsustainable, and prone to inaccurate data. The automation of existing systems makes them easier to maintain and reduces operator data entry errors. This can also avoid costly mistakes by providing feedback to operators if the incorrect parts are installed or assembled.

- **Process Improvement** - Improving performance is the fastest route to greater profits. Even minor tweaks can save money, speed up delivery, and identify/ eliminate waste in materials and time. It is important to be able to view clear information targeting your problems and solve them with minimum effort.

Whilst the software works very well as a localised service, it is restricted in the functionality it provides due to poor linkage to Cloud based services. It is limited to point- to-point connectivity and would benefit by linking the ADVENTURE to expand the portfolio of services that could be provided.

4.3.2 Challenges

One of the major areas of concern for any manufacturing company is the constant battle to achieve 100% efficiency. Although this is a dream, most organisations often lose so much on inefficient processes and often overlook areas where major cost impact could be achieved through process optimisation. Whilst lean and agile manufacturing has been around for decades, companies find it hard to get to the root cause of many of the production errors as often the root cause can stem from a variety of processing including human error, machine wear and tear, incorrect or badly designed processes or simply through lack of diagnostic information presented from the process. Labour costs are the most restrictive element in any business but particularly in manufacturing. The increase in the level of automation starts to address the cost issues but in turn introduces a new challenge as often systems need to be interconnected to achieve optimisation.

When it comes to integrating business processes with existing systems such as PLC and other control systems, MES and then ERP systems, it is assumed that the connectivity is structured and linear with neat self-contained silos. In reality though, there are no real clear cut boundaries between services and shows a more realistic relationship between processes and services between the two layers. It is hard to work out the demarcation lines in the multitude of infrastructures and databases in a typical business. Connectivity issues may occur between the ERP and Control Level in manufacturing environments that are very hard to track.

Random errors are the biggest challenge to production and since they cannot be forecast at runtime, they could be predicted if the right level of data is available. The challenge for ADVENTURE will be to consider the response to such errors and the tools that would be needed to monitor such breakdowns of communication. In the real world so much time and effort is spent looking at areas interconnectivity that can potentially go wrong and how the whole process of data capture and correction of errors is presented and monitored across multiple machines.

This is made more complex with flexible processes and the presentation of diagnostic data to operators and managers involved in the delivery of goods. Deficient operation due to missing interoperability between IT systems of manufacturing partners causes high integration issues when it comes to monitoring production machinery. Accessibility to otherwise non compatible software systems means that data could be lost or be none existent when it comes to open infrastructures supporting partner interoperation and the ability to constrain data access and handle data respecting specific restrictions where there are privacy concerns. Dynamic data information is data that is only available at a

given instance of the process. Whist it is typically used to give a snapshot of the current state of the process, it is derived from several sources of data and is not captured as the amount of data storage and time taken.

4.3.3 Current Solutions

One of Control 2K's key products is called "Industreweb" which is a suite of software for Business Intelligence. The software pulls data from different parts of a manufacturing process and presents the data gathered in the form of reports or screens available on web browser software (see Figure 19). The software works well in a localised SME business environment but as a service provider for the manufacturing domain, the range of information and business intelligence needs to be widened with the advent of Cloud services. This is why Control 2K has looked to ADVENTURE to expand its current range of services to connect to remote smart objects and provide supplier and customer data via Cloud services. The current solutions do link with non-intelligent sensors such as proximity switches or level detection equipment and pass information on to Enterprise Resource Planning, Materials Resource Planning and Manufacturing Enterprise Systems (MES) via common formats such as CSV files or SQL databases.

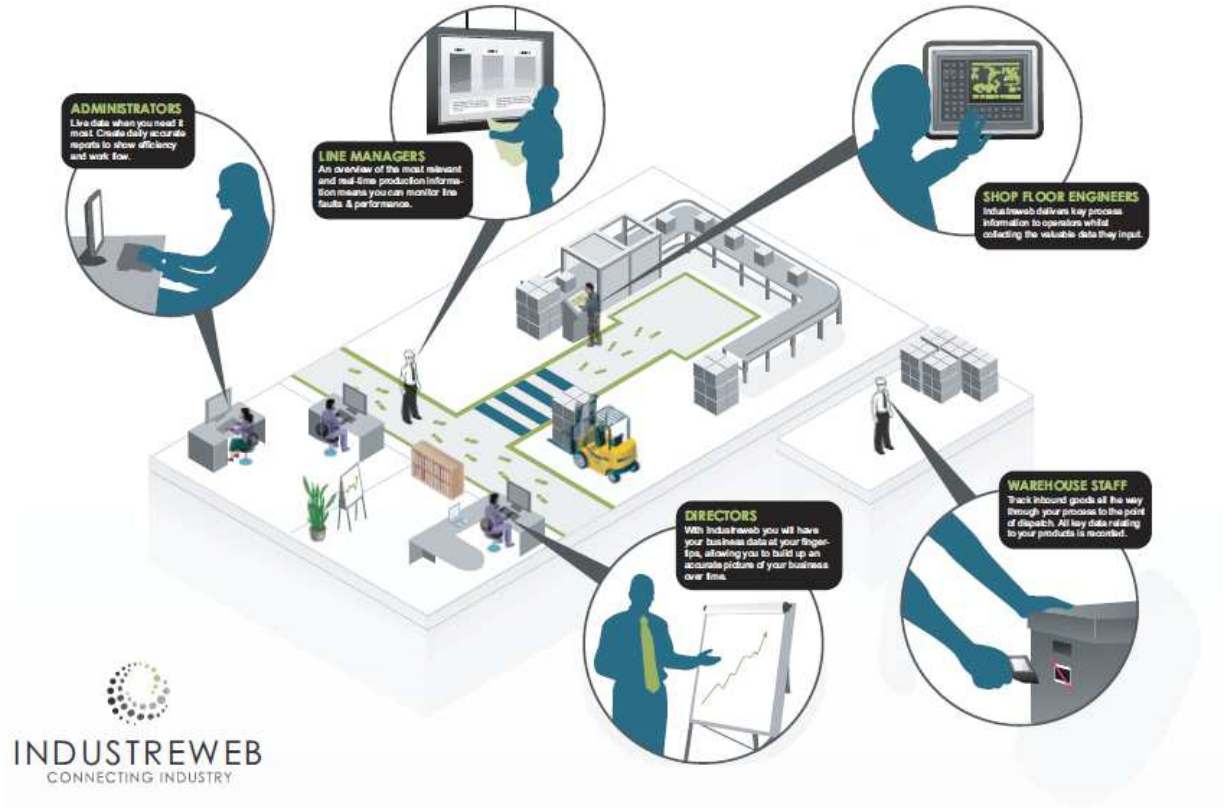


Figure 19: Data collection, monitoring and presentation at all levels of an SME

If we go back to basics, most businesses will have elements of order processing, financial transactions and dispatching processes. The processing of an order like any

business requires an order number and the normal process of financial clearance as highlighted in the other examples within this document.

The production process starts from the moment that the order is cleared for production or assembly and at this point all the elements of checking for stock and ensuring all the bill of materials is available for production to commence is gathered from the various systems. Industreweb provides a Flexible, Scalable and Low cost solution to systems integration at many levels. It is a MES Based Software (although it potentially offers more functionality than typical MES. It is primarily used to Connect Shop floor to ERP / MRP type systems providing Error Proofing, monitoring of processes and a customised dashboard to view your data. Figure 20 shows the typical application of the software in an SME environment.

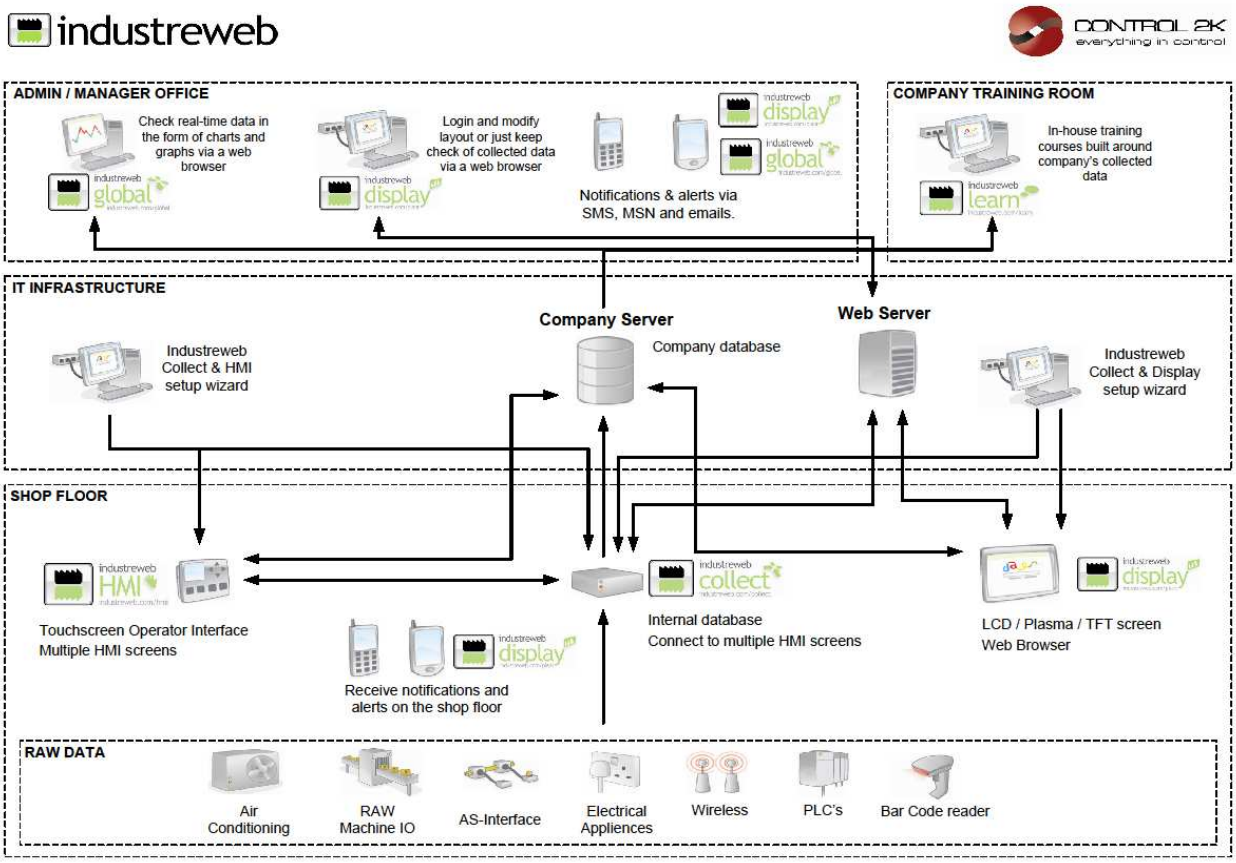


Figure 20: SME infrastructure for Data collection, monitoring and presentation

To iterate once more, the software works very well as a localised service but is restricted in the functionality it provides due to poor linkage to Cloud based services. It is limited to point to point connectivity and would benefit by linking via ADVENTURE to expand the portfolio of services that could be provided.

4.3.4 Application of ADVENTURE

Control 2K currently provides Hardware and software solutions to the client company in order to provide business intelligence for use around the client organisation to provide the client the capability to link to their suppliers and customers. As described in the

vision document (D2.1) and Figure 21, Control 2K focuses on integration software and has the option to supply hardware to the customer or the customer may purchase their own hardware from their preferred suppliers. Occasionally the supplier can be the same company that Control 2K sources from and also the customer sources from. These third party hardware suppliers provide sensors and hardware infrastructure to integrate Control 2K's clients with their manufacturing machines using Control 2K's Industreweb software suite.

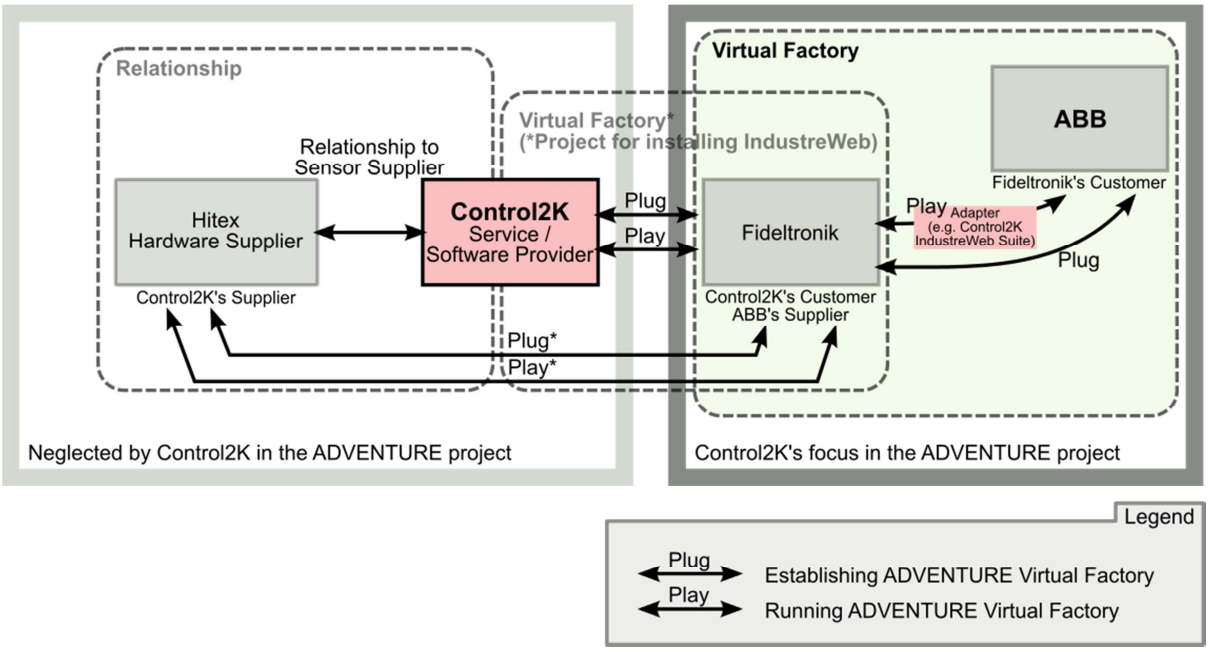


Figure 21: Control 2K as a service provider

Client companies normally commission Control 2K to provide all the necessary hardware and software to enable communications and monitoring capability to their organisation. Typically the connections are made from the shop floor machines via OPC compatible software to existing legacy MES or ERP systems. The hardware is installed or re-commissioned in order to monitor these machines through the Industreweb software. Control 2K is always looking for partners that can supply hardware at cheaper prices or shorter delivery times to improve its services to their client and increase their own profits at the same time.

The focus of Control 2K within ADVENTURE however is to enhance the connectivity features of Industreweb and ensure that companies using its Industreweb software are "ADVENTURE Ready" without the need for any major additional development work. This includes:

- A web service interface (specification) to allow ADVENTURE to query Industreweb data.
- A methodology and web service interface specification to allow Industreweb to push data to the ADVENTURE Cloud (for particular virtual factories).
- A web service interface to allow Industreweb to query or pull data from the ADVENTURE Cloud and therefore influence the product process.

- Provide custom monitoring and visualisation of complex data structure to the dashboard, thus allowing Control 2K clients and their customers a holistic view on their cooperative manufacturing venture
- Allow Control 2K customers to adapt their manufacturing process and machines without breaking into currently existing virtual factories
- Allow Control 2K to advertise its compatibility with a wide range of ERP/MES systems through ADVENTURE, through the support of third party vendors (e.g. TIE ERP/MES bridge).

These features will allow Control 2K to offer its customers additional features for them to become more flexible and enter business relationships faster with fewer costs involved.

Control 2K can benefit from ADVENTURE in several ways. Foremost, by connecting to ADVENTURE, Control 2K can offer their clients the ability to cooperate with their supply chain through ADVENTURE (see Figure 22). This offers the benefits of:

- Faster setup of business intelligence systems
- Integration with ERP/MES systems
- Wider monitoring capabilities including client-supplier tracking of all production related data (not just manufacturing machine related data)

Industreweb acts as an adapter to monitor manufacturing machines, and is itself complemented through the modular structure of ADVENTURE which allows connecting Industreweb to other products without the need to continuously adapt Industreweb to these products.

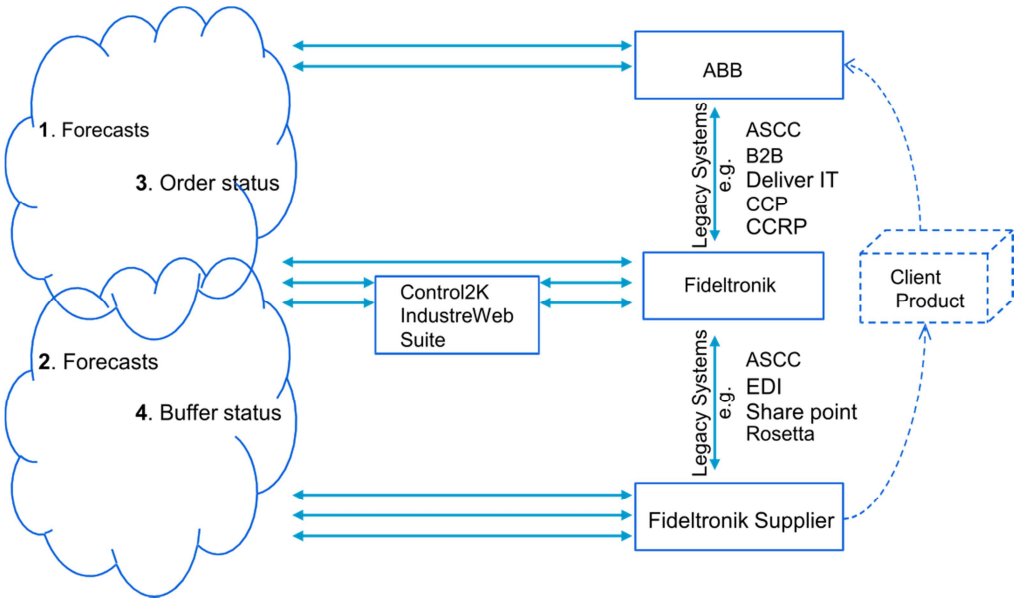


Figure 22: Industreweb suite via ADVENTURE linking ABB with a supplier

Control 2K is expecting to increase the visibility of the supply chain for its client companies such as ABB in this user case in order to present expected shipping dates, buffer stock levels and allow suppliers such as Fideltronik to see forecast schedules from ABB. As each project Control 2K conducts in relation to its clients is essentially

unique, it needs to remain flexible in terms of the automatic interactions through ADVENTURE so that changes to the process can be done with little effort. Control 2K currently relies strongly on personal relations and word of mouth for project acquisitions. As the Control 2K portfolio of services grows, it also becomes visible as a potential supplier of ADVENTURE compatible software and services through the ADVENTURE Dashboard's search functionality in order to win new business. As stated in the Vision document (D2.1) additional future prospects may include automatic or Cloud based deployment of Industreweb compatible software through ADVENTURE.

In order to demonstrate the Use Case requirements preliminary designs were made to reflect the user interface. The mock ups would allow the Technical partners to understand what it was that Control 2K required the ADVENTURE dashboard to display and the format and structure of the information layout.

The mock-ups are listed below, with associated background to the requirements of each.

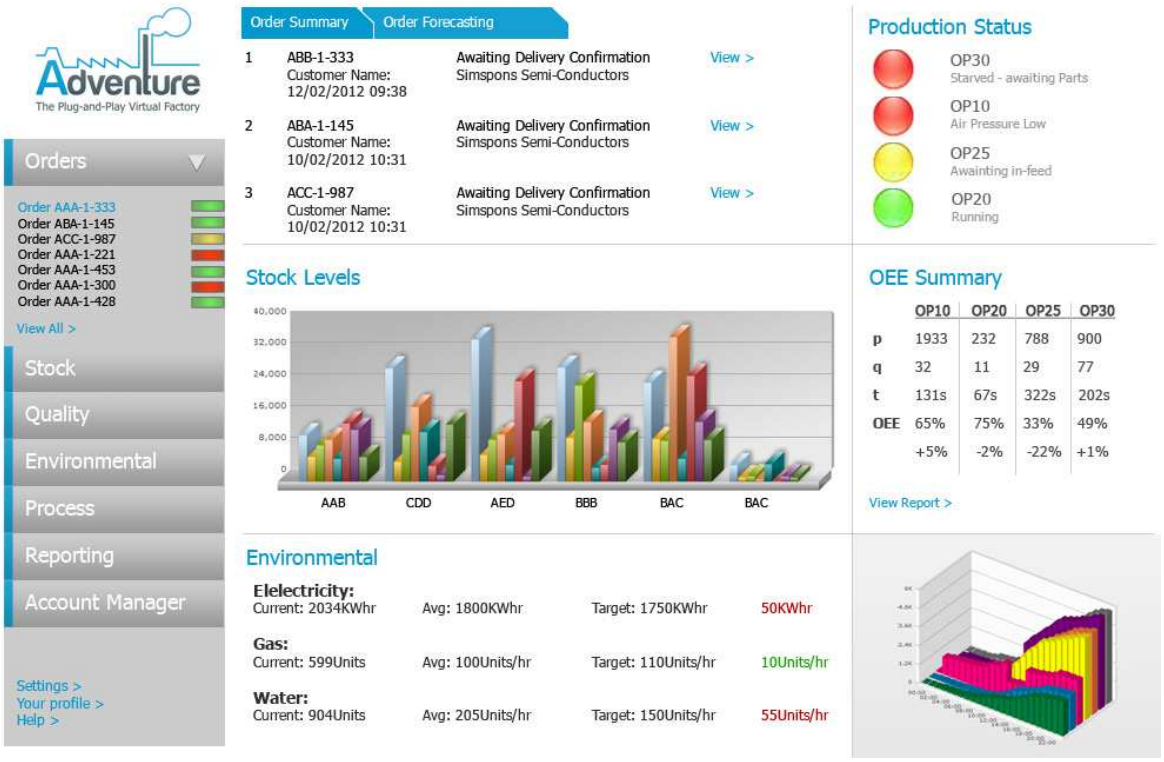


Figure 23: ADVENTURE Dashboard – Homepage (L0)

Figure 23 shows the proposed dashboard that would be displayed to the Administrative user role on first entering the ADVENTURE web user interface. This is referred to as Level 0. Navigation should be simple and intuitive and should be displayed vertically to allow additional options to be easily added. The main content area depicts a “Module” based layout with the most appropriate information being displayed. This layout should be user configurable.

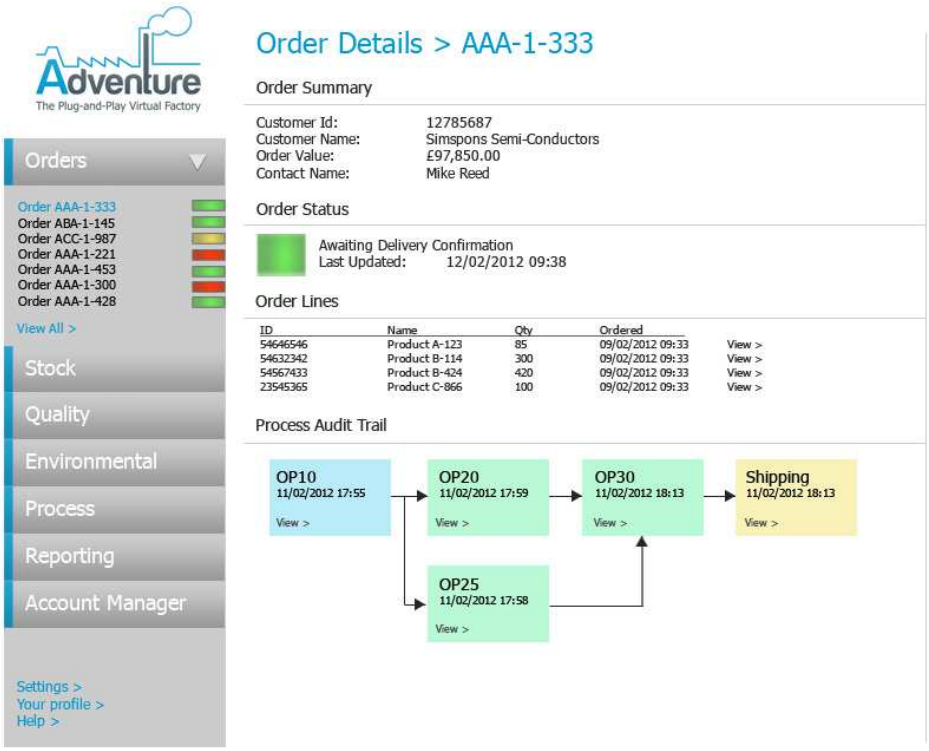


Figure 24: ADVENTURE Dashboard – Order Details (L1)

From Level 0 the user can click on a specific order to get more detailed information, this is referred to as Level 1. Figure 24 shows the layout of this view, features include the break-down of the order lines within the order, and also the current status of the order and the historical Audit Trail of it through the production process.

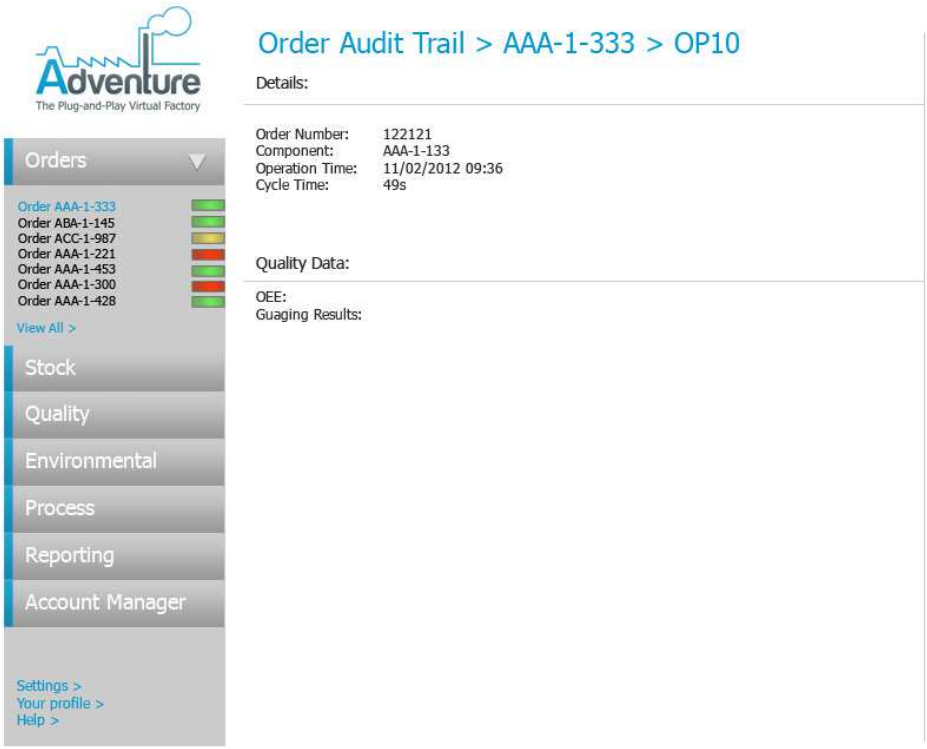
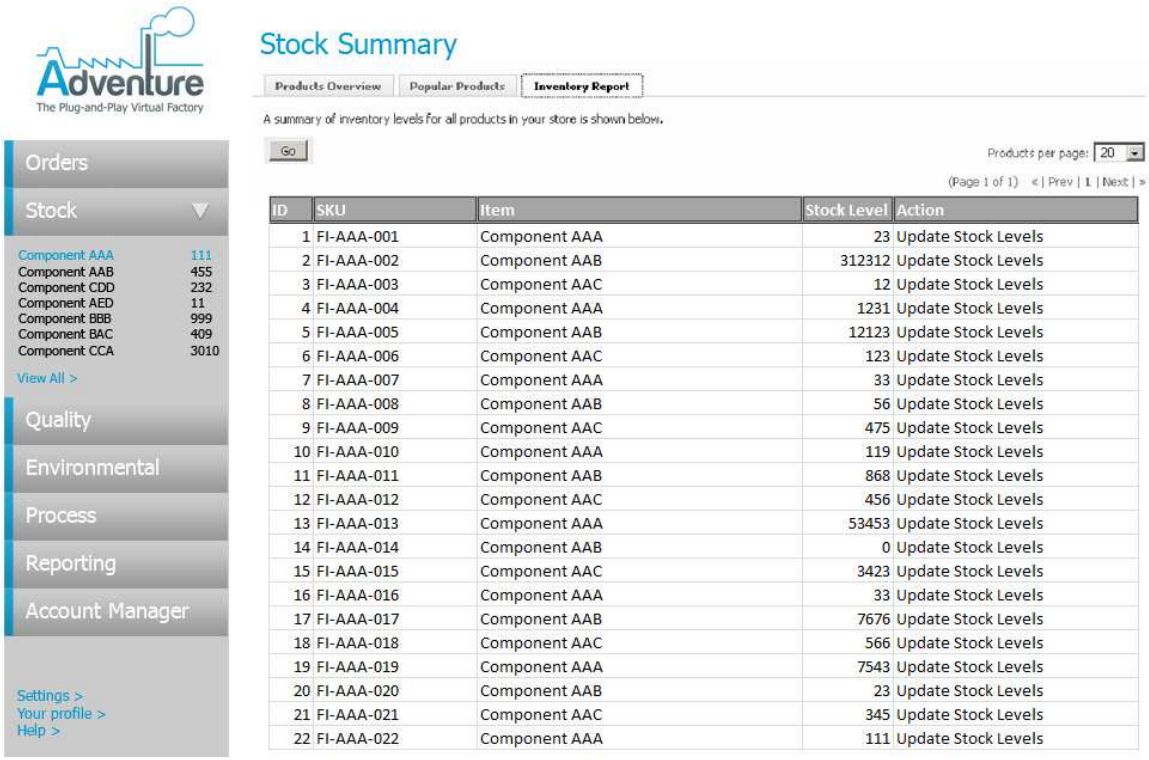


Figure 25: ADVENTURE Dashboard – Order Audit Trail (L2)

Figure 25 shows how Level 2 would allow the user to display details of a specific element of the order audit trail. This could include details of the quality data or associated errors at that point in the production process.



ID	SKU	Item	Stock Level	Action
1	FI-AAA-001	Component AAA	23	Update Stock Levels
2	FI-AAA-002	Component AAB	312312	Update Stock Levels
3	FI-AAA-003	Component AAC	12	Update Stock Levels
4	FI-AAA-004	Component AAA	1231	Update Stock Levels
5	FI-AAA-005	Component AAB	12123	Update Stock Levels
6	FI-AAA-006	Component AAC	123	Update Stock Levels
7	FI-AAA-007	Component AAA	33	Update Stock Levels
8	FI-AAA-008	Component AAB	56	Update Stock Levels
9	FI-AAA-009	Component AAC	475	Update Stock Levels
10	FI-AAA-010	Component AAA	119	Update Stock Levels
11	FI-AAA-011	Component AAB	868	Update Stock Levels
12	FI-AAA-012	Component AAC	456	Update Stock Levels
13	FI-AAA-013	Component AAA	53453	Update Stock Levels
14	FI-AAA-014	Component AAB	0	Update Stock Levels
15	FI-AAA-015	Component AAC	3423	Update Stock Levels
16	FI-AAA-016	Component AAA	33	Update Stock Levels
17	FI-AAA-017	Component AAB	7676	Update Stock Levels
18	FI-AAA-018	Component AAC	566	Update Stock Levels
19	FI-AAA-019	Component AAA	7543	Update Stock Levels
20	FI-AAA-020	Component AAB	23	Update Stock Levels
21	FI-AAA-021	Component AAC	345	Update Stock Levels
22	FI-AAA-022	Component AAA	111	Update Stock Levels

Figure 26: ADVENTURE Dashboard – Stock Summary (L1)

Figure 26 shows the corresponding Level 1 view for Stock or Inventory data, which would take the form of a user configurable report.

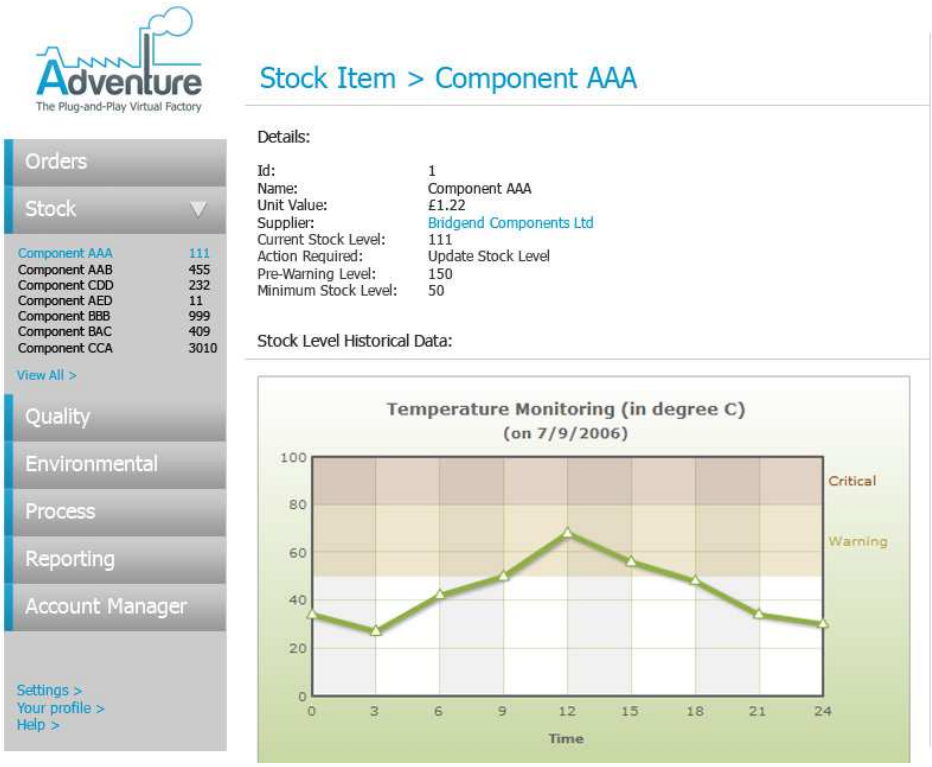


Figure 27: ADVENTURE Dashboard – Component Details (L2)

Figure 27 shows detailed information at Level 2 for a specific stock item. This would ideally show historical data relating to a specific component in order to support forecasting and trend analysis.

4.3.5 Usage of ADVENTURE components

Control 2K has specific interest in ADVENTURE's Real-time Process Monitoring component as well as in the integration of Smart Objects in order to allow their customers a holistic view on their cooperative manufacturing venture. For improving the visibility of their capabilities and products, Control 2K will use ADVENTURE's Data Provisioning and Discovery component. In order to improve the linkage of their Industreweb software platform to Cloud based services and to expand the portfolio of services that could be provided, Control 2K will make use of the ADVENTURE Cloud-based Data Storage component.

Thus, referring to Figure 1, the use case of Control 2K covers in summary at least ADVENTURE's Real-time Process Monitoring, Smart Objects Integration, and Cloud-based Data Storage.

5 Conclusion

The aim of this deliverable was to provide concrete examples for the future application of ADVENTURE within manufacturing companies. For that matter, this deliverable presented preliminary use case definitions, which have been contributed by the industry partners ABB, Azevedos and Control 2K.

In detail, each partner provided a brief summary of its current operations and processes. Furthermore, each partner outlined specific challenges and problems that arise due to insufficient ICT capabilities, and explained how ADVENTURE could help to address these issues.

The use case descriptions follow a common pattern and contain, as most important element, mocked-up user screens that constitute hands-on examples for the future application of ADVENTURE within the partner companies.

Given that the three aforementioned partners operate in different segments of the manufacturing industry, the specific focus areas of the provided use cases differ as well. However, there are some recurring patterns as to which capabilities are expected in ADVENTURE.

Most notably, all partners expect a tighter integration with third-parties, i.e., suppliers and customers, through the ADVENTURE system. In this context, most notably, ADVENTURE is expected to facilitate a more structured exchange of information. Accordingly, the system is expected to serve as primary channel of communication in the future, whereas multiple – not necessarily efficient – channels are used today. In addition, ADVENTURE is expected to provide centralized information storage and permit for the seamless aggregation of data from various sources.

Likewise, increasing the supply chain visibility is important to all involved partners. This concerns aspects such as real-time monitoring and status reporting, e.g., with respect to current buffer levels or production capacities. Receiving important status information in a timely manner is important to all business partners, because it permits proactive – rather than reactive – responses to potential problems in the supply chain.