FP7- FoF-ICT-2011.7.3 Virtual Factories and enterprises


**"Innovative end-to-end management of Dynamic Manufacturing Networks"**

# Deliverable D2.2.1

# Use Cases of the IMAGINE platform

| | |
|---|---|
| **Workpackage:** | 2 – Technology Foundation and Architecture Specification |
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# IMAGINE Project Profile

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|---|---|
| **Acronym:** | IMAGINE |
| **Title:** | Innovative End-to-end Management of Dynamic Manufacturing Networks |
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# Executive Summary

Deliverable D2.2.1 accomplishes the following primary objective:

- To define the Use Cases that describe how users will be using the integrated IMAGINE platform to execute the phases of the DMN Lifecycle specified in D1.1.2.

The defined Use Cases:

1. Capture the key functions of the IMAGINE platform.
2. Capture the key operations of the IMAGINE platform for the Analysis and Configuration, Design, Execution Management and Monitoring of Dynamic Manufacturing Networks.
3. Minimize the chance of mistakes that may occur during the transformation of user requirements, given also by non-IT experts, into system requirements, drafted by IT experts.
4. Offer the foundations for the software development that will cover the user requirements.
5. Facilitate the acceptance testing of the IMAGINE platform since they provide the user requirements, and therefore the different functions, in a pre-defined logical ordering.
6. Identify the flow of events, preconditions, post conditions and triggers along with supplementary specifications (security, identity and access controls).

This resulting deliverable will act as a foundation for the IMAGINE platform software development and testing by providing a common reference for IT experts and DMN managers. The Use Cases presented in this deliverable will be refined and improved throughout WP2.

The use cases of the IMAGINE platform that have been introduced in this deliverable are the following:

- Administration and On Boarding Process
  - A1.1 Administrator registers User
  - A1.2 Administrator edits Registered User's Roles and Rights
  - A2.1 Registered User Edit Company Data
  - A3.1 Registered User Logs In
  - A3.2 Registered User Logs Out
  - A4.1 Unregistered User Applies for Registration
  - A5.1 DMN Manager requests Certification of Supplier

- Network Analysis and Configuration
  - C1.1 DMN Manager defines the production request of a DMN network
  - C1.2 DMN Manager finds potential Supplier for a specific product/service/competency
  - C1.3 DMN manager defines KPIs of DMN network

- Network Design
  - D1.1 DMN Manager selects supplier for a specific product/service/competency

- D1.2 DMN Manager validates end to end manufacturing process
- D3.1 DMN Manager defines End-To-End manufacturing process
- D4.1 DMN Manager delegates duties to DMN Coordinators

- Network Execution Management and Monitoring
  - M1.1 DMN Manager sends manufacturing orders
  - M1.2 DMN Manager monitors status of manufacturing orders
  - M2.1 Client sends orders to DMN Manager
  - M2.2 Client monitors status of product request
  - M2.3 Client changes order to DMN Manager
  - M3.1 Supplier reports unexpected event

The description of all Use Cases can be found in Chapter 3.

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# 1 Introduction

## 1.1 Purpose and Scope

The main objective of this deliverable (D2.2.1) is to define the Use Cases that describe how users will operate the IMAGINE platform to execute the phases of the DMN lifecycle specified in T1.3.

A DMN could be described as a permanent or temporal coalition comprising production systems of geographically dispersed SMEs and/or OEMs that collaborate in a shared value-constellation to conduct joint manufacturing.

The Use Cases:

1. Capture the key functions of the IMAGINE platform.
2. Capture the key operations of the IMAGINE platform for the Analysis and Configuration, Design, Execution Management and Monitoring of Dynamic Manufacturing Networks.
3. Provide DMN managers with the capability to evaluate the consequences due to major or minor disruptions to the virtual production systems.
4. Minimize the chance of mistakes that may occur during the transformation of user requirements, given also by non-IT experts, into system requirements, drafted by IT experts.
5. Offer the foundations for the software development that will cover the user requirements.
6. Facilitate the testing of the IMAGINE platform since they provide the user requirements, and therefore the different functions, in a pre-defined logical ordering.
7. Identify the flow of events, preconditions, post conditions and triggers along with supplementary specifications (security, identity and access controls).

## 1.2 Approach for Work Package and Relation to other Work Packages and Deliverables

This deliverable is the tangible outcome of T2.1 and aims to record the required functionality that the integrated IMAGINE platform will perform in response to external requests, such as the requests of users or other systems, in a concise and semi-formal manner. Use Cases are a common approach used for the recording of user and system requirements that makes equally easy their understanding and use by both IT and non-IT experts.

In order to efficiently document the requirements for the integrated IMAGINE Platform, the Use Cases have been defined by taking into account the best practices in writing Use Cases. Use Cases are defined in a semi-structured natural language relying on a structured layout approach, and may be graphically depicted using the UML language 2.0. The structure of the Use Cases definition that has been used is described in the Annex B.

The primary inputs for this deliverable are interviews with the participating industry partners, desk research and the IMAGINE end-to-end management methodology that is specified in D1.1.2 which is the tangible output of Task 1.3.

In order to capture the Use Cases of the IMAGINE platform in a uniform layout the first step of our approach was to develop a semi-formal layout based on literature research and experience of IT oriented partners of the consortium. The layout for capturing the use cases can be found in Annex B. The second step of the approach was to develop a set of Use Cases for each living lab partner, that were defined using the predefined layout in order to capture the key user requirements in a uniform format. The defined use cases where also discussed in detail in interviews with the Living Lab partners. This process resulted in several Use Cases from all living lab partners covering a broad spectrum of different industry sectors. The Use Cases developed cover key requirements from the Aerospace and Defence industry, the Furniture Manufacturing industry, the Automotive manufacturing industry, the Engineering Sector and also from Industry Agnostic, multi-site, single factory context, manufacturing environments. The next step was to merge inputs received from the consortium into a single Use Case set for the IMAGINE platform. Finally the common set of Use Cases for the IMAGINE platform was iteratively improved and enhanced. This process is depicted in Figure 1-1: Initial Use Case Collection Process.

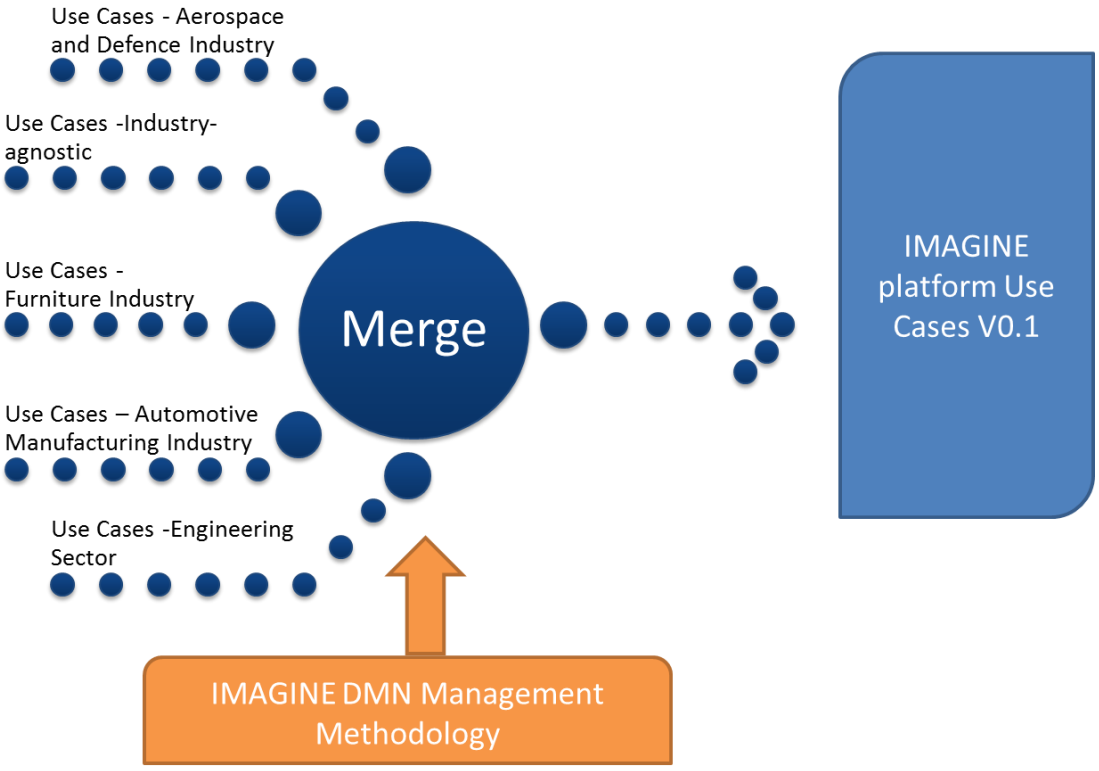



**Figure 1-1: Initial Use Case Collection Process**

The consortium iteratively converged into the single IMAGINE platform Use Cases presented in this deliverable. During this iterative process of Use Case development the common set of IMAGINE platform Use Cases was reviewed, refined and improved by all partners. The refinements, additions and improvements were merged into the IMAGINE Platform Use Cases, as can be seen in Figure 1-2. Finally the IMAGINE Platform Use Cases were validated by the end users.

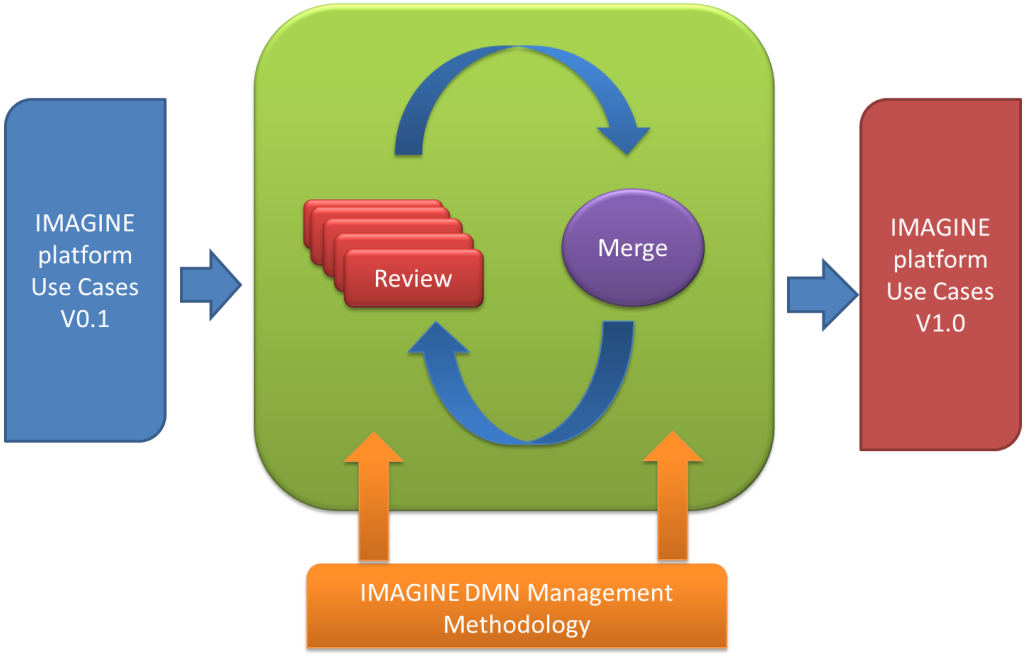



**Figure 1-2: Iterative Use Case development process**

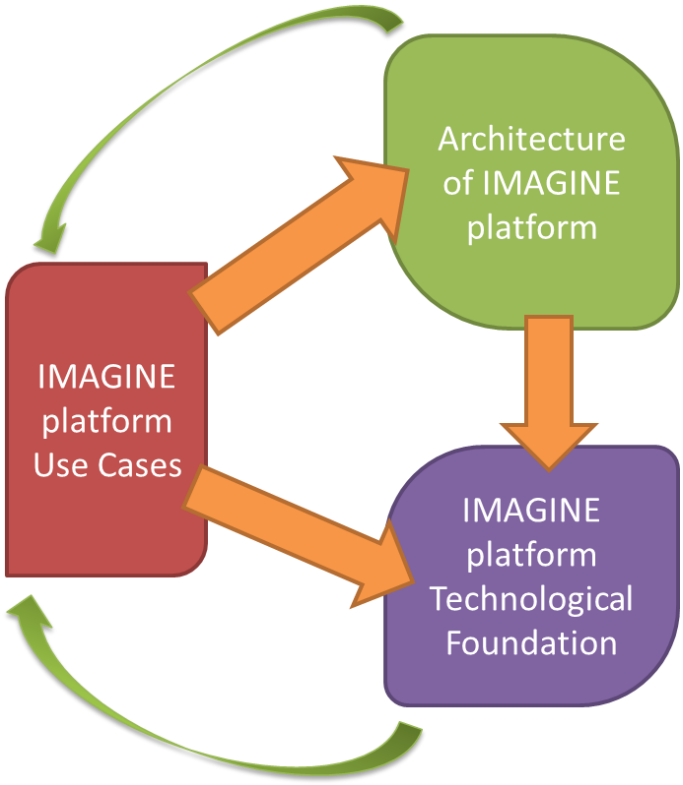



**Figure 1-3: Iterative Use Cases refinement and improvement process in WP2**

The Use Cases defined in this deliverable will be considered as an input for Tasks 2.2, Task 2.3 and Task 3.1. Tasks 2.2 and T2.3 will also iteratively refine and improve the Use Cases while at the same

time the architectural design and technological foundation developed in these tasks will be validated against the refined Use Cases (Figure 1-3).

- **Task 2.2** will define the conceptual architecture of the IMAGINE Platform based on T1.3 and T2.1. The description of the conceptual, physical and network architecture of the platform will be described in D2.2.3.
- **Task 2.3** that will develop an innovative technological foundation for the implementation of the IMAGINE Platform will also use T2.1 as an input. The developed technological foundation should be capable of bridging the conceptual level defined by the DMN lifecycle methodology of T1.3 and Use Cases of T2.1, with the technological underpinnings of the implementation of the IMAGINE. The IMAGINE platform technological foundation is the subject of D2.2.3.
- **Task 3.1** will use this deliverable to provide the detail specifications of the individual components, namely of DMN lifecycle management and IMAGINE Integration Bus, as well as of the integrated IMAGINE Platform. These specifications will be documented in D3.3.1.

## 1.3 Structure of the Document

In relation to the aforementioned, the deliverable follows a structure pertaining to the identified main sub-objectives. The Use Cases are grouped according to their relevance with the IMAGINE DMN Lifecycle and are given unique identifiers in order to facilitate future references to individual Use Cases during the development and testing phases.

Chapter 2 provides an overview of the IMAGINE platform use cases and a description of the Actors.

In Chapter 3 the IMAGINE platform Use Cases are defined. The Use Cases are grouped into four sections according to the IMAGINE DMN Lifecycle phases.

- In Section 3.1 the Use Cases that are relevant to the Administration and On Boarding process of the IMAGINE platform are defined.
- In Section 3.2 the Use Cases that are relevant to the Network Configuration phase of IMAGINE DMN Lifecycle are defined.
- In Section 3.3 the Use Cases that are relevant to the Network Design phase of IMAGINE DMN Lifecycle are defined.
- In Section 3.4 the Use Cases that are relevant to the Network Execution Management and Monitoring phase of IMAGINE DMN Lifecycle are defined.

Finally, Chapter 4 concludes the deliverable, by presenting the findings and the directions to be followed by the IMAGINE project.

# 2 IMAGINE Platform Use Cases Overview

This chapter provides an overview of the IMAGINE platform's Actors and the key Goals that each Actor aims to accomplish by using the IMAGINE platform as well as the actual Use Cases of the integrated IMAGINE platform.

## 2.1 Actors List

Actors of Use Cases are the end users of the integrated IMAGINE platform that interact with it in order to achieve certain key goals. The key goals that each Actor aims to accomplish by using the IMAGINE Platform are listed in Table 2-1. A first distinction of Actors could be in terms of their registration to the integrated IMAGINE platform. All Actors could be classified in two major classes; Registered and Unregistered Users.

**Unregistered Users** are only able to access public information (when available) and apply for registration. The information available to the public is under the direct control of each registered company. A typical company perhaps would expose general information such as contact details and products/services available. **Registered Users** are Actors that have successfully registered to the integrated IMAGINE platform and have several roles and rights that are granted to them by the **Administrator**. A Registered User may be given more than one Actor roles. The Administrator may also grant a subset of the roles and user rights available according to the needs of each partner company. All IMAGINE platform actors extend the Registered User Actor that allows them to Authenticate, log out and edit their company data.

Apart from Administrator the other Registered User subclasses are the Supplier, the DMN Manager, the Independent Certification Authority and Clients.

The **DMN Manager** is the Actor responsible for the management of a DMN network. Users in this group are able to configure, design, manage execution and monitor a DMN according to the novel IMAGINE DMN Management Methodology.

**Suppliers** are the ones who provide products/services to the DMN as well as information about them. DMN managers should be able to assign specific management roles by appointing DMN Coordinators roles among members of the DMN network. **DMN Coordinators** are members of a DMN that are given specific management roles inside the DMN. In that way the IMAGINE platform will be able to support dynamic collaborations of partners.

**Clients** are third parties interested mostly in the procurement of products or services. Clients can also search in order to find products and services as well as monitor the execution of their orders.

**Independent Certification Authorities** are third parties that are considered to be trusted and specialize in certifying Suppliers.

Since Actors represent groups of Users the IMAGINE platform will support a further breakdown of roles and rights in order to allocate efficiently company resources as well as responsibilities to the management of DMNs. For example a company may distribute the management of a large DMN to several employees by also taking into consideration their skills in order to utilize efficiently the company's human resources. This is a flexible approach that can be adopted to different company

organizational needs and at the same time scalable allowing for the management of an arbitrary number of DMNs of any size.

Table 2-1 lists the actors identified in the Use Cases as well as their respective goals in regards of using the IMAGINE platform.

**Table 2-1: Actors List**

| Actor | Key Goals |
|---|---|
| ***DMN Manager*** | ***1. Configure DMN network***<br>***a) Specify DMN product information***<br>***b) Find Potential Partners for specific material/product/service/competency***<br>***c) Filter Potential Partners according to cost, capacity, availability, trust, etc.***<br>***d) Optimize DMN partner selection***<br>***2. Design DMN network***<br>***a) Network Planning***<br>***b) End-to-End Process Design***<br>***c) Define KPIs***<br>***3. Verify a configured and designed DMN network.***<br>***4. Execute Management and Monitor DMN network***<br>***a) Track execution status of manufacturing orders***<br>***b) Track pending orders***<br>***c) Monitor KPIs***<br>***d) Reconfigure network***<br>***e) Substitute a supplier in an existing DMN.***<br>***5. Provide information regarding cost, capacity, availability, and trust for available materials/services/products that can be provided***<br>***6. Send, accept and confirm material/product/service orders***<br>***7. Be notified for pending orders***<br>***8. Be notified for problems***<br>***9. Delegate duties to DMN Coordinators*** |
| ***Supplier*** | ***1. Access information restricted to Suppliers.***<br>***2. Report problems***<br>***3. Provide information regarding cost, capacity, availability, and trust for available materials/services/products/competencies.*** |

| | |
|---|---|
| | 4. *Provide metrics and information regarding pending orders*<br>5. *Provide information regarding available products/services/materials/competencies*<br>6. *Accept and confirm material/product/service orders* |
| *DMN Coordinator* | 1. *Execute Management and Monitor DMN network*<br>a) *Track execution status of manufacturing orders*<br>b) *Track pending orders*<br>c) *Monitor KPIs*<br>d) *Reconfigure network*<br>2. *Send, accept and confirm material/product/service orders*<br>3. *Be notified for pending orders*<br>4. *Be notified for problems*<br>5. *Report problems* |
| *Unregistered User* | 1. *Access Public Information*<br>2. *Apply for registration* |
| *Registered User* | 1. *Log in*<br>2. *Access information restricted to members*<br>3. *Edit information regarding his company.*<br>4. *Log out* |
| *Administrator* | 1. *Confirm Applications for Registration*<br>2. *Registers User*<br>3. *Assigns roles and rights to Registered Users*<br>4. *Contact Registered User* |
| *Independent Certification Authority* | 1. *Receives certification request from DMN manager.*<br>2. *Evaluates Supplier.*<br>3. *Send the certificate to DMN manager.* |
| *Client* | 1. *Find Product/Service*<br>2. *Order Product/Service*<br>3. *Monitor Status of Product/Service order* |

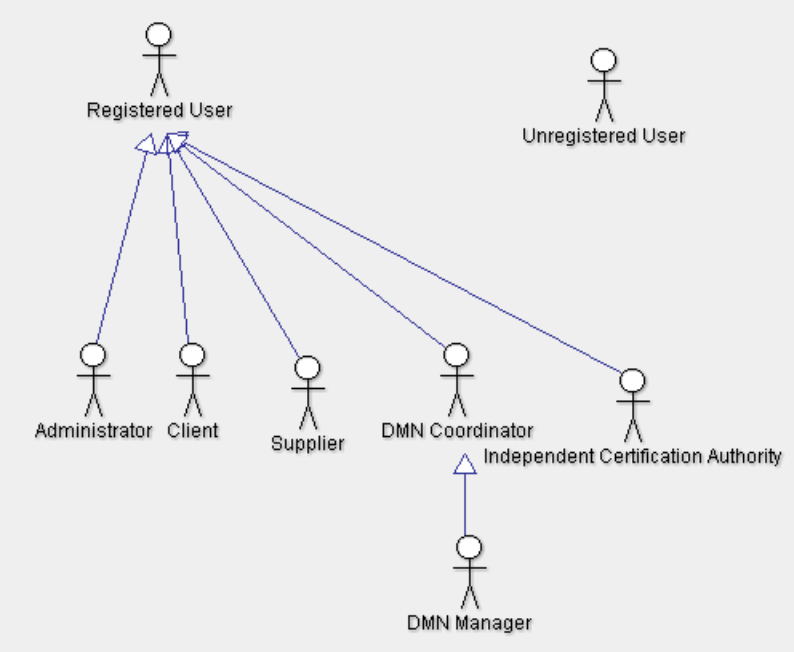



**Figure 2-1: Hierarchy of IMAGINE Platform's Actors**

## 2.2 Use Cases List

Table 2-2 lists the Use Cases of the IMAGINE platform as well as the involved actors in each Use Case. In Use Cases where several actors are involved the table indicates the primary and secondary Actors involved in each Use Case. The distinction among primary and secondary actors is the following:

- A primary actor is one having a goal requiring the assistance of the IMAGINE platform.
- A secondary actor is one from which the IMAGINE platform needs assistance to satisfy its goal.

**Table 2-2: Use Cases List**

| ***Primary Actors*** | *Use Case Id* | *Use Case Name* | *Secondary Actors* |
|---|---|---|---|
| ***Administrator*** | ***A.1.1*** | ***Administrator registers User*** | ***Registered User*** ***Unregistered User*** |
| ***Administrator*** | ***A.1.2*** | ***Administrator edits Registered User's Roles and Rights*** | ***Registered User*** |
| ***Registered User*** | ***A.2.1*** | ***Registered User Edit Company Data*** | |
| ***Registered User*** | ***A.3.1*** | ***Registered User Logs In*** | |
| ***Registered User*** | ***A.3.2*** | ***Registered User Logs Out*** | |
| ***Unregistered User*** | ***A.4.1*** | ***Unregistered User Applies for registration*** | ***Supplier*** ***Independent*** |

| | | | |
|---|---|---|---|
| | | | ***Certification Authority*** |
| ***DMN Manager*** | ***A5.1*** | **DMN manager requests Certification of Supplier** | |
| ***DMN Manager*** | ***C.1.1*** | ***DMN Manager defines the production request of a DMN network*** | |
| ***DMN Manager*** | ***C.1.2*** | ***DMN Manager finds potential Supplier for a specific product/service/competency*** | ***Supplier*** |
| ***DMN Manager*** | ***C.1.3*** | ***DMN manager defines KPIs of DMN network*** | ***Supplier*** |
| ***DMN Manager*** | ***D1.1*** | ***DMN Manager selects supplier for a specific product/service/competency*** | ***Supplier*** |
| ***DMN Manager*** | ***D.1.2*** | ***DMN Manager validates end to end manufacturing process*** | ***Supplier*** |
| ***DMN Manager*** | ***D.2.1*** | ***DMN Manager requests Certification of Supplier*** | ***Supplier*** ***Independent Certification Authority*** |
| ***DMN Manager*** | ***D3.1*** | ***DMN Manager defines End-To-End manufacturing process*** | ***Supplier*** |
| ***DMN Manager*** | ***D4.1*** | ***DMN Manager delegates duties to DMN Coordinators*** | ***DMN Coordinator*** ***Supplier*** |
| ***DMN Manager*** | ***M.1.1*** | ***DMN Manager sends manufacturing orders*** | ***Supplier*** |
| ***DMN Manager*** | ***M.1.2*** | ***DMN Manager monitors status of manufacturing orders*** | ***Supplier*** |
| ***Client*** | ***M.2.1*** | ***Client sends orders to DMN Manager*** | ***DMN Manager*** ***Supplier*** |
| ***Client*** | ***M.2.2*** | ***Client monitors status of*** | ***DMN Manager*** |

| | | | |
|---|---|---|---|
| | | ***product request*** | ***Supplier*** |
| ***Supplier*** | ***M3.1*** | ***Supplier reports unexpected event*** | ***Supplier***<br>***DMN Manager***<br>***DMN Coordinator*** |

## 2.3 Use Cases Diagram

Figure 2-2 is a UML Use Case diagram [1] of all the Use Cases of the integrated IMAGINE platform. Detailed description of all the Use Cases can be found in Chapter 3.


**Figure 2-2: Use Cases Diagram**

# 3 IMAGINE Platform Use Cases

## 3.1 Introduction

Use Cases are a standard tool in the design and development of software-based systems which is used in order to capture the intended functions that the integrated IMAGINE platform will perform in response to external requests in a clear and understandable manner.

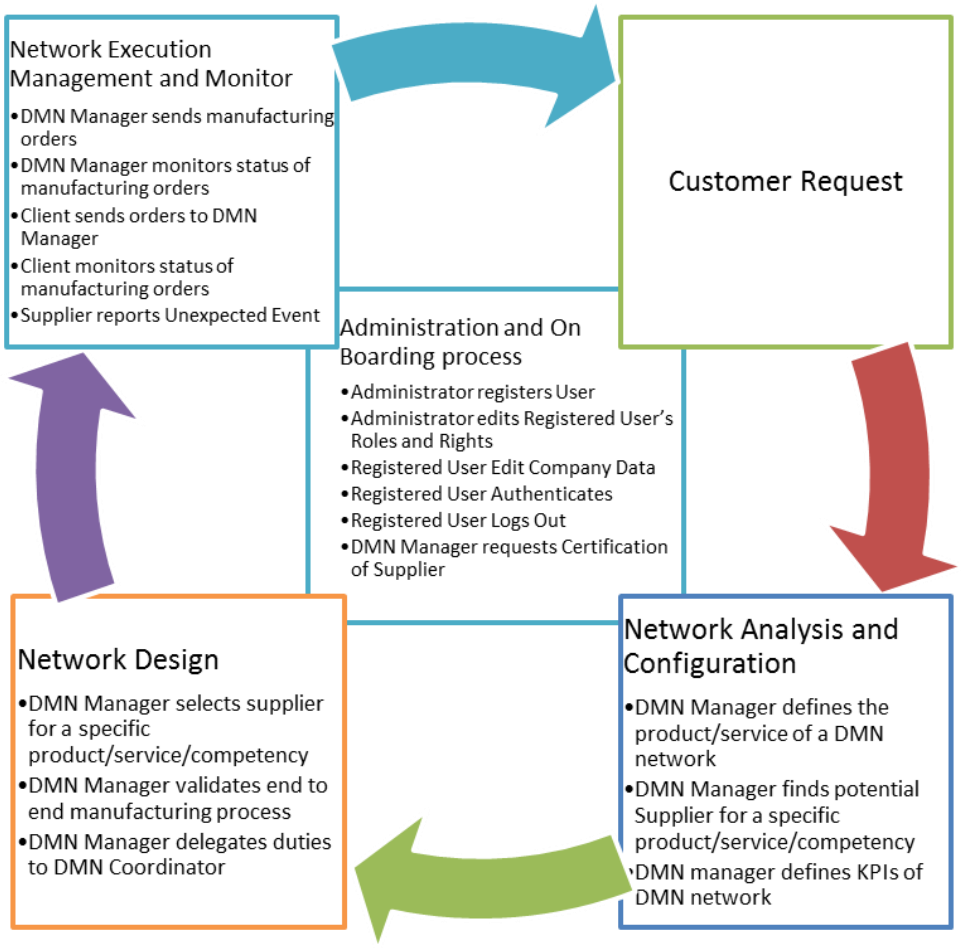
A use case defines a goal-oriented set of interactions between external actors and the system under consideration. That is, Use Cases capture who (actors) does what (interactions) with the system, for what purpose (goal). A set of use cases specifies how users may utilize the system, and thus defines the behaviour required of the system without dealing with the internal structure of the system. [2]

Use Cases are a common approach used for recording user and system requirements that facilitates their understanding and use by both IT and non-IT experts. This approach minimizes the mistakes that may occur during the transformation of user requirements (given also by non-IT experts) into system requirements (drafted by IT experts).

Use Cases will offer the foundations for the software development and testing phases of the IMAGINE platform by capturing the user requirements, and therefore the different functions of the platform. There for each identified Use Case's definition is given in a uniformly structured table and assigned a unique identifier allowing for easy future reference at the development and testing tasks.

The Use Cases of the IMAGINE platform are grouped into four sections. The first section defines supportive Use Cases of the IMAGINE platform that do not belong to the three phases of the IMAGINE Lifecycle. The following three sections provide the descriptions of IMAGINE platform Use

Cases in alignment with the IMAGINE DMN Lifecycle. The Use Cases of IMAGINE Platform are presented in Figure 3-1.




The following three sections define the main Use Cases of the IMAGINE platform grouped into the three phases of the IMAGINE Lifecycle.

- In Section 3.2 the Use Cases that are relevant to the Administration and Boarding process of the IMAGINE platform are defined.
- In Section 3.3 the Use Cases that are relevant to the Network Analysis and Configuration phase of IMAGINE DMN Lifecycle are defined.
- In Section 3.4 the Use Cases that are relevant to the Network Design phase of IMAGINE DMN Lifecycle are defined.
- In Section 3.5 the Use Cases that are relevant to the Network Execution Management and Monitoring phase of IMAGINE DMN Lifecycle are defined.

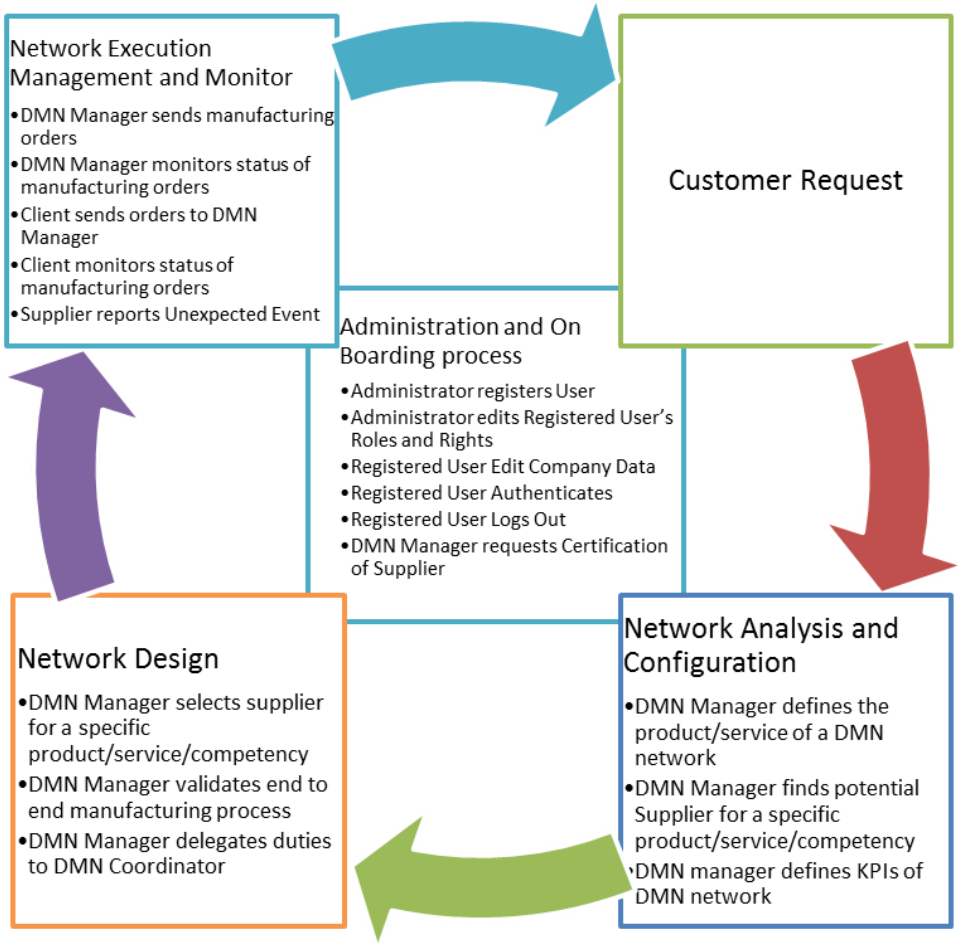



**Figure 3-1: Use Cases of IMAGINE platform and IMAGINE DMN Lifecycle phases**

## 3.2 Administration and On Boarding process

### 3.2.1 **A.1.1 Administrator registers User**

#### *3.2.1.1 Narrative Description*

The registration to IMAGINE platform requires the prior confirmation of an Administrator. An Unregistered User may have submitted a registration request that has been accepted. The Registered User Actor of the IMAGINE platform in most cases represents companies that would like to join, form or manage a Dynamic Manufacturing Network. Once an Administrator has registered a User to the integrated IMAGINE platform the Registered User is notified via mail.

#### *3.2.1.2 UML Diagram*

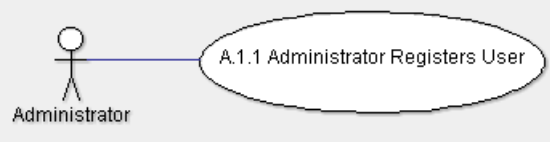



**Figure 3-2: A.1.1 Administrator registers User**

#### *3.2.1.3 Description*

**Table 3-1: A.1.1 Administrator registers User**

| | |
|---|---|
| **Use Case ID:** | **A.1.1** |
| **Use Case Name:** | Administrator registers User |
| **Primary Actor:** | 1. Administrator |
| **Secondary Actors:** | 1. Registered User<br>2. Unregistered User |
| **Description:** | Administrator registers a previously Unregistered User to the IMAGINE Platform |
| **Triggers:** | 1. An Unregistered User's registration request has been accepted |
| **Preconditions:** | 1. An Unregistered User has submitted a registration request. |
| **Postconditions:** | 1. Formerly Unregistered User is in Registered User status.<br>2. The Registered User is notified<br>3. The Registered User is able to log in the integrated Imagine Platform<br>4. The Registered User's Roles and Rights are set.<br>5. The minimum information, required by the Partner Blueprint, is specified. |
| **Flow of events:** | 1. Administrator specifies the data of the Unregistered User that is going to be registered to the IMAGINE platform<br>OR<br>1. Administrator chooses to accept the registration request of an Unregistered User that is going to be registered to the IMAGINE platform.<br>OR<br>1. Administrator imports LDAP metadata of Unregistered User.<br>2. <A.1.2 Administrator edits Registered User's Roles and Rights><br>3. IMAGINE Platform notifies the Registered User via mail. |
| **Exceptions:** | After step 1:<br>2. Administrator rejects Unregistered User.<br>3. Administrator optionally provides an explanation.<br>4. Unregistered User is notified for the rejection together with the optional explanation. |
| **Includes:** | 1. A.1.2 Administrator edits Registered User's Roles and Rights |

| | |
|---|---|
| **Priority:** | Required |
| **Frequency of Use:** | 1. Once per registration request |
| **Business Rules:** | 1. The Administrator is considered responsible for registering users in the IMAGINE platform |

### 3.2.2 A.1.2 Administrator edits Registered User's Roles and Rights

#### *3.2.2.1 Narrative Description*

IMAGINE Platform should allow the precise definition of user roles and rights so that individual users are able to perform actions according to their duties inside a company. Roles in the IMAGINE platform are granted to users taking into consideration their duties in the company. Each role is given certain rights in terms of the IMAGINE platform such as changing the company data. By assigning appropriate roles so that users can only perform actions in IMAGINE platform that are relevant with their duties. IMAGINE Platform will even allow the Administrator to define other Administrator users, possibly with less privileges that could for example administer the users of a specific company or the users of a specific company that are involved in certain DMNs. This is a flexible approach that can be adapted to different company organizational needs and at the same time scalable allowing for the management of an arbitrary number of DMNs of any size. IMAGINE platform administrator assigns Administrators inside individual companies with rights limited to the scope of their company. Roles and rights are managed individually inside a company according to company's needs. A Registered user may be regarded as one or more of the following IMAGINE Platform Actors: DMN Manager, Supplier, DMN Coordinator, Administrator, Independent Certification Authority and Client depending on the assignment of roles and rights by the Administrator.

#### *3.2.2.2 UML Diagram*


**Figure 3-3: A.1.2 Administrator edits Registered User's Roles and Rights**

#### *3.2.2.3 Description*

**Table 3-2: A.1.2 Administrator edits Registered User's Roles and Rights**

| | |
|---|---|
| **Use Case ID:** | **A.1.2** |
| **Use Case Name:** | Administrator edits Registered User's Roles and Rights |
| **Primary Actor:** | 1. Administrator |
| **Secondary Actors:** | 1. Registered User |

| | |
|---|---|
| **Description:** | Administrator specifies to the IMAGINE platform the Roles and Rights of each individual user. |
| **Triggers:** | 1. When a new Registered User is registered<br>2. When an existing Registered User responsibilities in a company change |
| **Preconditions:** | 1. Registered User exists |
| **Postconditions:** | 1. The new Roles and Rights are applied to the Registered User<br>2. The Registered User is notified about the changes |
| **Flow of events:** | 1. Administrator finds the Registered User by using the IMAGINE Platform<br>2. Administrator edits the Roles and Rights of the User<br>3. Changes are applied to the Roles and Rights of the User<br>4. User is notified about the changes |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. At least once per Registered User<br>2. Several times throughout a DMN lifecycle |
| **Business Rules:** | 1. Administrator can only grant roles and rights that he has.<br>2. Administrator cannot grant roles and rights that are not granted to him.<br>3. Roles and rights can be assigned per Company and per DMN network.<br>4. The principle of least privilege should be applied while allocating roles. |

### 3.2.3 **A.2.1 Registered User edits company data**

#### *3.2.3.1 Narrative Description*

Registered Users of the IMAGINE Platform should be able to edit and update information regarding their company as required by the IMAGINE DMN Lifecycle methodology. The information specified include what is required according to the IMAGINE blueprints' model. In order for a Registered User to edit or update information he should have been previously granted a role that provides adequate rights to do so. IMAGINE Platform should also allow a company to specify which information is confidential or public and restrict access to information accordingly.

#### *3.2.3.2 UML Diagram*


**Figure 3-4: A.2.1 Registered User edits company data**

#### *3.2.3.3 Description*

**Table 3-3: A.2.1 Registered User edits company data**

| | |
|---|---|
| **Use Case ID:** | **A.2.1** |
| **Use Case Name:** | Registered User edits company data |
| **Primary Actor:** | 1. Registered User |
| **Secondary Actors:** | None |
| **Description:** | Registered User are able to edit their company data that is required as well as to specify the level of confidentiality according to the IMAGINE DMN Lifecycle Methodology |
| **Triggers:** | 1. When company data change<br>2. When a company is registered to IMAGINE platform |
| **Preconditions:** | 1. Registered User exists |
| **Postconditions:** | 1. The company data specified in partner Blueprint have been updated.<br>2. The confidentiality of provided information is specified. |
| **Flow of events:** | 1. Register User provides company information to fill partner blueprint<br>2. Register User specifies the level of confidentiality of provided information |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. Often |
| **Business Rules:** | None |

### 3.2.4 **A.3.1 Registered User Logs In**

#### *3.2.4.1 Narrative Description*

IMAGINE platform requires from Registered Users to authenticate by using specific credentials. Authentication is required prior to the execution of all Use Cases involving Actors other than the Unregistered User, for this reason it is omitted for simplicity from all Use Cases. The prerequisite of authentication of all registered users also allows the platform to enforce the roles and rights imposed to each Registered User by the Administrator.

#### *3.2.4.2 UML Diagram*

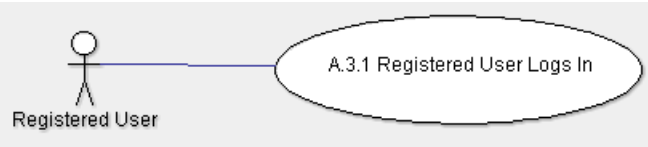


**Figure 3-5: A.3.1 Registered User Logs In**

*3.2.4.3 Description*

**Table 3-4: A.3.1 Registered User Logs In**

| | |
|---|---|
| **Use Case ID:** | **A.3.1** |
| **Use Case Name:** | Registered User logs In |
| **Primary Actor:** | 1. Registered User |
| **Secondary Actors:** | None |
| **Description:** | Registered User uses his credentials to login and authenticate himself. |
| **Triggers:** | 1. Prior to any Use Case execution of the IMAGINE Platform apart from Use Cases where primary actor is the Unregistered User |
| **Preconditions:** | 1. Registered User has valid credentials<br>2. Registered User is logged out |
| **Postconditions:** | 1. Registered User is able to execute the functionalities that are supported according to his Role and Rights. |
| **Flow of events:** | 1. IMAGINE Platform requires authentication<br>2. Registered User provides his credentials.<br>3. IMAGINE Platform confirms authentication<br>4. Registered User can access the integrated IMAGINE Platform functionalities according to his role. |
| **Exceptions:** | After step 2:<br>3. If wrong credentials are specified IMAGINE platform rejects authentication. |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. Prior to every use of the IMAGINE Platform |
| **Business Rules:** | 1. After a predefined period of time a Registered User may be required to re-authenticate.<br>2. Authentication should be secured.<br>3. Since an Actor may be a system/application or a user different authentications mechanisms may exist. |

### 3.2.5 **A.3.2 Registered User Logs Out**

*3.2.5.1 Narrative Description*

Registered Users should logout as soon as they have finished using the integrated IMAGINE platform to prevent unauthorized usage of the platform.

### *3.2.5.2 UML Diagram*

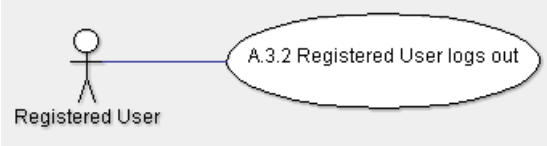



**Figure 3-6: A3.2 Registered User Logs Out**

### *3.2.5.3 Description*

**Table 3-5: A.3.2 Registered User Logs Out**

| **Use Case ID:** | **A.3.2** |
|---|---|
| **Use Case Name:** | Registered User logs out |
| **Primary Actor:** | 1. Registered User |
| **Secondary Actors:** | None |
| **Description:** | Registered User Logs out ending his session with IMAGINE platform. |
| **Triggers:** | 1. When the Registered User decides his use session of the integrated IMAGINE Platform is over. |
| **Preconditions:** | 1. Registered User is logged in |
| **Postconditions:** | 2. Registered User cannot continue using the integrated IMAGINE platform unless credentials are supplied again. |
| **Flow of events:** | 1. Registered user chooses to logout<br>2. IMAGINE Platform notifies the Registered User that he is logged out. |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. After every usage of the integrated IMAGINE Platform |
| **Business Rules:** | None |

## 3.2.6 **A.4.1 Unregistered User Applies for Registration**

### *3.2.6.1 Narrative Description*

IMAGINE platform requires registration to

#### *3.2.6.2 UML Diagram*

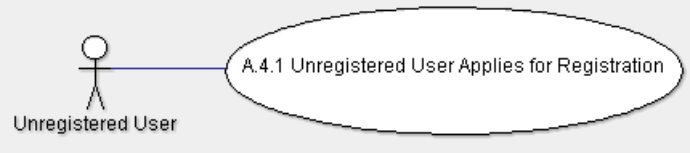



**Figure 3-7: A.4.1 Unregistered User Applies for Registration**

#### *3.2.6.3 Description*

**Table 3-6: A.4.1 Unregistered User Applies for Registration**

| | |
|---|---|
| **Use Case ID:** | **A.4.1** |
| **Use Case Name:** | Unregistered User Applies for Registration |
| **Primary Actor:** | 1. Unregistered User |
| **Secondary Actors:** | None |
| **Description:** | Unregistered User Applies for Registration to IMAGINE Platform. |
| **Triggers:** | 1. An Unregistered User's registration request has been accepted or Administrator decides to register a Registered User |
| **Preconditions:** | 1. Unregistered User does not exist in the system. |
| **Postconditions:** | 1. A registration is pending for approval for Unregistered User<br>2. Information required for registration is available |
| **Flow of events:** | 1. Unregistered User submits registration request to IMAGINE platform providing required information<br>2. IMAGINE Platform notifies Unregistered User that registration submission has been successfully submitted |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | Unspecified |
| **Business Rules:** | 1. A request for registration may be later rejected or approved based on Administrators judgement. |

### 3.2.7 **A5.1 DMN manager requests Certification of Supplier**

#### *3.2.7.1 Narrative Description*

In case certifications are required from partners to be selected in a DMN network the integrated IMAGINE Platform allows to the DMN Manager to request from an Independent Certification Authority

to certify a specific Supplier. The Supplier in question should also provide consent for such certification. When the certification process is over the Independent Certification Authority publishes the result to the DMN Manager that has requested it, as well as to the Supplier.

#### *3.2.7.2 UML Diagram*

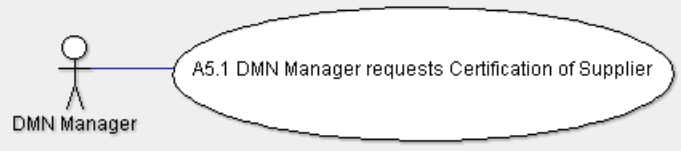



**Figure 3-8: A5.1 DMN manager requests Certification of Supplier**

#### *3.2.7.3 Description*

**Table 3-7: A5.1 DMN manager requests Certification of Supplier**

| **Use Case ID:** | **A5.1** |
|---|---|
| **Use Case Name:** | DMN manager requests Certification of Supplier |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier<br>2. Independent Certification Authority |
| **Description:** | A DMN Manager may request an Independent Certification Authority to certify a particular Supplier. |
| **Triggers:** | 1. When DMN Manager decides that Certification is required. |
| **Preconditions:** | 1. There is a Certification Authority able to certify the Supplier. |
| **Postconditions:** | 1. The Independent Certification Authority has agreed to Certify a specific Supplier<br>2. The Supplier has accepted to be certified by a specific Independent Certification Authority. |
| **Flow of events:** | 1. The DMN Manager specifies a Supplier, a certification, an independent Certification Authority and any other information needed.<br>2. IMAGINE Platform notifies the Supplier for the request of DMN Manager to certify the Supplier, the required certification, the Independent Certification Authority and any other information needed.<br>3. The Supplier confirms the request for certification<br>4. IMAGINE Platform notifies the Independent Certification Authority for the request of DMN Manager to certify the Supplier, the required certification and any other information needed.<br>5. The Independent Certification Authority Confirms the request<br>6. Independent Certification Authority submits the result of certification process.<br>7. IMAGINE Platform notifies DMN Manager about the result<br>8. IMAGINE Platform notifies Supplier about the result<br>9. Supplier Approves the result |

| | |
|---|---|
| | 10. DMN manager can see approved publication of the result in supplier profile<br>11. IMAGINE Platform credits Independent certification authority<br>12. IMAGINE Platform notifies DMN Manager that the certification is pending. |
| **Exceptions:** | After step 1:<br>1. If Supplier rejects the request for certification the Use Case is terminated and DMN Manager is informed.<br>After step 4:<br>5. If Independent Certification Authority rejects the request for certification the Use Case is terminated and DMN Manager is informed.<br>After step 9:<br>10. If Supplier does not approve the result then DMN Manager cannot see it published, but he is notified that Supplier rejected it. |
| **Includes:** | None |
| **Priority:** | Optional |
| **Frequency of Use:** | 1. When certification is required. |
| **Business Rules:** | None |

## 3.3 Network Analysis and Configuration

### 3.3.1 **C1.1** ***DMN Manager defines the production request of a DMN network***

#### *3.3.1.1 Narrative Description*

DMN Manager should be able to define in the IMAGINE Platform the product or service is to be manufactured/provided in a DMN. The description includes the processes, services and competencies required in order to produce the requested product/service. This description will be the basis of the DMN network configuration as partners that provide the required services will be identified by the IMAGINE platform. Information regarding the product/ service that is going to be provided is captured in the IMAGINE product blueprint as specified in IMAGINE DMN Management methodology.

#### *3.3.1.2 UML Use Case Diagram*

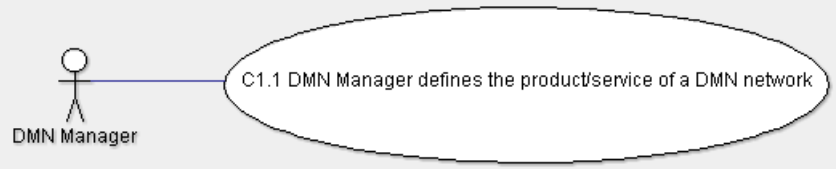



**Figure 3-9: C1.1 DMN Manager defines the production request of a DMN network**

#### *3.3.1.3 Description*

**Table 3-8: C1.1 DMN Manager defines the production request of a DMN network**

| Use Case ID: | C1.1 |
|---|---|
| Use Case Name: | DMN Manager defines the production request for a DMN network |
| Primary Actor: | 1. DMN Manager |
| Secondary Actors: | 1. None |
| Description: | DMN Manager defines the production request which is the product or service that will be produced by the DMN. |
| Triggers: | 1. DMN Manager wants to instantiate a DMN to provide a specific product/service<br>2. DMN Manager wants to modify the product/service that is being produced in a DMN |
| Preconditions: | 1. The product/service the DMN manager wants to provide is known<br>2. The processes, services and competencies required to provide the product/service are known to the DMN Manager |
| Postconditions: | 1. The information regarding the overall manufacturing process is available to the IMAGINE Platform and is stored in the Product Blueprint. |
| Flow of events: | 1. DMN manager provides the manufacturing process in terms of needed products, services and competencies in order to deliver the product/service to the IMAGINE platform. |
| Exceptions: | None |
| Includes: | None |
| Priority: | Required |
| Frequency of Use: | 1. Arbitrary |
| Business Rules: | 1. There is a standard description for every process, service and competency involved according to the IMAGINE manufacturing blueprint model.<br>2. The specifics of the information provided are described in the IMAGINE Product Blueprint. |

### 3.3.2 **C1.2** ***DMN manager finds potential suppliers for a specific product/service/competency***

#### *3.3.2.1 Narrative Description*

DMN Manager should be able to find the potential Suppliers for a specific product/service required by the overall manufacturing process. Potential suppliers retrieved by the IMAGINE Platform in the Partner Blueprints should match the product/service definition and other constraints like schedule, cost and quality requirements that are provided in the Product Blueprint. In order for a potential supplier to be identified the definition of the product/service should match the competencies of this supplier. In case no supplier is able to provide a required sub-component of the MBOM the IMAGINE platform should notify the DMN Manager so that he can take appropriate actions. There is also the case that there are potential suppliers available for that product/service but some other criteria are

not met, such as the cost, schedule or quality of the supplier. When a situation like this occurs the IMAGINE platform should notify the DMN Manager so that he can take appropriate actions. For example he could change the schedule or use a more expensive supplier than initially anticipated. IMAGINE platform need also provide supplementary information to the DMN Manager indicating the degree that potential partners have met the applied criteria as well as their comparative ranking. In this way the fitness of each potential partner is assessed.

#### *3.3.2.2 UML Diagram*

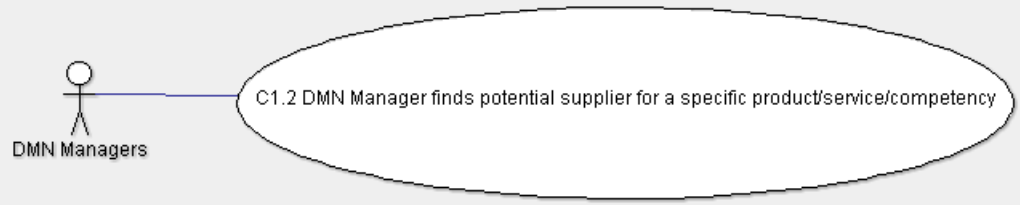



**Figure 3-10: C1.2 DMN manager finds potential supplier for a specific product/service/competency**

#### *3.3.2.3 Description*

**Table 3-9: C1.2 DMN manager finds potential supplier for a specific product/service/competency**

| | |
|---|---|
| **Use Case ID:** | **C1.2** |
| **Use Case Name:** | DMN manager finds potential supplier for a specific product/service/competency |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier |
| **Description:** | Given a specific product, service or competency the DMN Manager searches for the potential suppliers registered in the IMAGINE platform. |
| **Triggers:** | 1. A new DMN is being formed and DMN Manager is looking for suppliers.<br>2. An existing DMN network is reconfigured<br>3. DMN manager explores available suppliers network to identify business opportunities. |
| **Preconditions:** | 1. The product/service required is known.<br>2. The information required to perform the search is provided by the potential partners. |
| **Postconditions:** | 1. A list of potential suppliers is identified. |
| **Flow of events:** | 1. DMN manager provides the details regarding the required product, service or competency to the IMAGINE platform<br>2. DMN manager provides the constraints regarding schedule, cost, quality etc to the IMAGINE platform<br>3. The IMAGINE platform finds potential suppliers<br>4. Potential suppliers are presented to the DMN manager.<br>5. Detailed Information regarding the potential supplier is presented to the DMN Manager. |

| | |
|---|---|
| **Exceptions:** | After step 1:<br>1. If no partner is able to supply a required subcomponent of the MBOM then an empty list of potential suppliers is returned.<br>After step 2:<br>2. If there are partners that can supply the required product/service according to their competencies but do not meet other constraints such as schedule, cost, quality, etc. IMAGINE platform notifies the DMN Manager. |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. Multiple times at the configuration/design of a network<br>2. Possibly multiple times at the phase of Monitoring and Govern. |
| **Business Rules:** | 1. The matching between suppliers' competencies and required product/service is based on the standard descriptions of the partner and product blueprints.<br>2. The detailed information presented to the DMN Manager allow for the visualization of the achieved matching of potential suppliers with the supplied criteria. |

### 3.3.3 **C1.3 *DMN manager defines KPIs for a DMN network***

#### *3.3.3.1 Narrative Description*

DMN Manager should be able to define the KPIs of a DMN network in order to maintain precise management control of mission-critical information for key manufacturing and production parameters. KPIs are defined against the five SCOR levels as described in the IMAGINE methodology. According to IMAGINE DMN Management methodology information regarding KPIs is stored inside Quality Blueprint.

#### *3.3.3.2 UML Diagram*

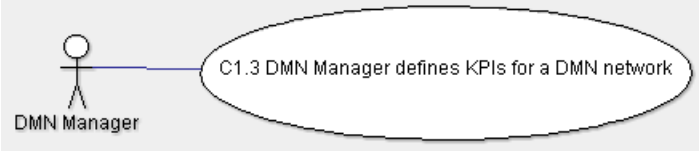



**Figure 3-11: C1.3 DMN manager defines KPIs for a DMN network**

#### *3.3.3.3 Description*

**Table 3-10: C1.3 DMN manager defines KPIs for a DMN network**

| | |
|---|---|
| **Use Case ID:** | **C1.3** |
| **Use Case Name:** | DMN manager defines KPIs for a DMN network |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | None |

| | |
|---|---|
| **Description:** | DMN manager defines the KPIs regarding a specific DMN Network. |
| **Triggers:** | 1. A new DMN is being formed.<br>2. A specific performance anomaly occurs multiple times in an existing DMN. |
| **Preconditions:** | 1. Appropriate KPIs have been identified |
| **Postconditions:** | 1. KPIs of the DMN network are defined.<br>2. KPIs are stored in the quality blueprint. |
| **Flow of events:** | 1. DMN manager defines the KPIs of the DMN network |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. Multiple times at the configuration/design of a network<br>1. During |
| **Business Rules:** | None |

## 3.4 Network Design

### 3.4.1 D1.1 DMN Manager selects supplier for a specific product/service/competency

#### *3.4.1.1 Narrative Description*

Given a list of potential Suppliers for a specific product/service the DMN Manager should be able to use the IMAGINE platform to assign specific Suppliers for each product/service required for the end product/service of the DMN. DMN manager will be able to iteratively define criteria to the IMAGINE platform until a satisfactory decision has been made. The IMAGINE platform should provide decision support information that assists the DMN Manager in selecting appropriate suppliers.

#### *3.4.1.2 UML Diagram*

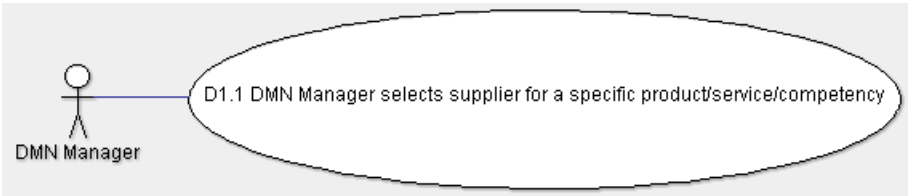



**Figure 3-12: D1.1 DMN Manager selects supplier for a specific product/service/competency**

#### *3.4.1.3 Description*

**Table 3-11: D1.1 DMN Manager selects supplier for a specific product/service/competency**

| | |
|---|---|
| **Use Case ID:** | **D1.1** |
| **Use Case Name:** | DMN Manager selects supplier for a specific product/service/competency |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier |
| **Description:** | DMN Manager is assisted by the IMAGINE platform in finding a Supplier for a specific product/service/competency that best matches his criteria. |
| **Triggers:** | 1. A Supplier of an existing DMN needs to be replaced.<br>1. A new DMN needs a supplier for a specific product/service/competency. |
| **Preconditions:** | 1. More than one potential supplier is able to provide the specified product/service/competency.<br>2. DMN manager is currently working on a specific DMN network existing or under formation. |
| **Postconditions:** | 1. A specific supplier is chosen for a specific product/service/competency in a specific DMN network.<br>2. These relations are captured to the end-to-end blueprint and the manufacturing blueprint. |
| **Flow of events:** | 3. DMN manager selects criteria for choosing partner<br>4. The IMAGINE platform provides a set of Suppliers that satisfy the criteria<br>5. The IMAGINE platform provides fitness assessment/ decision support information to DMN Manager.<br>6. DMN manager confirms the choice or goes to step 1<br>7. The IMAGINE platform assigns the chosen Supplier to the DMN network. |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | Multiple times at the Design lifecycle phase of the DMN |
| **Business Rules:** | None |

### 3.4.2 D1.2 DMN manager validates end to end manufacturing process

#### *3.4.2.1 Narrative Description*

A DMN Manager should be able to validate an end to end manufacturing process by using the IMAGINE platform. The IMAGINE platform will be able to validate an end to end manufacturing process for a DMN network and provide a report displaying the required feedback. The validation will take into consideration all the required information acquired from Suppliers. The DMN will then be simulated taking into consideration alternative realistic scenarios in order to detect potential faults or anomalies. Evaluation reports will allow the DMN Manager to validate and possibly compare different DMNs configuration and design for the same product or service and allow him to take appropriate corrective actions at an early stage. If some Suppliers are unable to provide the required information for the validation to be completed the IMAGINE platform will inform the DMN Manager also showing him which Suppliers did not provide information.

#### *3.4.2.2 UML Diagram*


**Figure 3-13: D1.2 DMN manager validates end to end manufacturing process**

#### *3.4.2.3 Description*

**Table 3-12: D1.2 DMN manager validates end to end manufacturing process**

| | |
|---|---|
| **Use Case ID:** | **D1.2** |
| **Use Case Name:** | DMN manager validates end to end manufacturing process |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier |
| **Description:** | IMAGINE platform provides a validation report for a DMN. |
| **Triggers:** | 1. A reconfigured DMN needs to be verified.<br>2. A new DMN design needs to be verified. |
| **Preconditions:** | 1. The end to end manufacturing process has been defined<br>2. Suppliers have been selected.<br>3. Sufficient information about the involved Suppliers is available |
| **Postconditions:** | 1. An validation report of the DMN is available for the DMN manager |
| **Flow of events:** | 1. DMN manager selects to validate a DMN network<br>2. IMAGINE platform presents available options.<br>3. DMN manager configures available options and starts validation<br>4. IMAGINE platform requests information from Suppliers<br>5. Suppliers provide required information to IMAGINE Platform |

| | |
|---|---|
| | 6. IMAGINE platform presents the validation report to the DMN manager |
| **Exceptions:** | 1. After step 4:<br>1. If a Supplier cannot provide required information validation report cannot be provided.<br>2. The Supplier(s) that cannot provide the required information are shown to the DMN manager by the IMAGINE platform. |
| **Includes:** | None |
| **Priority:** | Intermediate |
| **Frequency of Use:** | 1. At least once at the phase of the Design and Configuration/Reconfiguration of the network. |
| **Business Rules:** | Although Partner Blueprint contains all of the information required IMAGINE platform can also support real time dynamic information that may be requested from Suppliers in order to validate the end-to-end manufacturing process. |

### 3.4.3 D3.1 DMN Manager delegates duties to DMN Coordinators

#### *3.4.3.1 Narrative Description*

Dynamic Manufacturing Networks should be efficiently managed to allow for effective collaboration. In certain cases the DMN Manager should be able to delegate some of their duties to other members of the DMN network allowing them to manage certain parts of the DMN. The principle of least privilege should be applied to ensure that each member of the DMN network is never granted roles that provide more than the required rights to successfully complete its part. To ensure the previously mentioned principle, while addressing the evolution of collaboration, this Use Case can also take place during the Network Management and Execution phase of the DMN Lifecycle.

#### *3.4.3.2 UML Diagram*


**Figure 3-14: D3.1 DMN Manager delegates duties to DMN Coordinators**

#### *3.4.3.3 Description*

**Table 3-13: D3.1 DMN Manager delegates duties to DMN Coordinators**

| **Use Case ID:** | **D3.1** |
|---|---|
| **Use Case Name:** | DMN Manager delegates duties to DMN Coordinators |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. DMN Coordinator<br>2. Supplier |

| | |
|---|---|
| **Description:** | DMN Manager delegates duties to DMN Managers by assigning them specific roles. |
| **Triggers:** | 1. During network design phase of DMN<br>2. A need to change delegation of duties arises during Network Execution Management and Monitoring phase of DMN. |
| **Preconditions:** | 1. Supplier has been selected for a DMN. |
| **Postconditions:** | 1. DMN Coordinators have been appointed for a specific DMN.<br>2. Duties of DMN Manager have been delegated accordingly for a specific DMN. |
| **Flow of events:** | 1. DMN Manager selects DMN Supplier<br>2. DMN Manager assigns roles to DMN Supplier<br>3. IMAGINE Platform notifies DMN about the new roles |
| **Exceptions:** | None |
| **Includes:** | None |
| **Priority:** | Intermediate |
| **Frequency of Use:** | Not very frequent. |
| **Business Rules:** | 1. The principle of least privilege should be applied while allocating roles. |

### 3.4.4 **D4.1 DMN Manager defines End-To-End manufacturing process**

#### *3.4.4.1 Narrative Description*

The DMN Manager is able to define the end-to-end manufacturing process of a DMN so that a DMN is actually capable of fulfilling the specified production request. IMAGINE platform will support the design phase of the DMN Management Methodology by allowing the specification of the detailed orchestration and choreography levels that guarantee complex requirements fulfilment, such that those related to non-functional properties, as presented in IMAGINE DMN management methodology. The design of the End-To-End process will be an iterative process for the definition of:

1. Workflow
2. Information flow
3. Physical flow

Physical flow could be a material flow or a digital artefact flow as in the case of virtual products.

The information related to this Use Case is stored in the end-to-end process blueprint and quality blueprint and are directly linked to the product and partner blueprint.

### 3.4.4.2 UML Diagram

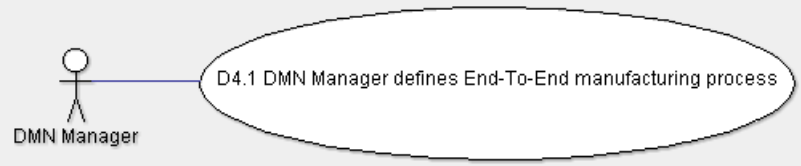



**Figure 3-15: D4.1 DMN Manager defines End-To-End manufacturing process**

### 3.4.4.3 Description

**Table 3-14: D4.1 DMN Manager defines End-To-End manufacturing process**

| **Use Case ID:** | **D4.1** |
|---|---|
| **Use Case Name:** | DMN Manager defines End-To-End manufacturing process |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier |
| **Description:** | DMN Manager designs the End-To-End manufacturing process that the DMN will follow in order to complete the production request. |
| **Triggers:** | 1. A new DMN network is designed.<br>2. An existing DMN network is re-designed. |
| **Preconditions:** | 1. DMN Network has been analysed and configured.<br>2. One or more Suppliers have been selected for each product/service/competency needed.<br>3. DMN manager is currently working on a specific DMN network existing or under formation. |
| **Postconditions:** | 1. The end-to-end process of the DMN is defined.<br>2. Information is captured in the IMAGINE Manufacturing blueprint model. |
| **Flow of events:** | 1. DMN Manager does the following until the end-to-end manufacturing process is fully designed:<br>2. DMN Manager assigns the subcomponents and services of the product blueprint to Suppliers<br>3. DMN Manager defines workflow in the DMN<br>4. DMN Manager defines information flow in the DMN<br>5. DMN Manager defines physical flow in the DMN<br>6. DMN Manager confirms to the IMAGINE Platform that design of the workflow, information flow, physical flow and order flow is completed<br>7. IMAGINE platform requests confirmation from Suppliers for the workflow, information flow, physical flow and order flow.<br>8. IMAGINE Suppliers confirm the workflow, information flow, physical flow and order flow.<br>9. IMAGINE platform notifies supplier that Suppliers have confirmed the workflow, information flow, physical flow and order flow. |
| **Exceptions:** | 1. After step 7:<br>8. If a Supplier does not confirm the workflow, information flow, physical |

| | |
|---|---|
| | flow or order flow IMAGINE Platform notifies DMN Manager. |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. Multiple times at the Design lifecycle phase of the DMN. |
| **Business Rules:** | None |

## 3.5 Network Execution Management and Monitoring

### 3.5.1 M1.1 DMN Manager sends manufacturing orders

#### *3.5.1.1 Narrative Description*

Once a DMN has been configured and designed the DMN Manager is capable of sending product/service orders via the integrated IMAGINE platform. Given the end-to-end process design the IMAGINE platform is able to send the appropriate orders to relevant Suppliers as well as changing the given orders. The IMAGINE platform confirms to the DMN manager that the order has been successfully entered when all Suppliers have confirmed the orders. In case a Supplier rejects an order or is unable to confirm an order IMAGINE platform will notify the DMN manager in order to take appropriate action.

After an order has been successfully entered and confirmed by all Suppliers the DMN Manager is able to track the overall process of the order as well as the orders send to each Supplier.

#### *3.5.1.2 UML Diagram*


**Figure 3-16: M1.1 DMN Manager sends manufacturing orders**

#### *3.5.1.3 Description*

**Table 3-15: M1.1 DMN Manager sends manufacturing orders**

| **Use Case ID:** | **M1.1** |
|---|---|
| **Use Case Name:** | DMN Manager sends manufacturing orders |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier<br>2. DMN Coordinator |
| **Description:** | DMN Manager sends orders to Suppliers and DMN Coordinators by using the IMAGINE Platform |

| | |
|---|---|
| **Triggers:** | 1. A product/service needs to be provided by a DMN.<br>2. An order for a product/service to a DMN needs to be changed. |
| **Preconditions:** | 1. DMN network has been designed, configured, validated and deployed. |
| **Postconditions:** | 1. Orders have been sent to DMN Network members (product/service suppliers)<br>2. Orders can be monitored. |
| **Flow of events:** | 1. DMN Manager inputs the order to the IMAGINE platform.<br>2. IMAGINE platform sends appropriate orders to the Suppliers and DMN Coordinators<br>3. Suppliers and DMN Coordinators confirm received orders to IMAGINE platform.<br>4. IMAGINE platform sends confirmation to DMN Manager. |
| **Exceptions:** | 1. After step 2:<br>3. If a Supplier cannot confirm or rejects an order the IMAGINE platform notifies the DMN manager. |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | None |
| **Business Rules:** | None |

### 3.5.2 M1.2 DMN Manager monitors status of manufacturing orders

#### *3.5.2.1 Narrative Description*

Once an order has been placed to a DMN the DMN Manager is able to monitor the overall progress of the order through the integrated IMAGINE Platform. IMAGINE Platform is able to present the overall progress as well as the progress of the orders to each Supplier. The monitoring process of the IMAGINE platform relies on the ability of Supplier to provide information so IMAGINE platform is able to notify the DMN Manager when a Supplier is unable to provide information regarding the pending order. Information provided include the updated KPIs that have been defined in use case C1.3 *DMN manager defines KPIs for a DMN network*.

#### *3.5.2.2 UML Diagram*

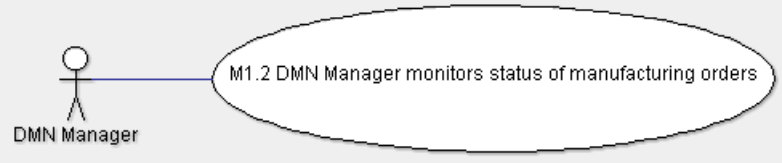



**Figure 3-17: M1.2 DMN Manager monitors status of manufacturing orders**

#### *3.5.2.3 Description*

**Table 3-16: M1.2 DMN Manager monitors status of manufacturing orders**

| **Use Case ID:** | **M1.2** |
|---|---|
| **Use Case Name:** | DMN Manager monitors status of manufacturing orders |
| **Primary Actor:** | 1. DMN Manager |
| **Secondary Actors:** | 1. Supplier |
| **Description:** | DMN Manager uses the IMAGINE platform to monitor the status of previously placed manufacturing orders. |
| **Triggers:** | 1. Arbitrary |
| **Preconditions:** | 1. Orders have been sent to the DMN network |
| **Postconditions:** | 1. The DMN manager has been informed about the current status of the manufacturing orders |
| **Flow of events:** | 1. DMN Manager specifies an order to a DMN network to the IMAGINE platform for which he needs update<br>2. IMAGINE platform requires information from Suppliers<br>3. Suppliers send required data to IMAGINE platform<br>4. IMAGINE platform presents order status to DMN manager<br>5. IMAGINE platform presents DMN KPIs to DMN manager |
| **Exceptions:** | After step 2:<br>3. If a Supplier is not able to send the required data IMAGINE platform informs the DMN manager accordingly. |
| **Includes:** | None |
| **Priority:** | Required |
| **Frequency of Use:** | 1. Several times a week |
| **Business Rules:** | None |

### 3.5.3 **M2.1 *Client sends orders to DMN Manager***

#### *3.5.3.1 Narrative Description*

IMAGINE platform allow Clients to give orders to DMN Managers which in turn are responsible for the Configuration, Design, Monitor and Govern of DMN to supply the required product/service.

#### 3.5.3.2 UML Diagram

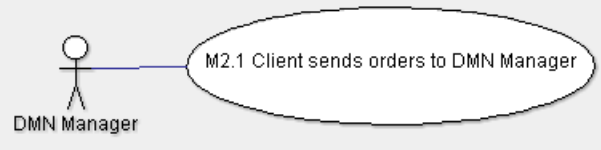



**Figure 3-18: M2.1 Client sends orders to DMN Manager**

#### 3.5.3.3 Description

**Table 3-17: M2.1 Client sends orders to DMN Manager**

| **Use Case ID:** | **M2.1** |
|---|---|
| **Use Case Name:** | Client sends orders to DMN Manager |
| **Primary Actor:** | 1. Client |
| **Secondary Actors:** | 1. DMN Manager<br>2. DMN Coordinator<br>3. Supplier |
| **Description:** | Clients send an order to DMN Manager |
| **Triggers:** | 1. At will. |
| **Preconditions:** | 1. None |
| **Postconditions:** | 1. The order is confirmed by the DMN Manager, DMN Coordinators and the Suppliers<br>2. The client is notified that the order has been accepted. |
| **Flow of events:** | 1. Client specifies a product/service request to the IMAGINE platform.<br>2. IMAGINE platform sends the order to the appropriate DMN Manager.<br>3. <C1.1 DMN Manager defines the product/service of a DMN network><br>4. <C1.2 DMN Manager finds potential supplier for a specific product/service><br>5. <D1.1 DMN Manager selects supplier for a specific product/service><br>6. <D1.2 DMN Manager Validates end to end manufacturing process><br>7. <M1.1 DMN Manager sends manufacturing orders><br>8. DMN Manager sends confirmation of order to IMAGINE platform<br>9. IMAGINE platform sends order confirmation to Client |
| **Exceptions:** | After step 2:<br>1. If any of the steps following step 1 fails the DMN Manager is able to inform the IMAGINE Platform that the order cannot be completed.<br>2. The IMAGINE Platform notifies the Client that the order cannot be completed. |
| **Includes:** | 1. C1.1 DMN Manager defines the product/service of a DMN network<br>2. C1.2 DMN Manager finds potential Supplier for a specific product/service<br>3. D1.1 DMN Manager selects Supplier for a specific product/service |

| | |
|---|---|
| | 4. D1.2 DMN Manager Validates end to end manufacturing process<br>5. M1.1 DMN Manager sends manufacturing orders |
| **Priority:** | Optional |
| **Frequency of Use:** | 1. At will |
| **Business Rules:** | None |

### 3.5.4 M2.2 Client monitors status of product requests

#### *3.5.4.1 Narrative Description*

Clients are able to monitor the status of their orders by using the IMAGINE platform.

#### *3.5.4.2 UML Diagram*


**Figure 3-19: M2.2 Client monitors status of product requests**

#### *3.5.4.3 Description*

**Table 3-18: M2.2 Client monitors status of product requests**

| **Use Case ID:** | **M2.2** |
|---|---|
| **Use Case Name:** | Client monitors status of product requests |
| **Primary Actor:** | 1. Client |
| **Secondary Actors:** | 1. DMN Manager<br>2. Supplier |
| **Description:** | A Client is informed about the status of a specific order by using the IMAGINE platform. |
| **Triggers:** | 1. At will |
| **Preconditions:** | 1. Orders have been sent to the DMN network |
| **Postconditions:** | 1. Client has been informed about the current status of the manufacturing orders |
| **Flow of events:** | 1. Client specifies an order to a DMN Manager for which he needs update<br>2. IMAGINE platform requests relevant information to Suppliers<br>3. Suppliers send required data to IMAGINE platform<br>4. IMAGINE platform presents order status to Client |
| **Exceptions:** | 1. After step 3: |

| | |
|---|---|
| | 1. If a Supplier does not respond the IMAGINE platform provides information that is available<br>2. IMAGINE platform notifies the Client about what the information that is not available. |
| **Includes:** | None |
| **Priority:** | Optional |
| **Frequency of Use:** | 1. Several times after an order has been sent. |
| **Business Rules:** | The information provided to a Customer that monitor orders in a DMN can be controlled by assigning appropriate rules and rights. |

### 3.5.5 M2.3 Client changes order to DMN Manager

#### *3.5.5.1 Narrative Description*

Dynamic Manufacturing Networks should be able to cope with emerging changes that occur in real world environments such as changes in client requests. A client order may be changed or even cancelled. IMAGINE platform should be able to support order cancellation and changes in orders' details such as the quantity of delivered products, the delivery date or even product specifications. IMAGINE platform allows clients to communicate their requests to DMNs.

#### *3.5.5.2 UML Diagram*

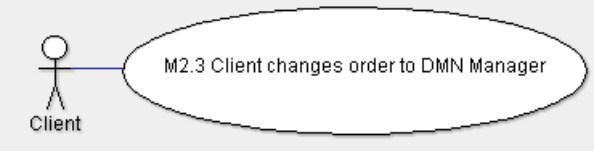



**Figure 3-20: M2.3 Client changes order to DMN Manager**

#### *3.5.5.3 Description*

**Table 3-19: M2.3 Client changes order to DMN Manager**

| **Use Case ID:** | **M2.3** |
|---|---|
| **Use Case Name:** | Client communicates changes to DMN Manager |
| **Primary Actor:** | 1. Client |
| **Secondary Actors:** | 1. DMN Manager |
| **Description:** | A client communicates a change request to DMN which dynamically tries to adopt in order to fulfil the request. |
| **Triggers:** | 1. At will |
| **Preconditions:** | 1. Orders changes have been sent to the DMN network. |

| | |
|---|---|
| **Postconditions:** | 2. Suppliers have been informed about the changes in manufacturing orders.<br>3. Changes have been confirmed to client. |
| **Flow of events:** | 1. Client specifies the order that will change.<br>2. Client specifies the change that should take place.<br>3. IMAGINE platform forwards change request to DMN Manager.<br>4. M1.1 DMN Manager sends order to Suppliers<br>5. IMAGINE platform presents changed status of order to Client |
| **Exceptions:** | None |
| **Includes:** | 1. M1.1 DMN Manager sends order to Suppliers |
| **Priority:** | Optional |
| **Frequency of Use:** | 1. Rare |
| **Business Rules:** | 1. In case changes are specified and exceptions occur in Use Case M1.1 the status presented to client in step 5 at the flow of events include the appropriate information. |

### 3.5.6 **M3.1 Supplier reports unexpected event**

#### *3.5.6.1 Narrative Description*

Given the stochastic nature of real world markets unexpected events can always appear. Unexpected events and environmental impact not planned for are common during project implementation. [3] In dynamic, stochastic manufacturing environments, managers must not only generate high-quality schedules but also quickly react to unexpected events and revise schedules in a cost-effective manner. [4] IMAGINE platform should allow the quick and efficient communication of information allowing for a quick response. Suppliers should be able to report exceptional or unexpected events as well as informing for the changes that result from such events. For example a failure in a production line of a product part that could result in the delay of the production of the whole product could be signalled to the other partners of the network via the IMAGINE platform together with information regarding changes such as schedule changes. The Suppliers, DMN Coordinators and DMN Manager that are involved and the DMN Manager are notified about the unexpected event. IMAGINE platform also requires confirmation of the received message. This is required to allow the sender to employ different means of communication to ensure notification of the members of the DMN in case an important unexpected event is not acknowledged for some reason.

#### *3.5.6.2 UML Diagram*

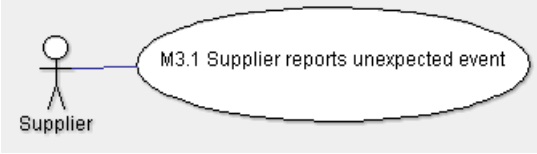


**Figure 3-21: M3.1 Supplier reports unexpected event**

*3.5.6.3 Description*

**Table 3-20: M3.1 Supplier reports unexpected event**

| **Use Case ID:** | **M3.1** |
|---|---|
| **Use Case Name:** | Supplier reports unexpected event |
| **Primary Actor:** | 1. Supplier |
| **Secondary Actors:** | 1. DMN Manager<br>2. DMN Coordinator<br>3. Supplier |
| **Description:** | A supplier reports an unexpected event to the Dynamic Manufacturing Network. |
| **Triggers:** | 1. In case of exceptional or unexpected events |
| **Preconditions:** | 1. DMN has been designed and configured<br>2. Information flow has been defined. |
| **Postconditions:** | 1. Client has been informed about the current status of the manufacturing orders |
| **Flow of events:** | 1. Supplier inputs information regarding unexpected event to IMAGINE Platform<br>2. IMAGINE Platform informs Suppliers, DMN Coordinator and DMN Manager that are affected.<br>3. Suppliers, DMN Coordinator, DMN Manager acknowledge receiving notification.<br>4. IMAGINE Platform informs Supplier that unexpected event has been reported successfully |
| **Exceptions:** | 2. After step 2:<br>1. If for any reason IMAGINE platform fails to inform a Supplier, DMN Coordinator or DMN Manager or they do not acknowledge the notification, the IMAGINE Platform informs the Supplier that some partners have not been notified. |
| **Includes:** | None |
| **Priority:** | Optional |
| **Frequency of Use:** | Rare |
| **Business Rules:** | None |

# 4 IMAGINE Platform Use Cases Discussion

## 4.1 Discussion of Results

The identified Use Cases of the IMAGINE Platform provide a description of the functionality that the IMAGINE platform should provide in order to facilitate the execution of the IMAGINE DMN Management Methodology. The functionality that IMAGINE platform should provide to address the Use Cases mentioned in the deliverable could be summarized as follows:

1. Administration Functionalities
   a) Authentication

      The novel IMAGINE DMN management methodology will link information from disparate production systems. IMAGINE platform will have to ensure the efficient and secure access to information provided by these systems. An approach similar to federated identity management could be considered in order to address the issue. Setting up individual passwords between a person and every organization he or she interacts with also offers very limited security in practice. Approaches such as federated identity management address this critical issue [5] and allow dynamic distribution of identity information across security domains, increasing the portability of users' digital identities. [6]

   b) Role Based Access Control

      The envisioned IMAGINE platform should be able to securely restrict system access only to those intended. Furthermore access to system resources should be flexible, able to address the dynamic nature of DMNs. In order to restrict system access to authorized users an approach similar to the Role-Based Access Control (RBAC) could be followed. Role-Based Access Control (RBAC) is a nondiscretionary access control mechanism which allows and promotes the central administration of an organizational specific security policy. [7] Following an approach similar to the RBAC approach rights could be assigned to roles and roles could be assigned to users. The RBAC approach is designed to discourage the accumulation of a toxic combination of permissions by lowering the cost of administration and enabling the creation of separation-of-duty constraints. RBAC generally lowers both the probability and cost of access control breaches. [8]

      Following the principle of least privilege could be followed to ensure that the security policy is enforced. The principle of least privilege requires that a user be given no more privilege than necessary to perform a job. Ensuring least privilege requires identifying what the user's job is, determining the minimum set of privileges required to perform that job, and restricting the user to a domain with those privileges and nothing more. By denying to subjects transactions that are not necessary for the performance of their duties, those denied privileges cannot be used to circumvent the organizational security policy. [7]

   c) IMAGINE Platform Users' Administration

      IMAGINE platform should support the registration of users. At this level user registration will handle the registration of companies, allowing the import of LDAP metadata for existing user

databases as well as the appointing of Administrators that will be responsible for the management of their companies. Approaches such as the Role Based Access Control allow for customized Administration within RBAC is flexible in that it can take on organizational characteristics in terms of policy and structure. One of RBAC's greatest virtues is the administrative capabilities it supports. [7]

d) Company administration

IMAGINE platform should be able to allow the Administrators of companies registered to the platform to manage company internal users as well as resources. In particular IMAGINE platform should support the following functionalities for administration of companies.

i) User Management

Company users with the appropriate administrating roles should have access rights limited inside the scope of their company and should be able to register more company users in order to distribute the work load and access rights effectively.

IMAGINE platform should be able to restrict access to its functionality for different roles inside a company. Moreover IMAGINE will allow the creation of customized role hierarchies inside each company with appropriate rights settings. In this way a company retains the flexibility to use the IMAGINE platform according to its needs by managing roles in order to fit their specific environment. So a company may decide to assign several users to play the role of the DMN Manager Actor, granting each one of them only the roles and permissions that are needed to perform his tasks. At the same time a company would be able to assign the management of one or more DMN to the same user giving him the appropriate roles.

ii) Company resources and information

Companies should be able to provide and edit the data required by the IMAGINE DMN methodology and that is specified in the partner blueprint. Given the importance for the management of a company inside IMAGINE platform, IMAGINE platform will ensure that only users that have roles with the appropriate rights should be able to edit company data. Among other information companies will be able to define the various sites, departments and services of the organization, including geographical information and define the available resources, services, products and competencies that can provided.

Access to company data and resources will also be restricted according to roles and permissions appointed to users by the company administrator.

e) DMN administration

This part of the IMAGINE platform will be responsible for managing roles and rights of within the scope of a DMN. In order to efficiently collaborate, the partners involved in such a coalition should securely access resources and information exposed by other partners. Given the dynamic nature of DMNs IMAGINE platform should provide a flexible access control approach that could restrict access to information efficiently. Approaches such as RBAC can address these needs. Imagine platform should support the management of roles and permissions among DMN members in all three phases of the DMN lifecycle, namely Configuration, Design, Monitoring and Execution Management. IMAGINE platform should also

be able to apply the principle of least privilege throughout the DMN lifecycle, taking into account the dynamic and progressive nature of the collaboration within DMN. To address this issue roles and permissions should be able to evolve through the DMN lifecycle to ensure the application of the principle of least privilege together with the efficient and effective collaboration.

2. DMN Management Functionality
   a) DMN Configuration Functionality

   IMAGINE Platform will support the configuration of Dynamic Manufacturing Networks by providing sophisticated functionality that supports the search for partners that provide specific materials, product, service or even master specific competencies and will also allow the filtering of these partners by supporting advanced and complex criteria based on dynamic, near real-time, data such as cost, capacity, availability, trust, allowing for accurate results. IMAGINE will also support the user to find best potential partners available. It should be noticed that IMAGINE platform will protect the partners' confidential data. The access to confidential information will be ensured and restricted only to members with appropriate rights.

   b) DMN Design

   IMAGINE platform will support the Design phase of the DMN Management Methodology by allowing the specification of the detailed orchestration and choreography levels that guarantee complex requirements fulfilment, such that those related to non-functional properties, as presented in IMAGINE DMN management methodology. Design will include the definition of:

      1. Workflow, providing support for heterogeneous workflow systems.
      2. Information flow, including Technical Data Package transportation and interchange.
      3. Physical flow, which could be a material flow or a digital artefact flow as in the case of virtual products.

   Furthermore for each DMN member a RBAC based approach could be used to define resources made available to the DMN by partners as well as restrict access to them as well as roles within the DMN.

   c) DMN Validation / Simulation

   The validation functionality provided by IMAGINE Platform will allow the validation of configured DMN end-to-end processes by taking into account near real time information and providing estimations regarding the ability of the configured DMN to provide the product/service intended. Appropriate simulation methods will be utilized leveraging both static and dynamic data in order to validate end-to-end processes. Simulation should be able to confirm correct schedule execution and cost assessment taking into account the stochastic nature of real world environment.

d) Execution Management and Monitor Functionality

IMAGINE platform will support the execution management, and monitoring of the Dynamic Manufacturing Network by gathering required information. Moreover, IMAGINE platform will allow the reconfiguration of the DMN when anomalies in the process are predicted or detected.

3. Order Functionality

a) Order placement

Imagine Platform will support the direct propagation of orders from clients to Dynamic Manufacturing Networks providing end-to-end DMN management.

b) Order Monitoring

IMAGINE platform will be able to provide information that allows the monitoring of placed orders, giving relevant information such as the overall process. The level of information provided will be dependent on the configuration of the DMN as well as the individual companies' access settings.

## 4.2 Future work

The key functionality of the IMAGINE platform has been captured in the form of Use Cases. The key functions that the integrated IMAGINE platform will perform in response to external requests is presented in a clear and understandable manner, providing a common reference for IT experts and end users.

The Use Cases presented in this deliverable together with the IMAGINE DMN Management methodology that is described in D1.1.2 will be used as an input to describe the conceptual, physical and network architecture of the IMAGINE platform. Several iterative circles will take place in WP2 to refine and improve the Use Cases while at the same time the architectural design and technological foundation will be validated against the developed Use Cases. This iterative process that will take place in WP2 will finally converge to the final description of the conceptual, physical and network architecture of the proposed platform and its two main components:

- The DMN lifecycle management component. This is the component that allows the execution of the phases of the DMN lifecycle, namely, network configuration, network design, and network execution management and monitoring.
- The IMAGINE integration bus component. This is the component that is responsible for the integration with the networked production systems and external services through blueprints, as well as the management of the blueprints, namely, the partners' blueprint, the manufacturing blueprint, the end-to-end process blueprint, the quality assurance blueprint.

The Use Cases provided in this document is a first step to describe how users will be using the IMAGINE platform to execute the phases of the DMN Lifecycle specified in T1.3. The Use cases are derived from the DMN lifecycle and the corresponding blueprints. In the future these Use Cases - in conjunction with the more detailed (meta-data) definition of the blueprints (D1.1.2), will serve as the basic fabric for architecting the IMAGINE platform in general, and the integration bus more in particular.

## Annex A: References

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# Annex B: Use Case Definition Structure

### Introduction

This chapter gives detailed information regarding the structure of the Use Cases description provided. It is included in this deliverable to act as a reference of the provided information.

Please note that any examples given in this chapter are not necessarily valid IMAGINE platform Use Cases and are used only for illustration purposes. The structure presented here has taken into account several sources [2], [1], [9], [10], [11], [12], [13] in order to be finalized, which include the Rational Unified Process (IBM-RUP) guidelines, the ITIL (IT Infrastructure Library) v3 framework of Best Practice guidance for IT Services Management as well as the best practices for recording Use Cases.

### Use Case ID

A unique identifier is assigned to each Use Case. The identifiers follow a specific syntax that indicates the IMAGINE DMN Lifecycle phase that a Use Case is relevant to as well hierarchy relationships between the use cases.

Each unique identifier is composed of dot separated integers preceded by a letter.

- The letter of the use case identifier is always one of A, B, C or D and denotes the DMN lifecycle phase which is more relevant to the Use Case as shown in Table B-1.

**Table B-1: Use Case Categories and ID letters**

| First ID letter | Use Case Category |
|---|---|
| **A** | Administration and On Boarding |
| **C** | IMAGINE Network Analysis and Configuration |
| **D** | IMAGINE Network Design |
| **M** | IMAGINE Network Execution Management and Monitoring |

- The dots that separate the integer part of each Use Case ID define a hierarchical form: X.Y. Related use cases can be grouped hierarchically.

Examples:

- A.1.1
- A.1.2
- A.2.1
- C.1.1
- D.1.1

### Use Case Name

Each use case has a unique name suggesting its purpose. The name expresses what happens when the use case is performed. It is recommended that the name is an active phrase that includes an active verb and a noun.

*Example: Register new User.*

**Actor**

Actors, in Use Case parlance, are parties outside the IMAGINE platform that interact with the IMAGINE platform. They may be users or other systems. Each actor defines a coherent set of roles that users of the IMAGINE platform can play. A distinction can be made between primary and secondary actors. A primary actor is one having a goal requiring the assistance of the IMAGINE platform. A secondary actor is one from which the IMAGINE platform needs assistance to satisfy its goal.

*Example: Administrator, User*

**Goal**

- The business goal of the initiating actor.
- Examples:
  - An Administrator's goal is to register a User to IMAGINE platform.
  - A User's goal is to access the IMAGINE platform

**Trigger**

A trigger indicates when this Use Case will normally be performed. Triggers numbering is for reference purposes and does not indicate sequence.

*Example: 1.When the Administrator has received a request to register a new User to the IMAGINE platform.*

**Description**

This field provides a brief description of the reason for and outcome of this use case or a high-level description of the sequence of actions and the outcome of executing the use case.

- Example: A new User should be registered to the IMAGINE platform by the Administrator.

**Preconditions**

Conditions that must be true for use case to start successfully. Each condition should be stated in a declarative manner, as a statement that evaluates to true or false. If a condition is false then it is unspecified what the use case will do. Preconditions numbering is for reference purposes and does not indicate sequence.

*Example:*

1. *User has provided the Administrator with his email and data.*
2. *Administrator has accepted User's request to register*.

**Postconditions**

Statements concerning the result of the execution, namely conditions that express success or failure of a use case. Similarly to the pre-conditions, the post-conditions should be expressed in a declarative manner, allowing for a true/false evaluation. Postconditions numbering is for reference purposes and does not indicate sequence.

*Example:*

1. *User is registered and can log in the IMAGINE platform.*

**Flow of events**

The interactions between the actors and the IMAGINE platform that are necessary to achieve the goal. The flow of events that is followed in the use case should is described in sequential discrete steps. Steps are presented as a sequence of interactions necessary to successfully meet the goal. The interactions between the IMAGINE platform and the actors are structured into one or more steps which are expressed in natural language. A step completes when all its component interactions have completed. There may be concurrent steps or conditional steps. All steps must be sequentially numbered. The numbering in the "Flow of Events" row indicates sequence of executions.

*Example:*

1. *<A1.3 Administrator Logs In the IMAGINE platform>*
2. *Administrator submits User's data to IMAGINE platform*
3. *IMAGINE platform sends registered User his credentials by email*
4. User verifies registration by performing <A.1.2 User Logs In the IMAGINE platform> within 5 days from registration.

Use cases can be mentioned and "called" like sub processes. When a use case includes calls to other use cases this should be clearly stated.

**Exceptions**

Provides a description for any anticipated error conditions that could occur during execution of the use case, and defines how the IMAGINE platform is to respond to those conditions. Also, describes how the IMAGINE platform is to respond if the use case execution fails for some unanticipated reason. If the use case results in a durable state change in a database or the outside world, states whether the change is rolled back, completed correctly, partially completed with a known state, or left in an undetermined state as a result of the exception. Each exception is numbered and if possible the step at which this exception takes place is identified.

*Example:*

*After step 2:*

*1) User does not verify registration by logging in the IMAGINE platform within 5 days*

*2) IMAGINE platform does not register User*

**Includes**

This field provides a list of all other use cases that are included ("called") by this use case. Common functionality that appears in multiple use cases can be split out into a separate use case that is included by the ones that need that common functionality.

*Example: <A.1.2 User Log In the IMAGINE platform>*

**Priority**

Indicate the relative priority of implementing the functionality required to allow this use case to be executed. Available priority tags are presented in Table B-2.

**Table B-2: Use Case Priority Categories Description**

| Priority | Description |
|---|---|
| **Required** | The functionalities of this priority level are required in order to execute the main business goals. |
| **Intermediate** | The functionalities of this priority level are of great use but are not absolutely required. |
| **Optional** | The functionality related to this use case is nice to have but should be developed only after higher priority level functionalities have been developed. |

**Frequency of Use**

This field provides an estimation of the number of times this use case will be performed by the actors per some appropriate unit of time.

*Examples:*

- One execution in one month.
- Several times per DMN instance.

**Business Rules**

This field provides a listing of all applicable business rules that influence this use case.

*Example:*

1. *Only an Administrator has the right to register a User.*
2. *A User should log in within 5 days of registration to successfully complete registration.*

**Narrative description**

This field provides a listing of all describes the use case in more detail using natural language.

*Example:*

*An Administrator is responsible for registering new Users to the IMAGINE platform. When an Administrator receives a valid request to register a User his goal is to register the User into the IMAGINE platform. In order to accomplish that goal he logs in the IMAGINE platform. He provides all required data to the IMAGINE platform which in turn sends an email to the User to confirm the registration. According to the security policy the User needs to log in within 5 days to complete the registration. In the exceptional case that the User does not log in within 5 days to complete the registration, the registration is rolled back and the user will not be able to log in.*