



*D26.3 –  
Innovation Ecosystem platform first prototype*

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## 1 Executive Summary

The objective of WP26 is to design and develop the MSEE Innovation Ecosystem Platform (IEP) and a set of ecosystem-oriented services for collaboration and tangible/intangible assets management, in order to enable the execution of the business processes that characterize a Manufacturing Service Ecosystem (MSE). Those processes have been categorized as MSE Governance, for the management of the ecosystem and of its members, MSE Innovation, for fostering and stimulating open innovation actions among the ecosystem actors, and Virtual Manufacturing Enterprise (VME) Operations, for allowing VMEs in the delivering of the new value proposition to the customer through collaborative processes. **This deliverable (D26.3) provides the first prototypical implementations of the IEP, namely of its Core Components.** This document is to be considered as an introduction to the overall IEP prototypes, whereas **MSEE D26.3 - Factsheet Number #1 “Innovation Ecosystem Platform – Core Components** provides the actual technical details of the Core Components that have been issued at month 12. The Core Components of the IEP are those components that provide the fundamental means to MSEs and VMEs to run the aforementioned processes. In particular MSE Innovation processes are supported by a customization of the open source Open ideal web application which exposes all the functionalities for the idea management, from idea creation, to idea enhancement with comments and evaluations, to idea workflow management (new ideas, draft ideas, accepted ideas, refused ideas, realized ideas). It also exposes functionalities for categorize ideas, search existing ideas, see most commented or latest ideas and so on. The MSE Governance processes and the VME Operation processes are supported by the open source Aperte Workflow Platform, which provides a complete set of BPM tools, from process editing to process execution, from process integration to process monitoring. Finally RDF models describing both (in)tangible assets and services that expose such assets are stored in the USDL Repository which is implemented, in this first basic release, through the Sesame2 RDF Store. All such components are integrated in a coherent Ecosystem Front-end that is represented by a Liferay web-portal. Such front-end includes also basic communication and collaboration services.

The source and binary code of the prototypical implementation of the IEP Core Components can be retrieved at:

<http://engrep.eng.it/msee/iep/>

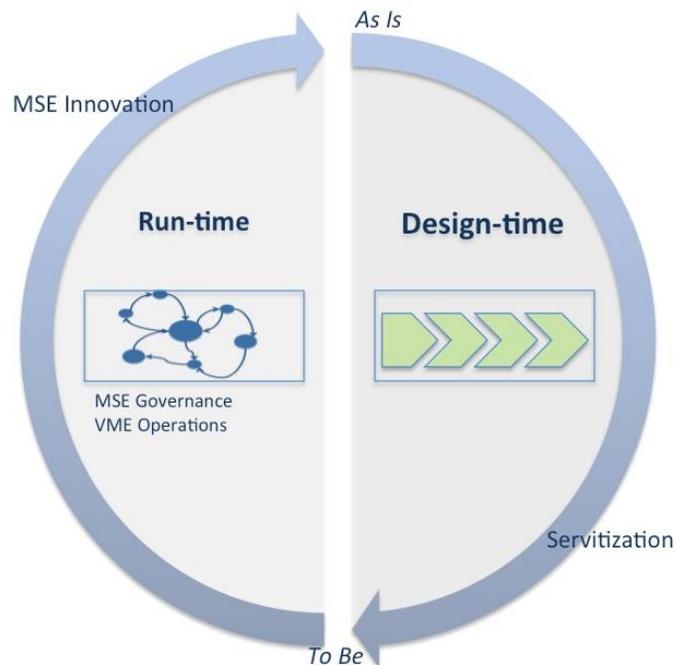
## 2 Introduction to the prototype modules and components

This section introduces the software components that have been developed in WP26 after a general introduction to the role of the Innovation Ecosystem Platform (IEP) in MSEE and to the overall architecture the components are related to.<sup>1</sup> It is to be noticed that the prototypes here introduces are described in detail and from a technical point of view in **MSEE D26.3 - Factsheet Number #1 “Innovation Ecosystem Platform – Core Components**

### 2.1 The IEP in the context of MSEE

Prototypes issued by WP26 are part of the overall architecture of the Innovation Ecosystem Platform defined, in its first version, in MSEE D26.1. The objective of such Platform is “to enable the execution of the business processes that characterize a Manufacturing Service Ecosystem (MSE). Those processes have been categorized as MSE Governance, for the management of the ecosystem and of its members, MSE Innovation, for fostering and stimulating open innovation actions among the ecosystem actors, and Virtual Manufacturing Enterprise (VME) Operations, for allowing VMEs in the delivering of the new value proposition to the customer through collaborative processes.

The scope of those processes must be defined in the context of the overall Service System Life Cycle (see Figure 1) that MSEE aims at supporting and guiding in the manufacturing industry.



**Figure 1 - MSEE Service System Life Cycle**

Such a cycle is composed of two main phases:

- The design-time phase, which corresponds to the *servitization* process. This phase, on the basis of precise new business opportunities and after the set-up of a Virtual Manufacturing Enterprise (VME)<sup>2</sup>, aims at grasping such opportunities, transforming

<sup>1</sup> the description of the overall architecture and of the most important components is adapted from MSEE D26.1 – Innovation Ecosystem Platform specifications and architecture

<sup>2</sup> According to the MSEE internal document “ Definition ME, MSE, VME” issued on August 27th 2012, “A virtual enterprise (VE) is a temporary alliance of businesses that come together to share skills or core competencies

the service system from its As-is situation to the most appropriated To-be in terms of operative processes, value-added services and through the leveraging of key assets of the VME. This process is responsible for the design of the VME’s human, physical and IT resources<sup>3</sup>, leading to a new business model that switches the value offered from physical products to product-service “bundles”.

- The run-time phase, that on the one hand allows the management of an MSE (MSE Governance), fostering and stimulating open innovation actions among the ecosystem actors (MSE Innovation), and on the other hand exploits the new techno-organizational configuration of VMEs (previously designed and developed in the design-time phase) in order to deliver the new value proposition to the customer through operational processes (VME Operations).

Figure 1 shows the two phases as separated and consequential: this can be considered only a logic view because in the real world they are performed at the same time influencing each other. Indeed the design-time phase is triggered by the MSE Innovation processes, which feed the servitization process with new potential business opportunities and new innovative ideas. When the servitization process starts, the Governance, Operative and Innovation processes continue to address their objectives independently from the status of the design-time phase. At the end of the servitization process, the newly defined operative processes are deployed and executed by the owner VME until they are dismissed.

Prototype D26.3 has a specific focus on the IEP, which is the technological platform that will support the run-time phase of the Service System Life Cycle.

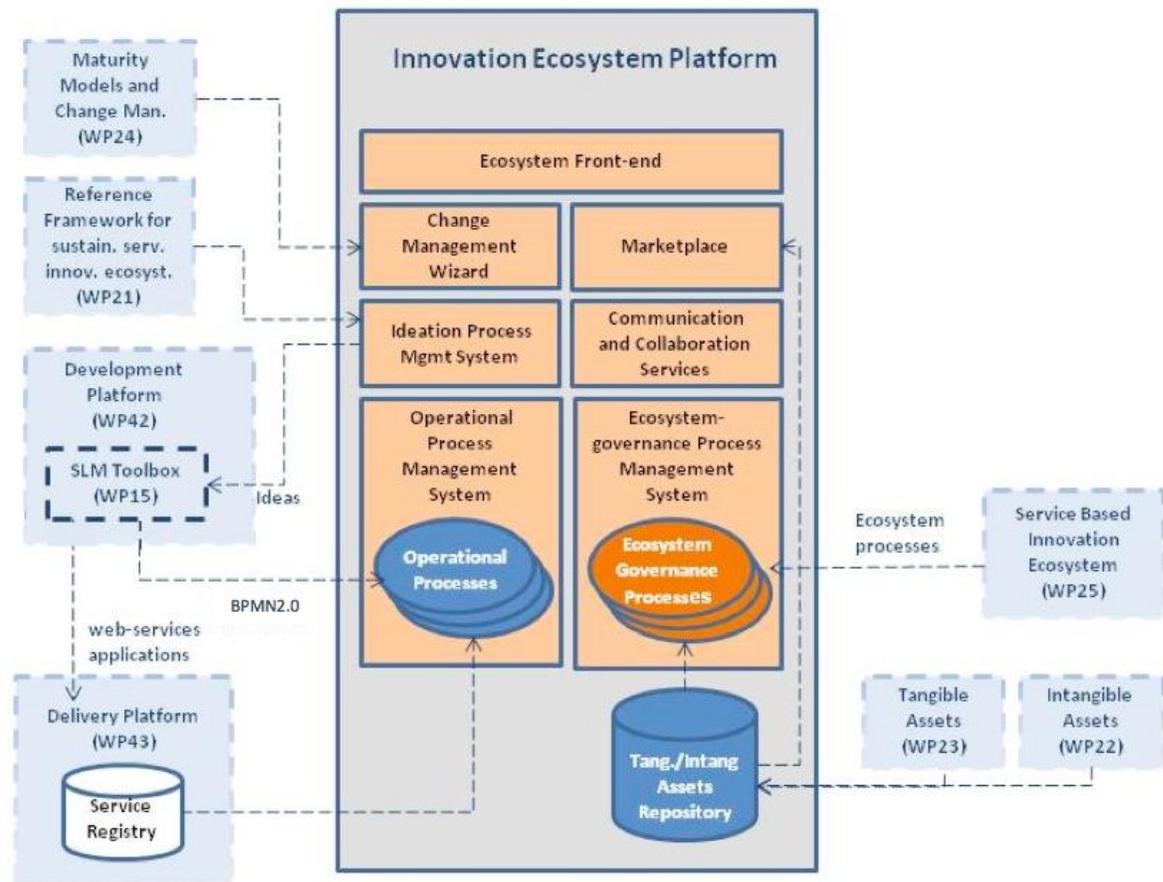
## 2.2 Overall architecture

From an architectural point of view, the IEP has been designed in [13] as a composition of seven main functional components (Figure 2).

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and resources in order to better respond to business opportunities, and whose cooperation is supported by computer networks (Wikipedia definition). Members of MSE can set up a Virtual Manufacturing Enterprise (VME) to face and tackle business opportunities. In the context of the MSEE project, we will just consider VMEs which are implementing the whole or part of a Service Lifecycle process: its ideation, its development, its operation. A VME can be considered as a spin-off (not spin-out) of the MSE but not only: some partners outside of the MSE can join the VME. At the End of its Life, the VME dissolves and transfers the gained knowledge and outcomes to the MSE which generated it.

<sup>3</sup> A human resource can be an operator, a manager or any people performing an activity in the service; Machine type resource are devices and equipments that are needed to provide and deliver services. These components may include: robots, specialized machines and devices for producing, delivering, maintaining services, movers/transport means, as well as any kind of physical facilities used for the creation and consumption of service; IT type resources include mainly software used to perform activities in the service to be delivered



**Figure 2 - Innovation Ecosystem Platform main components**

The **Ecosystem Front-end** is the single point of access to the Ecosystem for ecosystem members and it integrates in a single graphical environment all the other components.

The **Change Management Wizard**, represents a concrete tool to guide the enterprises through change management processes and toward a higher level of maturity with respect to their servitization level and their involvement in the ecosystem. This component can be considered a concrete implementation of the results coming from WP24 and is considered a tool to support the MSE Governance.

The **Ideation Process Management System**, is a system for fostering and managing the creation of new and innovative ideas through cross-organizational and user-inclusive initiatives. The component provides to the SLMToolbox (which is part of the Generic Service Development Platform) a continuous and unstructured stream of suggestions, hints, ideas and potential opportunities to innovate the product-service value-proposition that the ecosystem offers to its customers.

The **Communication and Collaboration Services** component, supports the three kinds of processes through a coherent set of communication and collaboration services that allow members of the ecosystem to share contents and collaborate on their evolution, discuss and interact through web2.0 tools.

The **Marketplace and Tangible/Intangible Assets Repository**, provides the means to ecosystem members to manage virtualized tangible and intangible assets and to offer their capabilities as services to the market (internal to the ecosystem or open to the Internet).

The **Operational/Ecosystem-governance Process Management System** components represent the front-end applications for the enactment and monitoring of operational and ecosystem-governance processes. Both provide a graphical interface that on one side allows members of the ecosystem to participate to those processes in specific human-oriented activities through ad-hoc defined web-forms, and on the other side presents the quantitative measures of Performance Indicators evaluated on the executed processes.

### 2.3 The focus of D26.3

The focus of the first prototype of the IEP (D26.3) is on a subset of the aforementioned components. Such components (the IEP Core Components) include all the functionalities that are directly related to management of the processes and to the integration issues. In the following the realized components/functionalities are presented at a high level. In **MSEE D26.3 - Factsheet Number #1 “Innovation Ecosystem Platform – Core Components** [12] the components are detailed with respect to their technical aspects.

Component	Implemented functionalities
Ecosystem Front -end	The <b>Ecosystem Front-end</b> is implemented using the enterprise open source portal Liferay[1]. The portal is the centralized interface through which ecosystem users can access to the functionalities of the Innovation Ecosystem Platform. Those functionalities are available from the portal in the form of portlets, iframe or links, and are integrated with respect to their graphical aspect and with respect to the authentication method through a Single Sign On system that allows users to switch from one functionality to another in a simple and transparent way. Users log in the portal and can access to all functionalities enabled in respect of their role.
Ideation Process Management System	The Ideation Process Management System exposes all the functionalities for the idea management, from idea creation, to idea enhancement with comments and evaluations, to idea workflow management (new ideas, draft ideas, accepted ideas, refused ideas, realized ideas). It also exposes functionalities for categorize ideas, search existing ideas, see most commented or latest ideas and so on. This module is implemented by a customization of the open source Open ideal [2] web application. This is a Drupal [3] based product, integrated in the Ecosystem Front-end using the authentication module, and specifically with the library phpCAS [4] and the Drupal CAS [5] module.
Communication and collaboration services	Communication and collaboration services are inherited from Liferay Portal basic applications. Those modules are blogs, forum, wiki or calendar. With Blog Portlet ecosystem users can run their own blog service. With Message Board Portlet it is possible to create forums where ecosystem users can exchange their views. Wiki Portlet allows creation of contents in the Wiki collaboration style. Calendar Portlet allows community users to

	have a common calendar with tasks list, where users can create, manage and search for events.
Operational/ecosystem-governance process management system	This component supports the management of both VME operational and MSE management processes, thus implementing both the functional components Operational process management system and ecosystem-governance process management system. The component is implemented using the open source Aperte Workflow Platform [6]. Its complexity requires a deeper decomposition. The following rows address each of the main sub-components.
Operational/ecosystem-governance process management system – Process Editor	This sub-component is implemented using the Aperte Modeler web application. Aperte modeler is a BPMN2.0 process editor integrated with Aperte Workflow. It is based on Signavio Core Components [7] open source library, and it is tailored to match specific needs of Aperte Workflow runtime engine. With this editor it is possible to manage and model BPMN2.0 processes, to define automatic and human tasks. For human tasks it is possible to design the user interface using a graphical editor, and to assign human tasks to users or roles. For automatic tasks it is possible to link the task with a Mule ESB flow, allowing in this way the interaction between the process and the external environment. When a process is modeled and all information about its execution behavior is defined, it is possible to publish it in the process management engine, making it available to ecosystem users.
Operational/ecosystem-governance process management system – Human-oriented tasks GUI	This sub-component is implemented by Aperte Workflow Activities portlets. This is a graphical interface accessible through the Ecosystem Front-end that allows users to create new processes, search existing processes, browse task queues and handle process tasks. Users can start processes according to their roles and accessing rules defined in the process editor. In the task queue users can see new tasks to be handled, or recent tasks already completed. They also can trace custom task queues defined in the process editor. After starting a new process, users are asked to fill some information in a form that was created in the process editor
Operational/ecosystem-governance process management system – Process Engine	This is the engine used by the process management system for executing processes created using the process editor. Aperte Workflow, the platform used to implement the process framework, supports currently two BPM engines: jBPM [9] and Activiti [8]. The process engine implementation used in the MSEE Ecosystem-governance Process Management System is Activiti, because of its more mature compatibility with the BPMN2.0 notation.
Operational/ecosystem-governance process management system – Enterprise Service Bus	This is the sub-component component which supports the enterprise integration, and it is implemented using an embedded version of Mule ESB [9]. Mule ESB is integrated in Aperte Workflow platform by means of an OSGi bundle, containing an instance of the Mule server. Automatic tasks defined with the process modeler are linked to a Mule Flow, also deployed as a bundle. This flow is executed within the Mule server instance integrated in the platform. Mule ESB represents the decoupling

	point for invocation of web-services from external Platforms (i.e. Generic Service Delivery Platform [11])
Operational/ecosystem-governance process management system – Process Monitor/Log	This component allows the monitoring of the state of a process. Aperte Workflow provides two functionalities in the Liferay Control Panel: Aperte Workflow Process Definitions and Aperte Workflow Process Instances. The first functionality allows administrators to take trace of all process definitions, with their description, version and state (enabled/disabled). It is also possible to disable/enable a process definition. If a process is disable users can't create new instances of the process. The second functionality allows administrators to take trace of all process instances, both active and inactive. For each instance it is possible to see the creation date, the creator, the current task and owner. It is also possible to see a graphical process map that shows the BPMN2.0 process, with the information of the current state (completed tasks are highlighted with a different color). It is also possible to see the process history, whit details about each user that participated to the process end about completed tasks.
USDL Repository	The USDL Repository is a sub-component of the <i>Marketplace and Tangible/Intangible Assets Repository</i> . It is implemented through the Sesame2 RDF Store, which allows the management of RDF models describing both (in)tangible assets and services that expose such assets. Descriptions are encapsulated in RDF Graphs to guarantee easy management of their lifecycle. Operations on resources is enabled by a web-application that provides a GUI for executing CRUD operations and SPARQL 1.1 queries. The same operations are exposed through a RESTful architecture for programmatic management of statements and RDF Graphs.

### 3 Prototype modules

The following table provides the list of the software prototypes that D26.3 delivers in the first iterations of the MSEE project cycle, as well as a first indication of the prototypes that will be developed in the second cycle. The table provides the name of the prototype, a brief description and the component and sub-components it is related to.

Name	Description	Related IEP components (MSEE Project Cycle)
Innovation Ecosystem Platform – Core Components	This component includes all the functionalities that are directly related to management of the processes and to the integration issues. The prototype is described in [12] from a technical point of view.	<ul style="list-style-type: none"> <li>● Ecosystem Front-end (1<sup>st</sup>)</li> <li>● Ideation Process Management System (1<sup>st</sup>)</li> <li>● Operational/ecosystem-governance process management system (1<sup>st</sup>) <ul style="list-style-type: none"> <li>○ Process Editor (1<sup>st</sup>)</li> <li>○ Human-oriented tasks GUI (1<sup>st</sup>)</li> <li>○ Process Engine (1<sup>st</sup>)</li> <li>○ Enterprise Service Bus (1<sup>st</sup>)</li> <li>○ Process Monitor/Log (1<sup>st</sup>)</li> <li>○ Business Intelligence Tools (2<sup>nd</sup>)</li> </ul> </li> <li>● Communication and collaboration services (1<sup>st</sup>)</li> <li>● USDL Repository (1<sup>st</sup>)</li> </ul>
Marketplace	The marketplace component has the aim of providing a point of contact among offers and demands of services built upon tangible/intangible assets. Functionalities provided by the Marketplace are meant to allow the dynamic and flexible creation of ad-hoc VMEs to respond to business opportunities through the search and identification of the right capabilities (i.e. tangible and intangible assets aaS) available in the MSE [13].	<ul style="list-style-type: none"> <li>● USDL Editor (2<sup>nd</sup>)</li> <li>● Access Restriction Service (2<sup>nd</sup>)</li> <li>● Marketplace (2<sup>nd</sup>)</li> <li>● Virtualized assets data import (2<sup>nd</sup>)</li> </ul>
Change Management Wizard	This component reflects the methodologies and the models defined in WP24 in order to provide concrete	<ul style="list-style-type: none"> <li>● Online Questionnaire (2<sup>nd</sup>)</li> <li>● Maturity Level Assessment (2<sup>nd</sup>)</li> <li>● Roadmap Definition (2<sup>nd</sup>)</li> </ul>

	means to guide the enterprises through change management processes that may vary from simple and short-term modifications of the technological infrastructures, to complex and long-term switch of the business model [13].	
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#### 4 Summary and conclusions

This first version of the prototype of WP26 provides the fundamental means to MSEs and VMEs to run the processes that characterize an ecosystem, namely MSE Governance, MSE Innovation and VME Operations processes. **This deliverable (D26.3) provides the first prototypical implementations of the IEP, namely of its Core Components.** This document is to be considered as an introduction to the overall IEP prototypes, whereas **MSEE D26.3 - Factsheet Number #1 “Innovation Ecosystem Platform – Core Components** provides the actual technical details of the Core Components that have been issued at month 12. The Innovation Ecosystem Platform is built on-top of the Liferay web-portal by integrating functionalities for fostering innovation processes, designing and running collaborative processes and storing semantic descriptions of (in)tangible assets and of services that expose such assets.

In the integration phase of MSEE (WP45), the IEP must be connected to the SLMToolbox [13] that will provide BPMN2.0 descriptions of VME Operational processes. Moreover the Process Editor should be enabled to retrieve services from the Generic Service Delivery Platform[11].

In the next iteration of the MSEE project, this prototype will be enhanced with additional modules that address more specifically the offers and demands of (in)tangibles as Services and the management of change processes of enterprises that enter a MSE.

## 5 References

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- [1] Liferay: <http://www.liferay.com/>
- [2] Open IdeaL: <http://www.openidealapp.com/>
- [3] Drupal: <http://drupal.org/>
- [4] phpCAS: <https://wiki.jasig.org/display/CASC/phpCAS>
- [5] CAS (Drupal): <http://drupal.org/project/cas>
- [6] Aperte Workflow: <http://www.aperteworkflow.org/>
- [7] Signavio Core Components: <http://code.google.com/p/signavio-core-components/>
- [8] Activiti: <http://activiti.org/>
- [9] Jbpm: <http://www.jboss.org/jbpm>
- [10] Mule ESB: <http://www.mulesoft.org/>
- [11] MSEE D43.1 - Service Delivery Infrastructure specifications and architecture
- [12] MSEE D26.3 - Factsheet Number #1 “Innovation Ecosystem Platform – Core Components
- [13] MSEE D26.1 – Innovation Ecosystem platform specifications and architecture
- [14] MSEE D15.2 - Specifications and Design of Service Lifecycle Management ToolBox