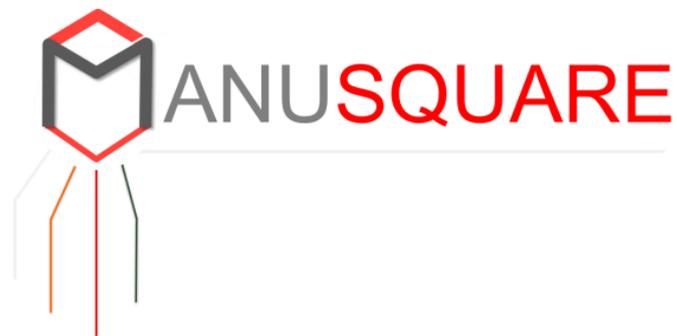


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**MANU**facturing eco**S**ystem of **QUA**lified **R**esources **E**xchange

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## D1.2

### Specifications definition

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## LIST OF ABBREVIATIONS

Acronym	Description
API	Application Program Interface
B2B	Business to Business
DoA	Description of Action
IPR	Intellectual Property Rights
KPI	Key Performance Indicator
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LE	Large Enterprises
MaaS	Manufacturing as a Service
RFQ	Request For Quotation
SaaS	Software as a Service
SME	Small Medium Enterprise
SW	Software
WP	Work Package

## 1 EXECUTIVE SUMMARY

This document describes the activities carried out within Task 1.2 that supported the definition of a set of reference specifications outlining the central elements of the MANU-SQUARE platform and paving the way for their inclusion in the following WPs (mainly WP2, WP3, WP4 & WP5). This work has created a specifications map integrating the main platform elements, ranging from platform stakeholders, and their needs, to the functionalities, tools and SW components that fulfil those needs through the platform provided services. Indeed creating this map from the very beginning is a hard, yet much needed, step. In building a platform as ambitious as MANU-SQUARE is a plethora of possible strategies and consequently of useful tools can be delivered. Choosing, among this complexity, what is the best trajectory to follow is the matter of this deliverable whose output allows to position all the other developments.

The work carried out to achieve the definition of the platform specifications has been therefore structured through a methodological approach going through the implementation of recursive interactions among consortium partners and stakeholders, that were meant to refine, at different levels, the developed specifications. In § 2 of this deliverable, the approach adopted, together with the tools that led the practical implementation of this approach are presented.

After a brief analysis of platforms supporting sharing of resources and innovation management, carried out in § 3, the following sections (§ 3.4, 5 and 6) describe how each part of the specifications map have been built. For each section i.e. (i) players and needs, (ii) platform functionalities, (iii) platform services, the deliverable reports a detailed description of the elements composing them, together with the different steps that led to their definition and validation.

In particular § 6 integrates the previous work in a concise description of the MANU-SQUARE provided services and in several preliminary use cases supporting the description of such use cases. A service blueprint, as input for technical and non-technical upcoming activities is eventually designed.

## 2 INTRODUCTION

This document, which sums up the activities developed in Task 1.2 and contains the main outputs, aims to define the specifications of the MANU-SQUARE platform by creating a common and consolidated starting point for all the activities that will be developed until the project end. MANU-SQUARE functional specifications have been defined in order to allow a general understanding of what the platform will include, focusing in particular on:

1. What the project partners are going to develop and include in the platform;
2. What the MANU-SQUARE stakeholders will find on the platform.

This document aims therefore at providing the functional specifications<sup>1</sup> at the basis of platform definition that will be integrated with non-functional ones, to be defined in the work of Task 1.4, in which platform reference framework is going to be designed. For the development of the introduced specifications, both internal analysis, coming from project partners involvement, as well as relevant insights derived by external interviews carried out in Task 1.1 have been taken into consideration. Task 1.2 constitutes a significant starting point for all the project activities. In particular, as it is showed in Figure 1, the outputs of Task 1.2 are relevant for Task 1.4 (Platform reference framework), belonging to the same Work Package, and for WP2 activities, providing inputs for the development of Task 2.1 (Semantic meta-model for ecosystem representation).

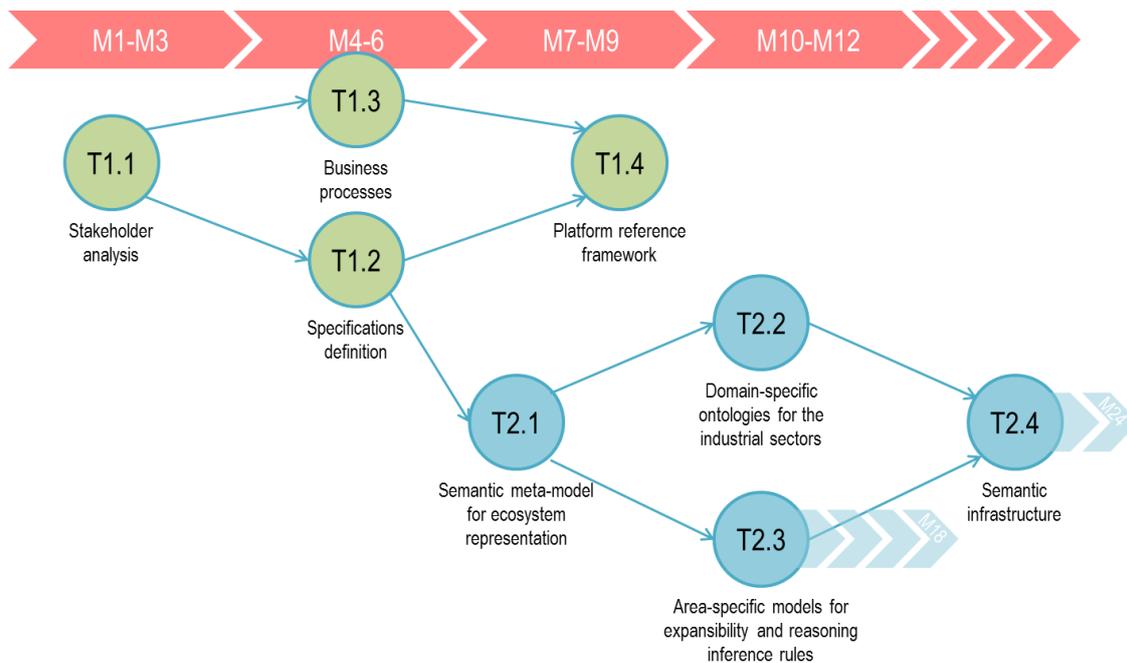


Figure 1 T1.2 relation with other tasks

Functional specifications are provided through the development of specific use-cases, which aim to explain how the different elements (e.g. players, tools, etc.) of the platform will work and interact. The main idea is to provide a general description of the platform tools, functionalities and services without fixing any relevant constraint for the task developers. The methodology behind the definition of the platform specifications is briefly described in the following section.

<sup>1</sup> In system and software engineering, functional specification specifies the functions that a system or component must perform [1].

## 2.1 Methodological approach

The main objective of this task is to guarantee that the platform provides the expected services in order to reach the stakeholders' expectations and needs. According to its original concept (Figure 2), the platform is composed of four layers:

- starting from the basement, the first two layers constitute the platform technological layers;
- the third one takes into consideration the value network of the ecosystem;
- the last one considers the business-related aspects.

The development of the platform specifications has been therefore aimed at covering all the four layers, providing a reference vision for the development of the following layer-specific project activities by considering not only each single layer but also their interactions.

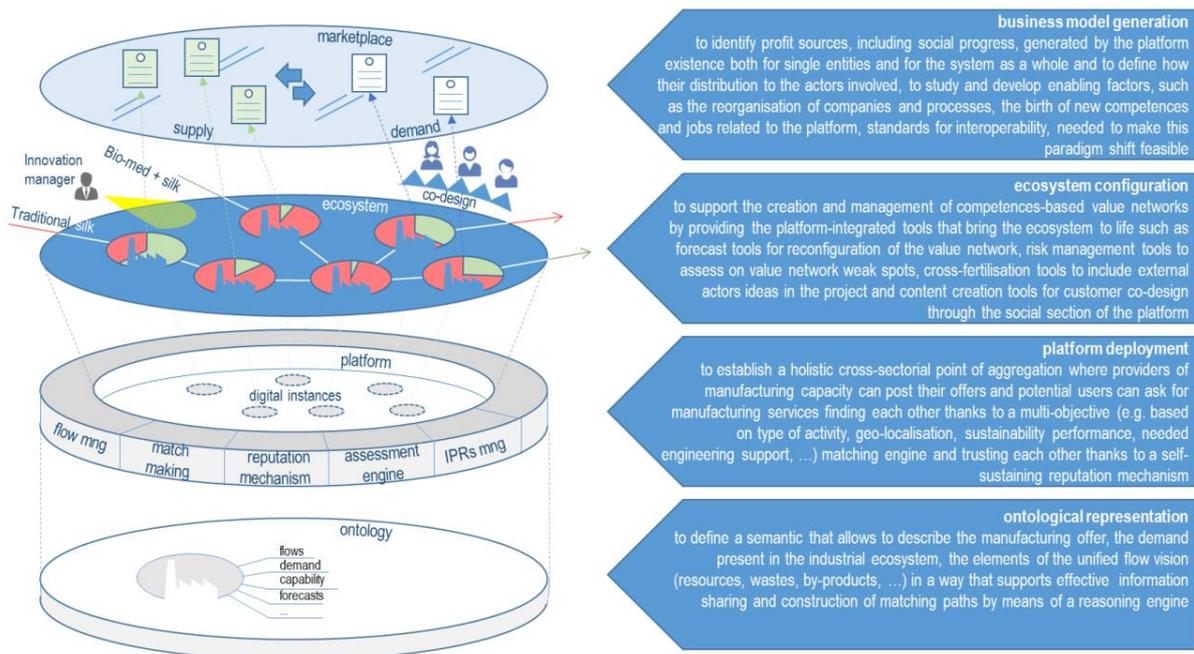


Figure 2 MANU-SQUARE concept layers

This activity has resulted in the identification of the specification requirements for each of the aforementioned layers as it is represented in Table 1:

Platform layers	Specification requirements
Business model generation & Ecosystem configuration	<ul style="list-style-type: none"> <li>• definition and analysis of platform stakeholders</li> <li>• characterisation of platform services</li> <li>• design of use cases</li> </ul>
Platform deployment	<ul style="list-style-type: none"> <li>• characterisation of platform functionalities</li> <li>• characterisation of platform tools</li> </ul>
Ontological representation	<ul style="list-style-type: none"> <li>• requirements for semantic and ontological representation (how it has to support tools and functionalities)</li> </ul>

Table 1 Relation between platform layers and specifications requirements

1. **Business model generation and ecosystem configuration:** being a digital platform relying on a “pay per service” business model, it is fundamental to have a clear understanding of the services that MANU-SQUARE will provide. This definition has to take into consideration the resources, processes and partners that the platform has to integrate in order to make each specific service available.

2. Similarly, to set-up the **platform deployment** layers, it is necessary to define platform functionalities and tools. Having a clear understanding of how the platform should support its stakeholders is a fundamental step to design and develop tools capable to provide the value that the MANU-SQUARE players expect. Tools development can be facilitated by defining in advance how they should be integrated in the platform and the way they have to interact in order to provide the expected functionalities.
3. Eventually, the layer which sustains the others is the **ontological representation**. To support its deployment, it is relevant to identify which entities have to be described in order to achieve a semantic and ontological architecture capable to support the functionalities and tools as best as possible.

Since specifications are fundamental for the successful development of the platform, they have been developed adopting an iterative approach (Figure 3), which allowed to verify, update and, in the end, validate the outputs of each step.

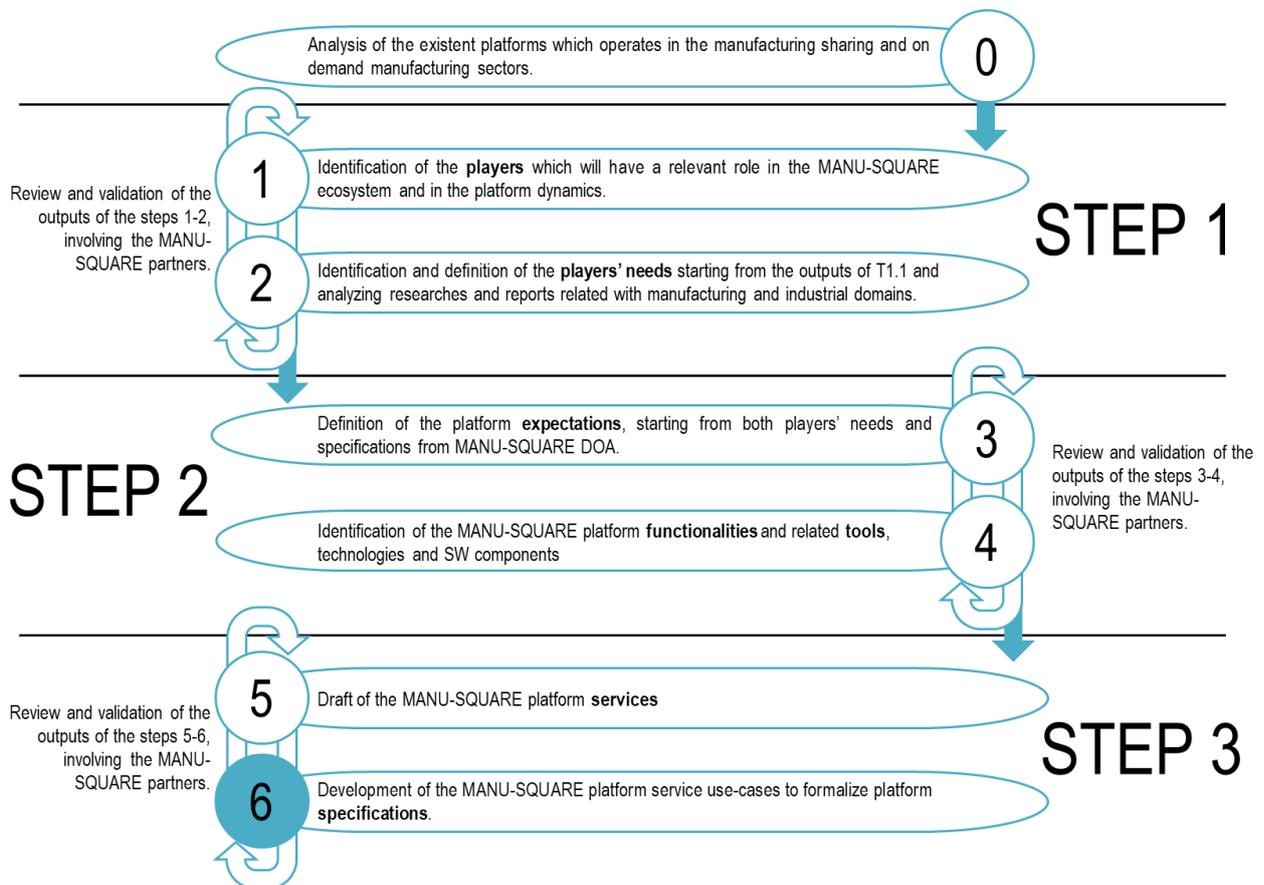


Figure 3 Adopted procedure to define platform specifications

### 2.1.1 Requirements and specifications gathering tools

Specifications define the customer's expectations representing a contractual agreement between the key stakeholders (e.g. customers, developers, service providers, etc.) which collaborate to develop the solution.

Specifications definition depends on the adopted methodology and business analysis practices (Brandenburg, 2018). In particular, functional specifications can be defined using different formats:

- Functional Requirements Document
- System Requirements Specification
- Business Requirements Document
- Use Cases

The purpose of the functional specification is to capture how the solution will support a business user. Often it is reviewed and approved by both business and technical stakeholders. A wrong definition of specifications can lead to a wrong or incomplete solution. The earlier detection of defects and/or missing parts allows saving money and time of rework. For this reason, the specifications document should be a living one that structures the agreement between the key stakeholders, but that can also be modified and updated if necessary.

The definition of the platform specifications has been carried out by incorporating the aforementioned concepts in the creation of three sets of instruments, respectively addressing requirements gathering, specifications definition, and specifications validation. Hereinafter a short description is provided for each of them:

- 1. Requirements and expectations gathering:** the first set of instruments, partially created in collaboration with Task 1.1, are dedicated to the acquisition of information and expectations from consortium partners and project stakeholders related to platform characteristics and services. This set includes 11 sheets that was used to facilitate a workshop who involved all the partners in the Porto General Assembly (25 people involved). Each sheet was dedicated to a possible platform service and it was composed by two sides. On both sides there is a description of the service. The first side has been used to collect inputs about what the interviewee liked in the service description, what they didn't, and what they thought was missing. The second side of the sheet has been used to allow the interviewed to describe the expected role of each player type of the MANU-SQUARE platform.

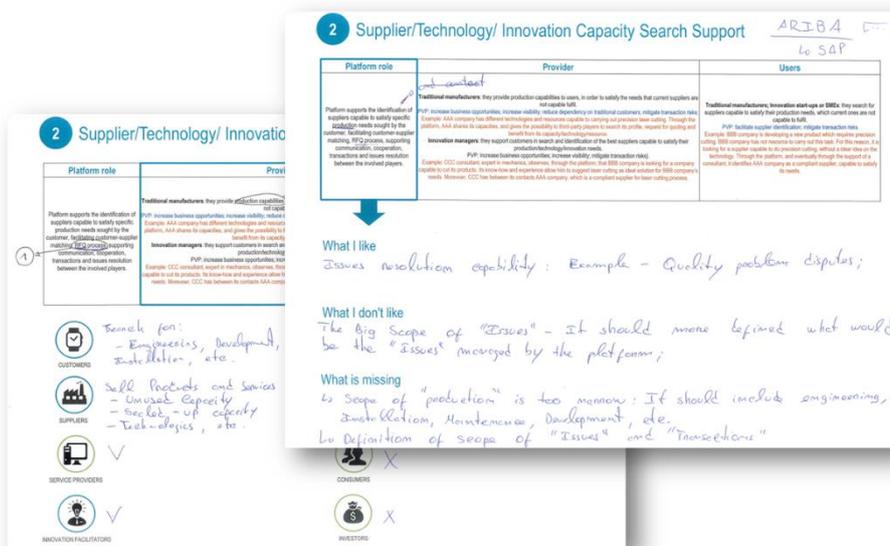


Figure 4 Requirements gathering sheet completed by a consortium partner

- 2. Specifications definition:** the second set of tools have been used to define, step by step, the platform functionalities and the related tools and services.
  - A map, whose final version is shown has been developed, and will be shown in § 5, through different updates and reviews, which have involved different partners. It has been used to formalize a structured overview of the platform general specifications.

- Detailed platform specifications are summed up using the service blueprints (Figure 5): the blueprint template, represented in appendix in Figure 26, is not suitable to completely describe the MANU-SQUARE platform specifications. As a platform, each service can involve more than one player. For this reason, it has been necessary to develop a dedicated service blueprint template, represented in Figure 5, which allowed to map the activities developed not only by the customers but also by the other involved players.

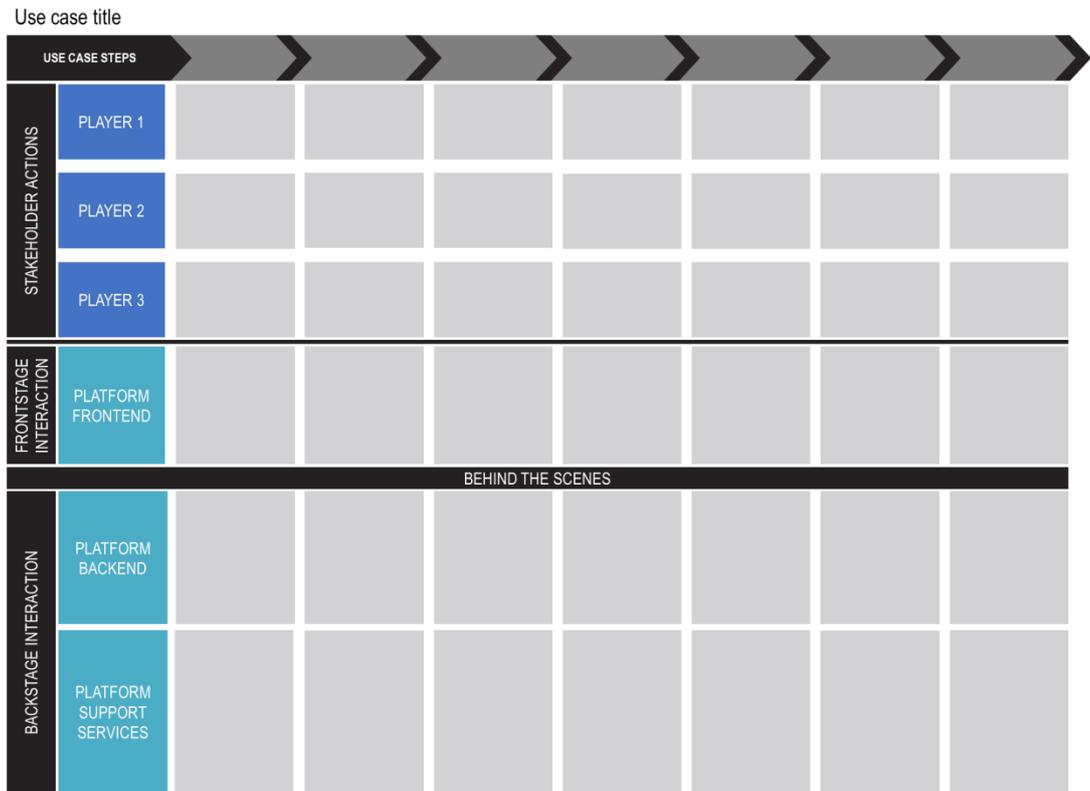


Figure 5 Platform service blueprint

- Specifications validation:** the last set of tools is dedicated to the validation of the specifications defined with the other tools. The validation has been conducted by involving the whole project consortium, in particular the industrial partners, in the identification of the relevance of the proposed solutions and in finding what could be still missing. To drive this activity the following tools have been used:
  - A template (Table 2) to assess the relevance of each identified functionality: to each interviewee, it has been asked to provide a score in order to evaluate each functionality (parameters: value added compared with existent solutions, the relevance for users, the strategic value for the platform). The possible score levels were: 1-not necessary functionality, 2-non-value-added functionality, 3-necessary functionality, 4-value added functionality, 5-fundamental functionality).

Functionalities	Value-added compared with existent solutions	Relevance for users	Economic strategic value for the platform	Total

Table 2 MANU-SQUARE platform functionalities relevance

- A presentation to introduce to the interviewed people the identified platform services (an example is shown in Figure 6): all the identified services have been presented to each interviewee, with the detailed

description, the workflow and a use-case example. It has been asked to each interviewee to provide feedback about each service.

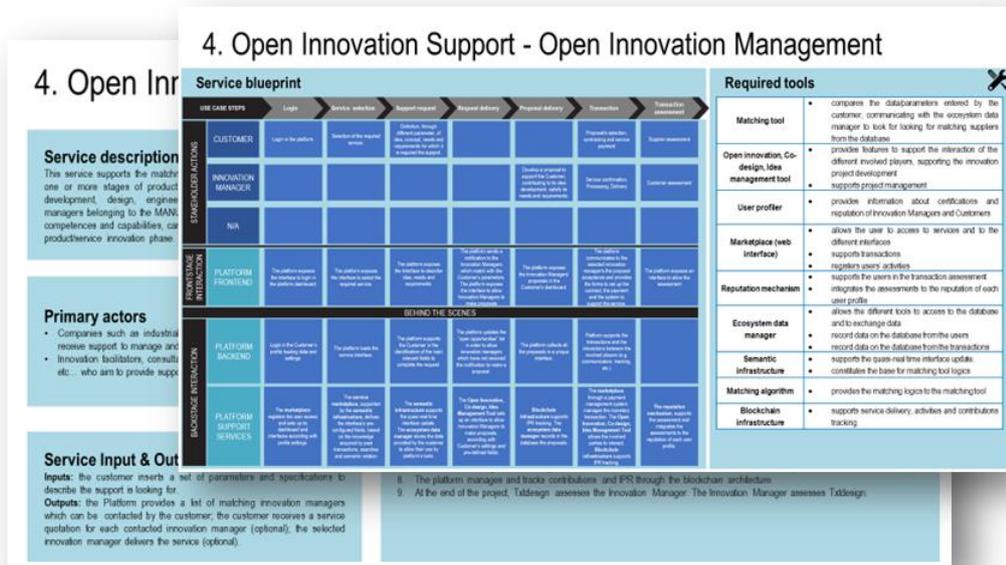


Figure 6 Services presentation to request feedbacks and inputs

### 3 EXISTING SHARING MANUFACTURING PLATFORM REVIEW

Several existent platforms which provide services similar to those of MANU-SQUARE have been analysed. These activities have been carried out to have a general understanding of how these platforms work, which are their main activities and functionalities.

#### 3.1 MaaS Platforms

Today, Sharing Economy is one of the trends that has become more and more relevant, replacing in different sectors traditional business methods (Wallenstein & Shelat, 2017). According with (Albinsson & Perera, 2012), Sharing Economy is a “peer-to-peer-based activity of obtaining, giving, or sharing the access to goods and services, coordinated through community-based online services”. Manufacturing as a Service (MaaS) is part of this trend. It is identified as making third-party machinery available through a web platform to increase the machines saturation during the periods of low productivity, to allow the sharing of resources, thus reactivating the added value of machinery that would otherwise remain unused.

An analysis of the platforms that currently operate under a MaaS approach has been carried out in order to coherently define MANU-SQUARE specifications by collecting ideas and inputs and thus, in the end, to design a platform capable to provide more value to users than existent solutions.

##### 3.1.1 Xometry

Xometry is current the largest on-demand manufacturing platform. It claimed to produce components faster and more effectively than traditional methods. Xometry is transforming custom manufacturing through a proprietary software platform which offers on-demand manufacturing to a diverse customer base, ranging from start-ups to Fortune 100 companies. It provides to product designers and engineers the most efficient way to source high-quality custom parts, with 24/7 access to instant pricing, expected lead time and manufacturability feedback. Its nationwide network of over 2,300 partner manufacturing facilities enables the platform to maintain consistently fast lead times while offering a broad array of capabilities, including CNC Machining, 3D Printing, Sheet Metal Fabrication, Injection Molding and Urethane Casting. Xometry has over 10,000 customers, including BMW, General Electric and NASA (Xometry.com, 2018).

Users, by creating a producer-type account, have the possibility to create a list of available machines and then offer processing time. When a producer registers its account on the platform, it has to enter several details on the profile. The details entered during this phase, such as the types of machines owned, workable materials, part size constraints, etc. are used to match the company with ideal production opportunities. Before a company can become an official partner of the Xometry network, it has to complete a trial for Xometry, which consists of producing a specific product that, depending on its specifications, is used to evaluate the level of competence and quality. The parts that are chosen by Xometry based on the production capacity of the company are sent via e-mail directly to the company. Once the company has produced the pieces, it sends them to Xometry that carries out different inspections to determine the acceptance of the partner. Once the company is accepted as a partner from the platforms, the cost of the product is reimbursed and free access to the "job board" is given.

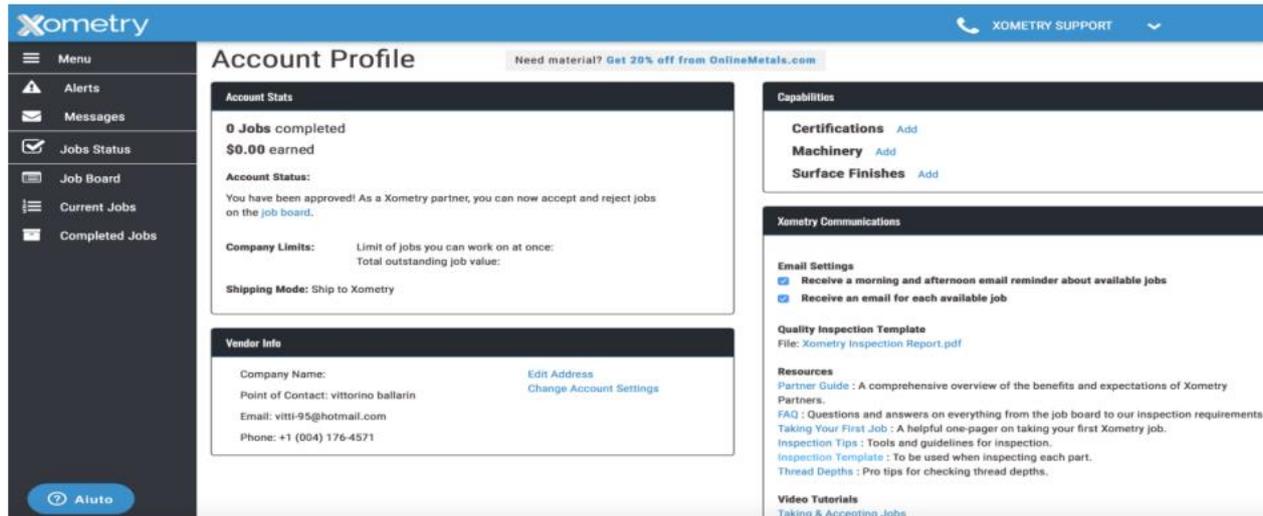


Figure 7 Xometry producer platform interface

### 3.1.2 Mink

Mink is a cloud manufacturing platform that allows every user to choose, customize and purchase a designed product, before starting its remote fabrication. The core of the whole system is represented by the Mink Engine, an algorithm capable to transform the uploaded geometries in a set of data and information that are understandable and executable by a dedicated manufacturing system.

In the Configurator platform area, starting from a series of models (templates) it is possible to edit every single parameter (dimensions, materials, finishes and so on) in order to obtain several product configurations; the Custom Project area supports the user during the creation of components of highly customized products. The disassembled final product is in the end packed and shipped to the customer. The main goal of the project is to create the first shared and remote driven production system, where the orders and the subsequent production processes are started by users directly from the Mink platform without having people working at the remote plant. Mink allows companies to make available their machines to support the production through the platform. On the other hand customers can:

- select the place where they want that their product to be produced based on type of processing (e.g. laser cutting, plasma cutting, water jet, milling, etc.), production cost (immediate estimates), processing times, geographical positioning (production plants displaced locally);
- create their virtual supply chain selecting a set of companies to perform individual processes;
- start production remotely through projects based on configurator and solutions.

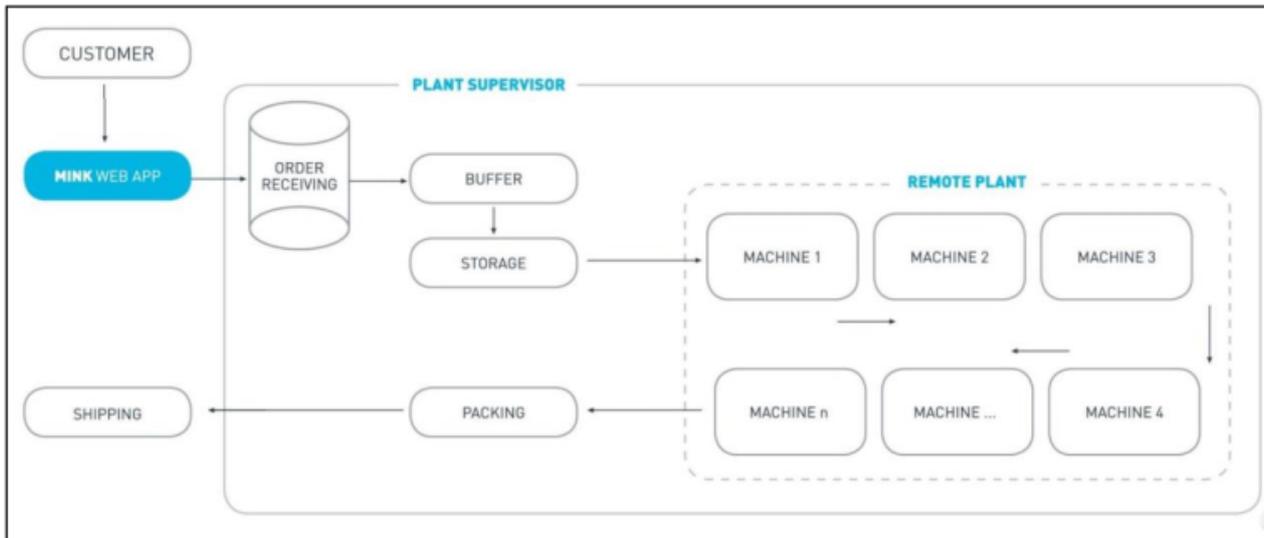


Figure 8 Schematic overview of the Mink platform

### 3.1.3 FLOW2

FLOW2 is a B2B sharing platform where companies can globally provide or access to expertise, goods and services, with the purpose of sharing and reusing assets according to the principles of the circular economy. Platform managers claim they have allowed meeting the supply and demand of 25,000 types of goods and services.

The goods and services that are most commonly shared on this platform are cars, meeting rooms, MRI (Magnetic Resonance Imaging), communication specialists, trucks, designers. Thanks to these solutions, companies and individuals are able to take full advantage of all available resources and be able to do extra business. FLOW2 offers additional services aimed to make B2B shares fast, simple and secure.

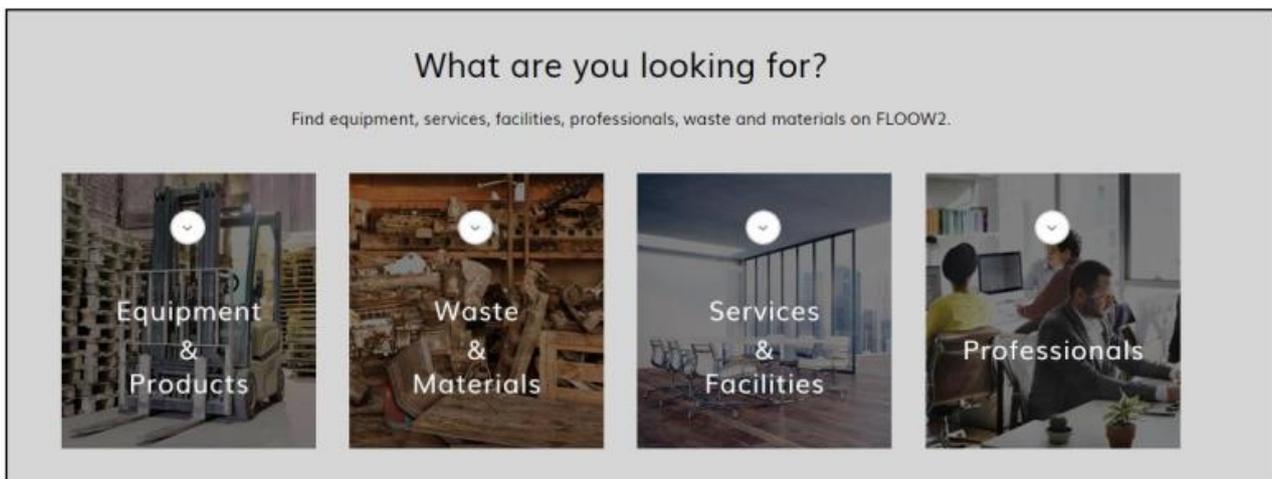


Figure 9 FLOW2 service options

The platform offers the possibility to register as a single user or to create an own market or a tailor-made market. The three options ensure visibility across the entire search network of the platform.

The platform is developed for all types of companies and associations. It allows the creation of markets related to business, networks, sports associations and hospitals. Each of these solutions has been developed and refers to a single type of company. For large companies, local government organizations, retail chains, universities, and

organizations with multiple departments or locations, the best solution is "Business". This option allows to create an internal sharing marketplace in which the user can structure his/her company on the network according to departments, locations or units. Equipment, services, excess staff structures and knowledge can be placed on the market by one department and used by another instead of being acquired. This means that existing company resources are used more efficiently and, as a result, costs are reduced.

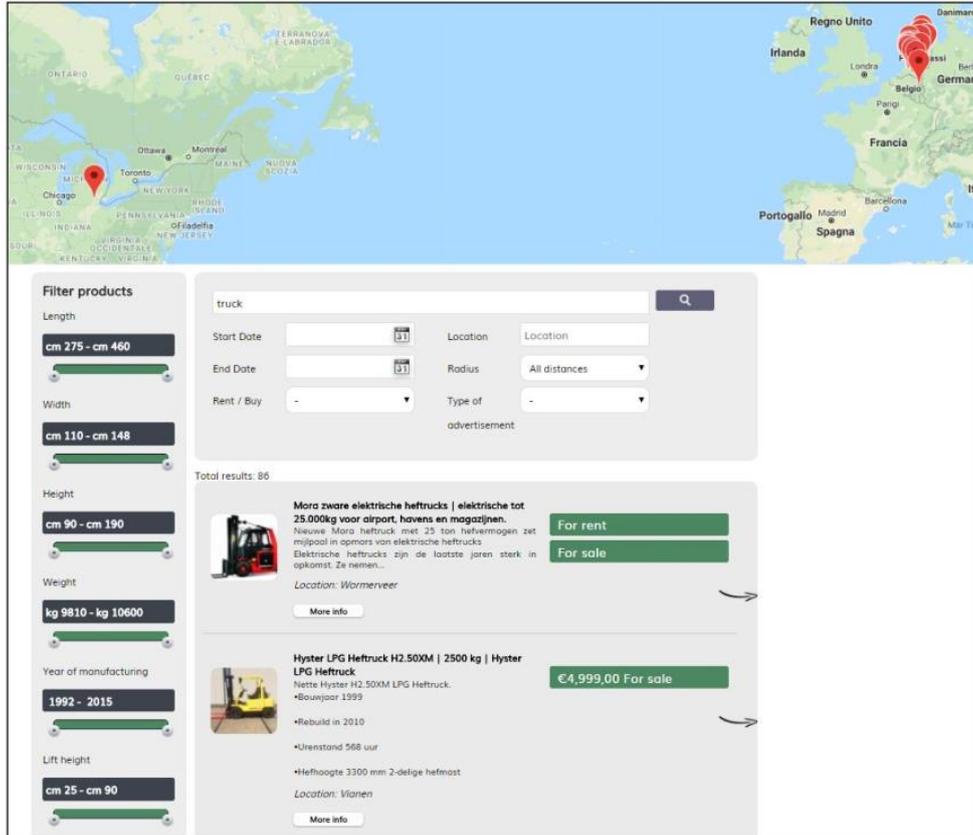


Figure 10 FLOW2 platform interface

### 3.1.4 3DEXPERIENCE

3DEXPERIENCE Marketplace is a platform developed by Dassault Systèmes, available on-premise or on the cloud. It allows companies to connect data, ideas, solutions, people, projects and services. The platform vision is to provide to the users a business management cockpit dedicated to different processes. The platform aims to respond to the growing demand for product customization, which generates the need for greater flexibility and shorter response times to change, and therefore the need to quickly reach a vast network of certified and specialized suppliers in a particular market. Dassault Systèmes has hundreds of certified partners all over the globe which can act through the platform specialized mainly in:

- 3D Printing
- CNC Machining
- Injection Molding
- Sheet Metal
- Laser Cutting

From these partners, users can obtain mechanical, electrical, sensorial, computer hardware, aircraft and space vehicle engineering components, hydraulic components and much more. There are also less tangible products, such as sharing 3D or Mock-up projects.

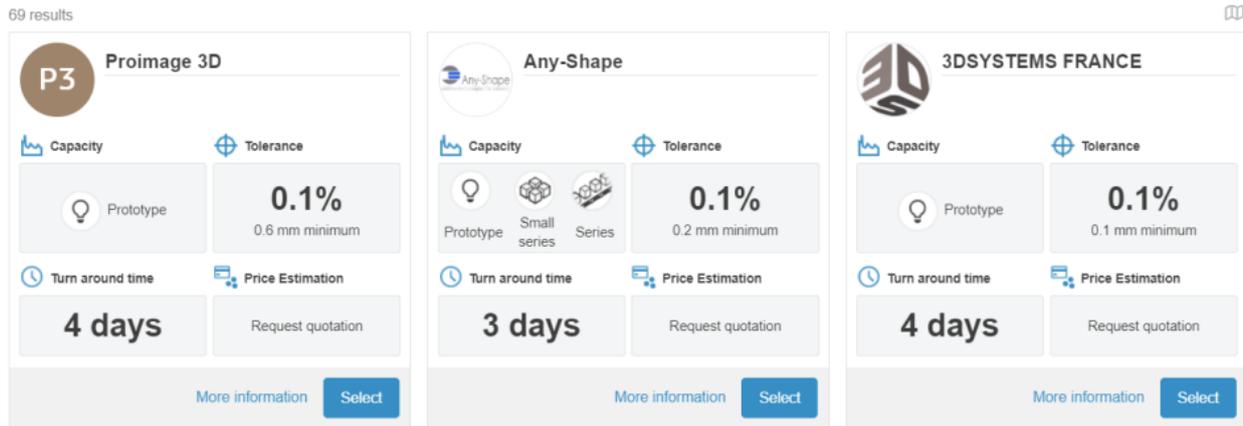


Figure 11 3DEXPERIENCE partners selection example

### 3.2 Open innovation platforms

As reported in “Open Innovation: The New Imperative for Creating and Profiting from Technology” (Chesbrough H. W., 2003): “Open innovation is a paradigm where companies can and must resort to external as well as internal ideas and access internal and external paths to the markets if they want to progress in their technological competences”.

Open innovation means a company could access to available innovations on the market, integrating them with its business model. This enables a faster time to market (from product/service design to go to market) and the possibility to involve external realities such start-up.

According to this scheme, it becomes more effective not to produce internally the best innovations but to create innovative products and services by modulating at best what comes from the company and what can be obtained from the players outside the company perimeter.

There are few large companies that have an audience of internal resources so large and functional that they do not need an exchange with the outside world. However, even these are realizing that external contributions are an essential stimulus.

There are different ways to realize open innovation: research competitions to find innovative ideas; collaboration agreements with partner; innovation hub or internal think tank; interesting acquisitions between realities.

It is possible to identify some kinds of archetypes of Open Innovation implementation:

1. **OI2Make**: methodologies to gather ideas and to internally transform them into prototypes. In this first archetype the collection of ideas is open and the development is “internal”.
2. **OI2Sell**: methodologies to gather ideas to propose to those who can develop them. In the second archetype the collection and the evaluation of ideas is open. The development is done by those interested in the idea. Approach to externally develop something that the company needs, bringing it to a high TRL.
3. **OI2Outsource**: the third archetype is based on an open identification of the partners and an “external” development made by those who offer innovation.
4. **OI2Solve**: approach to «solve problems»

The schema here below shows who use each specific open innovation archetype.

## D1.2 – Specifications definition

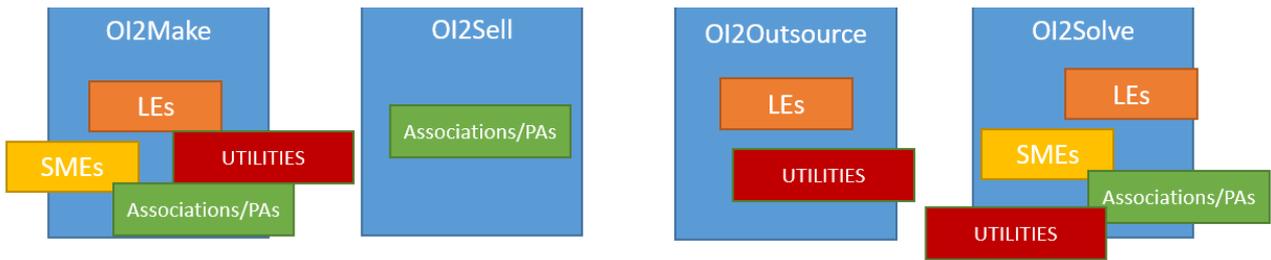


Figure 12 Open Innovation Users

In the OI2Make the objective is to research for ideas and concept that could be shared and elaborated in a collaborative way. There is no competition aspect because the main goal is to improve shared ideas. This archetype is usually adopted by large enterprises, always looking for new ideas. People inside the company, customers and designers for example participate to this kind of open innovation. An exemplification of a scenario could be the adoption of OI2Make from Indesit and Ducati. They adopted this archetype to find new ideas and to collaborate to advance them.

In the OI2Sell the objective is to collect ideas inside companies, communities or associations to find new concepts. This kind of archetype is often managed by a “broker”. People as designers, students could take part to it. The business model behind this approach is to propose ideas that are achievable.

In the OI2Outsource, after a contest defined to select new ideas, a direct project assignment is made. Actors as start-ups, spin-offs, universities, research centres and SMEs, usually take part to the use of this archetype. Large enterprises use this innovation management archetype to find new competences and proof of concepts of new products. Companies as Electrolux and Enel used it.

In OI2solve companies research ideas to solve issue. This archetype could be managed by third parties, SME or LE that want to improve a product or to solve products’ issues as lack of adoption, complexity. People inside the company, customer and citizens take part to this open innovation. An interesting tool that already apply this OIO2solve is OpenIDEO (<https://www.openideo.com/>).

The overall Open Innovation process can be generalised and represented as shown in Figure 12:

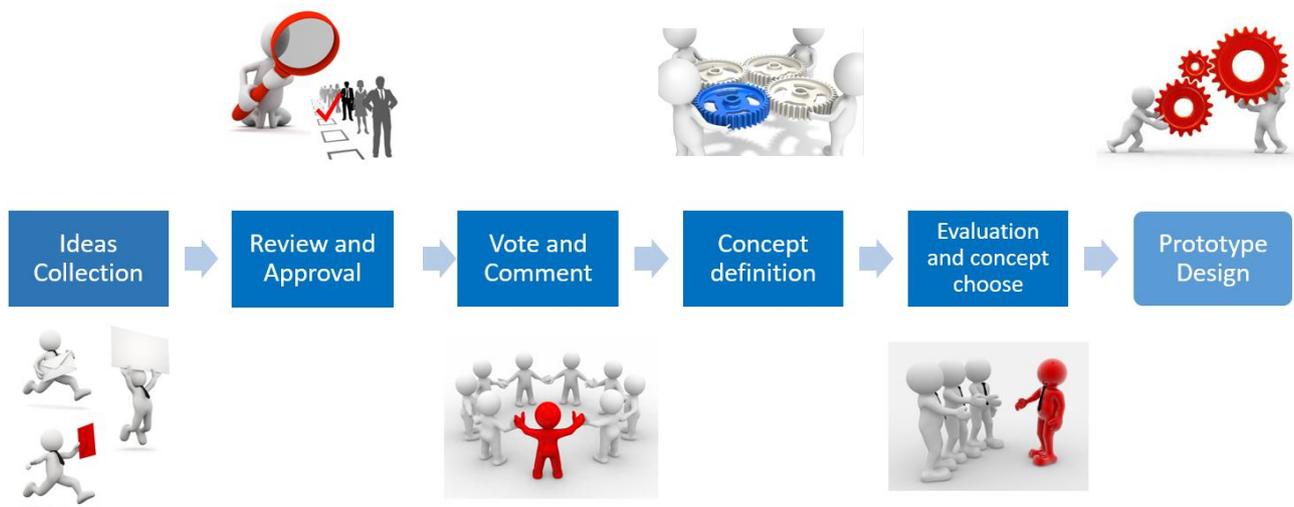


Figure 13 Open Innovation process schema

Some examples of Open Innovation initiatives launched by big companies follow so as to highlight cases of both success and failure:

- **calls for ideas:** some companies look for innovative ideas between different entities such as start-up, SMEs, associations or individuals. They use the call for ideas, an idea competition for people and companies active in specific market. The call organization, goals and results depend on the company who launch the challenge.
- **hackathon:** competitions in which developers have to develop innovative digital solution related to a specific domain in a restricted timeline as for example 24 or 48 continuative hours.
- **awards:** organizations choose awarding of prizes as a method to identify and highlight the innovative realities that have aroused their interest and with which, eventually, they intend to continue the relationship.

The following sections introduce two different open innovation platform, which have been analysed in order to understand their functional specifications, services, functionalities and value proposition.

### 3.2.1 Chaordix

Chaordix claims to be global leader in crowdsourced innovation. It powers collaborative communities for greater customer insights and ideas, co-creation and open innovation. Chaordix is specialized in community innovation and crowd activation. Chaordix uses crowdsourcing to help organizations gain sustained community engagement and predictive intelligence with its technology: Crowd Intelligence. Crowd Intelligence applies methods of crowdsourcing and data analysis to generate new levels of rich market insight and data that would be difficult, if not impossible, to acquire through traditional research methods (Chaordix). The method can be applied to deliver ideas, intelligence and solutions from the collective wisdom of participants of team insights programs, B2B forums, and product innovation communities.

Crowd Intelligence improves traditional methods of market research and open innovation in multiple ways, including:

- generating both rich qualitative and quantitative data from the same larger crowd;
- providing the ability to follow up on early findings with the same crowd for more clarity;
- involving the crowd in prioritization and filtering of the data;
- less survey and sample bias;
- higher sustained levels of participation and greater overall market data to analysis .

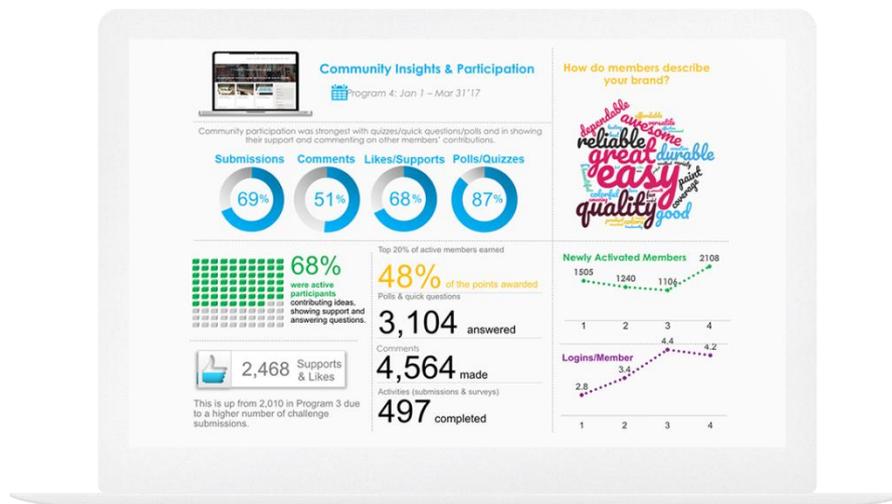


Figure 14 Chaordix interface example

### 3.2.2 Brightidea

Brightidea provides on-demand innovation management software and a SaaS platform that supports collaboration and crowdsourced feedback. Brightidea was developed specifically for mid-sized companies and divisions of large companies that have not time or resources to implement an enterprise level solution. Unlike enterprise idea management tools, which must be installed and configured on the organization’s computer network, Brightidea is totally web-based, MANU-SQUARE

and is hosted on a secure server outside of the organization’s network. The platform provides a complete suite for an end-to-end innovation management solution, from idea collection to the execution of the entire program to global customers (Innovationtools.com). The Brightidea modules include:

- **Research:** it is designed as a secure, collaborative blogging. It is a tool where anyone on the work team can post R&D updates, competitive notes, new developments in academia, and other relevant information.
- **Ideas:** this is the module where team members can submit their ideas. It is highly configurable. It is possible to set up an idea campaign customized around department’s workflow. The idea management module supports both peer review and review team types of evaluations.
- **Projects:** this module provides basic high-level project tracking capabilities, including milestones. It is not meant to compete with detailed task reviews, like those that can be handled by programs like Microsoft Project.
- **Experts:** the expert module’s helps evaluators to quickly find people with the relevant expertise. Not only does this module search employees’ skill profiles, but also their past ideas submitted, research notes and other content posted.
- **Rewards and recognition:** the rewards and recognition toolset is highly configurable. Team leaders can assign points to any achievement or activity in the system and can view reports.
- **Analytics/financial tracking:** Brightidea includes a set of analytics tools, designed to help innovation managers to measure their success and determine where improvements in workflows need to be made.

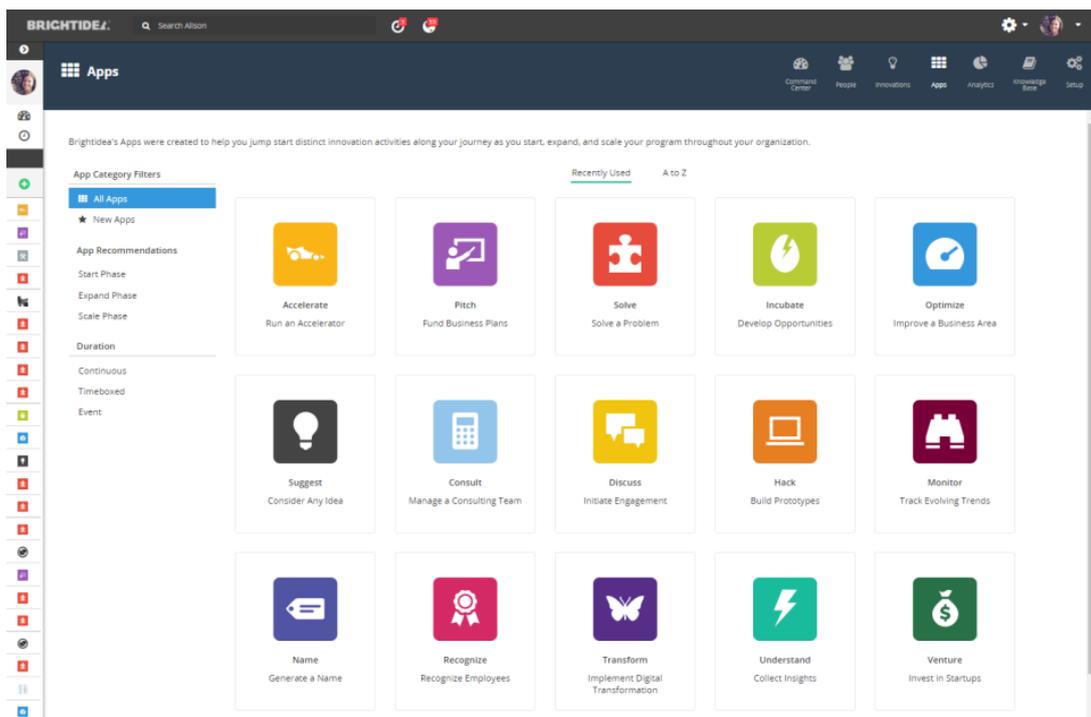


Figure 15 Brightidea modules interface

### 3.3 By-products exchange platforms

Circular economy and industrial symbiosis have been gaining traction as an approach for achieving local, national, and global sustainability. It has received increased attention from multinational companies and policymakers in industrialized countries (Lacy, et al., 2014). There are different examples of platforms which sustain the by-product exchange. Despite, these platforms being usually dedicated to limited regions and to support exchanges within simple marketplaces, they can inspire MANU-SQUARE specifications development, especially for the waste sharing section.

### 3.3.1 Austin materials marketplace

[Austinmaterialsmarketplace.org](http://Austinmaterialsmarketplace.org) brings together businesses of all sizes and entrepreneurs in the City of Austin and Travis County to create closed-loop systems in which one company’s waste is another company’s raw material. It works as follow:

1. A company posts materials and resources available
2. Through data and ID, the platform identifies potential resource matches
3. After check of the feasibility, the exchange is done

## What's in the Marketplace

To view descriptions, quantities available, additional photos and/or SDS attachments; or to start a transaction - you'll need an Austin Materials Marketplace account.

LOGIN

SIGN UP

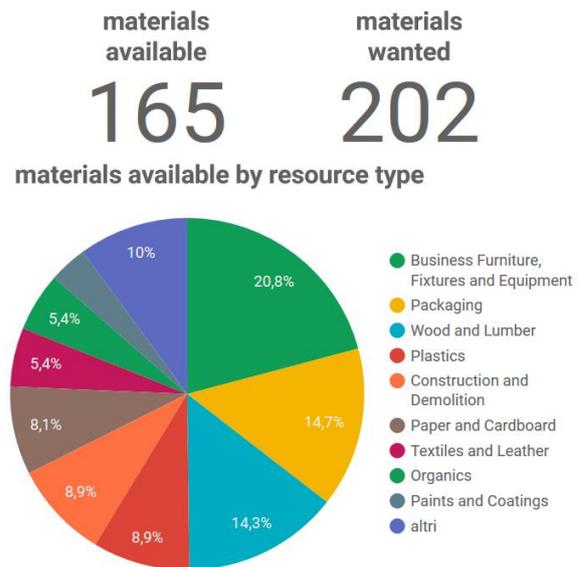


Figure 16 Austin materials marketplace interface

### 3.3.2 Ohio materials marketplace

[Ohio.materialsmarketplace.org](http://Ohio.materialsmarketplace.org) aims to create a closed-loop, collaborative network of businesses, organizations and entrepreneurs where one organization’s hard-to-recycle wastes and by-products becomes another organization’s raw material. The Ohio Materials Marketplace is hosted on the award-winning Materials Marketplace software platform from the U.S. Business Council for Sustainable Development. This online tool enables participating companies and project staff to easily post available or wanted materials, identify reuse opportunities, and exchange underutilized materials. Hundreds of large and small companies, academic institutions, non-profits and entrepreneurs are using the Materials Marketplace around the world.

## D1.2 – Specifications definition

Materials Available : Available		
Material	Description	Ge ^
Spent foundry Sand	Spent foundry sand	We
Caustic Water	We produce approximately 3500 gallons of spent caustic water which contains reactive sulfides and might t	We
Spent Hydro treating Catalyst	Non hazardous spent hydro treating catalyst. Contains aluminum, molybdenum, and nickel. Amount varies, Mc	Mc
SCR Brick	Brick like product.&nbsp; Circular in shape.10" to 12" diameter. 6' to 7" thick.	Mc
Plastic Bottle Caps	Mixed Rigid PP Post-Consumer Plastic Scrap; Pallet Total: 26; Pallet Size: 40" x 48" x 50"; Weight Per Palle	On
Adhesives	Out of date 3M solvent based adhesives. Great for solvent reclamation.	On
Aluminum Oxide	Used brown-fused aluminum oxide dust from grit blasting operation.	Ye
Spent Foundry Sand	Spent Foundry Sand available for pick up. Quantities available in roll off dumpster loads or equivalent	We
Steel racks	112# steel racks constructed out of angle iron and rolled steel.	Mc
Methyl ethyl keytone	Methyl ethyl keytone . 99.9% pure with c of a ; m32 -55gallon drums	Mc
Methyl alcohol		Mc
Un1993 blended solvent(paint related)	Mixed solvents. Great paint line flush. Acetone,hexane,heptane, methyl alcohol,toluene,xylene,ethyl acetate	Mc
Butt-Ends American White Oak	Sawmill has Butt-Ends of American White Oak Logs; Great for Firewood.; Sold by Tuck Load.	Da
Ferrous Chloride	Have ferrous chloride waste from galvanizing process. Spent ydrochloric acid that is classified as ferrous ch	Mc
Bark Fiber	Bark Fiber from American White Oak. Great for Landscape Mulch.	Da
Bark Chips	Bark Chips from American White Oak. Sold by Semi-Truck Load.	Da
Scrap tire fiber	This nylon cord material from scrap tires is very fine. Some tire rubber dust remains in the fiber. Material car	Mc
Corn Cobs whole or tub ground	Whole Corn cobs	On
Verxite, Specialty Vermiculite	Verxite is a highly purified form of vermiculite which is a mica-like mineral; It can be used as a thermal insula	On
Electronic Black AY8	Interior Automotive paint; 2K Solvent-Borne Urethane Basecoat; Laser etchable, flexible; Substrates: ABS, / On	On

Figure 17 List of available by-products from Ohio materials marketplace

### 3.3.3 SYNERGie® 4.0

This project will produce cross-industry material reuse. SYNERGie offers database, project management, and reporting functionality to capture and store information about companies' resources and to easily identify commercial opportunities for reuse. It is used in nine countries around the world. It allows to characterise, search, and match the company's resources within a site and across multiple sites. Input from the world's most experienced industrial symbiosis expert team supports the identifications. Synergie has the following functionalities:

- Integrated mapping of resources to prioritise local sourcing and reuse opportunities
- Advisor guides characterisation of resources for reuse and recommends opportunities based on machine learning (AI)
- Internal and supply chain KPI reporting aligned with stakeholder requirements
- External data set upload for system pre-population
- Secure multi-device app for your desktop, iPad or Android tablet

### 3.4 Main outputs

The analysis of existent platforms allowed to obtain a general overview of:

- the mechanism, operations and activities that are involved in sharing platforms;
- the information that is considered relevant to describe users and their profile in order to support the matching between demand and offer;
- the platform features and characteristics in general;
- the interfaces and the user experience that characterize the analysed platforms;
- the key business models elements and the services that characterize the analysed platforms.

The analysis portrayed a situation in which most of the existing B2B platform in the field aim to provide a brokerage service for the provision of finished goods. MANU-SQUARE aims to apply and extend the models that these existing platforms offer. First of all, since MANU-SQUARE is about capacity sharing, the focus is more on the process and on the associated resources rather than on the product being delivered.

Secondarily, most of the aforementioned examples in the manufacturing sector do not act as a facilitator, but as an effective intermediary which do not allow the direct interaction between customers and suppliers. Moreover, these platforms are mainly dedicated to very specific manufacturing sectors (few machining operations available, few materials, etc.).

MANU-SQUARE, to the contrary, aims to provide customized services that adapt to different users' needs in cross-sectorial domains, covering the whole spectrum of value chain activities. On top of basic services, MANU-SQUARE aims to foster the direct interaction between the players involved in a transaction, acting as it is expected from a platform. MANU-SQUARE has to be designed in order to guarantee secure and reliable transactions without be directly involved in the interaction. The platform has to support suppliers and customers in getting in touch, interact and generate transactions. In addition to an easy-to-use interface, that already also existent platforms provide, MANU-SQUARE aims to introduce a more advanced matching mechanism to increase the matching effectiveness thanks to the use of ontologies and inference rules. Moreover, through the adoption of Open Innovation, companies have the possibility to open their design processes to actors at any level residing in the platform to effectively achieve new customer-oriented product-service designs. The Innovation Managers can guide contributors in identifying new cross-domain collaborations for innovative PSS and to suggest possible reuse of unused capacities, including know-how and technologies, where different stakeholders (consumers but also technology and new material providers, new companies with brilliant ideas they cannot develop on their own etc.) can directly contribute, vote and comment on others' ideas.

## 4 MANU-SQUARE PLATFORM'S PLAYERS AND RELATED NEEDS

To define MANU-SQUARE specifications, it is necessary to clearly identify which players will use and interact with the platform. The success of the MANU-SQUARE platform, as any kind of platform, will be strictly dependent on the players of its ecosystem. A strong and growing community of many and different types of players will be fundamental. The capacity of the platform to directly provide value to the ecosystem's players and to facilitate the exchange of value between them will be the most relevant success factor. Therefore, this section aims to:

- Provide a description of the players that will have a relevant role in the MANU-SQUARE ecosystem.
- Provide an overview of the most relevant needs of these players that can be satisfied by the MANU-SQUARE platform.

The outputs of the T1.1 and the set of tools introduced in section 2.1.1 (requirements and expectations gathering) have been used to collect and define the MANU-SQUARE players' needs and expectations.

### 4.1 Players

T1.1 conducted a detailed stakeholder analysis of the MANU-SQUARE platform. The stakeholder analysis has been developed in order to maximize the MANU-SQUARE project results, addressing the interests, expectations, and requirements of the stakeholders. One of its objectives has been to identify and classify the potential stakeholders of the MANU-SQUARE platform. The stakeholders identified by the T1.1 activities are:

- **Manufacturers:** this stakeholder group consists of producer of products, components, as well as production technology (e.g. robotics, equipment), in all enterprise sizes (i.e. large, medium, small).
- **Start-ups and innovators:** this stakeholder group consists of start-ups and innovators that are seeking different types of support to develop, materialize, and industrialize their product/service concepts or ideas, including production capacity, know-how, and technology.
- **Service Providers:** this stakeholder group consists of IT service providers, Laboratory services providers, Legal, IPR, contract service providers, consultancy service providers, waste sub-contractors, maintenance and training service providers, and logistics and distribution service providers.
- **Knowledge providers:** this stakeholder group consists of research institutes and universities providing know-how for business activities or joint research projects with other stakeholders.
- **Innovation facilitators:** this stakeholder group consists of innovation facilitators such as innovation managers, innovation/technology centres for coaching and engagement, info & support organizations, and innovation hubs.
- **Multipliers:** for the success of the MANU-SQUARE platform, building communities and achieving a critical mass of customers and suppliers participating in the platform is a critical factor. This makes multipliers such as clusters and sectorial network organizations, industry associations and industry communities, potential stakeholders of the platform.
- **Investors:** investors that are looking for new business and investment ideas are potential stakeholders of the platform. Lack of or no access to financial resources is one of the most widely cited reasons for failure of innovation projects, especially ones promoted by start-ups. Developing a direct link with crowdfunding platforms and external investors is expected to mitigate this concern.
- **Regulators:** regulatory compliance, protection, and audit influence and set the rules that organizations must undergo, including the future MANUSQUARE spin-offs. It is therefore important to regulators and auditors such as relevant governmental bodies as a stakeholder.
- **Consumers:** this stakeholder group consists of consumers which can be real evaluators and co-designers of innovative business ideas and products/services, which make them a potential stakeholder of the MANU-SQUARE platform that can exploit and extend this value created by the consumers.

Starting from these players and related description, it is necessary to make the following considerations. The classification of stakeholder types is not the most suitable to identify players' needs. A manufacturer which is looking for capacity and a manufacturer which aims to share capacity have different needs. Consequently, the reasons for which they should access to the MANU-SQUARE platform are completely different. For this reason, specifications definition must take also into consideration the interaction that each stakeholder has with the platform.

Table 3 introduces the concept of user types, which are players differentiated by their specific interaction with the MANU-SQUARE platform. Each user type is associated with a description and with the possible stakeholder type.

User type	User type description	Stakeholder type
 <p><b>Customer</b></p>	<p><b>Through the MANU-SQUARE platform, this player can seek for production capacities to quickly ramp up production during peak periods, find production capacities, capabilities, know-how and by-products, supplied as a service, and/or third-party support for innovation.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Industrial companies seeking capacities, capabilities, know-how and/or technology, by-products</li> <li>• Industrial companies that need outsourcing of engineering to industrialize a product or idea</li> <li>• Industrial companies or start-ups looking for industrializing their products or a manufacturing site</li> <li>• Internal company offices that want to use the platform for sharing issues and discussing ideas</li> <li>• Innovation managers that are interested in new ideas for brand-new products</li> <li>• Innovator that is looking to develop an idea</li> </ul>	<p>Manufacturers, start-ups and innovators, multipliers</p>
 <p><b>Supplier</b></p>	<p><b>Supplier uses the MANU-SQUARE platform to share its production capacity, capabilities, know-how and/or technology through the platform. This player can have resources which are not fully used and/or production capacities, capabilities, know-how and by-products that it aims to provide as a service.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Industrial companies that want to sell non-used manufacturing capacity</li> <li>• Industrial companies that want to utilize non-used capacity for new product and business</li> <li>• Industrial companies that can provide by-products or waste</li> <li>• Raw materials or products suppliers</li> <li>• Production technology companies offering current and/or new production technology</li> </ul>	<p>Manufacturers, Knowledge providers</p>
 <p><b>Service Provider</b></p>	<p><b>Service provider uses the MANU-SQUARE platform to provide its services to the different players of the MANU-SQUARE ecosystem. The solutions made available by the service provider can support the different players in the use of the services available on the platform. Moreover, it can develop self-standing services, enriching the platform with new functionalities or integrating it with other software tools in compliance with the MANU-SQUARE vision.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Logistics and distribution providers</li> <li>• IT system, software, and service providers and integrators</li> <li>• Knowledge providers (universities, research centres, etc.)</li> <li>• Laboratory services providers (analysis, certification, and prototyping etc.)</li> <li>• Legal, IPR, and contract services providers</li> <li>• Business consultants for market analysis, application scouting, or engineering</li> </ul>	<p>Service Providers</p>

	<ul style="list-style-type: none"> <li>• Freelance engineers or product managers</li> <li>• Technical writers for documentation and marketing</li> </ul>	
 <p><b>Innovation Facilitators</b></p>	<p><b>Innovation facilitator uses the MANU-SQUARE platform to share its competences in innovation management, identifying innovation projects requiring, acting as a link between customers and suppliers, supporting in the identification of the suppliers for creating a sustainable value network, exploiting end-users' opinions for product-service early assessment.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Consultants</li> <li>• Innovation/Technology centre for coaching, engagement, etc.</li> <li>• (Digital) innovation/tech hubs for developing new technologies, prototyping, populating</li> <li>• Info&amp; Support organization</li> </ul>	<p>Innovation facilitators, Knowledge providers</p>
 <p><b>Multiplier</b></p>	<p><b>Multiplier uses the MANU-SQUARE platform to increase the value provided to its associates through the direct utilization of the services or supporting the access to the platform.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Clusters and sectorial network organizations</li> <li>• Industry associations</li> <li>• Start-up communities</li> <li>• Bloggers</li> <li>• Technology gurus</li> </ul>	<p>Multipliers</p>
 <p><b>Auditor</b></p>	<p><b>Auditor supports the MANU-SQUARE platform in order to make its services effective and reliable. It certifies the MANU-SQUARE players acting as an unbiased and objective actor.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Governmental bodies for regulation, maximization of industrial output, and promoting</li> <li>• External assessors for company/resource certification</li> <li>• Internal assessors for company/resource certification</li> </ul>	<p>Regulators, Knowledge providers, Service Providers</p>
 <p><b>Investor</b></p>	<p><b>Investor which use the MANU-SQUARE platform to have the access to investment opportunities, which aims to have innovation projects, especially ones promoted by start-ups. This player obtains through the platform the access to an organized, ontology-based repository of multi-sectorial innovative projects with different maturity levels, also directly assessed from consumers.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Investors looking for new businesses and/or investment ideas</li> <li>• Business angels</li> </ul>	<p>Investors</p>
 <p><b>Consumer</b></p>	<p><b>Consumer uses the platform to increase its involvement in the product development, obtaining the for-free access to a wide database of innovative products, innovative services and ideas, the easy contact with innovators and companies and the capability to influence the shape and functions of the products they will use in the future.</b></p> <p>This type of player can be embodied by:</p> <ul style="list-style-type: none"> <li>• Consumers looking for co-designing</li> <li>• Consumers which want to test products and services</li> <li>• Consumers which want to participate to crowd-funding and/or market analysis</li> </ul>	<p>Consumers</p>

Table 3 MANU-SQUARE players

## 4.2 Players' needs

The success of every company is strictly dependent on its ability to create products and services able to satisfy customer's needs. As Steve Jobs said, "You've got to start with the customer experience and work backward to the MANU-SQUARE

technology. You cannot start with the technology and try to figure out where you are going to sell it”. Taking the cure from this quote, the definition of the platform specifications must start with users’ needs. These are listed in Table 4 and have been collected through:

- The outputs from Task 1.1 obtained through interviews involving relevant stakeholders who may be potential adopters of the MANU-SQUARE platform
- A Workshop involving all MANU-SQUARE partners
- Reports and research from manufacturing industry, innovation management and economics

Need	Description
Find the right suppliers	Companies aim to find the right suppliers, compliant with their expectations and needs, with better conditions (e.g. preliminary information such as KPIs and track records, references from other companies, etc.) and precise information about their resources, capacities and capabilities. Companies usually refer to suppliers inside their network, without considering those outside. This does not happen because suppliers outside the network are not capable to satisfy their needs, but because the other potential suppliers are simply not known. This happens in particular for SMEs and start-ups (T1.1 outputs) (Celtrino Marketing, 2018) (Entrepreneur.com, 2018).
Manage fluctuating production demand	<b>Suppliers side:</b> demand fluctuation is an issue which afflicts companies in all sector, in particular manufacturing ones (T1.1 outputs) (Markovitz, 2017). Unused resources have a relevant impact on costs and on investment amortization. The opportunity to share production capacity, obtaining third-parties orders, allows to reduce unused resources, optimizing asset investment (Eurostat, 2017). <b>Customers side:</b> demand peaks have a relevant impact on revenues opportunities and in the capacity to fulfil customer needs and expectations. Having the opportunity to access to additional or not owned resources allows companies to have a flexible capacity without invest in assets.
Access to not owned competences and technologies	The successful development of new product and new processes, and the capability to satisfy special and custom orders may depend on competences and/or technologies that not always are owned or easily accessible. The access to not owned competences and technologies from third-party ease the activities of a company, increasing its business opportunity without investing for occasional needs.
Optimize supply chain and processes	Companies aim to continuously optimize their supply chain and processes. The opportunity to access to new suppliers, observing their capacities, capabilities and performances enables companies to compare existing and new suppliers. This allows to optimize supply chains and processes from both economic, social and environmental points of view.
Increase innovation opportunities	<b>Customers (Manufacturers):</b> Innovation is the key of survival for the companies. The lack of innovation can hurt a business regardless of its size. <b>Customers (SMEs and start-ups):</b> Europe historically lacks the ability of exploiting innovative ideas. The creation of an environment able to address non-financial start-ups and SMEs problems (i.e. support throughout product engineering phase, identify who can manufacture products, find market-driven design solutions, etc.), and to create the channels for accessing venture capital platforms and financing opportunities can be the keystone to exploit innovative ideas. <b>Innovation Facilitators:</b> having the experience in innovation management does not mean having great ideas. Innovation Facilitators aim to support not only their own ideas, but also those coming from third party players with professional know-how about the innovation process.
Trust in unknown partners	Even for the longest lasting relationships, the initial period is characterized by a suboptimal level of efficiency (need for a mutual adaptation of coordination mechanisms, lack of trust due to different industrial cultures or, simply, fear of the unknown, wastes due to possible misunderstandings in specifications’ definition and so on). The presence of a reliable third-party player, which acts as guarantor, can foster players involved in a transaction to trust each other.

## D1.2 – Specifications definition

Find new potential customers	The most pressing problem for SMEs is the difficulty in finding new customers with 25% of companies struggling in this search. (European Commission, 2016). Moreover, every kind of company has to face with customers that no longer have a need for a given product, or, for various reasons, find new solutions from competitors. If a company wants to be a business leader, it must regularly increase gross revenues by adding more and more buyers who will purchase their solutions to remain viable and profitable (Hall, 2012).
Make profit out of asset investments	Investment in resources has a relevant impact on business performance. Maximise the ROI is one of the main business objectives of every company. The opportunity to share production capacity, obtaining third-parties orders, allows to reduce unused resources, optimizing asset investment.
Access to needs and ideas to be transformed in marketable innovations	Having access to needs that can be covered by new products/services or to ideas from third-party entities is interesting for every company. Companies and investors are always interested in identifying new innovation initiatives to invest on, in particular if this can be accessed and assessed with minimum efforts and resource utilisation.
Ease relationship establishment and management	The possibility to have a structured channel to access to supplier or customer can be of incredible benefit for a company, reducing efforts and time dedicated to find new partners and to set-up collaboration agreements. As the creation of business connections is an activity that consume time and resources, manufacturers need structured & market certified channels able to provide solutions near to them in terms of time of delivery, cost, location and administrative effort.
Protect valuable information, data, and know-how	The internet has literally changed the way companies do business. It facilitates the access to information. However, it also presents considerable risk. Companies have to take care of their information and data, avoiding careless sharing. The adoption of external platforms for procurement has to be supported by secure local storage systems able to maintain data ownership across service delivery.
Access to structured, homogeneous and reliable information	Companies usually have not precise information about suppliers, providers, customers and partners, in particular of those they are looking for. Information are usually collected through the internet or the references coming from other companies in the network. This creates mistrust, delaying the creation of relationships. The access to an organized, ontology-based repository of players, whose information are guaranteed by an unbiased third-party actor can increase the search and the interaction effectiveness.
Identify opportunities for their associates	Industrial associations, innovation hubs and Chambers of Commerce aim to create a strong network in order to support as best as possible their associates. Have the access to a set of business opportunities or solutions to propose to their associates can strengthen relations and increase the value proposition.
Have reliable standard/technology platform through which develop and provide services	Developers, using standards and technology platform, can reduce development effort, having the access to already existent resources (code, libraries, API, etc.). Developing solutions based on standards, allows to increase their compatibility, decrease technology acquisition costs, give the opportunity to the users community to develop in-depth product expertise.
Find ideas and innovative solutions on which to invest	Investors aim to have a access to the largest pool of ideas and business opportunities, in order to identify the most profitable and successful ones.
Communicate their needs	These days, fulfilling customers' needs is fundamental for a company in order to be competitive. It is necessary also to consider that also consumers aim that companies satisfy their needs in order to have better products and services. However, for consumers, it is not easy to communicate and let understanding their needs. Companies usually have not a structured way which allows consumers to clearly communicate their needs.

**Table 4 MANU-SQUARE platform users' needs**

Figure 18 represents the first part of the MANU-SQUARE specification map and it aims to represent the relationship between stakeholders and needs. Each player is represented by a cue ball of the same colour of its icon (e.g. customers: yellow cue ball). The cue balls positioned near each need, represent the player/s to whom the need is related.



Figure 18 MANU-SQUARE specifications map (part 1)

### 4.3 Expectations from stakeholders

The interactions with MANU-SQUARE stakeholders and project partners allowed to collect not only their needs but also their expectations on the platform. Table 5 contains a list of MANU-SQUARE platform’s functional and technical expectations, gathered during the workshop carried out in Porto within the consortium members and, even though in an heterogeneous way, it creates an ideal bridge towards the identification of what the platform should offer.

#	Expectation description
1	“Platform should find the most fitting capacity and capability offer for Customers and the most attractive request for Suppliers.”
2	Platform should support buying and selling of production capacity, facilitating customer-supplier matching, RFQ process, supporting communication, cooperation, transactions and issues resolution between the involved players.”
3	“Platform should facilitate the accessibility to more options for suppliers/providers relevant to their business with better conditions (e.g. price) and precise information about their capacities and capabilities.”
4	“Platform should support the quicker establishment of contacts with suppliers or customers than using traditional channels.”

5	“Platform should support the identification of Suppliers able to provide specific capabilities requested by Customers, facilitating customer-supplier matching, RFQ process, supporting communication, cooperation, transactions and issues resolution between the involved players.”
6	“Platform should support the identification of industrial symbiosis opportunities and the management of coordinated resources flow across different value networks and sectors, facilitating the reduction of manufacturing activities footprints.”
7	“Platform should provide quicker and accurate prioritization of new business/product/service ideas through customer/supplier network, which applies to developing companies and start-ups to a larger extend due to their limitations in resources to commit.”
8	“Platform should provide support for the involved actors of the business activity, if the agreements are not met.”
9	“Platform should support the development of ideas, concepts and advancements, facilitating the contribution from different players and sides, cross-fertilising new business opportunities.”
10	“Platform should support the collaborative design of ideas, concepts and advancements to exploit community feedback aligning needs to service and products.”
11	“Platform should support handling of the contractual agreement for the business activity.”
12	“Platform should support external financing entities interested in identifying new innovation initiatives to invest on.”
13	“Platform should support the development of third-party application through dedicated SDK”
14	“Platform should support the monitoring and visualizing the business activity with the supplier/customer, providing traces of the business activities.”
15	“The collected data should be stored in secured databases.”
16	“All platform’s functionalities implemented should be available through a suitable and easy to use interface.”
17	“The platform should use a clear and unbiased method for users’ assessment and ranking.”
18	“The platform should be designed with modular components, in order to allow to scale up, adding functionalities and/or tools, guaranteeing extensibility”
19	“The platform should be designed and developed in order to guarantee accessibility, efficiency, maintainability, response time, stability and security.”
20	“One of the main strategic activity, which allow to have revenue and to provide value to users is transaction management. The platform should support the transactions as Booking, Air-bnb and other platforms do, being the guarantor between the involved party. How manage these transactions and the associated risks is a relevant aspect that should be taken in consideration in particular during the business model development.”

Table 5 MANU-SQUARE platform’s functional expectations

The interviewing activities carried out to gather MANU-SQUARE related expectations allowed also to identify few open issues defined as “Question marks” (Table 6), that should be taken in consideration in the future development of the platform. Even in this case, the list of open issues is based on the outcome of the workshop carried out in Porto within the consortium members. This list closes the first part of analysis of stakeholders’ needs that sets the basis for the definition of the platform functionalities in the next chapter.

#	Question marks description
1	“Competition between companies is a challenge. Rank companies based on their performances and previous transactions can reduce suppliers and customers’ involvement”.
2	“Reputation and reviews associated to each profile can have an impact also on business activities which are not related with the MANU-SQUARE platform”.
3	“Critical mass is a challenge. Customer should have the possibility not only to find a solution but also to choose between different options”.
4	“The MANU-SQUARE platform can be likely to be misused. The platform has to avoid spam and undesired request. Preventive actions and mechanism to avoid these issues should be developed”.

Table 6 MANU-SQUARE platform’s question marks

## 5 MANU-SQUARE PLATFORM FUNCTIONALITIES AND TOOLS

This chapter takes a further step from the identification of stakeholder’s needs by shifting the focus to the platform and, in particular, to how it is supposed to cope with those needs in terms of offered functionalities. An analysis is carried out to create this mapping of functionalities on needs and to evaluate their relevance according to a set of parameters. The second part of the chapter is meant to aggregate functionalities in the software packages that offer them thus showing a concrete link with the tools design and implementation to be carried out in WP4.

### 5.1 Functionalities coping with stakeholders’ needs

The definition of the functionalities to be included in the MANU-SQUARE platform is an important step for its successful development. In the following sections, we refer to functionalities as to:

***“a specific operation performed by the MANU-SQUARE platform, which can be carried out independently and/or to provide or support one or more services.”***

This section aims to introduce the MANU-SQUARE platform functionalities providing:

- general description of each functionality;
- qualitative assessment to identify the most relevant functionalities for the success of the MANU-SQUARE platform;
- general description of the tools, technologies and software (SW) components that have to support the MANU-SQUARE platform in providing each functionality.

MANU-SQUARE DoA provides a general and not-exhaustive list and description of the functionalities that should be included in the MANU-SQUARE platform. Table 7 has been developed in order to:

- Align functionalities described on the DoA with the users’ needs and stakeholders’ expectations introduced in § 3.1.3;
- Introduce functionalities not included on the DoA, to completely satisfy users’ needs and stakeholders’ expectations;
- Fix the scope and the boundaries for specifications definition.

Functionality	Description
Production capacity matching	The platform enables the matchmaking among Suppliers of available manufacturing capacity and Customers that aims to exploit that capacity. Starting from a set of parameters / attributes (resource characteristics, process characteristics, product characteristics, etc.), which characterizes the searched production capacity, the platform is able to propose the potential compliant suppliers, filtering them according to user selected KPIs. The match can be performed “automatically” by the platform thanks to the matching engine and the algorithms based on ontology and semantics. If the platform is not able to identify any matching, the support of external users (innovation facilitators, etc.) can be exploited to identify possible connections.
Know-how capabilities matching	The platform enables the matchmaking among Suppliers of available knowledge capacity and Customers that require support in the related field of expertise. Starting from a set of parameters/attributes which characterizes the searched know-how capabilities (competences, product characteristics, process characteristics, sector, problem to be solved, etc.), the platform is able to propose the potential compliant Suppliers. The match can be performed “automatically” by the platform thanks to the matching engine and the algorithms based on ontology and semantics. If the platform is not able to identify any matching, the support of external users (innovation facilitators, etc.) can be exploited to

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	identify possible connections.
By-product matching	<p>The platform enables the matchmaking among manufacturers whose manufacturing system generates one or more by-products, and customers that can exploit the by-product as input resource.</p> <p>Starting from a set of attributes which characterizes the input resources of the customer (by-product, waste and/or energy), the platform is able to propose the potential compliant solutions.</p> <p>The match can be performed “automatically” by the platform thanks to the matching engine and the algorithms based on ontology and semantics. If the platform is not able to identify any matching, the support of external users (innovation facilitators, etc.) can be exploited to identify possible connections.</p>
Sustainability Assessment	<p>The platform is able to support sustainability assessment of shared capacities, capabilities and by-products. The functionality supports the supplier to assess its resources in order to provide sustainability KPIs to allow Customers to compare Suppliers’ resources. The assessment and the obtained KPIs can be self-verified, platform verified, third-party verified, etc.</p>
Ecosystem optimization	<p>The platform is able to support the ecosystem optimization, adopting for Suppliers ranking, a specific objective function. This is developed in order to suggest the best solution to improve the overall sustainability and not only the ones of the two involved companies (Customer and Supplier).</p>
User Profile management	<p>The platform supports each user in the creation of its profile by providing a set of fields and parameters according to the type of service they are expected to use (for example inputs / outputs materials, processes, resources, technologies, competencies etc.). This allows reducing user efforts for data entering and to optimize the matching process.</p>
Reputation management	<p>The platform allows the users that are involved in a transaction to evaluate the involved parties. The evaluations are used to define the reputation of the users. The tool, that will manage the reputation, has to be developed in order to allow an impartial, unbiased and fair reputation system.</p>
Suppliers assessment	<p>The supplier assessment is a functionality that, upon a customer query on the platform, is able to provide as result a list of the available research outputs, ranked according to customer selected filtering parameters (cost, sustainability, speed of delivery, etc.).</p> <p>The mechanism exploits the results of the research coming from the matching algorithm and orders them by exploiting the KPIs gathered by the Reputation management. The ranking is based on the different assessment parameters such as reputation, sustainability performances etc. The evaluation is weighted by a measure of each parameters’ relevance for the specific user..</p>
Certifications management	<p>The platform allows Auditors to certify players through a verified and secure certifications management system. Certifications are associated to users’ profile.</p>
Information security and privacy	<p>The functionality supports the management of information across the platform. Users which insert information and data are able to decide which level of accessibility they are providing to their information, deciding to share with other users or only with the platform. The platform is able to avoid the access to critical information and to track the users’ contribution in order to clearly trace back the intellectual property rights. To do so, the functionality integrates a blockchain infrastructure supporting disintermediation from a trusted provider in the exchange of data and tracking of information ownership.</p>
Communication support	<p>The platform supports communication among platform users, streamlining connections and mediating the interactions among parties. According to the business model definition that will be performed in WP5 and the type of service the user will access, the functionality will manage blind or not-blind communication among platform users.</p> <p>The functionality will provide the means of communication necessary to ease connections (messages, e-mail system, chatbots, etc.), with particular attention to data exchange security, avoidance of spam generation and misuse of connection means.</p>
Innovation management	<p>The platform supports the management of a social interface where, starting from a defined content, different users can provide tracked and structured contributions. To this end, the platform administrates the introduction of new ideas, the gathering of feedback from</p>

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	potential users, the flow of contributions deriving from third parties and the creation of project related contributors' lists with public or private accesses.
RFQ management	The platform has to support the transaction between customers and suppliers streamlining the interactions among parties in the whole contractual and financial management aspects. Therefore, this functionality provides not only the infrastructure to enable the definition and management of quotations, but also manages the level of visibility of the quotations and of the partners exchanging requests and transactions, according to business model guidelines. The functionality will consider the main steps of an RFQ management process: definition of RFQ requirements, evaluation of the supplier responses, awarding the purchase order and providing feedback to suppliers.
Transactions management	The functionality supports the creation of traceable transactions across the platform value network. It is meant to satisfy two main needs: (i) traceability and transparency of resources; (ii) guarantee the ownership of contributions and information created on the platform.
Support to platform expansion	This functionality supports the extensibility of the platform by managing the integration of third-party services or the access by third-party applications to the functionalities of the platform itself. The functionalities integrate APIs required to connect with existing components, libraries to include basic services inside new applications, guidelines to produce add-ons to the basic GUI respecting overall style.

Table 7 MANU-SQUARE platform functionalities

Starting from the first part of the map, introduced in Figure 18, Figure 19 has been developed associating functionalities to the needs they solve.

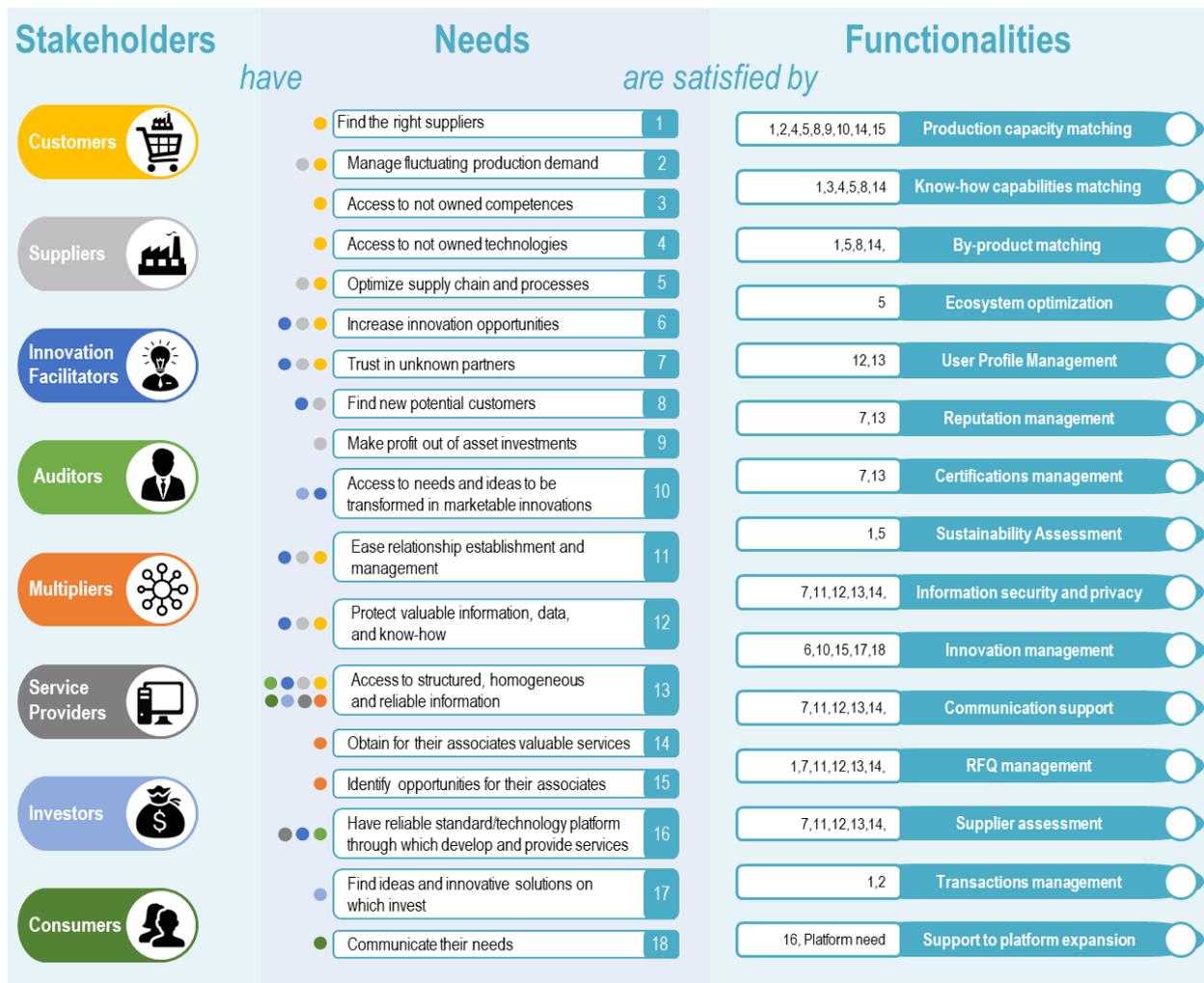


Figure 19 MANU-SQUARE specifications map (part 2)

**5.1.1 Functionalities relevance for the success of the MANU-SQUARE platform**

The evaluation of the platform functionalities has been performed involving all the project partners. Each partner has received a document describing the functionalities and it has been asked to evaluate them on three parameters: value-added compared with existent solutions, relevance for users, economic strategic value for the platform. To every parameter, the evaluator could assign points between 1 and 5 (1-not necessary functionality, 2-non-value-added functionality, 3 necessary functionality, 4 value added functionality, 5 exceptional functionality). The results, reported in Table 8 sorted by average relevance and in the following graphs, generally define development priorities of the platform's functionalities.

	Value-added compared with existent solutions	Relevance for users	Economic strategic value for the platform	Average Relevance
Production capacity matching	4.14	4.63	4.63	4.46
Blockchain-based contribution tracking	4.33	4.14	4.29	4.25
By-product matching	4.29	4.00	4.38	4.22
Know-how capabilities matching	4.14	4.13	3.88	4.05
Transactions management	3.20	3.86	4.14	3.73
Trust management	2.83	3.75	4.13	3.57
RFQ and Transactions management	2.83	3.71	3.86	3.47
Reputation management	2.57	4.00	3.75	3.44
Sustainability Assessment	3.43	3.43	3.43	3.43
Certifications management	2.71	3.50	3.38	3.20
User Profile management	2.57	3.25	3.50	3.11
Ranking mechanism	2.29	3.50	3.50	3.10
Idea management	3.00	3.14	3.14	3.10
Communication support	2.67	3.38	3.00	3.01
Support to platform expansion	2.57	2.75	3.25	2.86
Ecosystem optimization	2.83	2.71	2.86	2.80

Table 8 MANU-SQUARE platform functionalities relevance

Figure 20 and Figure 21 sum up the assessment results:

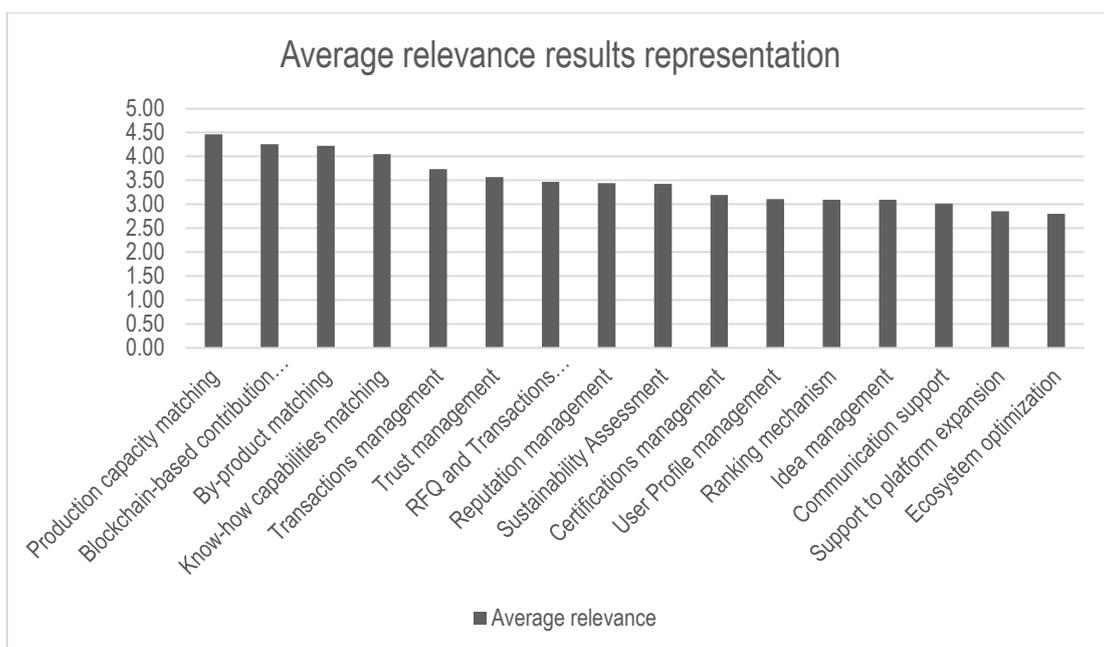


Figure 20 Average relevance of MANU-SQUARE functionalities

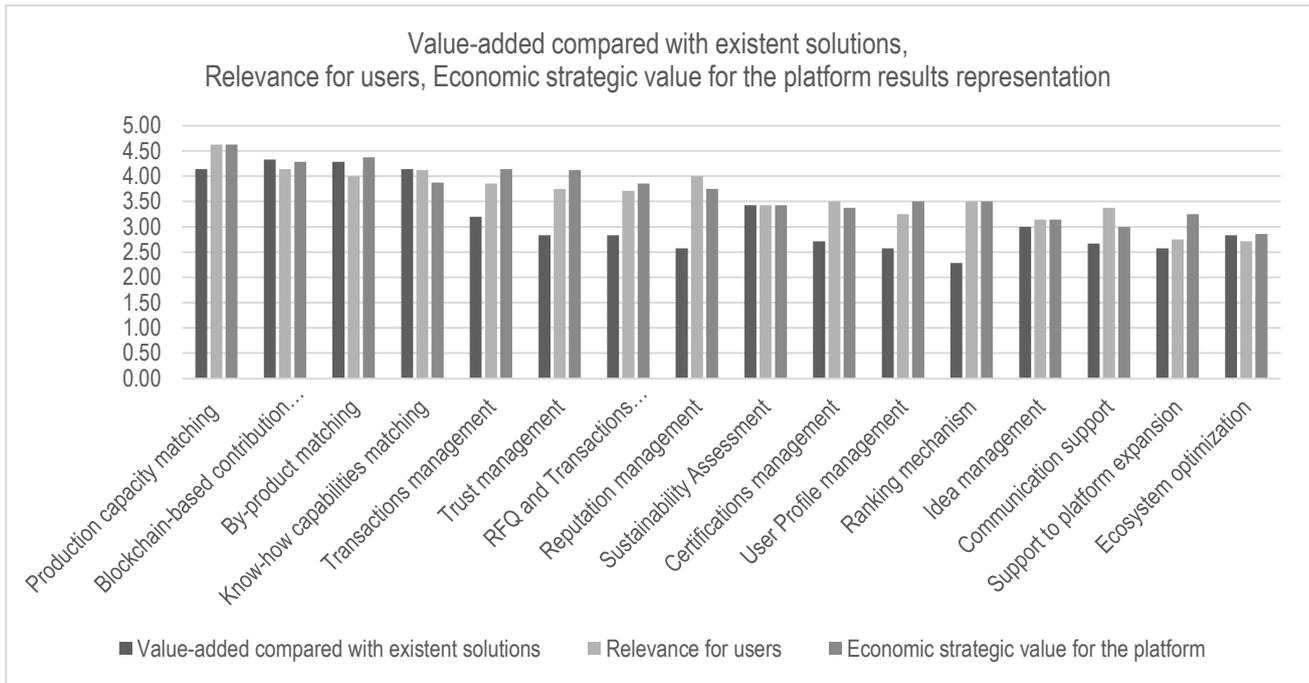


Figure 21 Value-added comparison with existing solutions, relevance for users and strategic value of MANU-SQUARE functionalities

### 5.1.2 Preliminary mapping and validation of end users’ needs

In collaboration with Task 1.3, the list of needs identified during the phase of specifications design has been discussed with the end users active in the consortium, in order to verify the alignment among requirements of their validation cases and MANU-SQUARE provided functionalities.

As a result, in Table 9, MANU-SQUARE players’ needs have been mapped on the related platform functionalities and on the two demonstrators (Machining and silk & textile industry) that will be used as validation cases in the second part of the project.

As it can be expected, the table highlights different validation needs in the two use cases, reflecting specific needs deriving from the implementation of the MANU-SQUARE services in sector specific contexts. Moreover, few of the needs identified in Task 1.2 are neglected by both the use cases, showing a good validation coverage for the elements to be developed in the project. However, in the following stages, it will be fundamental to verify if these needs are broadly considered not relevant, in order to better scope the functionalities provided by the platform.

Needs	Related Functionalities	Demonstrator I Machining Industry	Demonstrator II Silk & Textile Industry
Find the right suppliers	Production capacity matching	x	x
	Know-how capabilities matching	x	x
	By-product matching		x
	Sustainability Assessment		x
	RFQ management	x	x
	Transactions management	x	x
Manage fluctuating production demand	Production capacity matching		
	Transactions management		
Access to not owned and competences technologies	Production capacity matching	x	x
	Know-how capabilities matching	x	x

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Optimize supply chain and processes	Production capacity matching	x	
	Know-how capabilities matching	x	
	By-product matching		
	Sustainability Assessment		
	Ecosystem optimization	x	x
Increase innovation opportunities	Innovation management		x
Trust in unknown partners	Reputation management	x	x
	Certifications management	x	x
	Suppliers assessment	x	x
	Information security and privacy	x	x
	Communication support	x	x
	RFQ management	x	x
Find new potential customers	Production capacity matching	x	
	Know-how capabilities matching		x
	By-product matching		x
	Ecosystem optimization		
Make profit out of asset investments	Production capacity matching	x	
Access to needs and ideas to be transformed in marketable innovations	Production capacity matching		x
	Innovation management		x
Have a potential structured channel to access to suppliers/customers	Suppliers assessment	x	x
	Information security and privacy	x	x
	Communication support	x	x
	RFQ management	x	x
Protect valuable information, data, and know-how	User Profile management	x	x
	Suppliers assessment	x	x
	Information security and privacy	x	x
	Communication support	x	x
	RFQ management	x	x
Access to structured, homogeneous and reliable information	User Profile management	x	x
	Reputation management	x	x
	Certifications management	x	x
	Suppliers assessment	x	x
	Information security and privacy	x	x
	Communication support	x	x
	RFQ management	x	x
Identify opportunities for their associates	Production capacity matching		
	Innovation management		
Have reliable standard/technology platform through which develop and provide services	Support to platform expansion		

Find ideas and innovative solutions on which to invest	Innovation management		X
Communicate their needs	Innovation management		X

Table 9 Mapping among stakeholder needs, related functionalities and industrial validation cases

### 5.2 Tools and SW components to support functionalities

The MANU-SQUARE platform will integrate different tools in order to provide all the functionalities described in § 5. At this stage of the project, it is premature to provide all the detailed tools' characteristics. The responsible of each tool development will take care of the main relevant technological aspects. However, in this task, it is first necessary to provide an overview of the different functionalities that each tool has to provide. Secondly, plans are made for the development phase in order to guarantee that the different tools can be integrated in the platform by developing the expected functionalities.

The project plan provides a draft of the SW architecture. This section aims to add information related to the architecture's draft, detailing the role of tools and related components that will be integrated in the MANU-SQUARE platform in order to guarantee that specification include the technological aspect. The final architecture will be designed in Task 1.4.

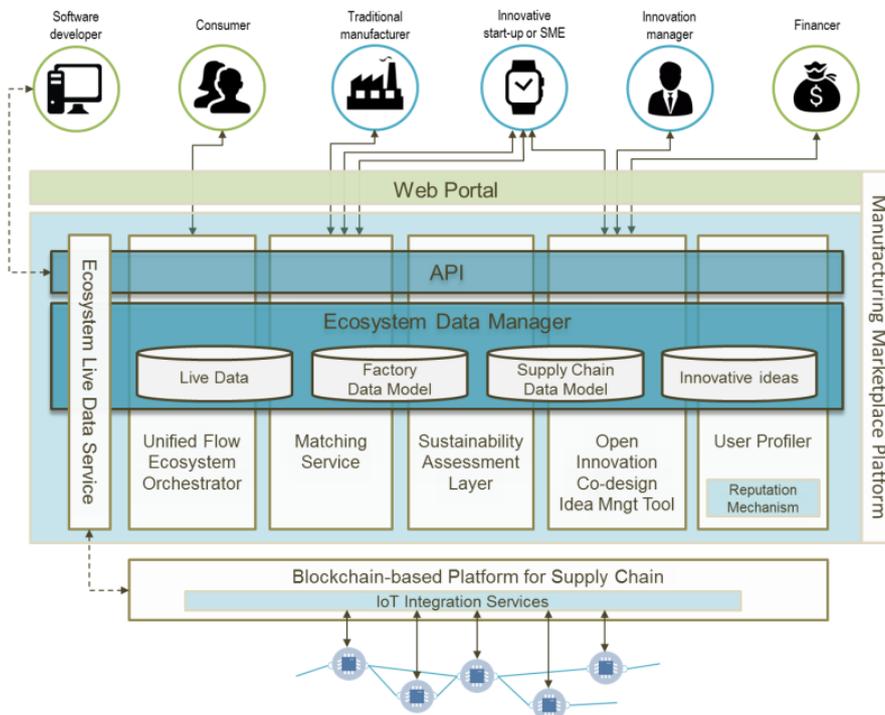


Figure 22 MANU-SQUARE platform architecture draft

A careful and detailed analysis of the functionalities that the MANU-SQUARE platform has to provide, has led to the tools reported in Table 10.

**Matching tool:** it stands at the core of the matching functionality within the MANU-SQUARE platform. It uses non-aprioristic relations offered by the semantic nature of the data models to identify all the possible and most fruitful connections between companies' needs and offer. It is an analytical engine based on semantic algorithms which support the matchmaking between the different stakeholders' needs and supplied capacities, materials and know-how available in the ecosystem. Given an entity described by a set of parameters, the matchmaking tool has to work as a smart operator that identifies those entities which semantically correspond to the given one.

Main functionalities: production capacity matching, know-how capabilities matching, by-product matching.

Challenges: match of entities described in natural language sentences, but referring to a wide spectrum of objects, services, behaviors; 80% of suggested combinations should be somehow applicable; identification of unexpected and smart solutions (e.g.: combining elements from really different sectors, etc.).

Responsible Partner: SINTEF

**Unified Flow Ecosystem Orchestrator:** it organizes the suppliers' ranking based on environmental-related multi-objective function that abandons the one-to-one approach by the adoption of an ecosystem-level perspective meant to enhance efficiency in the use of the resources (materials, energy, wastes, etc.) flowing between the ecosystem members.

The Unified Flow Ecosystem Orchestrator is a multi-layer optimization tool that coordinates the MANU-SQUARE ecosystem promoting an efficient use of resources, minimizing at the same time the environmental impacts related to the on-going activities. The tool is meant to analyze the needs of the different companies belonging to the manufacturing network and propose an ecosystem reconfiguration that matches the availability of resources and services while optimizing their use as well as the environmental performances of the ecosystem as a whole.

Main functionalities: ecosystem optimization

Challenges: reconfiguration proposals based on needs and availability of resources forecasting.

Responsible Partner: SUPSI

**User Profiler:** it allows the characterization of users and related demand, supply, know-how, competences and all the other information needed by the other tools and SW components to carry out their reasoning.

Main functionalities: player profiling, reputation management, certification management

Challenges: real-time support based on semantic infrastructure to facilitate profile completion

Responsible Partner: SUPSI

**Sustainability Assessment Layer:** it is a tool that calculates LCI and LCIA to measure the environmental sustainability of the processes and flows taking place in the ecosystem with the aim to complement the ranking functionality.

Main functionalities: sustainability assessment

Challenges: parametric sustainability performance calculation, historical effective performance calculation

Responsible Partner: SUPSI

<p><b>Open Innovation, Co-design, Idea Management Tool:</b> a tool dedicated for user interaction, where new projects and ideas can be posted and followed to incentivize other players' involvement in the development of the idea in an open innovation approach. This tool provides an environment where many and different user types can be engaged for defining, improving, promoting, refining and finally transfer to product development phases, new and innovative ideas. The tool supports the collection of new ideas either launching problem-solving context or asking for fully free idea provision. Contributors can create their own ideas by filling customized templates and extending them with additional information (drawings, sketches, technical documentation, etc.).</p> <p><u>Main functionalities:</u> Information security and privacy, innovation management</p> <p><u>Challenges:</u> develop a tool which is more than a social media, which integrates analytical functionalities and other features which effectively supports innovation through a totally different approach than current solutions.</p> <p><u>Responsible Partner:</u> Holonix</p>
<p><b>Services Marketplace:</b> It acts as the core managing system of the whole platform which allows the users to exploit the MANU-SQUARE services and functionalities, being integrated with all the other tools. It is a web-based application composed by a set of web pages which present a UI customized on the type of user. This tool is also the management system. At data management level it has two main functions: (i) it exposes interfaces for data connection with the Blockchain infrastructure; (ii) it keeps the various data repository (Live Data, Factory Data, Supply Chain Data, Innovative Ideas, etc.) updated through the Ecosystem Data Manager, which also takes care of the persistence of the data models. At service level, it leverages on a set of modules that, by reasoning on the semantic representation of the data models, provide complementary services for the platform users (both human and other software modules).</p> <p><u>Main functionalities:</u> interfacing and tools management, user communication support, RFQ management, Supplier assessment,</p> <p><u>Challenges:</u></p> <p><u>Responsible Partner:</u> SUPSI</p>
<p><b>Expansion SDK:</b> it allows external actors to interact directly with the functionalities and services exposed by the MANU-SQUARE platform. This kind of integration can be exploited by whoever wants to integrate their own applications directly with the MMP (e.g. software houses proposing a new service module to complement the platform, companies wishing to integrate the platform services in their own web portal, etc.). It provides support to new developments and services to be provided through the MANU-SQUARE platform by means of APIs leading to the direct access to platform functionalities. By Developers can create new applications for the users guided by the SDK into producing code that can be easily deployed in the MANU-SQUARE platform.</p> <p><u>Main functionalities:</u> platform expansibility</p> <p><u>Challenges:</u></p> <p><u>Responsible Partner:</u> SUPSI</p>

Table 10 MANU-SQUARE platform tools

The tools reported in Table 10 are supported by other SW components, which, through a different level of integration, allow the development of the expected functionalities. These are:

- **Matching algorithm:** semantic and ontological based algorithm, which allows identifying the matching solutions, guaranteeing a minimum level of accuracy, starting from a set of parameters defined by the users.
- **Semantic infrastructure:** it is the infrastructure to manage (from acquisition to inferencing) ecosystem data and knowledge, in a uniform semantic representation. It is a persistent semantic store capable of both (i) data storage and (ii) sufficient inference over it to support semantic inferencing, matchmaking and querying over structured domain ontology and area-specific models. Since one of the fundamental issues currently affecting industry practices concerns the need for interacting with a large number of proprietary formats used in different sectors, conversion services shall provide a bridge for homogenizing the different formats coexisting in the industry landscape.

- **Ontologies:** models that are generated by the extension of the core meta-model. They translate the domain-specific knowledge of the industrial sectors addressed in the project, and possibly some of those of the engaged stakeholders, into a set of descriptive domain ontologies. The domain ontologies are based on the engagement of domain experts (i.e. use case partners and engaged stakeholders) in future platform expansions (i.e. new vertical sectors).
- **Inference Rules:** it is a model composed by a set of inference rules that allow to find and infer new facts by reasoning on the data present in the ecosystem representation. Ontologies can support the identification of new opportunities residing in the ecosystem, until then unknown. Interoperation of this model with the Ontologies is a key factor for the success of the semantic representation.
- **Blockchain infrastructure & IOT integration service:** it improves the security, trust, and usability in various ways. Users can authenticate and register themselves with the blockchain and report their status in a trusted way. Blockchain based services ensure that the information is not tampered by third parties. It supports users which interact with the blockchain using their own blockchain identity / credentials, and thus can autonomously produce, sign, and invoke blockchain transactions, based on their internal state. Once the information has been stored on the blockchain its authenticity can be proved and is persistent. Blockchain can support:
  - Smart contracts: terms of a contractual agreement between two parties are in a contract running on the blockchain;
  - Traceability and provenance: with the help of some IoT, blockchain enables the safe digital transfer of material and goods end to end;
  - Availability and consumption of unused capacity: blockchain keeps track about who is offering production capacity, specifying technical, process and business conditions, establishing a link to a contractual agreement;
  - Tracking contributions on innovative ideas: one of the main barriers refraining people to contribute to open innovations approaches is the fear that own IPR, related to ideas for products and services they are providing to the companies, are not correctly managed.
- **Reputation mechanism:** it is the evaluation of trustworthiness and reliability of the ecosystem players. Thanks to the functions integrated in the blockchain-controlled transactions allowing to keep track of KPIs (on-time delivery time, quality of products, quality/price ratio, etc.) used in the calculation of suppliers and customers' reputation, with platform users' feedback based on the perceived quality of the interaction with another player of the ecosystem.
- **Ecosystem data manager:** it is the software system supporting the data orchestration among each tool integrated in the platform. The ecosystem data manager has therefore to dispatch data from different sources: data coming to the platform must be directed to each tool. Moreover, it has to provide a series of functionalities to allow higher-level APIs to access information stored in data models.

Associating to each functionalities the related tools, it has been possible to develop the third part of the MANU-SQUARE specifications map (Figure 23), adding to stakeholders, needs and functionalities, tools and SW components.

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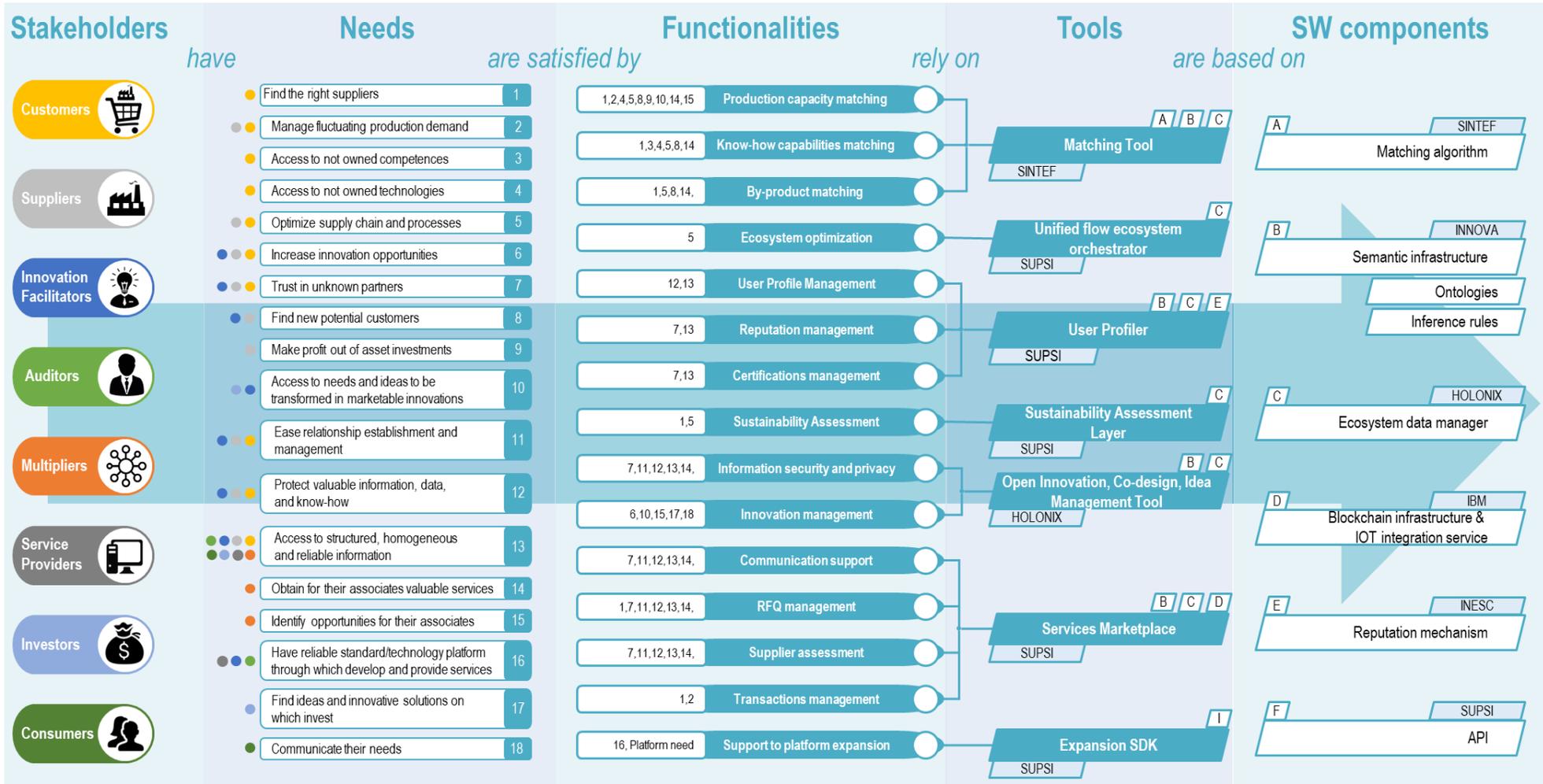


Figure 23 MANU-SQUARE specifications map (part 3)

## 6 MANU-SQUARE PLATFORM SERVICES

The MANU-SQUARE platform is developed to satisfy needs of different stakeholders and users. The functionalities introduced in § 5.1.1 aim to solve these needs. However, while some functionalities can be provided independently (e.g. communication support), others have to be integrated in a service to become usable and interesting for the users.

One of the objectives of the MANU-SQUARE platform is to foster manufacturing capacity and capabilities sharing, transforming them into a tradable commodity which can be dynamically exchanged in a marketplace. The cross-sectorial nature of the MANU-SQUARE envisioned ecosystem allows traditional companies offering their manufacturing capacity and capability to go beyond a mere saturation of internal resources opening to new market opportunities. In this cross-sectorial context, it becomes interesting not only the capacity and capability sharing but also by-product and waste sharing. Moreover, the platform has to act as innovation facilitator, in order to foster the full exploitation of the innovation potential residing in SMEs, start-ups and also in traditional companies. In this context, it becomes fundamental to intercept the emerging demand coming from consumers and to make the most out of the creative potential and opportunities residing in the industrial ecosystem.

Starting from the outputs of the previous sections and from the objective introduced above, the following platform's services have been identified:

- Resource finding & sharing
  - Supply and demand of manufacturing capacity
  - Supply and demand of knowledge
  - Supply and demand of by-products
- Innovation management
  - Open Innovation Management
  - Community involvement
  - Financing support

Services have been defined during the development of the MANU-SQUARE specifications map represented in Figure 24. Its development allowed to identify and analyse the main elements of the platform that have to be considered for specifications development: players and ecosystem, functionalities, tools and components, services.

The following sections aim to provide a description of each service, detailing the role of the platform tools, the related functionalities and the interactions that happen between players. The platform specifications are summed up in the tables at the end of each section. These contain different use-cases, together with the related blueprints.

According to the actual implementation of the business cases during platform development in the following activities of the project, the elements proposed in the tables will be updated. In particular, the work carried out in Task 5.1 will support the detailing and upgrade of services, while uses cases will be better defined and extended according to the final version of service design. The use cases provided hereunder are instrumental to explain the service logics and the platform specifications.

## D1.2 – Specifications definition

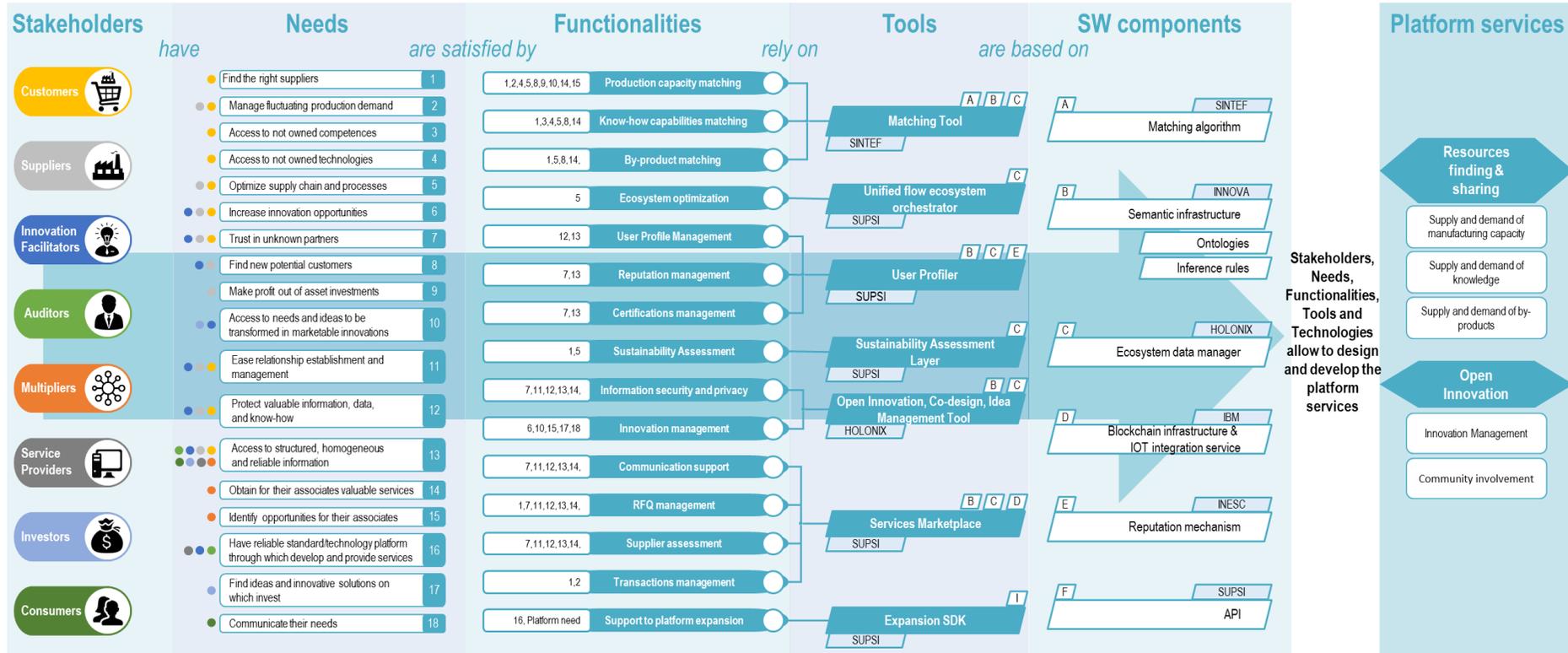


Figure 24 MANU-SQUARE specifications map

## 6.1 Resources finding & sharing

Resource finding & sharing is the platform service which allows users to share resources. Users can share manufacturing capacities, capabilities, know-how, technology and by-products. For this reason, in order to facilitate the service execution from both users' and platform's point of view, this service has been divided in three sub-categories:

- Supply and demand of manufacturing capacity (machines and technologies)
- Supply and demand of knowledge (capabilities and know-how)
- Supply and demand of by-products (waste, energy and by-products)

### 6.1.1 Supply and demand of manufacturing capacity

The MANU-SQUARE project is born from the idea that production capacity can be shared exactly like a commodity. Companies can make available their resources, giving the opportunity to third-party companies not to buy products, but production capacity. Companies who have unused resources such as machines and / or skilled operators, aim to have the opportunity to optimize their utilization and, in so doing, seize their value. Companies that do not have access, temporarily or permanently, to a specific resource can still satisfy their specific production needs by relying on this service.

The MANU-SQUARE platform aims to propose a service dedicated to manufacturing capacity-sharing which involves as main users:

- Suppliers: industrial companies which aim to sell non-used manufacturing capacity, sharing one or more resources
- Customers: industrial companies seeking capacity and/or technology

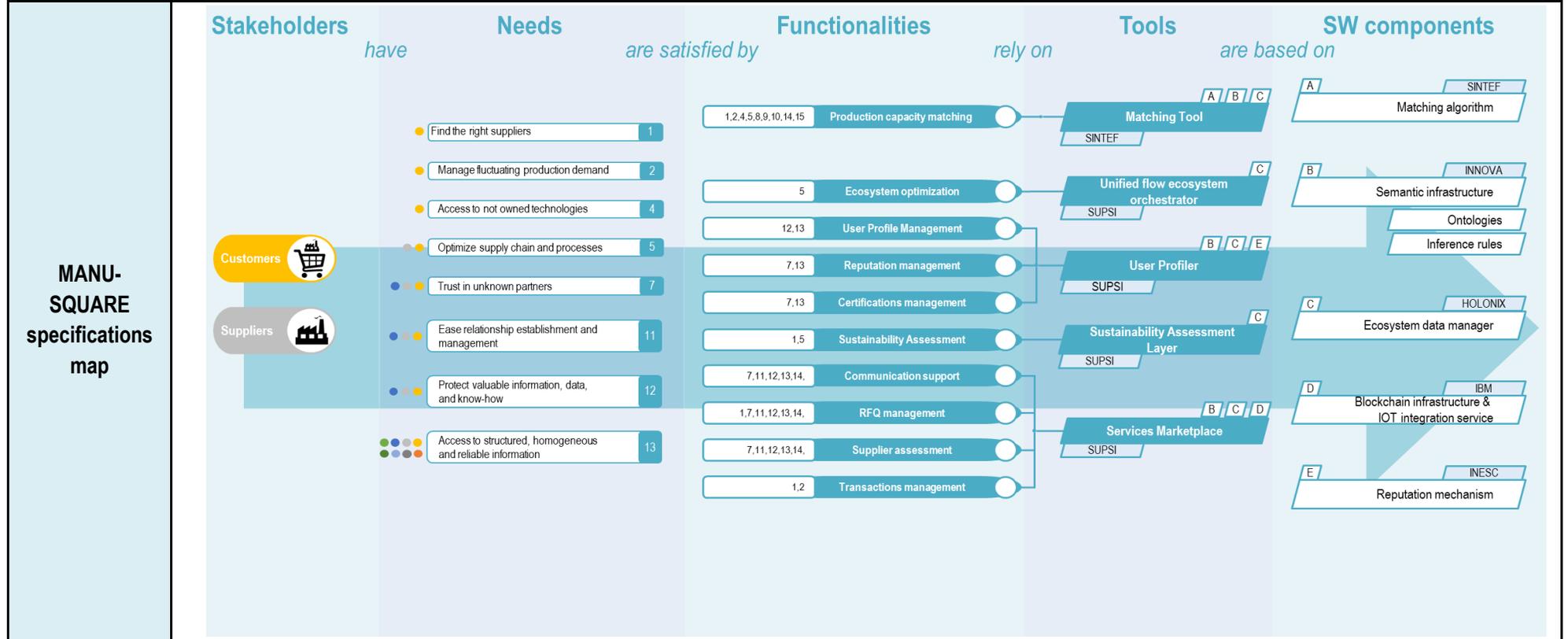
To be successful in this service, the platform needs to develop a strategy to attract first Suppliers, which have to add new sharable resources on the platform, creating a pool of available resources.

The MANU-SQUARE platform plays the facilitator role. It has to act as the link which facilitates the interaction between layers and, at the same time, it has to guarantee the reliability and robustness of the transactions. The platform has to propose solutions compliant with Customer parameters, providing the support to communicate with Suppliers, to deliver RFQ minimizing administrative activities of both Suppliers and Customers. Secondly, the platform has to provide all the functionalities that support the users in the service utilization, both Suppliers and Customers.

Table 11 describes the service "Resource finding and sharing - Supply of manufacturing capacity" from the Customer point of view. In , it is described the service "Resource finding and sharing - Demand of manufacturing capacity" from the Supplier point of view.

D1.2 – Specifications definition

<b>Title</b>	Resources finding and sharing – Supply of manufacturing capacity
<b>Service description</b>	This service supports the matchmaking among customers willing to produce parts/components/products through the MANU-SQUARE network, and suppliers with underused resources and/or technologies able to satisfy customers' requirements.
<b>Targeted stakeholders</b>	Companies that do not have access to specific manufacturing resources and/or need parts to be manufactured. Platform objective is to support them in finding the right supplier in time and at a sustainable price.
<b>Involved stakeholders</b>	<ul style="list-style-type: none"> <li>• Suppliers looking for new customers</li> <li>• Customers looking for new suppliers</li> <li>• MANU-SQUARE Platform</li> </ul>
<b>Service inputs &amp; outputs</b>	<p><b>Inputs:</b> the customer inserts a set of parameters and specifications to describe the resources is looking for and eventual characteristics to filter the suppliers.</p> <p><b>Outputs:</b> the Platform provides a list of matching; if requested, the customer receives a service quotation for each contacted supplier (optional); the selected supplier delivers the service (optional).</p>



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<p><b>Risks</b></p>	<ul style="list-style-type: none"> <li>• The information entered by the customer for the search are wrong, unreliable, without enough detail</li> <li>• Suppliers have not described correctly their resources in order to allow the match</li> <li>• Absence of suppliers</li> </ul>	
<p><b>Connected functionalities &amp; tools</b></p>	<p><b>Tool</b></p>	<p><b>Activities in the service use case</b></p>
	<p><b>Match-making tool</b></p>	<ul style="list-style-type: none"> <li>• compares the data/parameters entered by the customer, communicating with the ecosystem data manager to match suppliers from the database</li> </ul>
	<p><b>Sustainability assessment layer</b></p>	<ul style="list-style-type: none"> <li>• assesses the sustainability performance of matching suppliers</li> </ul>
	<p><b>Unified flow ecosystem orchestrator</b></p>	<ul style="list-style-type: none"> <li>• supports the performance optimization adopting a sustainability assessment from the ecosystem point of view (only if required by the Customer)</li> </ul>
	<p><b>User profiler</b></p>	<ul style="list-style-type: none"> <li>• provides information about certifications and reputation of Suppliers and Customers</li> </ul>
	<p><b>Marketplace (web interface)</b></p>	<ul style="list-style-type: none"> <li>• allows the user to access to services and to the different interfaces</li> <li>• supports transactions</li> <li>• registers users' activities</li> </ul>
	<p><b>Reputation mechanism</b></p>	<ul style="list-style-type: none"> <li>• supports the users in the transaction assessment</li> <li>• integrates the assessments to the reputation of each user profile</li> </ul>
	<p><b>Ecosystem data manager</b></p>	<ul style="list-style-type: none"> <li>• allows the different tools to access to the database and to exchange data</li> <li>• records data on the database from the users</li> <li>• records data on the database from the transactions</li> </ul>
	<p><b>Semantic infrastructure</b></p>	<ul style="list-style-type: none"> <li>• supports the quasi-real time interface update.</li> <li>• constitutes the base for matching tool logics</li> </ul>
<p><b>Blockchain infrastructure</b></p>	<ul style="list-style-type: none"> <li>• supports service delivery, activities and contributions tracking</li> </ul>	

Table 11 Resource finding and sharing – Supply of manufacturing capacity service

In order to provide a clearer understanding about how the service works, Table 12 contains a use-case. This is not exhaustive (the service can involve more functionalities, more activities, etc.). However, the use case is sufficiently developed to understand the service working principles.

D1.2 – Specifications definition

<p><b>Scenario story</b></p>	<p>Manufacturing company working in the wood sector is looking for a machine to produce 300 customized metal components to be integrated into its products. The company needs the manufactured parts in three weeks from the date of the request. They want to receive the RFQ answer in a week from the date of the request. The supplier must be ISO 9001 certified.</p> <ol style="list-style-type: none"> <li>1. Woody SA does not have any resources and competences to produce the components. Thus, it aims to use the MANU-SQUARE platform, accessing to its website to find a supplier...</li> <li>2. Woody SA has already a profile as Costumer. It logs into the platform using the web-interface with username (WOODYSA) and password(123456).</li> <li>3. Woody SA is interested to obtain manufacturing capacity. Therefore, through the web interface, it selects the service “Resource finding and sharing” and its sub-category “Demand of manufacturing capacity”.</li> <li>4. Woody SA uploads component design and completes the following fields: Material (steel), Size (10*20*30 cm), Quantity (300), Expected process to be used (Milling), Expected machine (CNC 5 axes), RFQ response time (1 week), Production lead time (3 weeks), Certifications (ISO 9001).</li> <li>5. Woody SA waits that the platform engine identifies matching solutions. The platform, using the matching tool, accessing to the database, verifies the solutions which match with the Customer’s parameters. It identifies 4 possible suppliers. The platform, using the information coming from different tools, assesses and orders the suppliers based on previous transactions, sustainability performance and matching compliance.</li> <li>6. Woody SA obtains a ranked list of 4 suppliers. It accesses to each profile in order to view and evaluate their characteristics and resources.</li> <li>7. Woody SA selects 3 suppliers which it considers compliant with its requirements. It creates a message which contains the RFQ starting from a pre-compiled template provided by the platform, containing the most relevant information such as the number of pieces, design and lead time.</li> <li>8. Woody SA receives 2 feedbacks. The third supplier has rejected the request. It has verified its current capacity and it is not able to satisfy the order within the required lead time.</li> <li>9. Woody SA selects Metally SA because it has better sustainability performance. The platform sets up the contract between the two involved parties. Metally SA processes the 300 components, updating their status on the platform each day and delivers the complete order after two weeks.</li> <li>10. Woody SA assesses Metally SA service, evaluating communication effectiveness and service quality. Metally SA assesses Woody SA evaluating communication effectiveness and specifications definition ability.</li> </ol>
<p><b>Extensions</b></p>	<ol style="list-style-type: none"> <li>1. The platform does not identify automatically any supplier (this can happen for different reasons; see Risks). The search appears on the dashboard (“open opportunities area”) of all the suppliers and innovation managers on the platform. This allows interested suppliers and innovation managers to make a proposal if they are able to satisfy customer needs.</li> <li>2. Woody SA aims to implement a new marketing campaign based on sustainability commitment. For this reason, it uses the ranking based on “Ecosystem Optimization”. The MANU-SQUARE platform, through the “Unified Flow Ecosystem Orchestrator” has pointed out that, to optimize the ecosystem performance, the best supplier is not Metally SA, which usually receives every week orders from closer companies (which transactions are characterized by lower environmental impact than that with Woody SA) and with the Woody SA order it has no more capacity available.</li> </ol>
<p><b>Inputs</b></p>	<p><b>Customer enters in the platform’s search interface:</b> Customer location (Lugano), Component design, Material (steel), Size (10*20*30 cm), Quantity (300), Expected process to be used (Milling), Expected machine (CNC 5 axes), RFQ response time (1 week), Production lead time (3 week), Certifications (ISO 9001)</p> <p><b>Suppliers have to describe their attributes and resources in order to allow the match.</b></p>

D1.2 – Specifications definition

Outputs		<ul style="list-style-type: none"> <li>• A ranked list of suppliers capable to produce a batch of metal components that fit with user's quality and time requirements.</li> <li>• A selected supplier which satisfies customer's needs</li> </ul>						
USE CASE STEPS		Login	Service selection	Supplier search	Matching and ranking	Request for quoting	Transaction	Transaction assessment
STAKEHOLDER ACTIONS	CUSTOMER	Login in the platform	Selection of the required service	Search parameters and data entry		Preparation and delivery of RFQ to a set of selected suppliers.	RFQ selection, contracting and service payment	Supplier assessment
	SUPPLIER					Capacity/capability compliancy and resources availability verification, Answer to the RFQ	Service confirmation, Processing, Delivery	Customer assessment
	N/A							
FRONTSTAGE INTERACTION	PLATFORM FRONTEND	The platform exposes the interface to login in the platform dashboard.	The platform exposes the Interface to select the required service	The platform exposes GUI to describe the resource needed.	The platform exposes a list of suppliers ranked according with its characteristics (reputation, sustainability, performance, matching compliancy)	The platform sends to suppliers the request for quoting. The platform sends to customers the RFQ answer.	The platform communicates to the selected supplier the RFQ acceptance and provides the forms to set up the contract, the payment and the system to support the order management.	The platform exposes an interface to allow the assessment
BEHIND THE SCENES								
BACKSTAGE INTERACTION	PLATFORM BACKEND	Login in the Customer's profile loading data and settings.	The platform loads the service interface.	The platform supports the Customer in the identification of the main relevant fields to complete the request.	The platform creates a lists of ranked suppliers using different KPIs (sustainability, reputation, matching %) and provides an ranked lists.		Platform supports the transactions and the interactions between the involved players (e.g. communication, tracking, etc.)	
	PLATFORM SUPPORT SERVICES	The marketplace registers the user access and sets up its dashboard and interfaces according with profile settings.	The <b>service marketplace</b> , supported by the <b>semantic infrastructure</b> , defines the interface's pre-configured fields, based on the knowledge acquired by past transactions, searches and semantic relation.	The <b>semantic infrastructure</b> supports the interface updating. The <b>ecosystem data manager</b> stores the data provided by the Customer to allow their use by platform's tools.	The <b>matching tool</b> compares the stored data/parameters with the databases ones, looking for matching suppliers. The <b>sustainability assessment layer</b> assesses the sustainability performance of matching suppliers.	The <b>ecosystem data manager</b> records in the database the RFQ and the answers.	The <b>marketplace</b> , through a payment management system manages the monetary transaction. <b>Blockchain infrastructure</b> supports service delivery, activities and contributions tracking.	The <b>reputation mechanism</b> , supports the assessment and integrates the assessments to the reputation of each user profile.

Table 12 Resource finding and sharing – Supply of manufacturing capacity – Use-case

D1.2 – Specifications definition

<b>Title</b>	Resources finding and sharing – Demand of manufacturing capacity	
<b>Service description</b>	This service supports companies which have underused resources (machines & technologies) in finding new customers which require these resources to satisfy a specific production need.	
<b>Targeted stakeholders</b>	Companies who have unused resources such as machines and/or skilled operators. Platform objective is to provide the opportunity to optimize their utilization.	
<b>Involved stakeholders</b>	<ul style="list-style-type: none"> <li>• Supplier looking for new customers</li> <li>• Customers looking for new suppliers</li> <li>• Regulators / auditors</li> <li>• MANU-SQUARE Platform</li> </ul>	
<b>Service inputs &amp; outputs</b>	<b>Inputs:</b> the customer inserts a set of parameters and specifications to describe the resources is looking for and eventual characteristics to filter the suppliers. <b>Outputs:</b> the supplier receives a request for quotation and eventually a production order.	
<b>MANU-SQUARE specifications map</b>	<p>The diagram illustrates the MANU-SQUARE specifications map, showing the relationship between Stakeholders, Needs, Functionalities, Tools, and SW components. Stakeholders (Customers, Suppliers, Auditors) have Needs (1-13) which are satisfied by Functionalities (1-13). These Functionalities rely on Tools (User Profiler, Services Marketplace) which are based on SW components (Semantic infrastructure, Ecosystem data manager, Reputation mechanism).</p>	
<b>Risks</b>	<ul style="list-style-type: none"> <li>• Supplier is not able to describe correctly the resources</li> </ul>	
<b>Connected functionalities &amp; tools</b>	<b>Tool</b>	<b>Activities in the service use case</b>
	<b>Match-making tool</b>	<ul style="list-style-type: none"> <li>• compares the data/parameters entered by the customer, communicating with the ecosystem data manager to match suppliers from the database</li> </ul>
	<b>Sustainability assessment layer</b>	<ul style="list-style-type: none"> <li>• assesses supplier’s resource sustainability performance</li> </ul>
	<b>User profiler</b>	<ul style="list-style-type: none"> <li>• supports supplier and resource characterization</li> </ul>

D1.2 – Specifications definition

		<ul style="list-style-type: none"> <li>• registers the certifications and assessment</li> </ul>
	<b>Marketplace (web interface)</b>	<ul style="list-style-type: none"> <li>• allows the user to access to services and to the different interfaces</li> <li>• supports transactions</li> <li>• registers users' activities</li> </ul>
	<b>Ecosystem data manager</b>	<ul style="list-style-type: none"> <li>• allows the different tools to access to the database and to exchange data</li> <li>• record data on the database from the users</li> <li>• record data on the database from the transactions</li> </ul>
	<b>Semantic infrastructure</b>	<ul style="list-style-type: none"> <li>• supports the quasi-real time interface update</li> </ul>
	<b>Blockchain infrastructure</b>	<ul style="list-style-type: none"> <li>• supports service delivery, activities and contributions tracking</li> </ul>

Table 13 Resource finding and sharing – Demand of manufacturing capacity

In order to provide a clearer understanding about how the service works, Table 14 contains a use-case. This is not exhaustive (the service can involve more functionalities, more activities, etc.). However, the use case is sufficiently developed to understand the service working principles.

<b>Scenario story</b>	<p>A company (Metally SA) working in the metal sector purchased a CNC machine to produce a new product. Since this is not already well-known on the market, its demand is currently low. For this reason, the company aims to saturate the machine looking for external production orders.</p> <ol style="list-style-type: none"> <li>1. Metally SA decides to find new customers through the MANU-SQUARE platform accessing to its website to obtain the required support...</li> <li>2. Metally SA has already a profile as Supplier. It logs inside the platform using the web-interface through the username (Metally) and the password.</li> <li>3. Metally SA is interested in sharing its manufacturing capacity. Therefore, through the web interface, it selects the service “Resource finding and sharing” and its sub-category “Supply of manufacturing capacity”.</li> <li>4. Metally SA completes the following fields to describe its resource: user location (Lugano), products (cantilever roofs, intermediate floors, stairs, metallic carpentry), materials: (steel, iron), sector (production machining &amp; fabrication, automotive, plastics, defense, consumer), time availability (20 hours a week), resources (1 CNC machine with related features/characteristics description (e.g. machine name, brand, n° of axes, tools, working cube, etc.))</li> <li>5. Metally SA aims also to certify the sustainability performance of its machine, not only through a self-certification but with a verified certification. It accesses to the certification management functionality to verify its resource, supported by a platform’s auditor.</li> <li>6. Metally SA has a resource on the platform and it is able to receive RFQ.</li> </ol>
<b>Extensions</b>	Metally SA does not require a verified certification. It self-certifies the sustainability performance of its resources.
<b>Inputs</b>	<b>Supplier enters in the platform’s search interface:</b> user location (Lugano), products (cantilever roofs, intermediate floors, stairs, metallic carpentry), materials: (steel, iron), sector (production machining & fabrication, automotive, plastics, defence, consumer), time availability (20 hours a week), resources (1 CNC machine with related features/characteristics description (e.g. machine name, brand, n° of axes, tools, working cube, etc.))

D1.2 – Specifications definition

Outputs		The supplier receives RFQ from customers and at a second iteration level, the supplier receives orders to be satisfied.						
USE CASE STEPS		Login	Service selection	Resource characterisation	Capacity availability update	Certification request	Certification	RFQ receiving enabling
STAKEHOLDER ACTIONS	SUPPLIER	Login in the platform.	Selection of the service for which it makes its resource available	Definition of the characteristics of the resource.	Update of the resource availability	Request to certify the resource characteristics by a third-party auditor.		RFQ receiving
	AUDITOR						Resource audit and certification	
	N/A							
FRONTSTAGE INTERACTION	PLATFORM FRONTEND	The platform exposes the GUI to login in the platform dashboard.	The platform exposes the GUI to select the required service.	The platform exposes GUI to describe the resource.	The platform exposes the GUI to describe the resource availability.	The platform exposes the GUI to request the certification.	The platform exposes the GUI to certify the Supplier.	The platform delivers the RFQ to the Supplier.
BEHIND THE SCENES								
BACKSTAGE INTERACTION	PLATFORM BACKEND	Login in the Customer's profile loading data and settings.	The platform loads the service interface.	The platform supports the Supplier in the identification of the main relevant fields to characterize as better as possible the resource.	The platform updates the database with a new resource, with the related and availability.	Platform supports the transactions and the interactions between the involved players (e.g. communication, etc.)	The platform updates the Supplier's profile.	The platform makes available the Supplier's resource to RFQ.
	PLATFORM SUPPORT SERVICES	The marketplace registers the user access and sets up its dashboard and interfaces according with profile settings.	The <b>User Profiler</b> , supported by the <b>semantic infrastructure</b> , defines the interface's pre-configured fields, based on the customer's profile and the knowledge acquired by past transactions, searches and semantic relation.	The <b>semantic infrastructure</b> supports the interface updating. The <b>ecosystem data manager</b> records in the database the data provided by the Supplier.		The <b>marketplace</b> , through a payment management system manages the monetary transaction.	The <b>ecosystem data manager</b> records in the database the certification results. <b>User Profiler</b> registers the certification.	

Table 14 Resource finding and sharing – Demand of manufacturing capacity – Use case

### 6.1.2 Supply and demand of knowledge

Companies develop knowledge during years of research and innovation. This knowledge can generate not only value for products and services of the companies which own them, but also for third-parties, if properly shared. The “Supply and demand of knowledge” aims properly to promote the competence, know-how and technology sharing. A company, which is looking for a certain knowledge (e.g. engineering) that it has not internally, can search for a supplier able to provide resources (e.g. specific professional figures and / or technologies) that are capable to satisfy its needs.

The MANU-SQUARE platform aims to propose a service dedicated to supply and demand of knowledge dedicated specifically to:

- Suppliers: industrial companies which aim to sell non-used knowledge capabilities capacity, sharing technologies and competences
- Customers: industrial companies seeking knowledge, competences and / or technologies

Companies who have specific and advanced knowledge have the opportunity to benefit from it (by turning it into profit) through not only their products and services but also providing a service similar to consultancy.

Table 15 describes the service “Resource finding and sharing - Supply and demand of knowledge” from the Customer point of view. The service “Resource finding and sharing - Supply and demand of knowledge” from the Supplier point of view has specifications and a scenario story similar to Table 13. For this reason, it has been considered not necessary to replicate the specific representation.

D1.2 – Specifications definition

<b>Title</b>	Resources finding and sharing – Supply of knowledge
<b>Service description</b>	This service supports the matchmaking among customers willing to obtain competences to support their business activities, and suppliers with specific knowledge and know-how.
<b>Targeted stakeholders</b>	Companies that do not have the access to a specific capability, which allows to meet specific needs.
<b>Involved stakeholders</b>	<ul style="list-style-type: none"> <li>• Supplier looking for new customers</li> <li>• Customers looking for new suppliers</li> <li>• MANU-SQUARE Platform</li> </ul>
<b>Service inputs &amp; outputs</b>	<p><b>Inputs:</b> the customer inserts a set of parameters and specification to describe the supplier and the competences is looking for.</p> <p><b>Outputs:</b> the Platform provides a list of matching suppliers to be contacted by the customer; the customer receives a service quotation for each contacted supplier (optional); the selected supplier delivers the service (optional).</p>
<b>MANU-SQUARE specifications map</b>	<p>The diagram illustrates the MANU-SQUARE specifications map, showing the relationship between Stakeholders, Needs, Functionalities, Tools, and SW components. Stakeholders (Customers and Suppliers) have Needs (1-13) which are satisfied by Functionalities (1, 3, 4, 5, 8, 14). These Functionalities rely on Tools (Matching Tool, Unified flow ecosystem orchestrator, User Profiler, Sustainability Assessment Layer, Services Marketplace) which are based on SW components (Matching algorithm, Semantic infrastructure, Ontologies, Inference rules, Ecosystem data manager, Blockchain infrastructure &amp; IOT integration service, Reputation mechanism). The diagram also shows the involvement of various partners like SINTEF, SUPSI, INNOVA, HOLONIX, IBM, and INESC.</p>
<b>Risks</b>	<ul style="list-style-type: none"> <li>• The information entered by the customer for the search are wrong, unreliable, without enough detail</li> </ul>

D1.2 – Specifications definition

	<ul style="list-style-type: none"> <li>• Suppliers have not described correctly their resources in order to allow the match</li> <li>• Absence of suppliers</li> </ul>	
<b>Connected functionalities &amp; tools</b>	<b>Tool</b>	<b>Activities in the service use case</b>
	<b>Match-making tool</b>	<ul style="list-style-type: none"> <li>• compares the data/parameters entered by the customer, communicating with the ecosystem data manager to match suppliers from the database</li> </ul>
	<b>Sustainability assessment layer</b>	<ul style="list-style-type: none"> <li>• assesses supplier's resource sustainability performance</li> </ul>
	<b>User profiler</b>	<ul style="list-style-type: none"> <li>• supports supplier and resource characterization</li> <li>• registers the certifications and assessment</li> </ul>
	<b>Marketplace (web interface)</b>	<ul style="list-style-type: none"> <li>• allows the user to access to services and to the different interfaces</li> <li>• supports transactions</li> <li>• registers users' activities</li> </ul>
	<b>Ecosystem data manager</b>	<ul style="list-style-type: none"> <li>• allows the different tools to access to the database and to exchange data</li> <li>• record data on the database from the users</li> <li>• record data on the database from the transactions</li> </ul>
	<b>Semantic infrastructure</b>	<ul style="list-style-type: none"> <li>• supports the quasi-real time interface update</li> </ul>
	<b>Blockchain infrastructure</b>	<ul style="list-style-type: none"> <li>• supports service delivery, activities and contributions tracking</li> </ul>

Table 15 Resources finding and sharing – Supply of knowledge

In order to provide a clearer understanding about how the service works, Table 16 contains a use-case. This is not is not exhaustive (the service can involve more functionalities, more activities, etc.). However, the use case is sufficiently developed to understand the service working principles.

<b>Scenario story</b>	<p>A manufacturing company, named Woody SA, producing wood products for the luxury sector, has received a custom order from a new customer. Woody SA aims to satisfy customer's request in order to create a lasting relationship. The customer requires 10 ship wheels of precious wood which have to be covered with water-repellent resin. Woody SA usually produces luxury furniture which not requires this kind of process. Therefore, it has not competences on the type of resin to use, how to apply it. For this reason, it aims to receive the support from an experienced supplier in order to be sure to satisfy customer expectations.</p> <ol style="list-style-type: none"> <li>1. Woody SA has not any resources and competences to satisfy the customer request. Thus, it aims to use the MANU-SQUARE platform accessing to its website to find a supplier.</li> <li>2. Woody SA has already a profile as Costumer. It logs inside the platform using the web-interface through the username (WOODYSA) and the password(123456).</li> <li>3. Woody SA is interested to obtain knowledge capabilities. Therefore, through the web interface, it selects the service "Resource finding and sharing" and its sub-</li> </ol>
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D1.2 – Specifications definition

	<p>category “Demand of Manufacturing knowledge”.</p> <ol style="list-style-type: none"> <li>4. Woody SA uploads the request: sector (wood, vessel-building, wood processign), product type (boat component, ship-wheels, water-repellent resin), Process (resin application, resin covering), component size (120*120*30 cm), quantity (10), RFQ response time (2 week), production lead time (4 week), certifications (ISO 9001).</li> <li>5. Woody SA waits that the platform engine identifies matching solutions. The platform, using the matching tool, accessing to the database, verifies the solutions which match with the Customer’s parameters. It identifies 2 possible suppliers. The platform, using the information coming from different tools, orders the suppliers based on previous transactions, sustainability performance and matching compliance.</li> <li>6. Woody SA obtains a ranked list of 2 suppliers. It accesses to each profile in order to view and evaluate their characteristics and resources.</li> <li>7. Woody SA the message which contains the RFQ starting from a pre-compiled template provided by the platform, containing number of pieces, design and lead time.</li> <li>8. Woody SA receives the feedbacks from both the companies and it selects WSA SA. This is located at only 10 km from Woody SA and the price and lead time of the quote are better than the other Supplier.</li> <li>9. The platform sets up the contract between the two involved parties. Woody SA delivers the 10 components. WSA suggests the type of resin and the application process in order to obtain the better results. Woody SA agrees and the 10 components are processed. WSA updates components’ status on the platform each day and delivers the complete order after two weeks.</li> </ol> <p>Woody SA assesses WSA service, evaluating communication effectiveness and service quality. WSA SA assesses Woody SA evaluating communication effectiveness and specifications definition ability.</p>
<b>Extensions</b>	<p>The platform does not identify automatically any supplier (this can happen for different reasons; see Risks). The search appears on the dashboard (“open opportunities area”) of all the suppliers and innovation managers on the platform. This allows interested suppliers and innovation managers to make a proposal if they are able to satisfy customer needs.</p>
<b>Inputs</b>	<p><b>Customer enters in the platform’s search interface:</b> sector (wood, vessel-building, wood processing), product type (boat component, ship-wheels, water-repellent resin), Process (resin application, resin covering), component size (120*120*30 cm), quantity (10), RFQ response time (2 week), production lead time (4 week), certifications (ISO 9001).</p> <p><b>Suppliers have to describe their attributes and resources in order to allow the match.</b></p>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• A ranked list of suppliers capable to satisfy the request fitting with user’s quality and time requirements.</li> <li>• A selected supplier which satisfies customer’s needs</li> </ul>

Table 16 Resources finding and sharing – Supply of knowledge – Use-case

### 6.1.3 Supply and demand of by-products

The current lack of visibility over the type and level of wasted resources prevents the identification of valuable opportunities for the re-use of by-products and energy. Supply and demand of by-products is a service developed to support companies in exchanging by-product and waste, aiming to identify and exploit unexpected synergies between players. The presence of different stakeholders belonging to different value network inside the MANU-SQUARE ecosystem increases the probability that the undesirable outputs of a company are valuable inputs for others. This match can happen only through the necessary support. The MANU-SQUARE platform, through the Supply and demand of by-products, aims to support:

- Suppliers: industrial companies which aim to sell undesirable outputs (by-products, waste and energy)
- Customers: industrial companies looking for valuable inputs to increase their economic, environmental and / or social performances.

To be successful in this service, the platform needs to develop a strategy to attract first Suppliers, which have to add new sharable outputs on the platform, creating a pool of available by-products and waste to be used as resources.

The MANU-SQUARE platform plays the role of facilitator. It has to act as the link which facilitates the exchanges between players while, at the same time, guaranteeing the reliability and robustness of the transactions.

Table 17 describes the service “Resource finding and sharing - Supply and demand of by-product” from the Supplier point of view. The service “Resource finding and sharing - Supply and demand of by-product” from the Customer point of view has specifications and a scenario story similar to that of Table 11. For this reason, it has been considered not necessary to replicate the specific representation.

D1.2 – Specifications definition

<b>Title</b>	Resources finding and sharing – Demand of by-product
<b>Service description</b>	This service supports the matchmaking among manufacturing companies which have a by-product that can be further exploited, and customers that could use it as process input in their manufacturing systems.
<b>Targeted stakeholders</b>	<ul style="list-style-type: none"> <li>Companies who have wastes and by-products that can be reused.</li> </ul>
<b>Involved stakeholders</b>	<ul style="list-style-type: none"> <li>Companies who have wastes and by-products that can be reused.</li> <li>Companies which aim to use and/or transform wastes and by-products from other companies as valuable inputs Supplier looking for new customers</li> <li>MANU-SQUARE Platform</li> </ul>
<b>Service inputs &amp; outputs</b>	<p><b>Inputs:</b> the supplier inserts a set of parameters and specifications to describe its profile and the characteristics of the by-product.</p> <p><b>Outputs:</b> the supplier can receive requests for sharing its by-product (optional); the supplier shares its by-product (optional), (to-be explored: the Platform provides a list of matching customers which can be contacted by the supplier)</p>
<b>MANU-SQUARE specifications map</b>	<p>The diagram illustrates the MANU-SQUARE specifications map, showing the relationship between stakeholders, their needs, the functionalities they require, the tools used, and the underlying software components.</p> <ul style="list-style-type: none"> <li><b>Stakeholders:</b> Customers (Shopping cart icon), Suppliers (Factory icon), and Auditors (Person icon).</li> <li><b>Needs:</b> <ul style="list-style-type: none"> <li>Optimize supply chain and processes (5)</li> <li>Trust in unknown partners (7)</li> <li>Find new potential customers (8)</li> <li>Make profit out of asset investments (9)</li> <li>Ease relationship establishment and management (11)</li> <li>Protect valuable information, data, and know-how (12)</li> <li>Access to structured, homogeneous and reliable information (13)</li> </ul> </li> <li><b>Functionalities:</b> <ul style="list-style-type: none"> <li>Ecosystem optimization (5)</li> <li>User Profile Management (12,13)</li> <li>Reputation management (7,13)</li> <li>Certifications management (7,13)</li> <li>Sustainability Assessment (1,5)</li> <li>Communication support (7,11,12,13,14)</li> <li>RFQ management (1,7,11,12,13,14)</li> <li>Supplier assessment (7,11,12,13,14)</li> <li>Transactions management (1,2)</li> </ul> </li> <li><b>Tools:</b> <ul style="list-style-type: none"> <li>Unified flow ecosystem orchestrator (SUPSI)</li> <li>User Profiler (SUPSI)</li> <li>Sustainability Assessment Layer (SUPSI)</li> <li>Services Marketplace (SUPSI)</li> </ul> </li> <li><b>SW components:</b> <ul style="list-style-type: none"> <li>Semantic infrastructure (INNOVA)</li> <li>Ontologies</li> <li>Inference rules</li> <li>Ecosystem data manager (HOLONIX)</li> <li>Blockchain infrastructure &amp; IOT integration service (IBM)</li> <li>Reputation mechanism (INESC)</li> </ul> </li> </ul> <p>Relationships are indicated by arrows and dependency labels (A-E):</p> <ul style="list-style-type: none"> <li>Customers have Needs 5, 7, 8, 11, 12, 13.</li> <li>Suppliers have Needs 9, 11, 12, 13.</li> <li>Auditors have Needs 11, 12, 13.</li> <li>Needs 5, 7, 8, 11, 12, 13 are satisfied by Functionalities 5, 12, 13, 7, 13, 1, 5, 7, 11, 12, 13, 14, 1, 7, 11, 12, 13, 14, 7, 11, 12, 13, 14, 1, 2.</li> <li>Functionalities 5, 12, 13, 7, 13, 1, 5, 7, 11, 12, 13, 14, 1, 7, 11, 12, 13, 14, 7, 11, 12, 13, 14, 1, 2 rely on Tools.</li> <li>Tools rely on SW components.</li> </ul>
<b>Risks</b>	<ul style="list-style-type: none"> <li>The information entered by the customer for the search are wrong, unreliable, without enough detail</li> <li>Suppliers have not described correctly their resources in order to allow the match</li> </ul>

D1.2 – Specifications definition

	<ul style="list-style-type: none"> <li>Absence of suppliers</li> </ul>	
<b>Connected functionalities &amp; tools</b>	<b>Tool</b>	<b>Activities in the service use case</b>
	<b>Services Marketplace</b>	<ul style="list-style-type: none"> <li>allows the user to access to services and to the different interfaces</li> <li>supports transactions</li> <li>registers users' activities</li> </ul>
	<b>User Profiler</b>	<ul style="list-style-type: none"> <li>supports resource characterization</li> <li>registers the certification</li> </ul>
	<b>Ecosystem data manager</b>	<ul style="list-style-type: none"> <li>allows the different tools to access to the database and to exchange data</li> <li>record data on the database from the users</li> </ul>
	<b>Semantic infrastructure</b>	<ul style="list-style-type: none"> <li>supports the quasi-real time interface update.</li> </ul>

Table 17 Resources finding and sharing – Demand of by-product

In order to provide a clearer understanding about how the service works, Table 18 contains a use-case. This is not is not exhaustive (the service can involve more functionalities, more activities, etc.). However, the use case is sufficiently developed to understand the service working principles.

<b>Scenario story</b>	<p>Desia SA is a company settled near Lion, in France, manufacturing high-quality mirrors for aeronautic applications. The process Desia applies to polish their mirrors generates high-quality polishing sand that they cannot use two times due to quality reasons. They aim to find a company interested in buying the sand for other applications.</p> <ol style="list-style-type: none"> <li>Desia SA is looking for a company interested in buying its sand. Thus, it uses the MANU-SQUARE platform accessing to its website to find a supplier.</li> <li>Desia SA has already a profile as Supplier. It logs inside the platform using the web-interface through the username (desia) and the password(123456).</li> <li>Desia SA is interested in sharing its manufacturing capacity. Therefore, through the web interface, it selects the service “Resource finding and sharing” and its sub-category “Supply of by-product”.</li> <li>Desia SA completes the following fields to describe its by-product: user location (Lion), sector (aerospace), product type (mirrors), by-products/wastes (sand), by-products/wastes characteristics (1,5 µm per grain, aluminum micro-spheres), quantity (100 kg/week), expected exploiting process (industrial sanding, sandblasting), expected sector of application (machine tools manufacturers), expected refining process; in-house/third-party (dry-sifting; in-house)</li> <li>Desia SA has a by-product on the platform and it is able to receive RFQ.</li> </ol>
<b>Extensions</b>	<ol style="list-style-type: none"> <li>The platform does not identify automatically any customer (this can happen for different reasons; see Risks). The search appears on the dashboard (“open opportunities area”) of all the customers and innovation managers on the platform. This allows customers and innovation managers to make a proposal.</li> <li>Innovation managers and customers can also identify a by-product/waste, that, with the appropriate</li> </ol>
<b>Inputs</b>	<b>Suppliers have to describe their attributes and resources in order to allow the match.</b>

D1.2 – Specifications definition

Outputs		<ul style="list-style-type: none"> <li>• A ranked list of suppliers capable to produce a batch of metal components that fit with user's quality and time requirements.</li> <li>• A selected supplier which satisfies customer's needs</li> </ul>								
		USE CASE STEPS								
		Login	Service selection	Resource characterisation	RFQ receiving enabling					
Service blueprint	STAKEHOLDER ACTIONS	SUPPLIER	Login in the platform.	Selection of the service for which it makes its resource available	Definition of the characteristics of the resource.	RFQ receiving				
		REGULATOR/AUDITOR								
		N/A								
	FRONTSTAGE INTERACTION	PLATFORM FRONTEND	The platform exposes the interface to login in the platform dashboard.	The platform exposes the GUI to select the required service.	The platform exposes GUI to describe the resource.	The platform is ready to deliver the RFQ to the Supplier.				
	BEHIND THE SCENES									
	BACKSTAGE INTERACTION	PLATFORM BACKEND	Login in the Customer's profile loading data and settings.	The platform loads the service interface.	The platform supports the Supplier in the identification of the main relevant fields to characterize as better as possible the resource.	The platform makes available the Supplier's resource to RFQ.				
PLATFORM SUPPORT SERVICES		The marketplace registers the user access and sets up its dashboard and interfaces according with profile settings.	The User Profiler, supported by the semantic infrastructure, defines the interface's pre-configured fields, based on the customer's profile and the knowledge acquired by past transactions, searches and semantic relation.	The semantic infrastructure supports the interface updating. The ecosystem data manager records in the database the data provided by the Supplier.						

Table 18 Resources finding and sharing – Demand of by-product – Use-case

## 6.2 Open Innovation Support

The role of the MANU-SQUARE platform is not limited to supporting resource sharing, but also to provide support to innovation in products and processes. The way MANU-SQUARE pursues this goal is by fostering the adoption of open innovation. Most of the big firms from the beginning of 2000s, has started to understand that *“Not all the smart people work for us”* (Chesbrough H. , 2003). The platform aims to act as a facilitator for unleashing the full innovation potential residing in traditional companies, SMEs and start-ups bringing new ideas or new technologies, competences and processes into play, recognizing that as the tougher gap to be filled, from concept to market. This service is divided in three sub-categories, which differ based on the type of player requiring support:

- Open Innovation Management (Innovation Facilitators)
- Community Involvement (Community)
- Financing support

### 6.2.1 Innovation Management

The platform supports the interaction between Customers and Innovation Managers, to support the different phases of the innovation process represented in Figure 25, providing a dedicated area of the platform. This service involves:

- Customers: industrial companies, SMEs and start-up aims to receive support to manage and develop one or more of the innovation phases.
- Innovation Facilitators: consultants, innovation managers, sector experts, etc. who aims to provide support for innovation management.

Also for the Innovation Management service, the MANU-SQUARE platform plays the facilitator role. It supports Customer in the identification of the Innovation Facilitator/s that it considers more compliant with its needs. Moreover, it has to support Innovation Facilitators in delivering their services, guaranteeing efficiency and reliability of the interaction.

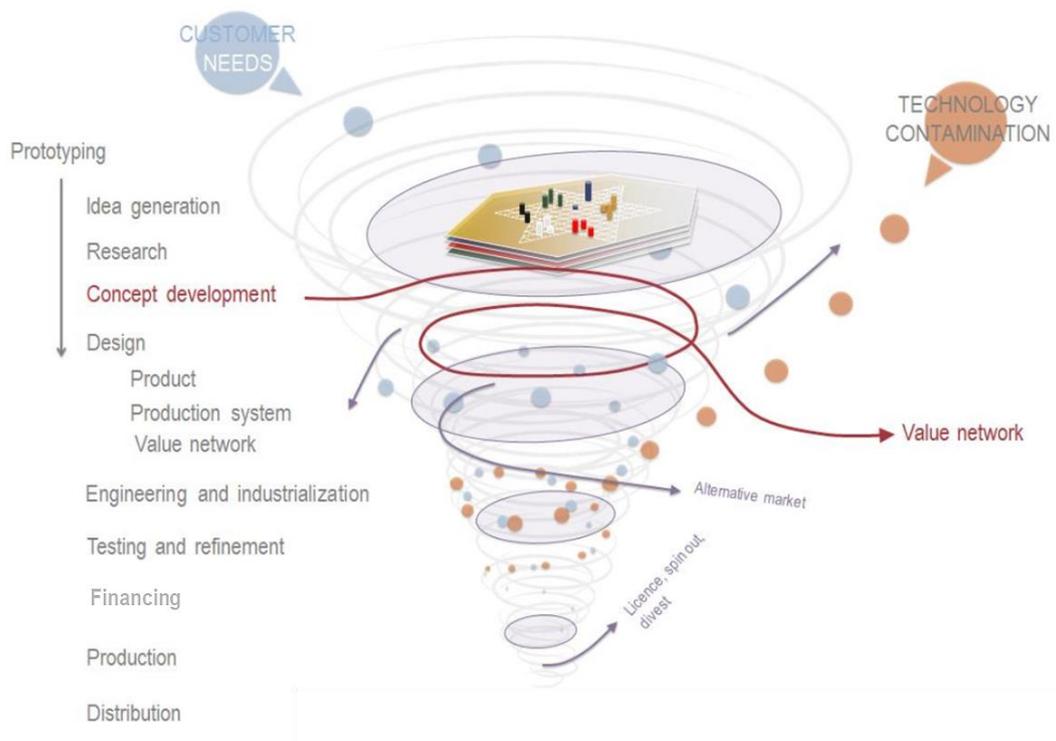


Figure 25 Innovation vortex

Table 19 describes the service “Innovation Management – Open Innovation Management”.

D1.2 – Specifications definition

<b>Title</b>	Innovation Management - Open Innovation Management																																										
<b>Service description</b>	This service achieves the matchmaking of companies requiring support in one or more stages of product development (idea generation, concept development, design, engineering, etc.) with companies / innovation managers belonging to the MANU-SQUARE network that, thanks to their competences and capabilities, can support the development of one or more product/service innovation phase.																																										
<b>Targeted stakeholders</b>	Companies such as industrial companies, SMEs and start-ups aim to receive support to manage and develop one or more innovation phases.																																										
<b>Involved stakeholders</b>	<ul style="list-style-type: none"> <li>• Companies aim to receive support in innovation management.</li> <li>• Innovation facilitators (consultants, innovation managers, sector experts, etc.) who aim to provide support for innovation management.</li> <li>• MANU-SQUARE platform</li> </ul>																																										
<b>Service inputs &amp; outputs</b>	<p><b>Inputs:</b> the customer inserts a set of parameters and specifications to describe the support is looking for.</p> <p><b>Outputs:</b> the Platform provides a list of matching innovation managers which can be contacted by the customer; the customer receives a service quotation for each contacted innovation manager (optional); the selected innovation manager delivers the service (optional).</p>																																										
<b>MANU-SQUARE specifications map</b>	<p>The diagram illustrates the MANU-SQUARE specifications map, showing the relationship between Stakeholders, Needs, Functionalities, Tools, and SW components. Stakeholders (Customers and Innovation Facilitators) have needs that are satisfied by functionalities, which rely on tools, which are based on SW components.</p> <table border="1"> <thead> <tr> <th>Stakeholders</th> <th>Needs</th> <th>Functionalities</th> <th>Tools</th> <th>SW components</th> </tr> </thead> <tbody> <tr> <td rowspan="13"> <b>Customers</b> (Shopping Cart icon)  <b>Innovation Facilitators</b> (Lightbulb icon)         </td> <td>Find the right suppliers (1)</td> <td>1,3,4,5,8,14 Know-how capabilities matching</td> <td>Matching Tool (SINTEF)</td> <td>A Matching algorithm (SINTEF)</td> </tr> <tr> <td>Access to not owned competences (3)</td> <td>7,13 Reputation management</td> <td>User Profiler (SUPSI)</td> <td>B Semantic infrastructure (INNOVA)</td> </tr> <tr> <td>Increase innovation opportunities (6)</td> <td>7,13 Certifications management</td> <td rowspan="2">Open Innovation, Co-design, Idea Management Tool (HOLONIX)</td> <td>C Inference rules (HOLONIX)</td> </tr> <tr> <td>Trust in unknown partners (7)</td> <td>7,11,12,13,14 Information security and privacy</td> <td>D Blockchain infrastructure &amp; IOT integration service (IBM)</td> </tr> <tr> <td>Ease relationship establishment and management (11)</td> <td>6,10,15,17,18 Innovation management</td> <td>Services Marketplace (SUPSI)</td> <td>E Reputation mechanism (INESC)</td> </tr> <tr> <td>Protect valuable information, data, and know-how (12)</td> <td>7,11,12,13,14 Communication support</td> <td></td> <td></td> </tr> <tr> <td>Access to structured, homogeneous and reliable information (13)</td> <td>1,7,11,12,13,14 RFQ management</td> <td></td> <td></td> </tr> <tr> <td></td> <td>7,11,12,13,14 Supplier assessment</td> <td></td> <td></td> </tr> <tr> <td></td> <td>1,2 Transactions management</td> <td></td> <td></td> </tr> </tbody> </table>		Stakeholders	Needs	Functionalities	Tools	SW components	<b>Customers</b> (Shopping Cart icon) <b>Innovation Facilitators</b> (Lightbulb icon)	Find the right suppliers (1)	1,3,4,5,8,14 Know-how capabilities matching	Matching Tool (SINTEF)	A Matching algorithm (SINTEF)	Access to not owned competences (3)	7,13 Reputation management	User Profiler (SUPSI)	B Semantic infrastructure (INNOVA)	Increase innovation opportunities (6)	7,13 Certifications management	Open Innovation, Co-design, Idea Management Tool (HOLONIX)	C Inference rules (HOLONIX)	Trust in unknown partners (7)	7,11,12,13,14 Information security and privacy	D Blockchain infrastructure & IOT integration service (IBM)	Ease relationship establishment and management (11)	6,10,15,17,18 Innovation management	Services Marketplace (SUPSI)	E Reputation mechanism (INESC)	Protect valuable information, data, and know-how (12)	7,11,12,13,14 Communication support			Access to structured, homogeneous and reliable information (13)	1,7,11,12,13,14 RFQ management				7,11,12,13,14 Supplier assessment				1,2 Transactions management		
Stakeholders	Needs	Functionalities	Tools	SW components																																							
<b>Customers</b> (Shopping Cart icon) <b>Innovation Facilitators</b> (Lightbulb icon)	Find the right suppliers (1)	1,3,4,5,8,14 Know-how capabilities matching	Matching Tool (SINTEF)	A Matching algorithm (SINTEF)																																							
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		7,11,12,13,14 Supplier assessment																																									
		1,2 Transactions management																																									
	<b>Risks</b>	<ul style="list-style-type: none"> <li>• The platform is not able to filter out bad contributions</li> <li>• The ecosystem is not populated by a sufficient number of contributors</li> </ul>																																									
	<b>Connected</b>	<b>Tool</b>	<b>Activities in the service use case</b>																																								

D1.2 – Specifications definition

<b>functionalities &amp; tools</b>	<b>Match-making tool</b>	<ul style="list-style-type: none"> <li>compares the data/parameters entered by the customer, communicating with the ecosystem data manager to match suppliers from the database</li> </ul>
	<b>Open innovation, Co-design, Idea management tool</b>	<ul style="list-style-type: none"> <li>provides features to support the interaction of the different involved players, supporting the innovation project development.</li> </ul>
	<b>Services Marketplace</b>	<ul style="list-style-type: none"> <li>allows the user to access to services and to the different interfaces</li> <li>supports transactions</li> <li>registers users' activities</li> </ul>
	<b>Reputation mechanism</b>	<ul style="list-style-type: none"> <li>supports the users in the transaction assessment</li> <li>integrates the assessments to the reputation of each user profile</li> </ul>
	<b>Ecosystem data manager</b>	<ul style="list-style-type: none"> <li>allows the different tools to access to the database and to exchange data</li> <li>record data on the database from the users</li> <li>record data on the database from the transactions</li> </ul>
	<b>Semantic infrastructure</b>	<ul style="list-style-type: none"> <li>supports the quasi-real time interface update.</li> <li>constitutes the base for matching tool logics</li> </ul>
	<b>Matching algorithm</b>	<ul style="list-style-type: none"> <li>provides the matching logics to the matching tool</li> </ul>
	<b>Blockchain infrastructure</b>	<ul style="list-style-type: none"> <li>supports service delivery, activities and contributions tracking</li> </ul>

Table 19 Innovation Management - Open Innovation Management

In order to provide a clearer understanding about how the service works, Table 20 contains a use-case. This is not is not exhaustive (the service can involve more functionalities, more activities, etc.). However, the use case is sufficiently developed to understand the service working principles.

<b>Scenario story</b>	<p>Txtdesign aims to have a third-party support also for industrialization. Paolo Rossi has not competences on this activity. Therefore, Txtdesign re-uses the “Open Innovation Management” service, finding a new Innovation Manager, Luca Bianchi, which is able to provide the required support. Through the Open Innovation, Co-design, Idea Management Tool, Luca Bianchi can access to the outputs developed within the transaction between Txtdesign SA and the Paolo Rossi, adding contributions that he considers relevant. Contributions are tracked by the blockchain architecture.</p> <ol style="list-style-type: none"> <li>1. Txtdesign SA has the idea to develop a new curtain product line for smart-housing, but it wants to develop a complete concept supported by an external player, which can provide an innovative point of view. Thus, it decides to use the MANU-SQUARE platform accessing to its website to obtain the required support...</li> <li>2. Txtdesign SA has already a profile as Costumer. It logs inside the platform using the web-interface through the username (Txtdesign SA) and the password (smart).</li> </ol>
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D1.2 – Specifications definition

	<ol style="list-style-type: none"> <li>3. Txtdesign SA is interested in “Innovation Management ”. Therefore, through the web interface, it selects the service “Innovation Management” and its sub-category “Open Innovation Management”</li> <li>4. Txtdesign SA completes the following fields to describe its idea and needs: idea description (text), sector (home decor, textile, smart house, smart textile), product (curtains), innovative elements (curtains with integrated led), target contributors (designers, innovation managers, sector experts), innovation stage (Concept development)</li> <li>5. The platform, using the matching tool, accessing the database, identifies Innovation Managers which match with the customer’s search parameters. To the matching Innovation Managers, the platform sends a notification. Moreover, it updates the “open opportunities” list in order to allow Innovation Managers which have not received the notification to make a proposal.</li> <li>6. 10 Innovation Managers deliver a proposal to Txtdesign SA, describing in detail their profile and experience, providing a brief description of the concept that they aims to develop.</li> <li>7. Txtdesign selects Paolo Rossi, an Innovation Manager with a long experience in textile sector, starting the collaboration. The platform sets up the contract between the two involved players (Txtdesign SA and the Innovation Manager). The Open Innovation, Co-design, Idea Management Tool allows the two players to collaborate in the development of the innovative concept.</li> <li>8. The platform manages and tracks contributions and IPR through the blockchain architecture.</li> <li>9. At the end of the project, Txtdesign assesses the Innovation Manager. The Innovation Manager assesses Txtdesign.</li> </ol>
<b>Extensions</b>	<p>Txtdesign aims to have a third-party support also for industrialization. Paolo Rossi has not competences on this activity. Therefore, Txtdesign re-uses the “Open Innovation Management” service, finding a new Innovation Manager, Luca Bianchi, which is able to provide the required support. Through the Open Innovation, Co-design, Idea Management Tool, Luca Bianchi can access to the outputs developed within the transaction between Txtdesign SA and the Paolo Rossi, adding contributions that he considers relevant. Contributions are tracked by the blockchain architecture.</p>
<b>Inputs</b>	<p><b>Customer enters in the platform’s search interface:</b> idea description (text), sector (home decor, textile, smart house, smart textile), product (curtains), innovative elements (curtains with integrated led), target contributors (designers, innovation managers, sector experts), innovation stage (Concept development)  <b>Innovation Facilitators have to describe their attributes and competences in order to allow the match.</b></p>
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• A collection of contributions and proposals.</li> <li>• A selected supplier which satisfies customer’s needs</li> </ul>

D1.2 – Specifications definition

		USE CASE STEPS								
		Login	Service selection	Support request	Request delivery	Proposal delivery	Transaction	Transaction assessment		
Service blueprint	STAKEHOLDER ACTIONS	CUSTOMER	Login in the platform.	Selection of the required service.	Definition, through different parameter, of idea, concept, needs and requirements for which it is required the support.			Proposal/s selection, contracting and service payment	Supplier assessment	
		INNOVATION MANAGER					Develop a proposal to support the Customer, contributing to its idea development, satisfy its needs and requirements.	Service confirmation, Processing, Delivery	Customer assessment	
		N/A								
	FRONTSTAGE INTERACTION	PLATFORM FRONTEND	The platform exposes the GUI to login in the platform dashboard.	The platform exposes the GUI to select the required service.	The platform exposes the Interface to describe idea, needs and requirements.	The platform notifies to matching Innovation Managers a request. The platform exposes the GUI to allow Innovation Managers to make proposals	The platform exposes the Innovation Managers' proposals in the Customer's dashboard.	The platform communicates to the selected innovation manager/s the proposal acceptance and provides the forms to set up the interaction (contract, payment and project management)	The platform exposes an GUI to allow the assessment	
	BEHIND THE SCENES									
	BACKSTAGE INTERACTION	PLATFORM BACKEND	Login in the Customer's profile loading data and settings.	The platform loads the service interface.	The platform supports the Customer in the identification of the main relevant fields to complete the request.	The platform updates the "open opportunities" list in order to allow innovation managers which have not received the notification to make a proposal.	The platform collects all the proposals in a unique interface.	Platform supports the transactions and the interactions between the involved players (e.g. communication, tracking, etc.)		
		PLATFORM SUPPORT SERVICES	The marketplace registers the user access and sets up its dashboard and interfaces according with profile settings.	The service marketplace, supported by the semantic infrastructure, defines the interface's pre-configured fields, based on the knowledge acquired by past transactions, searches and semantic relation	The semantic infrastructure supports the interface updating. The ecosystem data manager stores the data provided by the customer to allow their use by platform's tools.	The Open Innovation, Co-design, Idea Management Tool sets up an interface to allow Innovation Managers to make proposals, according with Customer's settings and pre-defined fields.	Blockchain infrastructure supports IPR tracking. The ecosystem data manager records in the database the proposals.	The marketplace, through a payment management system manages the monetary transaction. The Open Innovation, Co-design, Idea Management Tool allows the involved parties to interact. Blockchain infrastructure supports IPR tracking	The reputation mechanism, supports the assessment and integrates the assessments to the reputation of each user profile.	

Table 20 Innovation Management – Open Innovation Management - Use-case

### 6.2.2 Community Involvement

The platform supports the interaction between the members of a community and Customers by exposing a “social” area dedicated to product-service ideation and community involvement. This service is dedicated to collaboratively define ideas, concepts, designs, advancements and then exploiting community feedback for better aligning development to actual needs and in the end to achieve better products and services. This service involves:

- Customers: industrial companies, SMEs and start-up aims to receive inputs from consumers
- Community: designers, experts, consumers which aim to be more involved in the product/service development, contributing with ideas, feedbacks, etc.

Table 21 describes the service “Innovation Management – Community involvement”.

D1.2 – Specifications definition

<b>Title</b>	Innovation Management – Community involvement	
<b>Service description</b>	This service supports customer in the collection of contributions, ideas and feedbacks from a community (e.g. sector experts, innovators, designers, consumers, etc.)	
<b>Targeted stakeholders</b>	Companies such as industrial companies, SMEs and start-ups looking for ideas, designs, contributions and feedbacks from the market.	
<b>Involved stakeholders</b>	<ul style="list-style-type: none"> <li>• Companies such as industrial companies, SMEs and start-ups looking for ideas, designs, contributions and feedbacks from the market.</li> <li>• Designers and innovators which aims to contribute with their ideas and contributions</li> <li>• Consumers which aim to be involved in product/service development</li> </ul>	
<b>Service inputs &amp; outputs</b>	<b>Inputs:</b> the customer inserts the description of its idea/concept/product/service/etc. <b>Outputs:</b> the members of the community provide contributions.	
<b>MANU-SQUARE specifications map</b>	<p>The diagram illustrates the MANU-SQUARE specifications map, showing the relationship between Stakeholders, Needs, Functionalities, Tools, and SW components. Stakeholders (Customers and Consumers) have needs that are satisfied by functionalities, which rely on tools (Open Innovation, Co-design, Idea Management Tool and HOLONIX), which are based on SW components (Semantic infrastructure, Ontologies, Inference rules, Ecosystem data manager, Blockchain infrastructure &amp; IOT integration service).</p>	
<b>Risks</b>	<ul style="list-style-type: none"> <li>• The platform is not able to filter out spam</li> <li>• The ecosystem is not populated by a sufficient number of contributors</li> </ul>	
<b>Connected functionalities &amp; tools</b>	<b>Tool</b>	<b>Activities in the service use case</b>
	<b>Matching tool</b>  <b>Open innovation, Co-design, Idea management tool</b>	<ul style="list-style-type: none"> <li>• compares the data/parameters entered by the customer, communicating with the ecosystem data manager to match suppliers from the database</li> <li>• provides features to support the interaction of the different involved players, supporting the innovation project development</li> <li>• supports project management</li> </ul>

## D1.2 – Specifications definition

	<b>User profiler</b>	<ul style="list-style-type: none"> <li>provides information about certifications and reputation of Innovation Managers and Customers</li> </ul>
	<b>Marketplace (web interface)</b>	<ul style="list-style-type: none"> <li>allows the user to access to services and to the different interfaces</li> <li>supports transactions</li> <li>registers users' activities</li> </ul>
	<b>Ecosystem data manager</b>	<ul style="list-style-type: none"> <li>allows the different tools to access to the database and to exchange data</li> <li>records data on the database from the users</li> <li>records data on the database from the transactions</li> </ul>
	<b>Semantic infrastructure</b>	<ul style="list-style-type: none"> <li>supports the quasi-real time interface update</li> <li>constitutes the base for matching tool logics</li> </ul>
	<b>Blockchain infrastructure</b>	<ul style="list-style-type: none"> <li>supports service delivery, activities and contributions tracking</li> </ul>

Table 21 Innovation Management – Community involvement

In order to provide a clearer understanding about how the service works, Table 22 contains a use-case. This is not is not exhaustive (the service can involve more functionalities, more activities, etc.). However, the use case is sufficiently developed to understand the service working principles.

<b>Scenario story</b>	<p>A company working in the textile sector aims to innovate its curtains product lines, introducing a dedicated one for the smart-housing. It has already a conceptual idea, but it wants to evaluate the market interest in this solution.</p> <ol style="list-style-type: none"> <li>1. A company working in the textile sector aims to innovate its curtains product lines, introducing a dedicated one for the smart-housing. It has already a conceptual idea, but it wants to evaluate the market interest in this solution and collect inputs.</li> <li>2. Txtdesign SA has a general idea to develop a new curtain product line for smart-housing, but it want to collect feedbacks on the idea from the consumers inscribed to its newsletter. Thus, it decides to use the MANU-SQUARE platform accessing to its website to have a dedicated tool to collect data and analyze information...</li> <li>3. Txtdesign SA has already a profile as costumer. It logs inside the platform using the web-interface through the username (Txtdesign SA) and the password (smart).</li> <li>4. Txtdesign SA is interested in "Innovation Management ". Therefore, through the web interface, it selects the service "Innovation Management" and its sub-category "Open Innovation Management"</li> <li>5. Txtdesign SA develops a description of the idea and a set of question for the customers subscribed to its newsletter.</li> <li>6. The community obtains the access to the survey through a newsletters, receiving a code to access to access to the MANU-SQUARE platform interface.</li> <li>7. Each community member has the possibility to complete the survey and to assess the contribution of the other members (providing comments and points).</li> <li>8. Txtdesign, after 30 days, closes the survey and it is able to observe results and feedbacks.</li> </ol>
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D1.2 – Specifications definition

Inputs	Customer enters in the platform's search interface: Idea description								
Outputs	Community feedbacks								
Service blueprint	USE CASE STEPS								
	STAKEHOLDER ACTIONS	CUSTOMER	Login in the platform.	Selection of the service for which it makes its resource available	Definition of the idea/concept for which it is required a contribution.	Design of the template and/or the survey to be filled by the community.	Access to the dashboard to observe the preliminary results.	Community' access closing. Results analysis	
		COMMUNITY					Access to the platform to generate contributions. Possibility to comment and assess others' contributions		
		PLAYER 3							
	FRONTSTAGE INTERACTION	PLATFORM FRONTEND	The platform exposes the GUI to login in the platform dashboard.	The platform exposes the GUI to select the required service.	The platform exposes the GUI to describe idea/concept.	The platform exposes the dashboard to each community member who requests to access through the newsletter.		The platform blocks the access to the community. The platform provides the dashboard to support the complete view and analysis of the results	
	BEHIND THE SCENES								
	BACKSTAGE INTERACTION	PLATFORM BACKEND	Login in the Customer's profile loading data and settings.	The platform loads the service interface.	The platform interface supports the customer in the identification of the main relevant fields for search, updating the interface's fields every time the customer inserts a new parameter/attribute.	The platform creates a dashboard in order to allow community members to provide their contributions.			
		PLATFORM SUPPORT SERVICES	The marketplace registers the user access and sets up its dashboard and interfaces according with profile settings.	The User Profiler, supported by the semantic infrastructure, defines the interface's pre-configured fields, based on the customer's profile and the knowledge acquired by past transactions, searches and semantic relation.	The semantic infrastructure supports the interface updating. The ecosystem data manager records in the database the data provided by the Customer.	The Open Innovation, Co-design, Idea Management Tool provides all the features to support the template and survey design.	The Open Innovation, Co-design, Idea Management Tool provides all the features to support preliminary results analysis. The ecosystem data manager records in the database the data provided by the community members.	The Open Innovation, Co-design, Idea Management Tool provides all the features to support results analysis.	

Table 22 Innovation Management – Community involvement - Use-case

### 6.2.3 Financing support

Considering the already available platforms for projects financing and start-ups acceleration, MANU-SQUARE will favour an approach of external platforms integration instead of creating new facilities from scratch. The methodology to provide this service will be further detailed in Task 5.1.

### 6.3 Specification validation process: open issues

As final validation of the defined services and functionalities, the developed elements have been shared with consortium partners for a preliminary analysis as reported in § 2. From the preliminary validation, the following open issues to be addressed in the next service development phase (WP5) have been identified:

#### Blockchain support

- The RFQ process could be supported by the blockchain so that KPIs can be measured.
- Transaction assessment records (as well as the reputation) could persist on the blockchain. This is a crucial component of the trust system.
- Each interaction step between the different players involved in a transaction could have a time limit. For example, the supplier has a limited time to answer to the RFQ and to satisfy the order. In the same way, the customer should have a limited time to answer to quotations.

#### Certification and Reputation management

- The reputation mechanism has to be chosen, developed and enforced with caution. Too many platforms use this mechanism and in many of those the reputation can be misleading, since it has been actively “improved”. Of course, the MANU-SQUARE platform will not allow manipulation, but the general way reputation mechanisms are perceived may not look “professional enough” for all users. What is certainly of a much higher value is the mechanism on certification management exclusively run by auditors and regulators. Data from the reputation mechanism can also be taken into account for the certification management.
- It should be considered adding the certification management mechanism to the required tools. Certifications can provide valuable information on sustainability, ISO conformity, etc. that can be crucial decision factors for the customer.

#### RFQ management

- The RFQ process needs solutions for documentation sharing between customer and supplier – for example the customer will certainly need to share the drawings of the parts with the supplier. The platform should have the ability to concentrate the documentation in one place, to avoid the usage of other platforms or similar services – email, etc. (e.g. as benchmark ARIBA from SAP).
- For the sharing of proprietary information between the parties, before a contract is signed, there should be in place a standard Non-Disclosure Agreement established by the platform to protect the disclosing party. This is a standard procedure in RFQ processes and it could be a value-added feature to be included in the platform.
- The inclusion of visualisation tools (e.g. 3D) such that suppliers could facilitate and make more efficient and effective the RFQ process.
- The RFQ functionality could be based on available open source tools.

#### Innovation management

- How to promote engagement? Often companies or practitioners are requested to provide and to fill in a set of questionnaires. The platform could introduce an incentive-based app as a solution.

- The platform could support the community involvement developing a monetisation system in order to foster community members contributions (what is the value for contributors for expending their time?)
- Assessment of the importance of each contribution is a key element.

### **Business model**

- It is possible that companies will only use the platform to find new customers, without having unused resources. How is the platform meant to deal with this? Will it give preference to suppliers that share free capacity in between their own manufacturing over those companies that only registered as suppliers?
- How to deal with confidentiality and required anonymous offer? This may be the case of companies that do not want that this information is publicly available (e.g. is it possible for the company to choose for not disclosing its name? How does this interfere with the reputation verification?).
- The publishing of real time or specific available capacity could be an issue for companies (in many cases they do not want to reveal it, e.g. in order to maintain negotiation leverage). In this sense this should be optional as it may crowd out potential users. In order to ensure companies platform utilisation, this should be optional.
- The management of legal documents and contracts will be a relevant issue to be discussed in detail.

### **General topics**

- Does the platform enable “natural language” searches? This may enable an additional matching (e.g. knowledge that despite belonging to other sectors can be applied to specific projects and the case that the demand side does not know all the specifics of the solution).
- For some by-products, a certification may not be possible – especially in case this by-product is identified by the platforms itself. Since the platform is supposed to provide as much information and apparently also services (up to transactions, etc.) as possible, it has to be investigated how newly identified by-products could be certified (if at all aimed for)?
- The three matching functionalities (capacity, know-how, by-product) could be based on a single versatile configurable, dynamic matching engine.

## 7 CONCLUSIONS

This report describes the activities of Task 1.2 that defined a set of reference specifications outlining the core elements of the MANU-SQUARE platform. The main obtained result is the specifications' map (Figure 24), a reference specifications diagram that maps together all the different services provided by the platform.

The specifications' map connects the stakeholders, identified in Task 1.1, with the services that Task 5.1 will design. To this purpose, needs of each stakeholder have been analysed showing how the functionalities that the platform delivers can be bundled in user-oriented services aimed to cope with those needs. The specifications' map acts also as a bridge towards the implementation of the MANU-SQUARE tools by aggregating the platform's functionalities in dedicated software packages.

The elements constituting the specifications' map are the result of a work of analysis carried out within and outside the consortium and that is meant to pave the way for the following development of the MANU-SQUARE platform both at technical and business level. The strict collaboration with activities of Task 1.4, Task 2.1 and Task 5.1 have been fundamental to pave the way for a coherent and proficient integration of the specifications defined at architectural, ontological and service design level.

While providing the reference specifications for MANU-SQUARE platform design, this document is not intended to remain static during project continuation but to be updated according to technical and non-technical revisions along the actual implementation of such specifications in the platform's tools and services.

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**APPENDIX**

A service blueprint is an operational tool that describes the nature and the characteristics of the service interaction in enough detail to develop, verify and implement it. It is a graphical technique that displays the process functions above and below the line of visibility to the customer (Kalakota & Robinson, 2004) (Bitner, Ostrom, & Morgan, 2007). Similar to customer-journey maps, blueprints are instrumental in complex scenarios spanning many service-related offerings. Blueprinting is an ideal approach to experiences which involve multiple touchpoints or require a cross-functional effort (coordination of multiple entities) (Gibbons, 2017). Service blueprints provide a complete understanding of a service and the underlying resources and processes seen and unseen to the user. Blueprints are treasure maps that help businesses to identify the mechanism on which are based their services, discover weaknesses and help identify opportunities for optimization and improvement. Blueprinting exposes the big picture and offers a map of dependencies. For these reasons, they can be used to support specifications definition, providing a detailed view of the entities which compose and interact with the platform.

Service blueprints take different visual forms, some more graphic than others. An example is reported in Figure 26.

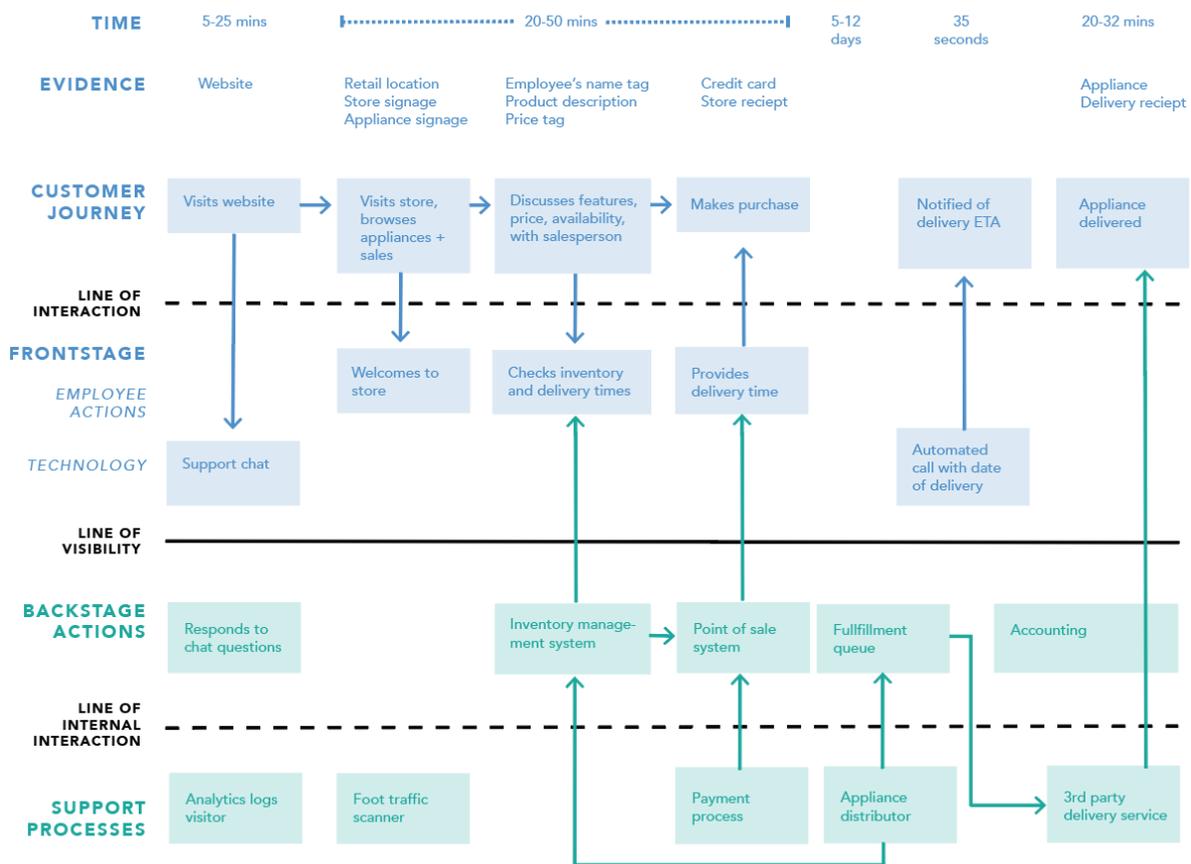


Figure 26 Service blueprint example

The service blueprint is usually composed by:

- **Customer actions / journey:** steps, choices, activities, and interactions that customer performs while interacting with a service to reach a particular goal.
- **Frontstage actions:** actions that happen directly in view of the customer. These actions can be human-to-human or human-to-computer. Human-to-human actions are the steps and activities developed by employee

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(the person who interacts with the customer), human-to-computer actions are carried out when the customer interacts with self-service technology (for example, a mobile application or a software)

- **Backstage actions:** steps and activities that occur behind the scenes to support those which happen onstage. These actions could be performed by a backstage employee (e.g., a cook in the kitchen) or by a frontstage employee who does something not visible to the customer (e.g., a waiter entering an order into the kitchen display system).
- **Support processes:** internal steps, and interactions that support the employees in delivering the service.