Ref. Ares(2017)465790 - 27/01/2017

TagItSmart!

Smart Tags driven service platform for enabling ecosystems of connected objects

Grant agreement 688061

D5.1 Infrastructure for trials and pilots

Deliverable ID:	**D 5.1**
Deliverable Title:	**Infrastructure for trials and pilots**
Revision #:	**2.0**
Dissemination Level:	**Public**
Responsible beneficiary:	DNET
Contributing beneficiaries:	All
Contractual date of delivery:	31/12/2016
Actual submission date:	27/01/2017

Start Date of the Project: 1 January 2016 Duration: 36 Months

Contents

Section 1 - Introduction ***4***

Section 2 - Validation requirements ***4***

2.1 SmartTag printing and scanning **4**

2.2 Use Case 1 - Digital product **5**

2.3 Use Case 2 - Lifecycle management **7**

2.4 Use Case 3 - Brand protection **9**

2.5 Use Case 4 - Dynamic pricing **11**

2.6 Use Case 5 - Home services **16**

Section 3 - Infrastructure ***21***

3.1 Use Case 1 - Digital product **21**

3.1.1 SmartTag Scanner 21

3.1.2 SmartTag Printing 21

3.1.3 Identity Management and Access Control 21

3.1.4 Data Logic and Event Processing 21

3.2 Use Case 2 - Lifecycle management **21**

3.2.1 SmartTag Scanner 21

3.2.2 SmartTag Printing 21

3.2.3 Identity Management and Access Control 21

3.2.4 Data Logic and Event Processing 22

3.3 Use Case 3 - Brand protection **22**

3.4 Use Case 4 - Dynamic pricing **22**

3.4.1 SmartTag Scanner 22

3.4.2 SmartTag Printing 22

3.4.3 Identity Management and Access Control 22

3.4.4 Data Logic and Event Processing 22

3.5 Use Case 5 - Home services **23**

3.5.1 SmartTag Scanner 23

3.5.2 SmartTag Printing 23

3.5.3 Identity Management and Access Control 23

3.5.4 Data Logic and Event Processing 23

3.6 TagItSmart partner involvement in use case **24**

Section 4 - Validation plan ***25***

4.1 Use Case 1 - Digital product **26**

4.2 Use Case 2 - Lifecycle management **26**

4.3 Use Case 3 - Brand protection **27**

4.4 Use Case 4 - Dynamic pricing **28**

4.5 Use Case 5 - Home services....28
Section 5 - User engagement strategy....30
5.1 User engagement for trials and pilots....30
Section 6 - References....31

Section 1 - Introduction

Validation of the TagItSmart platform will be performed in laboratory, controlled and real environment during trials and pilots. The goal of the trials is to validate requirements against individual components and services, while the focus of the pilot will be on the complete framework, the ease of use, end users' feedback, ease of use from the developers' point of view, integration with other systems, etc. Different stakeholders, as identified in D1.1, will be involved in the validation process. The rest of this deliverable is structured as follows:

Section 2 introduces validation requirements for infrastructure components for trials and pilots.

Section 3 defines infrastructure to be used for validation. Mapping of infrastructure components to planned validation environment is also provided.

Section 4 presents validation plan and implementation workflow for different trials and pilots.

Finally, Section 5 identifies the initial strategy for end-users and stakeholders engagement.

Section 2 - Validation requirements

A detailed system architecture description is provided in D1.2. As the architecture design work is still on-going at the time of preparation of this document (D5.1), there is a chance that the list of components identified in this document will be updated. This will be done once the architecture is finalized. It is worth noting that this will be a bidirectional process, with the outcomes of the trialling process feeding the architectural design process based on the real life validation, findings and lessons learnt; with the architecture updates –if needed- being put back to the real life test. This is expected to continue until M24, when the final version of the architecture will be delivered.

TagItSmart framework will consist of a large number of components required to enable the complete workflow of all envisioned use cases. However, not all individual components will be included in the validation during trials and pilots. Instead, the main focus of the trials will be on validation of the core components specific to TagItSmart, i.e., components involved in the SmartTag scanning driven process, from the design and printing of the tags, to processing of data obtained from the tags together with the contextual information and finally delivering corresponding services.

The aim of the pilots will be on validation of functionality and performance of the system as a whole, not on the individual components. Further to the trial and pilots run by the project partners, additional validation will be done by the new partners joining the project through the open calls.

2.1 SmartTag printing and scanning

SmartTag printing and scanning are generic features representing the core functionality of all use cases. Validation requirements (FR – Functional requirements, PR – Performance requirements) for identified components are presented in Table 1, together with an indication of the phase in which the validation is planned.

Component	Validation Requirement	Validation phase
SmartTag printer	SP_FR1 Print different types of SmartTags (NFC, QR code, Image).	Trial, Pilot
	SP_FR2 Print SmartTags with sensing capabilities (temperature, light, humidity).	Trial, Pilot
	SP_FR3 Print SmartTags of different size.	Trial, Pilot
	SP_FR4 Print SmartTag for unique identification.	Pilot
	SP_FR5 Reset SmartTag to action when relevant.	Pilot
	SP_PR1 Print SmartTag at expected speed.	Trial, Pilot
SmartTag scanner	SS_FR1 Scan different types of SmartTags (NFC, QR code, Image.	Trial, Pilot
	SS_FR2 Scanning SmartTags of different size.	Trial, Pilot
	SS_FR3 Scanning SmartTags at different light conditions.	Trial, Pilot
	SS_FR4 Identify product by different stakeholder.	Pilot
	SS_FR5 Provide different information to different stakeholders throughout the lifecycle of the product.	Pilot
	SS_FR6 Update the product's properties by scanning at different lifecycle stages.	Pilot
	SS_FR7 Retrieve (and store) active sensor data and generate an alert.	Pilot
	SS_FR8 Setting up data	Pilot
	SS_FR9 Scanning SmartTag to action when relevant	Pilot
	SS_PR1 Scanning SmartTags at expected speed.	Trial, Pilot

Table 1 Component requirements

For individual Use Cases, more detailed requirements are presented in subsequent sections.

2.2 Use Case 1 - Digital product

In the Digital Beer use case we will test the whole Digital Product lifecycle. The main point of the test is traceability in different states of the product lifecycle.

Brewing
In the beginning of the process, we want to collect data from Raw material. If SmartTags are used in our Raw material suppliers' packages, those tags will be read into the database.

Bottling
In this process beer batch in tanks will be bottled. During the bottling process, these tags (printed beforehand) are attached into a batch and every bottle will get a unique SmartTag.

Component	Detailed Validation Requirement
SmartTag printer	UC1_SP_FR2 Print SmartTag (Data Matrix) with sensing capabilities that will react to any change of temperature higher than 8 ºC

	UC1_SP_FR4 Print SmartTag with a unique ID
SmartTag scanner	UC1_SS_FR6 Once the SmartTag is placed onto a bottle, embedded FC scanner (in bottling line) scans the FC Code and the relevant information, i.e., : time of packaging, producer name, type of beer, temperature history of batch, recipe of batch. is stored in the platform
	UC1_SS_PR1 Scanning SmartTags at expected speed.(1/sec)

Table 2 Detailed validation requirements at manufacturer level

Packaging
During packaging, bottles (which already have a SmartTag) will be packed into boxes, which will also get a unique SmartTag. This information is stored in the warehouse system.

Component	**Detailed Validation Requirement**
SmartTag printer	UC1_SP_FR2 Print SmartTag (Data Matrix) with sensing capabilities that will react for change of temperature higher than 8 ºC
	UC1_SP_FR4 Print SmartTag with unique ID
SmartTag scanner	UC1_SS_FR6 Once the SmartTag is placed onto a box the relevant information is stored in the platform: time of packaging, type of the box.
	UC1_SS_PR1 Scanning SmartTags at expected speed.(1/sec)

Table 3 Detailed validation requirements for packaging

Transport
When a customer orders bottles from the brewery, the number of ordered boxes will be picked according to Sales Order. When a SmartTag is read from box, order number will be updated into system. Now one knows where each unique bottle has been delivered.

Component	**Detailed Validation Requirement**
SmartTag scanner	UC1_SS_FR6 Once the SmartTag is place into box the relevant information is stored in the platform: time of packaging, type of the box.
	UC1_SS_PR1 Scanning SmartTags at expected speed.(1/sec)

Table 4 Detailed validation requirements for transport

Retail
When boxes of Digital Beer come into the retail store, SmartTags will be read and Systems will update the status of bottles into the platform

Component	Detailed Validation Requirement
SmartTag scanner	UC1_SS_FR6 Update location of an item into platform.
	UC1_SS_FR5 Deliver additional information (if there is any) to the retail store
	UC1_SS_PR1 Scanning SmartTags at expected speed.(1/sec)

Table 5 Detailed validation requirements for retail store

Consumer
Consumer can read code in mobile market version of SmartTag reader application.

Component	Detailed Validation Requirement
SmartTag scanner	UC1_SS_FR6 When a consumer reads a SmartTag, it is possible to add it into personal product portfolio.
	UC1_SS_FR5 If there are additional information to deliver to retail store, it will be delivered (e.g. problems in product batch)
	UC1_SS_PR1 Scanning SmartTags at expected speed.(1/sec)

Table 6 Detailed validation requirements for consumer usage

Recycling
When bottle is empty and have to be recycled, SmartTag will tell how to do it. Reading a code will tell you nearest recycling station. In Finland every shop has automated process for reading value of empty bottle. SmartTag scanner will read code and update information into platform – recycled.

Component	Detailed Validation Requirement
SmartTag scanner	UC1_SS_FR6 Update the product status into “to be Recycled”
	UC1_SS_PR1 Scanning SmartTags at expected speed.(1/sec)

Table 7 Detailed validation requirements for recycling

2.3 Use Case 2 - Lifecycle management

In this Use Case, we will develop and pilot an IoT solution that promotes recycling behaviour change, to improve recycling in the EU and reduce the amount of waste. It will work by enabling consumers to use their smartphones to scan not only the SmartTags and traditional product barcodes on the pack at the point of disposal, but also the SmartTags included in those waste collection sites that have this features enabled, in order to link it to the previous scanning/recycling action.
A cloud-based back-end system will deliver accurate, geographically appropriate waste prevention and recycling information to the end-users’ phones. The design of the front-end system will promote consumer engagement and behaviour change through gamification and rewards.

Depending on the lifecycle of the product, the infrastructure and the components will be different:

Production/Manufacturing
During this process, all recycling information of the products, and their components and parts, is collected and included in a database. This information will be used afterwards to inform the end-user about the recyclability of the product.

Distribution
SmartTags will be included manually in some random batches of products, getting their unique SmartTag.

Component	Detailed Validation Requirement
SmartTag printer	UC2_SP_FR2 Print SmartTags with sensing capabilities (temperature higher than -10ºC).
	UC2_SP_FR3 Print SmartTags of different size, from 0.5x0.5cm to 2x2cm
	UC2_SP_FR4 Print SmartTag for unique identification.
	UC2_SP_FR6 Print SmartTags (NFC, QR code and Image) on materials that can stand high temperatures.
SmartTag scanner	UC2_SS_FR1 Scanning different types of SmartTags (NFC and QR code).
	UC2_SS_FR2 Scanning SmartTags of different size from 0.5x0.5cm to 5x5cm
	UC2_SS_FR3 Scanning SmartTags at different light conditions (natural light, LED light, dimmed light)
	UC2_SS_FR5 Provide different information to different stakeholders throughout the lifecycle of the product (first scan and upload will be done by different agents).
	SS_FR6 Update the product's properties by scanning at different lifecycle stages (first scan and upload will be done by different agents).
	SS_FR8 Setting up data (first scan will upload and set up the data for every product).
	UC2_SS_PR1 Scanning SmartTags at expected speed (<1s)

Table 8 Detailed validation requirements for distribution

Consumption at home
Consumers can read the SmartTags with the Unilever's Android application.

Component	Detailed Validation Requirement
SmartTag scanner	UC2_SS_FR1 Scan different types of SmartTags (NFC and QR code).

	UC2_SS_FR2 Scan SmartTags of different size (as above)
	UC2_SS_FR3 Scan SmartTags at different light conditions (as above)
	UC2_SS_FR6 Update the product's properties by scanning at different lifecycle stages (update the end-user recycling batch and history)
	UC2_SS_PR1 Scan SmartTags at expected speed (as above)

Table 9 Detailed validation requirements for consumption at home

Recycling

When the product is consumed or used separated at home, and is ready for disposal. The SmartTag and the mobile application will indicate the collection options available, and link it to those bins or containers that have TagItSmart components/features. SmartTag reader will read the SmartTags in the bins code and update information into the platform.

Component	Detailed Validation Requirement
SmartTag scanner	SS_FR1 Scan different types of SmartTags (NFC and QR code).
	SS_FR2 Scan SmartTags of different size (as above)
	SS_FR3 Scan SmartTags at different light conditions (as above)
	UC2_SS_FR6 Update the product's properties by scanning at different lifecycle stages (update the product as recycled, and update the end-user recycling history)
	SS_FR7 Retrieve (and store) active sensor data and generate an alert.
	SS_PR1 Scan SmartTags at expected speed (as above)

Table 10 Detailed validation requirements for recycling

2.4 Use Case 3 - Brand protection

Brand protection use case focuses on providing a tag printed on certain textures that reacts and changes to light in the VIS band (400-700 nm), providing brands with a difficult to counterfeit mechanism to guarantee the authenticity of the product. Consumers will be able to validate the origin and obtain information about the genuine product by using their mobile devices.

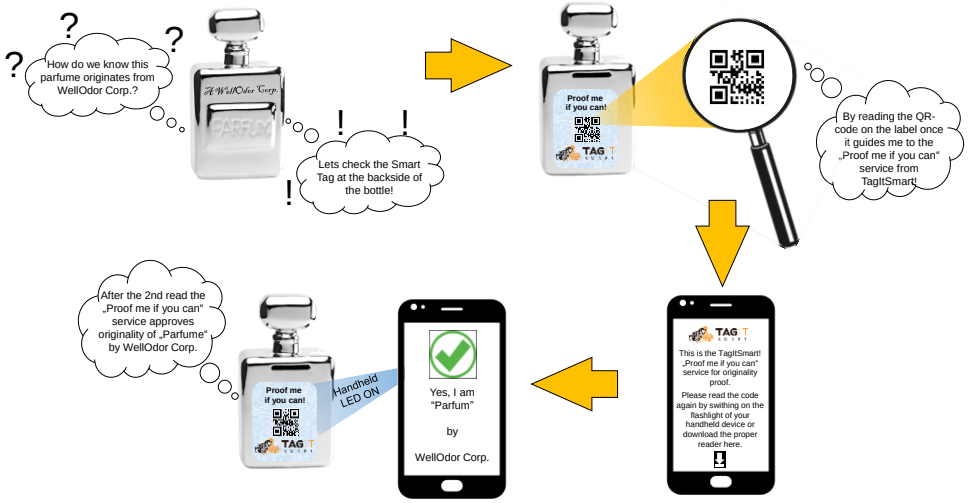


Figure 1 SmartTag used for brand protection

Production/Manufacturing

At manufacturing stage, the SmartTags are created, encoding the relevant properties of the product, as well as a unique identifier to guarantee authenticity. This information will be used afterwards during the authenticity check.

Component	Detailed Validation Requirement
SmartTag printer	UC3_SP_FR2 Print SmartTags with sensing capabilities that react to light in the VIS band (400–700 nm) as it is found in blue LEDs of common handheld devices by switching the colour (photochromism).
	UC3_SP_FR3 Print SmartTags of different size from 0.5x0.5cm to 2x2cm.
	UC3_SP_FR4 Print SmartTag for unique identification.

Table 11 Detailed validation requirements for Brand Protection at Production/ Manufacturing

Consumer/Authenticity Check

During the authenticity check consumers are able to validate the origin and obtain information about genuine product by scanning with mobile devices.

Component	Detailed Validation Requirement
SmartTag scanner	UC3_SS_FR1 Scan different types of SmartTags. Only QR codes are considered in this use case
	UC3_SS_FR2 Scan SmartTags of different size from 0.5x0.5cm to 2x2cm.
	UC3_SS_FR3 Scan SmartTags at different light conditions. Light changes the QR code so the reading should be precise enough based on the changing pattern.

	UC3_SS_FR5 Provide different information to different stakeholders throughout the lifecycle of the product. Consumers get lifecycle information that has been added up to the check point to authenticate the product.
	UC3_SS_FR6 Update the product's properties by scanning at different lifecycle stages. Manufacturers will scan and activate the product and consumers will scan for authenticity checks, that are recorded and added to the product lifecycle.
	SS_FR7 Retrieve (and store) active sensor data and generate an alert. When the SmartTag is read if there is a suspicion the product is not authentic based on the SmartTag reading and the context, an alert will be flagged.
	UC3_SS_PR1 Scanning SmartTags at expected speed (<1s).

Table 12 Detailed validation requirements for Brand Protection at Consumer/ Authenticity Check

2.5 Use Case 4 - Dynamic pricing

With the dynamic pricing use case, we aim to provide the ability to check the time elapsed from the moment meat is packaged, the conditions under which it is stored and transported to the shelf, as well as additional information about the product. Traceabilityand cold chain control over time is available to different stakeholders with relevant information duringthe life-cycle of the meat product from the farm to a consumer. Detailed validation requirements relevant to each stakeholder are provided in the following tables.

Manufacturer (meat producer) – prints SmartTags at their production line to enable individual tracking; obtains information about the package's condition whenever it is scanned by other actors.

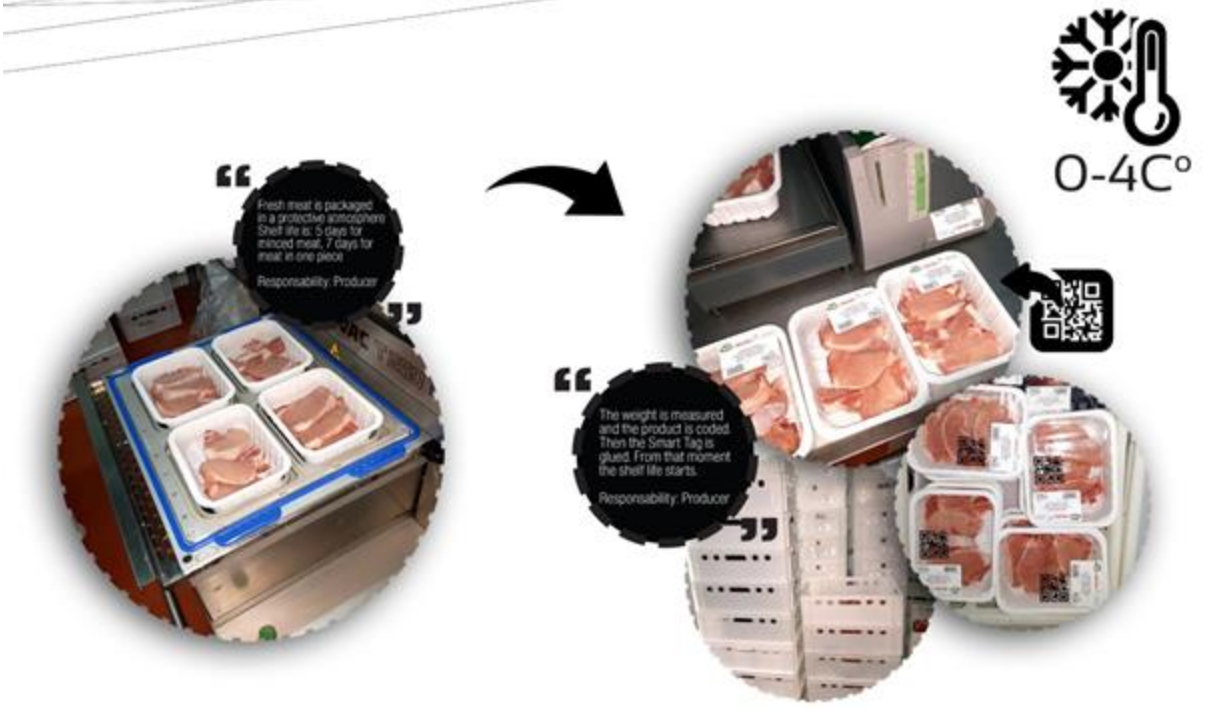


Figure 2 Printing SmartTag at manufacturer level

Component	Detailed Validation Requirement
SmartTag printer	UC4_SP_FR2 Print SmartTag with sensing capabilities that will react for change of temperature outside 0-4ºC
	UC4_SP_FR4 Print SmartTag for unique identification at package level. Embed date of packaging with expiry date based on the type of packaged meat (5 days for minced and 7 days for whole meet). Once the SmartTag is printed the relevant information is stored in the platform: time of packaging, producer name, type of package, temperature at packaging.
	UC4_SP_PR1 Print at least 20 SmartTags per minute.

Table 13 Detailed validation requirements at manufacturer level

Transport company (meat distributor) – scans the SmartTag to check the compliance with cold-chain control.

Figure 3 ScanningSmartTag at transport level

Component	Detailed Validation Requirement
SmartTag scanner	UC4_SS_FR4 Retrieve product identification when scanned at transport level: package is uniquely identified.
	UC4_SS_FR5 Retrieve general product information at transport level: time of packaging, producer name, violation if already detected by embedded sensor. Retrieve product information related to cold-chain control when scanned at transport level. Temperature above 7ºC longer than 30 minutes.
	UC4_SS_FR6 Once scanned at transport level the relevant information is stored in the platform: time of scanning, violation if detected by embedded sensor.
	UC4_SS_PR1 Scan SmartTag at expected speed (2 sec)

Table 14 Detailed validation requirements at transport level

Retailer – scans the SmartTag to check the compliance with cold-chain control and at check-out to provide dynamic pricing.

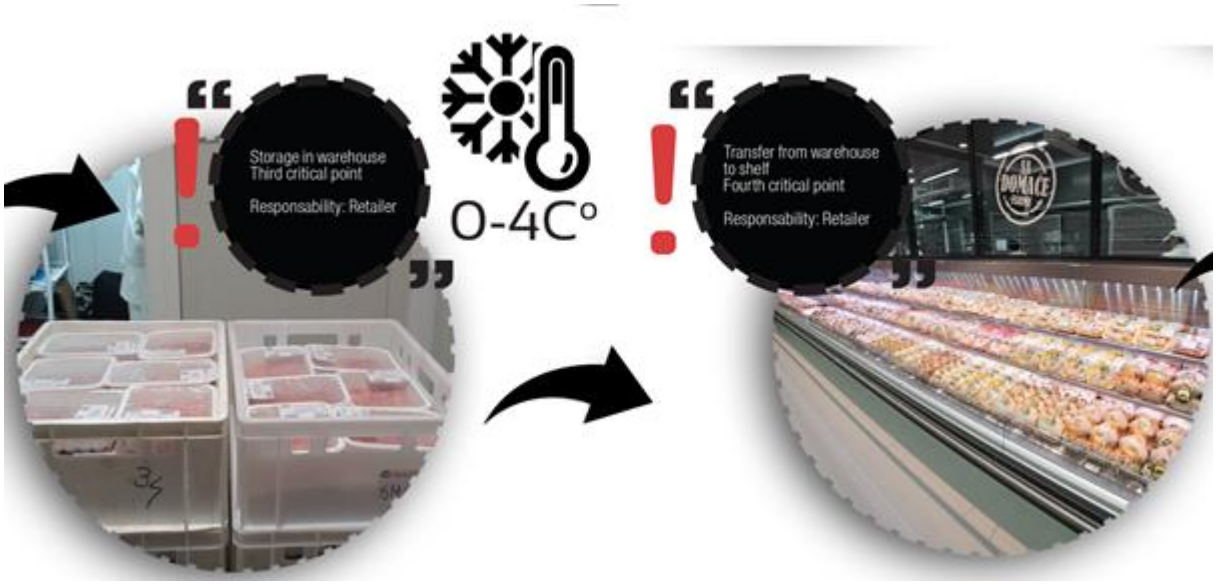


Figure 4 Scanning SmartTag at retailer level

Component	Detailed Validation Requirement
SmartTag scanner	UC4_SS_FR4 Retrieve product identification when scanned at retailer level at storing time (not the check-out): package is uniquely identified. Retrieve product identification when scanned at retailer level at check-out: package is uniquely identified.
	UC4_SS_FR5 Retrieve product information when scanned at retailer level at storing time (not the check-out): time of packaging, producer name, violation if already detected by embedded sensor, days to discounted price. Retrieve product information related to cold-chain control when scanned at retailer level. Temperature above 7ºC longer than 30 minutes. Retrieve product information related to dynamic pricing when scanned at retailer level at storing time (not the check-out): days to expiry, days to discounted price, warning when expiry date is exceeded, warning when discounted price date is reached (so that package can be moved at designated shelf). Retrieve product information when scanned at retailer level at check-out: discounted price if 24h before expiry date.
	UC4_SS_FR6 Update the product's properties by scanning at retailer level before check-out: time of scanning, violation if detected by embedded sensor, retailer name and location. Update the product's properties by scanning at retailer level at check-out: time of scanning, discounted price applied or not, retailer name and location.
	UC4_SS_PR1 Scan SmartTag at expected speed (2 sec)

Table 15 Detailed validation requirements at retailer level

Consumer – scans the SmartTag to check the meat origin, compliance with cold-chain control, dynamic pricing at retailer facilities or past check-out about available recipes or recycling.

Figure 5 Scanning SmartTag at consumer level

Component	Detailed Validation Requirement
SmartTag scanner	UC4_SS_FR4.4Retrieve product identification when scanned at consumer level before buying: package is uniquely identified.
	UC4_SS_FR4.5 Retrieve product identification when scanned at consumer level after buying: package is uniquely identified.
	UC4_SS_FR5.7 Retrieve product information when scanned at consumer level before buying: time of packaging, producer name, violation if detected by embedded sensor, days to expiry.
	UC4_SS_FR5.8 Retrieve product information related to cold-chain control when scanned at consumer level. Temperature above 7ºC longer than 30 minutes.
	UC4_SS_FR5.9 Retrieve product information when scanned at consumer level after buying: time of packaging, producer name, violation if detected by embedded sensor, days to expiry,

	available recipes, recycling guidelines.
	UC4_ SS_FR6.4 Update the product's properties by scanning at consumer level before baying: time of scanning, violation if detected by embedded sensor.
	UC4_ SS_FR6.5 Update the product's properties by scanning at consumer level after buying: time of scanning, violation if detected by embedded sensor, consumer (use) location.
	UC4_SS_PR1 Scan SmartTag at expected speed (2 sec)

Table 16 Detailed validation requirements at consumer level

2.6 Use Case 5 - Home services

The home services use case provides different services to the customer all along the life of the equipment at home. Some of the services will leverage access to information related to product, its environment and its use, while some will provide specialized services (installation, maintenance, repair, etc.).

Retailer - prints SmartTags in the store or the warehouse, before selling the product to a customer; sets up initial data; sends list of defective products; proceeds consumable reordering.

Component	Detailed Validation Requirement
SmartTag printer	UC5_SP_FR1 Print different types of SmartTags: NFC, QR code
	UC5_SP_FR2 Print SmartTags with sensing capabilities (temperature, light, humidity): Temperature : above 50°C time : 11 months (boiler) time : 3 months (filtering station) humidity : contact with water carbon monoxide : above 50ppm light intensity : to be confirmed
	UC5_SP_FR4 Link SmartTag to product or appliance for unique identification. Link SmartTag to retailer Link SmartTag to customer
SmartTag scanner	UC5_SS_FR5 Setting up data <u>PRODUCT</u> Identification information Technical information Manufacturing information Recycling information Purchasing information Guides, manuals Warranty & maintenance planning

	Maintenance / repair / change actions Consumables CUSTOMER Customer identification Privacy settings SERVICE Authorized service providers Authorized retailers Recommendations in case of problem HOME Home identification Home configuration (rooms) Products & appliances (locations) Sensors & actuators (locations) Consumption information Recycling location
	UC5_SS_FR1 Scanning different types of SmartTags: NFC, QR code.
	UC5_SS_FR3 Scanning SmartTags at different light conditions.
	UC5_SS_FR4 Identify product (by the retailer) and provide relevant information in real-time
	UC5_SS_FR6 Update the product's properties by scanning at different lifecycle stages.
	UC5 SS_FR7 Retrieve (and store) active sensor data and generate an alert (bad air conditions, optimal conditions are back) to the retailer Smoke detector Water quality sensor Manage alert
	UC5 SS_FR9 Defective products - Send list of defective products (received from the retailer) Consumable reordering - Chat with a salesperson for advice on consumables; Order confirmation

Table 17 Detailed validation requirements at retailer level

Service provider - prints SmartTags in its office or at customer's home when SmartTag has to be reset after maintenance or repair action; scans SmartTags at home to retrieve product information; provides service

Component	**Detailed Validation Requirement**
SmartTag printer	UC5_SP_FR1Print different types of SmartTags: QR code
	UC5_SP_FR4 Link SmartTag to product or appliance for unique identification. Link SmartTag to retailer Link SmartTag to customer
	UC5_SP_FR5 Link reset SmartTag to action (maintenance,

	repair, reorder, curative, …) when relevant
	UC5_SP_FR4 Link SmartTag to room for unique identification. Link SmartTag to customer
SmartTag scanner	UC5_SS_FR1 Scanning different types of SmartTags: NFC, QR code.
	UC5_SS_FR3 Scanning SmartTags at different light conditions.
	UC5_SS_FR5 Identify product (by the service provider) and provide relevant information in real-time PRODUCT Identification information Technical information Manufacturing information Recycling information Purchasing information Guides, manuals Warranty & maintenance planning Maintenance / repair / change actions CUSTOMER Customer identification SERVICE Recommendations in case of problem HOME Home identification
	UC5_SS_FR6 Update the product's properties by scanning SmartTags reacting to context to prove warranty conditions are preserved Temperature : below 50°C humidity : no contact with water

Table 18 Detailed validation requirements at service provider level

Customer

Component	Detailed Validation Requirement
SmartTag scanner	UC5_SS_FR1 Scanning different types of SmartTags: NFC, QR code.
	UC5_SS_FR3 Scanning SmartTags at different light conditions.
	UC5_SS_FR5 Identify product (by the customer) and provide relevant information in real-time PRODUCT Identification information Technical information Manufacturing information Recycling information Purchasing information Guides, manuals Warranty & maintenance planning

	Maintenance / repair / change actions Consumables CUSTOMER Customer identification Privacy settings SERVICE Authorized service providers Authorized retailers Recommendations in case of problem HOME Home identification Home configuration (rooms) Products & appliances (locations) Sensors & actuators (locations) Consumption information Recycling location
	UC5_SS_FR5 Scan SmartTag (by the customer) related to the room and provide relevant information on air conditions in real-time
	UC5_SS_FR6Update the product's properties by scanning at different lifecycle stages.
	UC5_SS_FR6 Update the product's properties by scanning SmartTags reacting to context to prove warranty conditions are preserved Temperature : below 50°C humidity : no contact with water
	UC5_SS_FR6Update the product's properties by scanning at customer level : link product to customer (if not done by the retailer)
	UC5_SS_FR9 Scan SmartTag (by the customer) for automatic reordering of related consumables
	UC5_SS_FR7 Scan SmartTag (by the customer) for an alert (bad air conditions, optimal conditions are back)
	UC5_SS_FR7 Retrieve (and store) active sensor data and generate an alert (bad air conditions, optimal conditions are back)to the customer (and the retailer) Smoke detector Water quality sensor
	UC5_SS_FR9 Consult sensors dashboard
	UC5_SS_FR9 Scan SmartTag trigger actions: Actuator control Control actuator (i.e. alarm, ventilation, boiler switch-off, windows opening, …) through an external home automation system Defective products Notification sent to the customers owning defective products Service ordering Maintenance process: Maintenance planning, Notification, Call

	for service, Quotations management, Maintenance order and schedule Repair process: Warranty conditions (humidity and temperature data measured with the SmartTag and sent to the retailer), Confirmation that “repair actions can be performed under warranty conditions”, Call for service, Quotations management, Repair order and schedule <u>Consumable reordering</u> Replenishment planning management Notification / Mail: consumable range according to the replenishment planning Notification / Mail: proposition of automatic reorder according to the replenishment planning Notification / Mail: proposition of automatic reorder according to the water quality sensor data Chat with a salesperson for advise on consumables Consumable reorder Order confirmation <u>Home safety</u> Receive recommendations for immediate actions (e.g. room airing), Command Home automation external system Boiler switch off window opening ventilation system activation Receive recommendations for curative actions (e.g. boiler maintenance, chimney sweeping), Order a service (among the providers proposed by the retailer) for a repair / maintenance work.

Table 19 Detailed validation requirements at consumer level

Section 3 - Infrastructure

In this section we discuss the infrastructure to be used during trials and pilots.

Combination of identified components will be validated for individual use cases, based on the proposed validation requirements.

3.1 Use Case 1 - Digital product

3.1.1 SmartTag Scanner

We will develop a smartphone application for scanning of the SmartTags. For bottling line and packaging we are using dedicated readers. Information from scanning procedure is retrieved from the platform.

3.1.2 SmartTag Printing

SmartTags are printed before bottling.

3.1.3 Identity Management and Access Control

User access depend state of process, when a code is read. For example, in the bottling line the scanner is totally controlled by a unique computer.

Access to the system is allowed only to authorised and authenticated users. Different levels of access rights are provided.

Once the product is moved to recycling the customer identification should not be available anymore and is removed from the product.

3.1.4 Data Logic and Event Processing

Unique data of the bottles are stored during the first scan of a SmartTag (in bottling line). Each time the SmartTag is scanned, information of SmartTag is retrieved using access level control.

3.2 Use Case 2 - Lifecycle management

3.2.1 SmartTag Scanner

We will develop an Android application for scanning the SmartTags, that will also be able to scan product barcodes.

3.2.2 SmartTag Printing

SmartTags will be printed with metadata encoded for unique identification. SmartTags will be printed after the packaging process and the deployment of bins/waste containers, and will be included manually in the bins and in a random batch of Unilever products.

3.2.3 Identity Management and Access Control

User access does not depend on the state of process, just when the SmartTag is read.

Access to the system is allowed only to authorised and authenticated users. Different levels of access rights are provided.

Once the product is moved to recycling the customer identification should not be available anymore and is removed from the product.

3.2.4 Data Logic and Event Processing

During the manual process of incorporating the SmartTags to the objects, and by doing the first scan of the SmartTag, unique data of the objects (products and bins) will be stored. Each time the SmartTag is scanned, information will be retrieved using access level control.

3.3 Use Case 3 - Brand protection

Infrastructure to be used for validation of this use case will be defined by third party joining the project through open calls.

3.4 Use Case 4 - Dynamic pricing

3.4.1 SmartTag Scanner

Smartphone application will be developed to enable scanning of the SmartTags. Retrieved information should be relevant to the user using the application and specific lifecycle stage of the product.

3.4.2 SmartTag Printing

When SmartTags are printed the metadata are encoded for unique identification. SmartTags can be printed off-site and then attached to product at production-line. SmartTag parts with temperature sensing capabilitiescan be printed off-site, packed and transported in temperature controlled container to production-line; or they will have to be printed at manufacturer's premises in temperature controlled environment. This will allow non-compromised behaviour related to specific temperature sensing capabilities (detect temperature above 7^0C longer than 30 minutes or temperature outside 0-4^0C range).

3.4.3 Identity Management and Access Control

Access to the system is allowed only to authorised and authenticated users. Different levels of access rights are provided. DunavNET's identity management module will be used.

3.4.4 Data Logic and Event Processing

Service logic and event processing will be implemented on Azure cloud using functionality implemented by DNET as well as Azure's platform component (like stream analytics and machine learning). The service logic will provide information on the threshold calculation, discounted price and personalization.

3.5 Use Case 5 - Home services

3.5.1 SmartTag Scanner

The smartphone application has to be able to: scan SmartTag, scan barcodes, tap NFC tags. Retrieved information from TIS platform is adapted to: User profile (i.e. consumer vs service provider) and context (i.e. location), Product identification, context (i.e. warranty period, installation phase) and schedule (i.e. maintenance action to be launched), Room identification and context (i.e. air pollution).

3.5.2 SmartTag Printing

SmartTags are printed either: in-store or the warehouse by the retailer (who sets up initial data), in its office or at customer's home by the Service provider (when SmartTag has to be reset after maintenance or repair action).
After SmartTag has been reset, the new one is linked to the old one.

3.5.3 Identity Management and Access Control

Access to the system is allowed only to authorised and authenticated users. Different levels of access rights are provided. Customer identification can only be accessed by the customer himself. Once the product is moved to recycling the customer identification should not be available anymore and is removed from the product.
DNET"s identity management module will be used in pilot deployment and validation.

3.5.4 Data Logic and Event Processing

After any action applying to the product (i.e. installation, maintenance, repair, reorder …), the product identity card is updated. Each time the SmartTag is scanned, modification of metadata should be provided.
Application logic will be implemented and deployed on Azure IoT platform.

3.6 TagItSmart partner involvement in use case

The initial mapping of partner involvement in specific use case is presented in the Table 20.

	DNET	FILE	UNIS	VTT	EVT	UNIPD	UPC	SIE	TFE	UNL	DURST	PICOM	DONDE	UNIEX	RD
UC1 Digital product		X	X	X	X	X	X	X	X		X		X		
UC2 Lifecycle management		X	X			X	X	X	X	X	X		X		
UC3 Brand protection											X				
UC4 Dynamic pricing	X		X	X		X								X	X
UC5 Home services	X		X			X						X			X

Table 20 TagItSmart partner involvement in use case

Section 4 - Validation plan

TagItSmart platform validation will be performed in three phases: operational trial and two field trials. The 1st field trial will be conducted in controlled environments, while the 2nd field trial (pilot) will be executed in settings which are as close to real as possible.

Each phase is defined with a specific goal:

- The operational trial is focusing on the creation of SmartTags and SmartTags scanning interaction. Different target groups will evaluate the services in laboratory environments.
- The 1st field trial is focusing on combining more advanced tools for implementation of services including information usage and service creation. Stakeholders and end users will evaluate the services in controlled environments.
- Pilot (2nd field trial) is focusing on a full ecosystem that combines all the aspects of the platform. The pilot will engage real end users in both business and consumer perspective and in order to evaluate the services in real environment.

Time line for each phase:

- Operational trial – the initial validation to be executed between M12 and M15 of the project and will be continued until the end of the project to ensure validation of all updates
- The 1st field trial – to be executed between M12 and M24 of the project
- Pilot (2nd field trial) – to be executed between M24 and M36 of the project

Trials

The main objectives of the Trials are the following: to gather the results of components testing; to evaluate strategy and improvements for the final pilots; to correct detected bugs and malfunctions; to collect suggestions from the user's perspective. The first phase will be carried out by the project partners.

During the second trial we will aim at promoting involvement of users external to the project and representing different stakeholders in a controlled environment. The number of the users will be limited. The users will be selected at the workshops organized by the project. Integration of components to a fully working system has to be accomplished.

The whole testing process should follow the common stages:

- prototype development and testing – new applications/modules developed and tested in lab environment
- users enrolment and trial deployment – developed prototypes are ready to be deployed and integrated to a working system, at the same timeframe, trial users and developers will be selected, informed and introduced to the objectives of the trial
- trial evaluation and feedback collection – once the trial environment is ready the evaluation process with selected users can be performed and feedback collected for later stage improvements
- corrections and improvements actions – as soon as prototype development is started the problem recording system should be set in order to track reported problems, bugs and suggested improvements

Based on validation requirements defined in Section 2 - , a set of KPIs will be defined in order to evaluate the success rate of individual trials. Test cases will be executed to meet the expectations defined by KPIs.

Pilots

During Pilots the main focus is to bring the full ecosystem that combines all the aspects of the platform to the end users in both business and consumer perspective and in order to evaluate the services in real environment.

4.1 Use Case 1 - Digital product

First trial will be made in a lab environment. Second Trial is in controlled environment. We will utilize our own brewery, packaging line and retail store. All functions will be made in a very small area. We can fine tune the process very easily even during the trial. Feedback will be collected from a small group of people (20).

In Pilot phase Super Markets are coming into supply chain. More SmartTags will be used and we will use many different beers in pilot – many digital products.

Digital Beer

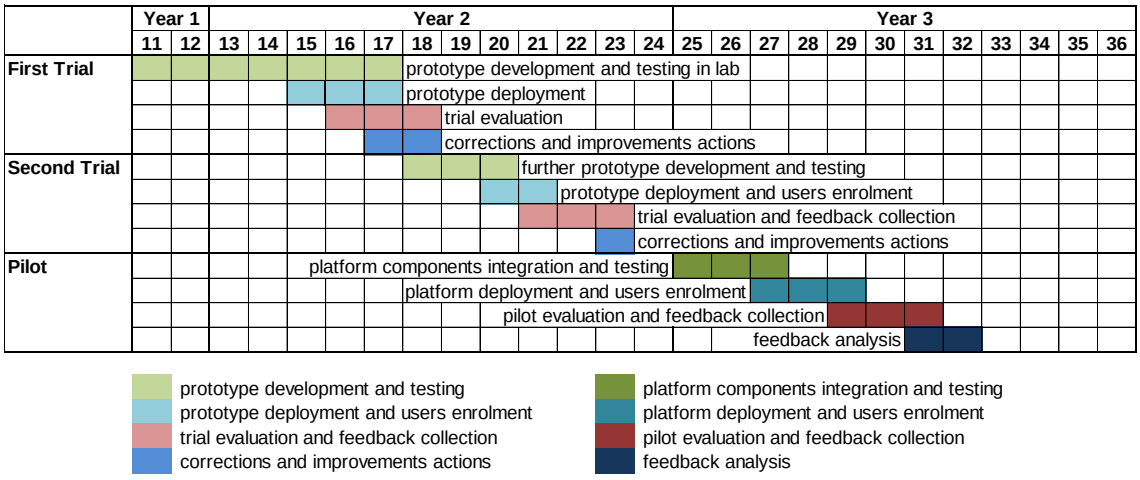


Table 21 Digital product validation plan

4.2 Use Case 2 - Lifecycle management

We structure the Use Case trials and pilots using 2 work streams:

1. Food waste reduction work stream. This work stream will apply the new sensor technologies, available with TagItSmart, because of the food perishable nature and sensitivity to supply chain conditions, as the most appropriate application in the FMCG arena. Using IoT, consumers will receive information about the edibility of food items based on the physical history of the product, ensuring safe consumption, while reducing the amount of still edible food thrown away. Again, taking the point of disposal, we will aim to deliver information about the fitness for consumption of ice cream products. We will aim to demonstrate that we can provide real time information that more accurately reflects the edibility of ice cream products based on their supply chain history, helping to prevent the disposal of perfectly edible food.

2. Recycling work stream. The Recycling work stream uses existing technology in an innovative way to solve the key engagement and the waste separation problem. It will use IoT to provide consumers with accurate recycling information at the point of disposal. It will improve both the quantity and quality of the recycled goods, as it will provide accurate information to know if a product, and its parts and components, is recyclable or not, how can the end-user separate it at home, and which are the collection option available around him.

Each phase of the Use Case is defined depending on the goals and timing:

- First trials (lab environment):
  - Both work streams (UK and Spain M11-M15): We will do the first trials developing the system that scans the created SmartTags and interacts with the back-end system. It will focus in FMCG and will include thermochromic labels in the product, combined with standard barcodes, and NFC labels for street bins.
- Second trials (controlled environment):
  - Food waste reduction work stream (UK M16-M24): We will conduct trials in UK, where recycling is predominantly in private locations (Kerbside collection). We mainly focus in Ice cream products, to demonstrate the functionality of the thermochromic labels, combined with the supply of the recycling information. There will be a physical distribution of the app between some target groups in the Unilever ecosystem that will use the service and make able a quantitative and qualitative evaluation to prove that SmartTags provide valid and reliable information that can be understood by the consumer.
  - Recycling work stream (Spain M16-M24): We will conduct trials in Spain, where recycling is predominantly in central locations or bring sites (communal street bins or Recycling Centres). We will aim FMCG with only barcodes, but will include SmartTags (NFC labels) in street bins. It will demonstrate that SmartTags can be included in other objects that can interact with FMCG that do not include SmartTags, and have the same valid and reliable information, that can also be understood by the consumer.
- Pilots (real environment):
  - Recycling work stream (Spain M25-M36): We will look to conduct a small pilot in Spain, where recycling is predominantly in central locations or bring sites (communal street bins or Recycling Centres). This pilot will try to reach at least 1000s consumers in Spain whose main recycling activities not only occur in-home but also in the city (with the street containers).

4.3 Use Case 3 - Brand protection

As of this moment, none of the consortium partners is capable of providing the infrastructure and business environment to validate the Brand protection use case in controlled and real environments. Therefore, we will be looking for adequate partners through open calls (the first open call will be published in February 2017) who will be able to validate relevant functionality and run a pilot.

4.4 Use Case 4 - Dynamic pricing

Time plan for dynamic pricing use case is presented in Table 22.

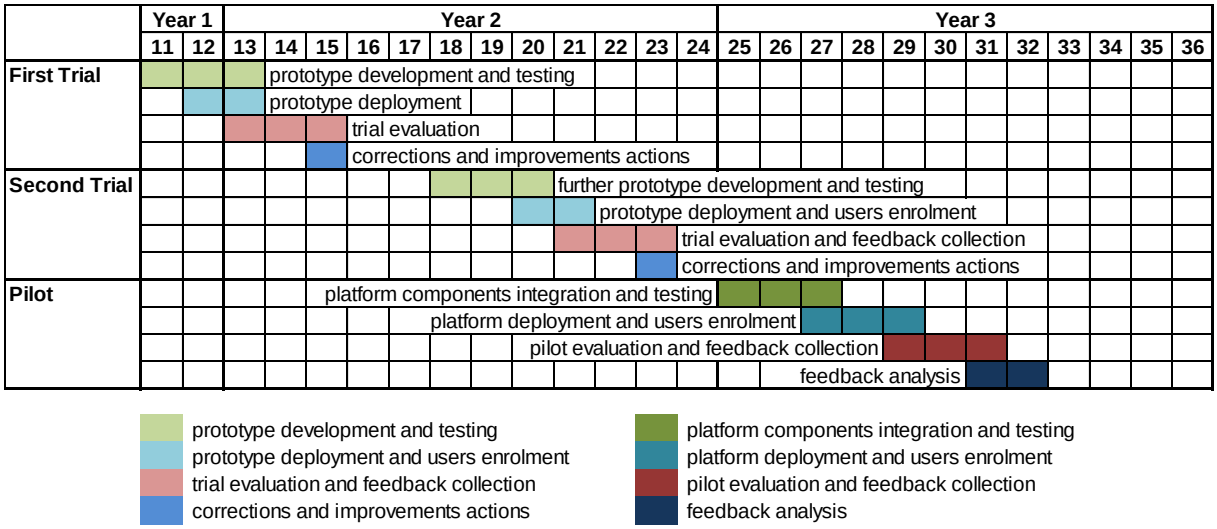


Table 22 Dynamic pricing validation plan

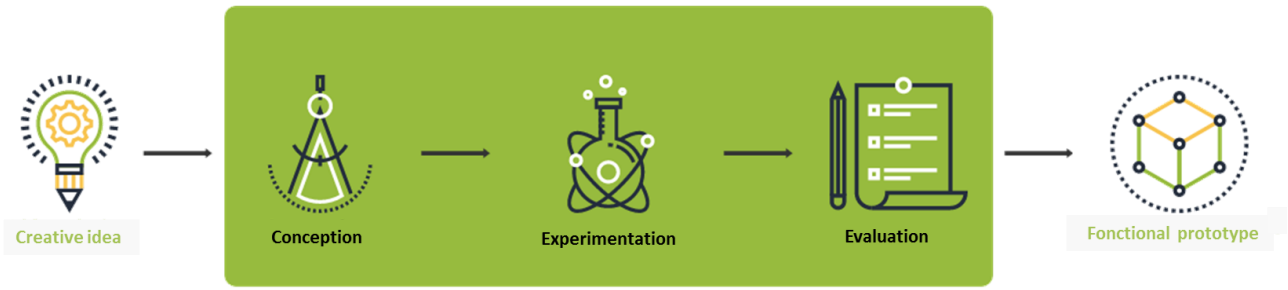
During the operational trial (laboratory environment) no users, but only project partners and developers will be involved. For the first field trial (controlled environment) enrolment of users and introduction to the platform will have to be carried out. Collection of users' feedback will be performed to provide improvements for the pilot.

During the pilot, platform components are integrated and deployed for end users' evaluation. Feedback collected through interviews and questionnaires will be analysed and documented.

4.5 Use Case 5 - Home services

Trials will be performed in a French controlled environment called Shopping Innovation Lab (M12-M24).
This Lab is both:

- A resource center : Home environment, Store environment and3D immersive environment
- A service center : CoDesign and Use lab



CoDesign area : Take into accout customer behaviour during the innovation process

Store & Home labs : Quickly create and evaluate new customer journey; Take advantage of new technologies dedicated to connected commerce.

3D immersive environment : Design, Evaluate and value your retail project with VR.

Laboratory of use : Evaluate and Enhance your custumer experience
With concrete and factual methods

Pilots will be performed at end-users homes and in one Leroy Merlin store (M24-M36).

Section 5 - User engagement strategy

There are two types of user engagement that are addressed in WP6; internal co-creation of requirements for use cases and Open Call specifications; and once the use cases have all been defined to engage in co-creation activities with the external stakeholders that the use cases engage with in pilots and demos. The work until now has focused one the internal alignment. This is described in D6.3.

Project thus streamlines end-user engagement support in two main tasks; facilitating through co-creation with stakeholders productive end-user engagement in the creation of the use cases in the demos and pilots, and facilitating adequate, coherent and consistent stakeholder coordination throughout and especially after the project has ended.

We further investigate, test and propose application strategies in the project partner's ecosystems and in the real world application use cases, as well as the Responsible Innovation RRI community, with which in Y2 and 3, links will be built in order to strengthen practical reflection on ethics, privacy and security as unique selling points in a business ecology as actionable enablers alongside technical enablers. RRI seeks new ways to understand these differences and explore their implications as an integral part of the innovation process.

5.1 User engagement for trials and pilots

Project will kick-start the exercises for identifying lead users with the specific use cases, Using Studio Dott's internet of things ideation pack[1], Nathalie Stembert's co-creation methodology CoCreate the Internet of Things[2] and lead user methodology tools.

Lead users are defined as being in "advance of the market with respect to a given important dimension which is changing over time. Therefore, before one can identify lead users in a given product category of interest, one must identify the underlying trend on which these users have a leading position. Identification of important trends affecting promising markets is already commonly performed by many firms as a necessary component of their corporate strategy."[3]

User engagement strategy and more general creation of TagItSmart ecosystem will be driven by WP6. Planned activities are described in D6.2 and D6.3.

[1] http://know-cards.myshopify.com/products/ideation-pack?variant=26466737027

[2] http://stembertdesign.com/#subnav

[3] Revised paper published as: von Hippel, Eric (1986) "Lead Users: A Source of Novel Product Concepts," Management Science 32, no. 7 (July):791-805.

Section 6 - References

[1] TagItSmart D1.1 deliverable - Use Case Descriptions, Requirements and Market Analysis, July 2016.
[2] TagItSmart D1.2 deliverable - Initial TagItSmart Reference Architecture and API description, January 2017.
[3] TagItSmart D6.2 deliverable - Report on ecosystem bootstrapping activities, December 2017.
[4] TagItSmart D6.3 deliverable - Report on TagItSmart! ecosystem status, exploitation and sustainability plans v1 December 2017, v2 December 2018