D2.4 – FITMAN V&V Assessment Package instantiations per Trial

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VERSION HISTORY

VERSION	DATE	NOTES AND COMMENTS
0.1	28.6.2013	Draft TOC for comments
0.2	4.9.2013	Updated ToC and writing responsibilities
0.8	9.9.2013	Draft contents from VTT before Athens meeting
0.9	25.9.2013	Draft delivered to WP2 for comments, including inputs from VTT, NTUA, POLIMI and IVLAB.
1.0	27.9.2013	For peer review
2.0	4.10.2013	Final after peer review

DELIVERABLE PEER REVIEW SUMMARY

ID	Comments	Addressed (✔) Answered (A)
1	**RELEVANCE OF THE WORK SCOPE, ADHERENCE TO THE TARGET OBJECTIVES**	✔ **Addressed**
2	**PRESENTATION STYLE, EXEC SUMMARY, READABILITY**	The summary and the content on each section is clear. The presentation is ok, the document is in a good shape and it contains all the essential sections.
3	**PARTNERS' CONTRIBUTION EVIDENCE**	Addressed. The contribution, per partner, is clear.
4	**INDUSTRIAL EXPLOITATION AND IMPACT POTENTIALS**	Addressed, but not in detail.
5	**PLEASE TAKE INTO CONSIDERATION THE CHANGES AND COMMENTS IN THE DOCUMENT'S BODY**	**Answered**: Comments have been reviewed and the document has been modified according to them.

Table of Contents

Executive Summary

FITMAN is an FI-PPP phase II project aiming at providing the FI-PPP with a set of industry-led Use Case Trials in the Smart, Digital and Virtual Factories manufacturing domain, in order to test and assess the suitability, openness and versatility of FI-WARE Generic Enablers (GEs). In this context, the overall objective of WP2 is to develop a method for the evaluation and assessment of the FITMAN Use Case Trials. In more detail the goal of WP2 is:

- A general, holistic V&V method along with techniques to be applied for the eleven trials.
- A new and innovative way of performing V&V activities, for example by:
  - Balancing and bridging the business and technical perspectives.
  - Infusing a crowd assessment mentality within the V&V activities.
  - Providing proper sets of business and technical criteria.
  - Delivering a set of guidelines to assist all actors involved in implementing the FITMAN V&V methodology in practice.
- A method reusable beyond FITMAN in parallel Phase II projects and open calls as well as in future Phase III projects

Until M6 WP2 has developed a method for the evaluation and assessment of the FITMAN Trials, through:

- The identification and integration of existing V&V methods into a holistic FITMAN V&V methodology (D2.1 [1]).
- The description of functional and non-functional technical indicators for evaluating openness and versatility of FI-WARE in FITMAN trials (D2.2 [2]).
- The definition of the FITMAN approach to define business indicators in the trials to evaluate business benefits after the adoption of FI-WARE Generic Enablers (GEs) and FITMAN software elements. The selected method is simplified ECOGRAI (D2.2 [2]).
- The integration of technical and business indicators in a generic V&V assessment package (D2.3 [3]).
- The preparation for instantiation of the generic V&V package into the chosen Use Case Trials and application domains.

The Task T2.4 *Instantiation of V&V Assessment Package Instantiation Per Use Case Trial* covers the last point in the list above. The results of the task is reported in this deliverable "D2.4 – FITMAN V&V Assessment Package instantiations per Trial". Instantiation means specifying and adapting the Generic FITMAN Assessment Package and indicators for each FITMAN trial. As a result of instantiation each trial has defined the scope of V&V assessment, selected the performance indicators to be evaluated, selected the people to be involved in the assessment, identified the source of data for the indicators, collected and individually prefilled the data collection templates and sheets.

As a whole the instantiation is a *preparation* task started in T2.4 and completed for the trials in WP4-5-6, where the final selections and definitions are carried out. The collection of values for technical and business indicators as well as the community-based assessment or self-certification is not part of instantiation. The actual collection of values is part of the trial experimentation.

The FITMAN Trials are not yet mature enough to complete the whole instantiation process. The trials have to finally choose the Generic Enablers to be deployed together with the Specific Enablers and Trial Specific Components. Also the selection of business and technical indicators must be finalized. The instantiation of the V&V Assessment Package takes place in two steps involving different FITMAN Tasks:

- Task T2.4 defines the instantiation process and creates the necessary preparedness and guidelines for the instantiation.
- Tasks T4.4, T5.4 and T6.4 involve the final selection of business and technical indicators and generation of the needed online support and data collection tools.

The scope of D2.4 is to make all necessary preparation for an easy and well managed trial-specific instantiation of the FITMAN V&V Generic Assessment Package. D2.4 specifies the instantiation scope and process and all the information and training support needed in the second step as describe above. The deliverable further aims to continue the simplification of the holistic FITMAN V&V methodology for the trials through:

- Identification of the *viewpoints of different stakeholders* involved in the V&V: technical partners vs. end users and trial team.
- Making a proposal of *mandatory and optional* steps in the V&V methodology; thus aiming to ensure that the trials focus on the most important aspects, even if they are partially allowed to make their own choices in the V&V process.

The target for D2.4 is a fast, smooth and well managed instantiation in Tasks T4.4, T5.4 and T6.4

Acronyms

GE	Generic Enabler
SE	Specific Enabler
TSC	Trial Specific Component
PI	Performance Indicator
TI	Technical Indicator
BPI	Business Performance Indicator
V&V	Verification and Validation
WP	Work Package
DoW	Description of Work
IT	Information Technology
KPI	Key Performance Indicators

1. Introduction

1.1 Purpose and Scope

The Work Package 2: FITMAN Verification & Validation Method has as an overall purpose to develop a method for the evaluation and assessment of the FITMAN Trials, through:

- The identification and integration of existing V&V methods
- The description of functional and non-functional technical indicators for evaluating openness and versatility of FI-WARE in FITMAN trials
- The description of business indicators for evaluating the business benefits in the trial after the adoption of FI-WARE Generic Enablers (GEs)
- The integration of technical and business indicators in a generic V&V assessment package for FI-WARE evaluation in manufacturing smart-digital-virtual factories of the future
- The instantiation of the generic V&V package into the chosen Use Case Trials and application domains.

(FITMAN DoW)

The Task T2.4 *Instantiation of V&V Assessment Package Instantiation Per Use Case Trial* covers the last point in the list above. Figure 1 shows the interaction between WP2 tasks.

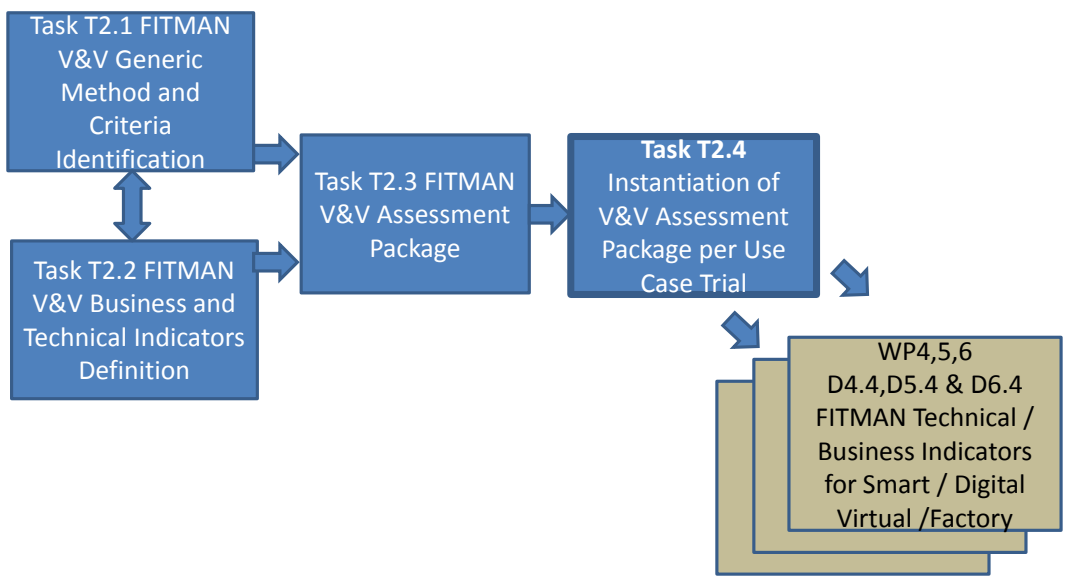

Figure 1. WP2 interaction and contribution to the FITMAN concept.

The objectives of Instantiation of V&V Assessment Package are to provide each trial the needed support and tools to apply the FITMAN V&V Assessment Method, including;

- Instantiation of the FITMAN V&V methodology for each trial, based on the trial objectives, stakeholders and interests, but fulfilling the mandatory V&V tasks.
- Define and select the performance indicators (business and technical) with end user involvement.

- Transform the Generic FITMAN V&V package into customized and directly usable tools for all the specific eleven Trials, including; Data collection, evaluation and presentation tools.

The delivery date for this Deliverable D2.4 is Month M6. Before this point of time the eleven Trials have not yet been mature enough to complete the whole instantiation process. Consequently the Instantiation of the V&V Assessment Package takes place in two steps involving different FITMAN Tasks:

- Task T2.4 defines the instantiation process and creates the necessary preparedness and guideline for the instantiation. The task involves preliminary collection of trial instantiation data and selection of the appropriate indicators to be used.
- Tasks T4.4, T5.4 and T6.4 involve the final selected business and technical indicators and generate the needed online support and data collection tool (adaptation of V&V package).

The scope of D2.4 is thus to develop and define all the necessary process and steps needed to complete a successful trials specific instantiation of the FITMAN V&V Generic Assessment Package. D2.4 specifies the instantiation process and all the information and training support needed in the second step as describe above. The target for D2.4 is a fast, smooth and well managed instantiation in Tasks T4.4, T5.4 and T6.4.

Due to the fact that the final trial-specific instantiation takes place in the trial WPs 4, 5 and 6, instead of WP2 (as originally planned), resources from WP2 and Task 2.4 will be transferred to Tasks T4.4, T5.4 and T6.4 to support the V&V methodological application and technical instantiation for data collection.

1.2 Structure of the Document

Chapter 2 gives a summary of the WP2 background developments which directly create the basis for the instantiation activity. Chapter 3 opens the term “instantiation” for the FITMAN context. Chapter 4 defines the scope and fields of instantiation, from different viewpoints (IT developers/ trial support partners, end users / trial team). Chapter 5 presents the instantiation process. In Annex 2, an example of the Trial instantiation data sheet is presented. Using this kind of sheet the aim is to collect together all the information of the trials, which affects the creation of the different data collection forms of V&V assessment package. The sheets will be finalized and detailed in Tasks 4.4, 5.4 and 6.4.

2. Background and previous work in FITMAN

As described in the previous section, WP2 has advanced through the three previous partly parallel Tasks in WP2:

Task T2.1 FITMAN V&V Generic Method and Criteria Identification
Task T2.2 FITMAN V&V Business and Technical Indicators Definition
Task T2.3 FITMAN V&V Generic Assessment Package

The following sections will briefly recap the achievements in the WP2 previous tasks.

2.1 FITMAN V&V Assessment Method summary

In short, Deliverable D2.1 ”FITMAN Verification & Validation Method and Criteria” [1] describes:

- 7-step FITMAN V&V Methodology. An all-inclusive framework for verifying, validating and evaluating a software product
- Business and IT evaluation criteria
- A common WP2 Glossary.

As D2.1 states, the goal is to provide FITMAN with the appropriate methodology in order to verify that the FI-WARE generic and FITMAN specific enablers (as well as Trial Specific Components) satisfy the technological platform and architectural integration requirements imposed; validate that the FI-WARE generic and FITMAN specific enablers (as well as Trial Specific Components) satisfy the requirements of Smart-Digital-Virtual Use Case Trials; and identify the evaluation and assessment criteria to be used in all Use Case Trials. The FITMAN V&V methodology introduces a new and innovative way of performing V&V activities in various ways.

The developed V&V method is essentially divided into two perspectives:

- The trial specific perspective (T) which assesses whether the IT and business requirements and domain’s needs are met, and
- The product-specific perspective (P) which describes how to verify and validate the product (i.e. the Generic Enabler (GE), the Specific Enabler (SE) or the Trial Solution Component (TSC)) during its development.

In particular, the FITMAN V&V method is elaborated step-by-step, providing the potential techniques to be employed, the stakeholders to be engaged, and the potential crowd engagement methods to be applied, and featuring:

I. **Business Validation (T-2)** to assess whether the overall trial solution eventually offers sufficient added value to the trial.
II. **Trial Solution Validation (T-1)** to guarantee that the overall trial solution satisfies intended use and user needs.
III. **Product Validation (P-5)** to examine whether the product satisfies intended use and user needs.
IV. **Release Verification (P-4)** to determine whether the requirements of the final product release are met.
V. **Backlog Verification (P-3)** to determine whether the requirements of the product after each sprint are met.

VI. **Model Verification (P-2)** to coordinate the alignment between design and requirements, as well as between design and code.

VII. **Code Verification (P-1)** to ensure functionality, correctness, reliability, and robustness of code.

2.2 FITMAN V&V Business and Technical Indicators Definition summary

In short Deliverable D2.2 "FITMAN Business and Technical Indicators Definition" [2] describes Business indicators for business benefits and sustainability assessment, in particular:

- Trial specific business performance Indicators based ECOGRAI [2] simplified method usage
- Technical indicators for assessing openness and versatility
- Quantitative as well as qualitative indicators to measure conformance with evaluation criteria

The goal of the deliverable D 2.2 "FITMAN Business and Technical Indicators Definition" is to identify and define a selection of Business Performance Indicators and Technical Indicators for the "FITMAN Verification & Validation Method".
The Task 2.2 evaluates two kinds of performance:

- The performance of Generic Enablers (GE), Specific Enablers (SE), Trial Specific Components (TSC), and also the various platforms developed in FITMAN project based on GEs and SEs. The nature of the systems is "Technologic", the criteria of evaluation are more oriented on the technical performance.
- The performance of a "Business System": the Trials. This System has a different behavior and the criteria of evaluation are different. It is necessary to combine Economic, Social and Human behavior with Technics. This evaluation is based on Business Performance Indicators (BPI).

The main results of deliverable D2.2 [2] are the following:

- Definition of concepts connected with Business Performance Indicators and Technical Indicators.
- For Business Performance Indicators (PIs) the method to define PIs is the simplified method ECOGRAI.
- A list of potential PIs, this list has been determined starting from the ENAPS [2] list of 117 generic indicators which were modified in order to fit with the domain of FITMAN.
- Examples to determine Technical and Business Performance Indicators. The proposition is to consider technical indicators more oriented to evaluate GEs, SEs, and IT platforms defined by the V&V method and the Business Performance Indicators to evaluate trials performance by a simplified version of ECOGRAI.

2.3 FITMAN generic V&V Assessment package

The Deliverable D2.3 "FITMAN Verification & Validation generic Assessment Package" [3] is the consolidation of the developed V&V Generic Method, assessment criteria, technical and business performance indicators into a generic package. Taking as inputs the results of the previous Deliverable D2.1 [1] and D2.2 [2] the final goal is to integrate all the necessary indicators and their metadata, to support the application of these indicators and the documentation and visualization of the assessment results and to allow the context-based comparison with other Use Case Trials. The Deliverable D2.3 [3] also constitutes the input for the subsequent Deliverable

D2.4 (FITMAN V&V Assessment Package instantiations per Trial). It constitutes the generic integrated reference model for the practical achievement of the three following objectives:

- the Verification of the already developed Generic Enablers (GEs);
- the Verification of the Specific Enablers (SEs) and Trial Specific Components (TSCs) under development during the FITMAN project;
- the Validation of the complete solution which will be developed for each Use Case Trial in the framework of the FITMAN project.

The following steps have been followed in Task 2.3:

- The 7-Steps FITMAN V&V Methodology developed in Deliverable D2.1 [1] has been integrated with the IT and Business Performance Indicators established in Deliverable D2.2 [2] in a common logical framework.
- Three different kinds of Forms to collect the necessary data for the FITMAN V&V Process, i.e. Self-certification Form, PIs Measurement Form and Community-based Form have been identified, defined and developed from a methodological point of view;
- The three kinds of Forms have been integrated in the generic conceptual framework of the FITMAN V&V Assessment Package, which constitutes of three main Sections, i.e. the Technology Section, the General Information Section and the Instructions and Support Section.

The whole conceptual FITMAN V&V Assessment Package has been practically implemented on the FITMAN Website by means of static web pages. At this link the implementation of the support page can be found: http://www.fitman-fi.eu/intranet/wp-folders/wp2-fitman-verification-validation/test-environment/fitman-support-page.

- The Technology Section has been in particular published by means of the online survey tool (SurveyMonkey software) [4], the tool effectively used to manage the different data collection Forms.

The FITMAN V&V Assessment Package's Technology Section's "lifecycle" has been properly taken into account. In fact, three different chronological phases have been properly defined in the exploitation of the FITMAN V&V Package's Technology Section:

- Data Collection, regarding the correct and efficient gathering of different kind of data
- Data Elaboration, regarding all the aspects related to data analysis and aggregation.
- Data Presentation, regarding the different modalities to report and discuss the final results of the FITMAN V&V Process.

3. Instantiation in FITMAN

3.1 Definition of instantiation

The word instantiation has different meanings depending on the context where it is used. It is widely used in computer science and programming. Definitions suitable for the FITMAN V&V context are gathered here below:

a) Instantiation is the process of deriving an individual statement from a general one by replacing the variable with a name or other referring expression. (http://dictionary.reverso.net/english-definition/instantiation)

b) The fact or act of producing an instance, example, or specific application of a general classification, principle, theory, etc. (http://en.wiktionary.org/wiki/instantiation)

c) To represent (an abstract concept) by a concrete or tangible example. (The American Heritage® Dictionary of the English Language, http://www.thefreedictionary.com/instantiation)

d) Producing a more defined version of some object by replacing variables with values (or other variables). (http://www.freedictionary.org/?Query=instantiation)

Thus something resulting from the act of instantiation is an instance.

3.2 Instantiation in FITMAN

In FITMAN instantiation means specifying and adapting the Generic FITMAN Assessment Package for each FITMAN trial, including the selection of PIs.

"*The Use Case Trial scope and specific requirements and environment conditions will affect each instantiation of the package. In addition to the necessary indicators relevant to all the optional indicators are reviewed and selected. The Instantiation of Package will be provided to the Use Case Trial to support and document the assessment*." (FITMAN DoW)

Instantiation in FITMAN is the activity of specifying and adapting the generic FITMAN V&V Assessment Methodology and Package for each FITMAN trial.

As the result of instantiation, each trial has defined the scope of V&V assessment according to FITMAN V&V methodology, following the guidelines for mandatory and optional V&V elements:

- selected the SEs and TSCs for self-certification (optional)
- identified the GEs, SEs and TSCs for product validation (P-5)
- defined the technical indicators for Trial solution
- defined business PIs to be used in the Trial and scenarios according to FITMAN simplified ECOGRAI methodology
- selected the people to be involved in the assessment in different phases (stakeholders)
- identified the source of data for the indicators
- Data Collection forms have been created for the trials.

To support the instantiation, regional training sessions and specific communication package (D2.3 [3]) are planned.

The instantiation is performed per trial. This means that the scope, metrics and data collection forms are created at the trial level and for the trials (not for specific development teams). This means that the product-specific V&V phases, optionally performed by the development teams, should be performed using a trial entry to the V&V package.

As a whole the instantiation is a preparation task started in T2.4 and completed for the trial in WP4-5-6 where final selections are done to support evaluation and assessment. The collection of values for technical and business indicators as well as the community-based assessment or self-certification is not part of instantiation.

4. Scope of V&V Assessment Package Instantiation

4.1 FITMAN V&V methodology and scope of instantiation

As describe above and in D2.1 [1] the 7-step FITMAN V&V assessment methodology includes two main phases:

- V&V Methodology Phase I: Product Specific (P)
- V&V Methodology Phase II: Trial Specific (T)

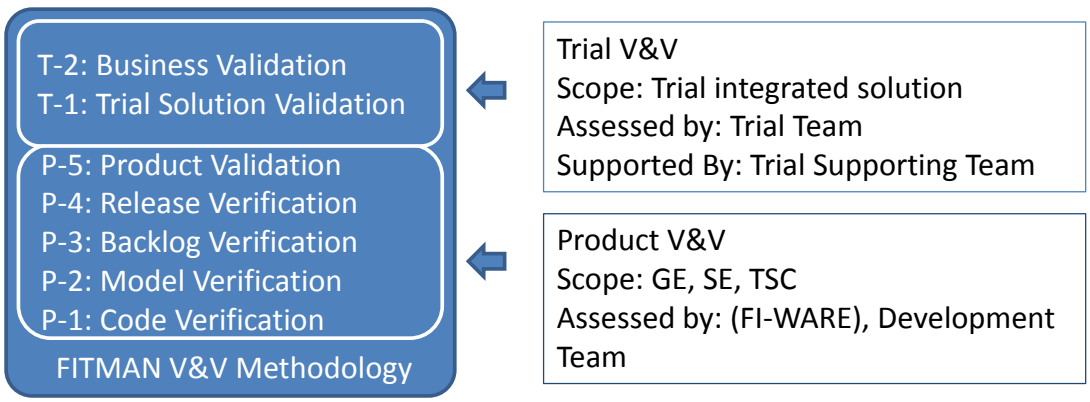

Figure 2: V&V Assessment Scope and assessment

The scope of the V&V Methodology Product Specific Phase I is software development. The scope of the V&V Methodology Trial Specific Phase II is the integrated trial solution. Consequently also the assessment is performed by a different group of stakeholders. The Product Specific assessment (P), mostly verification, is performed by the software developers while the Trial Specific validation (T) is performed by the solution users, Figure 2. Part of the V&V phases should be performed in each trial, partly the phases are optional.

As described in chapter 1, the objective of instantiation is to configure the perhaps large and complex FITMAN V&V methodology for each trial. Thus the instantiation includes the following items:

1. Selection of the V&V assessment scope in the trial – which of the optional phases and tasks are performed in the trial. This mainly deals with product-specific phases P1-P4.
2. Selection of the technical indicators in phases P-5 and T-1 from a pre-defined list. Partly the technical indicators are mandatory, partly optional.
3. Definition of the business performance indicators using the FITMAN simplified ECOGRAI methodology.
4. Creation of the data collection forms for different phases, based on the previous definitions/ selections.

It is clear that after these items have been initially defined, it is possible that they need to be revised, for example because of new GEs, SEs or TCS to be used in the trial or new PIs or scenarios involved in the trial.

4.2 Selection between optional and mandatory V&V phases

As mentioned above, not all phases of the overall FITMAN V&V methodology are mandatory for each trial. The trial team may partly decide which phases they will perform. Additionally, the different phases are performed by different trial stakeholders.
Figures 3 – 4 give a proposition of mandatory and optional tasks for different stakeholders in the FITMAN V&V. The figures also show which kind of data collection forms are needed for the phases.
Figure 3 gives a viewpoint of trial developer or IT partner: which phases should be performed by the developers/ IT partners in the trials. The product-specific phases (P1-5) are focused on the solution components: GEs, SEs and TSCs. Phases P1-4 are performed during the development of the software components; thus they can only be performed for components being developed in FITMAN (SEs and TSCs). GEs are coming from FI-WARE cannot thus be run through phases P1-P4 in FITMAN. For phases P1-P4 techniques have been recommended in D2.1 [1] but as the different IT companies may each have their own methodologies the self-certification forms (as described in D2.3 [3]) do not require usage of specific technique. Because of the different timings and maturity in the development of SEs and TSCs, phases P1-P4 are optional.

Phase P-5 deals with the product (GE, SE, TSC) validation. As one of the main objectives of FITMAN V&V is to assess the openness and versatility of FI-WARE developments, this phase is mandatory for GEs and SEs (optional for TSCs as they are used only by one trial). In P-5 technical indicators related to software components (not the trial solution as a whole) are validated.

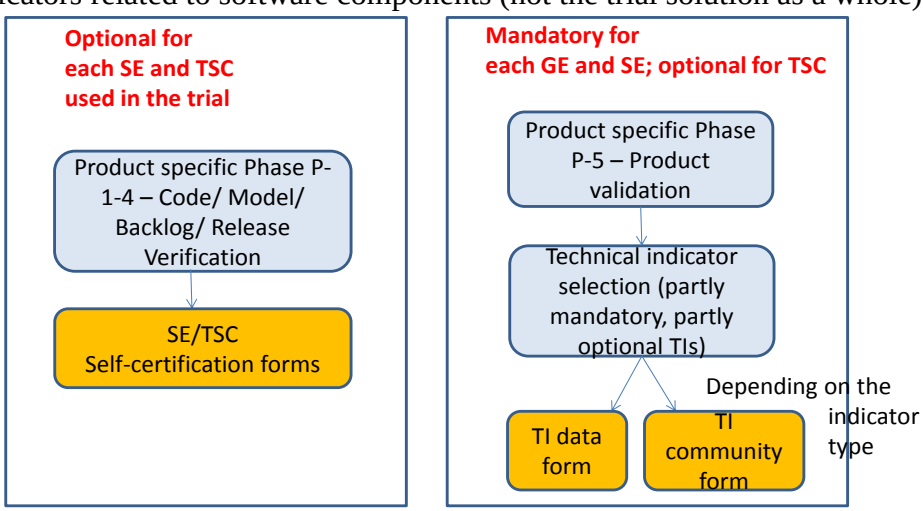

Figure 3. Developer / It provider viewpoint to FITMAN V&V

Figure 4 looks at the V&V from the Trial end user / trial team viewpoint: what the trial teams and end users should validate. Now the focus is on the trial solution as a whole or a trial scenario; not specific solution components. The end users need to validate the solution both from the technical and business point of view. Both views are mandatory for each trial but the trials may define or select the indicators they use for the validation. The indicators may be either quantitative or qualitative; thus different kinds of data collection forms may be needed.

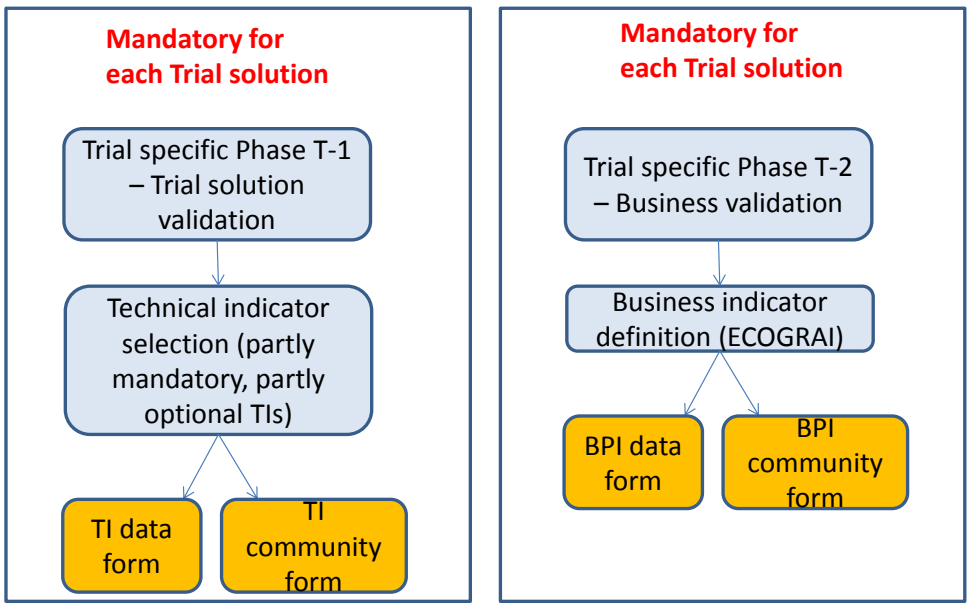

Figure 4. End user/ Trial team viewpoint to FITMAN V&V

4.3 Selection of technical indicators in phases P-5 and T-1

As shown above, technical indicators are applied in two different phases:

- in P-5 the focus is on software components, GEs, SEs or TSCs
- in T-1 the focus is on trial solution as a whole.

Thus the technical indicators used in these two phases are typically not the same.

In D2.2 [2] technical indicators have been defined, and priorities for them have been given. The definition of what is mandatory and what is optional follows this definition of priority. For example, in P-5 validation, indicators related to openness and versatility are mandatory and for T-1 validation indicators related to usability aspects are mandatory. The usability aspects often require the application of community forms.

4.4 Business validation - Definition of business performance indicators

Business validation through business performance indicators is a mandatory task of the end users and trial team. FITMAN D2.2 [2] includes a selection of potential business indicators but the final selection and definition of the business indicators is performed in each trial, based on the trial objectives and scenarios. For the business indicator definition, simplified ECOGRAI methodology is used. It is recommended that each trial / scenario defines the 3 most important business indicators.

4.5 Creation of data collection forms

For each phase of the FITMAN V&V, data collection forms (part of FITMAN V&V package) are used to support the V&V. As described in D2.3 [3] three different kinds of forms are used: self-certification forms, TI/BPI data collection forms and community forms which allow the involvement of different stakeholders in the trial. To support the creation of the forms, a specific

trial instantiation data sheet has been created. The sheet consolidates the trial data affecting the sheet creation (Annex 2).

5. Instantiation process

The main steps involved in the instantiation of the generic V&V package, Figure 5, are:

- Communication and Training support to Trials
- Preparation for Instantiation
- ECOGRAI check for business indicators
- Instantiation of data collection process
- Support to Trials and evolution

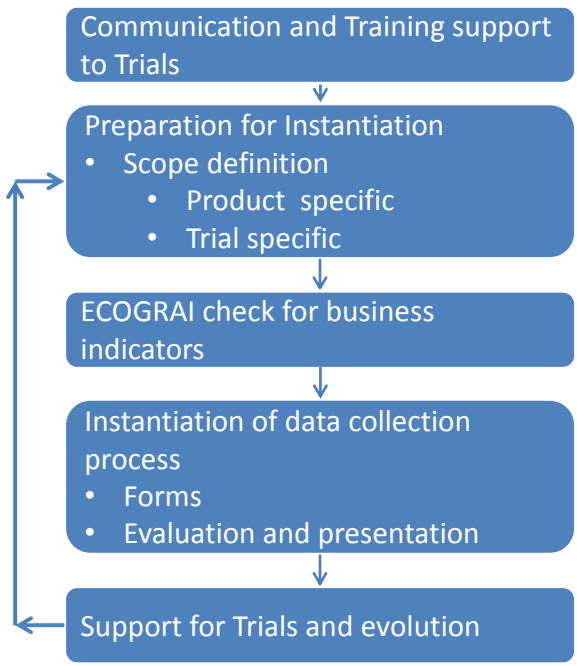

Figure 5: Overall Instantiation process

The following section will go into more details of the steps in the overall methodology.

5.1 Communication and training support to trials

FITMAN V&V package (D2.3 [3]) offers communication material for trials to support the instantiation and V&V assessment. As described in D2.3 the communication package has two parts:

- General information section
- Instructions and support section

This part of the V&V package is similar for all trials and does not need any instantiation / trial. Main part of the information is useful for all trial stakeholders. However, some of the elements of the information package are directed to specific groups, like Trial teams or Development teams.

In addition to supporting material, the plan is to support the trials in the instantiation also through *training events*, organized by WP2 task leaders, involved in the V&V methodology development (VTT, NTUA, VLAB, POLIMI). The aim is to carry out the training in a "lean" way. This means that:

- The target group for the training are the *trial support organizations*. These organizations are research institutes or technology providers involved in the trials (listed in Table 1). Also other stakeholders of the trial team are welcome to the training event but managing the instantiation activity in each trial is the responsibility of the trial support partner. The trials and their technical support partners are listed in more detail in Annex 1.
- The training events are planned to be organized in a flexible way, not just one event which should be difficult to include all the partners (there are more than 10 partners involved). One alternative is to organize the events according to geography, collecting together partners near each other. Each WP2 task leading organization should run one event, for example:
    - Region Italy: **POLIMI**, TXT, Softeco
    - Region Spain: **NTUA**, ATOS, UPV, Innovalia
    - Region France+ Portugal: **IVLAB**, Lyon2, UBX1, Uninova,
    - Region Germany + UK: **VTT**, IPK, Coventry
    - (**Training organizer**)
      Another alternative is to utilize the structure of Smart/Virtual/ Digital Factory or a proper mixture of the approaches (most probable alternative).
- Common training presentations are prepared for the events, based on the instruction material in D2.3 [3].
- The training is performed in the phase when each *trial has the preparedness* for it. This means that the trial has *at least initially* defined the trial objectives and information needed for ECOGRAI application and preliminarily selected the GEs, SEs and TSCs to be used. This enables hands-on training. However, it should be noted, that *the training does not produce the final PIs* for the trials as the ECOGRAI methodology requires the participation of the end users in the PI definition process.

The plan is to run the training events, depending on the availability of the trials and WP2 partners, in M8-9. The idea is that after the training the support partners have the knowledge to run the V&V methodology instantiation in the trial. This is necessary to take care of the participative approach (as defined by ECOGRAI).

Table 1. Support partners for trials

Trial	Support/ technical partner
1 Volkswagen	IPK
2 TRW	ATOS
3 AugustaWestland	TXT
4 Whirlpool	POLIMI
5 Piacenza	Softeco
6 A.P.R.	Lyon2
7 Consulgal	Uninova
8 TANet	Coventry
9 COMPlus	IPK
10 Geoloc Woodfactory	UBX1
11 AIDIMA	UPV

The main scope of the training events is:

- The overall V& V methodology
- Business PI methodology (ECOGRAI)
- Technical indicator application
- Product-specific phase application
- Using the V&V package for data collection

The expected time needed for each training event is 1-1,5 days.

5.2 Preparation for Instantiation

In order to be able to support verification, validation and business evaluation in the eleven trials there is a need to collect information regarding the scope of the assessment for each trial. Figure 6 presents the scope definition at the high level. For each trial:

- Identification of GEs, SEs and TSCs to be used in the trial
  - Step P-5 will be performed for each GE and SE
  - Select the TSCs for which P-5 is used
- Inclusion of Product Specific assessment optional phases P1-P4 yes/no
  - If yes the select SEs to be assessed in steps P-1 to P-4
  - If yes the select TSCs to be assessed in steps P-1 to P-4
- Identification of business PIs using FITMAN ECOGRAI simplified methodology. Most of the trials have made the initial identification already in the trial requirements phase but the indicators need to be validated using ECOGRAI approach. The following metadata is needed:
  - number of PI / trial & scenario
  - PI definitions
  - how to collect data for the PIs, data sources, who gives the values
  - timing of measurement (e.g. current, after short period, ….).

  The PI definition following ECOGRAI is documented in the table in Annex 2 (example data from TRW trial).

- Identification of the optional quantitative and qualitative technical PIs to be used in the trial. Phase P-5 and T-1 typically have different indicators. Partly the technical indicators are mandatory, partly they can be selected from a pool of predefined technical indicators, see D2.2 [2].

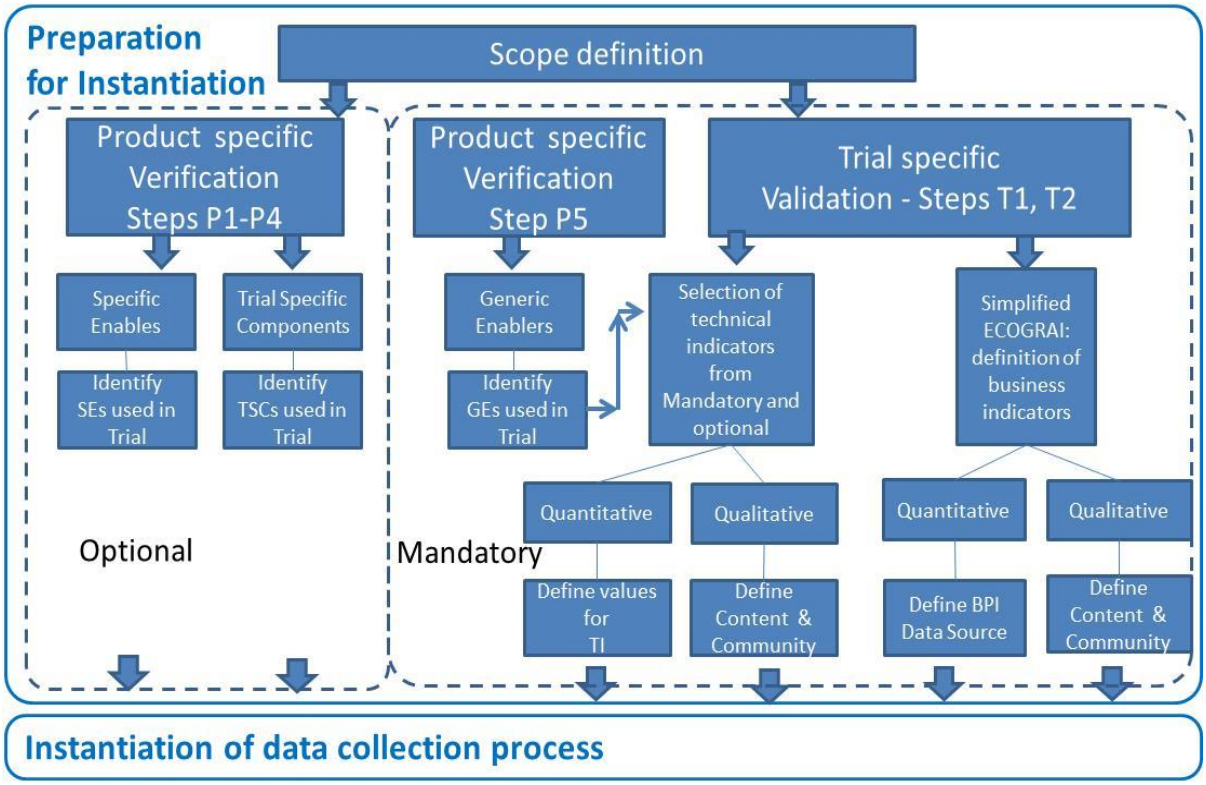

Figure 6: Preparation for Instantiation

In Annex 2 a draft of a specific table (Trial instantiation data sheet) to collect the information created in the preparation phase is presented. The table includes the generic information about GEs and SEs and technical indicators to support the selection. The idea is not to duplicate the creation of this information but to collect together all the information needed to go further in the technical instantiation: The table will support the partners responsible for creating the different types of data collection forms. In addition to this table, at a more technical level, an additional Data collection form may be needed for the development of forms for new indicators that have not been defined before (like business indicators).

5.3 ECOGRAI check for business indicators

During the trial requirements phase (WP1) all the trials already defined their preliminary objectives and business indicators. At that phase the business PI methodology had not yet been defined in FITMAN. After that, some of the trials have further detailed their definition and it will continue in the V&V training events. However, to ensure, that the thinking behind the methodology has been correctly understood and that the indicators are correctly defined to measure correct performance, this additional "check"-phase has been added to the V&V instantiation process. Following ECOGRAI methodology and its participatory approach, the trial end users and needed stakeholders are involved in the check process. The practical approach is to run phone meetings between the trials and the ECOGRAI experts (IVLAB).
The check also includes the definition of:

- information sources for the PI definition
- scope/ context of the measurement
- how to collect data for the PIs, who gives the values
- timing of measurements: as-is, to-be, what is the interpretation for the measurement "after"

- community approach needed
- etc.

The PI definition is documented in a table (general template in table 2); also being part of the Trial instantiation data sheet.

Table 2. Business PI definition

Indicator	*The title of the PI*
Purpose:	*Why the measure is performed*
Objective	*The trial objective*
DV/AV	*The Decision/Action variables which allow to reach the objective*
PI nature	*Quantitative or Qualitative*
Information needed	*The information needed to calculate the PIs*
Processing (Formula)	*The formula to calculate the PI*
Required evolution (Target)	*Evolution of the value of the PI that it is recommended*
The owner (Who measures)	*The person who is responsible of the domain in which the PI is implemented*
Period	*The interval of time to evaluate the value of the PI*
Actions to react depending on the value of the PI	*Action that the owner that take to evolve in the right direction*
Description mode	*Representation of the PI* *Example: Histogram*

5.4 Instantiation of data collection process

In this step the actual data collection forms defined in the Generic V&V Assessment Package are instantiated. Based on type of forms the instantiation comes alive through the adaption of predefined forms (templates) or by developing new forms. A data collection tool (SurveyMonkey [4]) is used for the purpose (as described in D2.3 [3]). Depending on the section done in '*Preparation for Instantiation'* step a varying number of data collection forms will be established, as shown in Figure 7.

The three types of forms and subforms to be instantiated are:

1. **Self-certification Form:** Its aim it is to verify and validate the different single software components deployed or developed, following V&V phases P1-P4. These forms are created / not created for the trial based on their selection in Trial data instantiation sheet (Annex 2).

2. **PIs Measurement Form:** Its aim is to validate the Trial solution business benefits by means of the measurement of different quantitative Business PIs. Additionally quantitative measurement of IT indicators may be used to validate the technical solution: GEs and SEs in product-specific phase P5 and the overall Trial-specific solution in T-1. This will end up to:
   a. **Subforms** for Technical Indicators
   b. **Subforms** for Business Indicators

5. **Community-based Form**: Its aim is to validate the overall Trial-specific solution or a software component (GE, SE, TSC) by means of the collection the opinions and judgments of a group of human beings regarding qualitative PIs. For this reason self-explanatory traditional questionnaire aiming at discovering the impact of the specific Trial-solution.

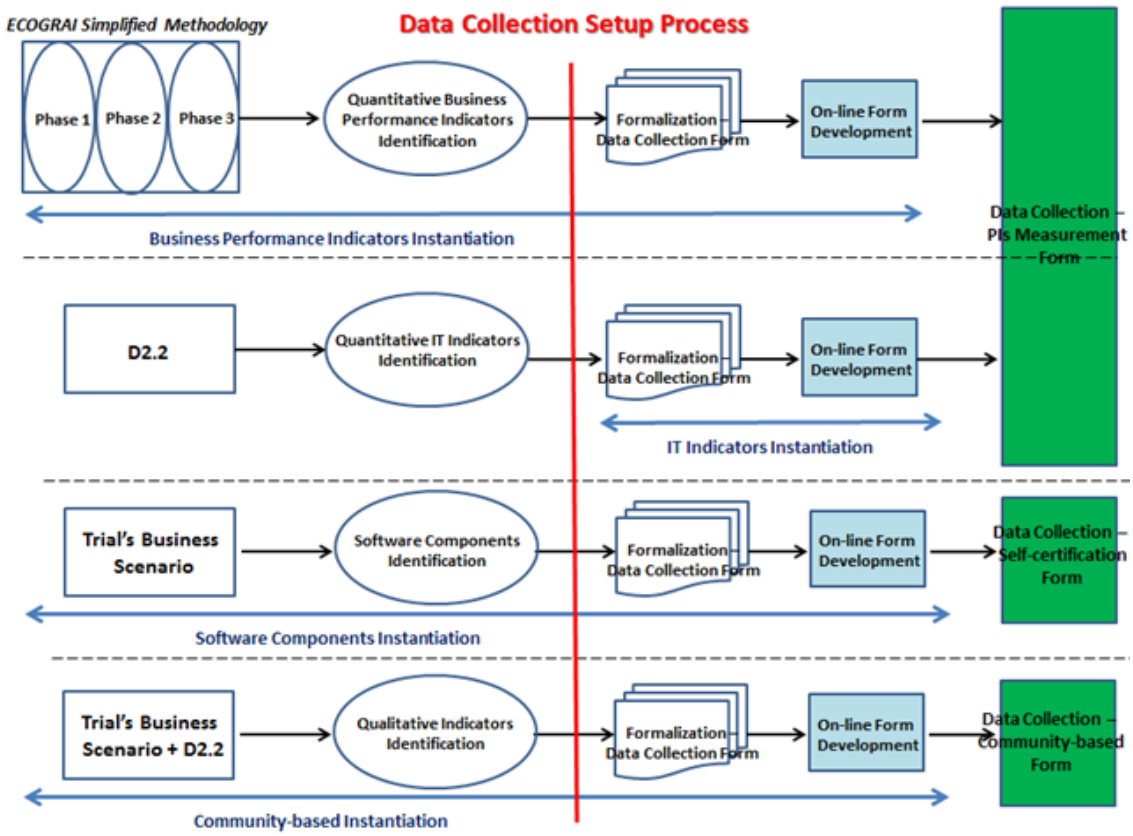

Figure 7. Data collection set up process (D2.3 [3])

5.5 Support for V&V instantiation & evolution

To finalize the PI measurements and carry out the V&V activities at different levels the trials will need support and guidance from the V&V methodology team (WP2 task leaders). The idea is not that the trial end users should learn the holistic methodology. The main partners supporting the end users in the final instantiation and assessment are the trial support partners. Even if they have participated in the training and learned the V&V methodology they may also need support during the final instantiation. This is given by FITMAN WP2 team, also present in the following tasks T4.4, T5.4 and T6.4. The technical implementation of the V&V package, the creation of the data collection forms is also performed by the WP2 team; the end users do not need to learn the survey tool.

During the project, changes will take place. Trials may identify GEs, SEs or TSCs which were not originally in their interest. The trial solution as a whole may live to some extent. There may also come changes in the technical and business indicators, based on increased understanding of the trial development and how FITMAN tools influence it. Thus it is practical to prepare also for the evolution of the V&V instantiation in the trials, even if at some phase, the solutions may need to be "freezed" at some level.

The expectation for changes and evolution has been taken into account in Trial instantiation data sheet (Annex 2). If there are changes, they may also affect the data collection and the data collection forms created. The forms may require modification or new forms may be needed.

6. **Conclusion**

In WP2 a holistic FITMAN V&V methodology, as well as the related criteria and indicators (business & technological) have been defined. The development has progressed from a holistic theoretical V&V approach (D2.1 [1]) gradually towards more concrete V&V elements, like IT and business indicators and FITMAN V&V assessment package. The passing from a holistic, complex approach towards practical tools and guidelines is needed to ensure that the trials are able to follow the FITMAN methodology and its essential goals. As the final task of WP2 D2.4 further continues the path to the real application of the V&V and indicators in the trials, through further clarification and simplification of the V&V through:

- Identification of the *viewpoints of different stakeholders* involved in the V&V: technical partners vs. end users and trial team.
- Making a proposal of *mandatory and optional* steps in the V&V methodology; thus aiming to ensure that the trials focus on the most important aspects, even if they are partially allowed to make their own choices in the V&V process.

The selection of what is mandatory and what is not is made focusing on the base goals described in FITMAN DoW about the object of V&V:

- to describe functional and non-functional technical indicators for evaluating openness and versatility of FI-WARE in FITMAN trials.
- to describe business indicators and STEEP (social-technological-economical-environmental-political) sustainability criteria for evaluating the business benefits in the trial after the adoption of FI-WARE Generic Enablers

Still, each trial has the freedom to perform all the steps (P1-P5, T1-T2) or the ones they select in addition to the mandatory ones. A specific Trial instantiation data sheet is developed to collect together the information affecting the instantiation of V&V for each trial. The target for D2.4 is a fast, smooth and well managed instantiation in Tasks T4.4, T5.4 and T6.4.

In the end of WP2 it is now a good moment to look at the generic measurable objectives of FITMAN project as described in FITMAN DoW, which relate to WP2. Among the objectives the following one can be found (page 38):

- To develop a *FITMAN verification and validation system* which will give common structure and clear methodological / practical guidelines for the assessment and evaluation of FI-WARE core platform through FITMAN experimentation sites and test applications (WP2) Obj2 will be monitored and assessed and the end of WP2 (M6) by a set of quantitative KPIs such as those reported by example here below:
- **Obj2.a.** Development of a Methodology and Package for Trials verification and validation by merging together *at least 3 state of the art methodology* and providing *at least a set of 30 business indicators. (30+ business indicators)*
- **Obj2.b.** Validation of the methodology for Trials business assessment in each Use Case (22+ according to Obj1.a) by *identifying for each of them a set of at least 3 KPIs covering strategic tactical and operational business objectives; (3+ KPIs per Use Case)*

It can now be stated that within FITMAN WP2:

- *FITMAN verification and validation methodology* and guidelines have been defined (D2.1 and D2.3-4). The methodology is based on adapting and consolidating together existing V&V state of the art methods.
- *A set of 30 business indicators. (30+ business indicators)* have been provided as a result of review of existing *state of the art methodologies (see D2.2* [2]*) (37 methods have been reviewed; 117 business indicators)*

- The final objective of *"identifying for each of them a set of at least 3 KPIs covering strategic tactical and operational business objectives; (3+ KPIs per Use Case)"* is still in the process and will be finalized in the Trial work packages (WP4/5/6). In the current phase most of the trials have preliminarily identified *2 business performance indicators*.

7. References

1. Deliverable D2.1 - FITMAN Verification & Validation Method and Criteria
2. Deliverable D2.2 - FITMAN V&V Business and Technical Indicators Deliverable D2.3 – FITMAN V&V Generic Assessment Package
3. Surveymonkey, «http://www.surveymonkey.com,» [Online]. Available: http://www.surveymonkey.com.

Annex 1: Trial table

	Trial sector & objective	Trial company	VF/DF/SF	Country	Tech.partner(s)
TR1	**Automotive OEM** / To improve certainty and reliability of estimated figures of in-house production costs at early phases of the product development process.	Volkswagen	Digital	Germany	Fraunhofer
TR2	**Automotive supplier** / To improve the health and safety of workers in production workplace through the adoption of FI-Ware technologies in risk prevention and management.	TRW	Smart	Spain	Innovalia
TR3	**Aeronautics OEM** / Secure and timely flow of technical knowledge between an original equipment manufacturer and its ecosystem of customers and service stations spread all over the world. This will lead to better efficiency and safety.	AgustaWestland	Digital	Italy	TXT
TR4	**White goods OEM** / To ddemonstrate how the new technologies will enable a better integration of workforce in decision phases of a production process.	Whirpool	Smart	Italy / Milano	POLIMI and Engineering
TR5	**Textile-clothing** / Creating agreements between competitors to share production facilities, i.e. core of a cloud production.	Piacenza	Smart	Italy	Softeco
TR6	**Plastic industry** / Explore new business processes collaboration capabilities using new IT capabilities.	Applications Plastiques du Rhône (APR)	Virtual	France	University Lumiere Lyon 2
TR7	**Construction industry** / Optimising the management of the construction projects, by early identification of design and technical mistakes, including on line detection and real time fixing of incongruences using remote collaboration.	Consulgal	Digital	Portugal	Uninova
TR8	**Manufacturing Resource Management** / Monitoring the flow of goods within a manufacturing SME network, and allow the tracking of such products, using smart objects and	TANet	Virtual	United Kingdom	Coventry University

	mobile tracking technology.				
TR9	**LED Lighting** / Aims to improve the information sharing of the collaborative networked enterprises producing LED - lighting systems, in order to insure the accordance of the systems to requirements in an early design phase.	COMPlus	Smart	Germany	Fraunhofer
TR10	**Geoloc woodfactory** / Objectivesa are 1) to process automatically the workflow which supports the wood factory core activities of machinery engineering in its surrounding eco-system (customers, suppliers and co-traitors), and manage data accordingly 2) to achieve the global integration of the internal and external processes by the facilitation of the information flows among all actors involved in the commercial, design, manufacturing and installation processes.	Geoloc systems	Virtual	France	Université Bordeaux 1
TR11	**Furniture** / Capturing fashion trends and turning them into designs quickly and frequently, making products that follow the trends quickly, with lots of variety, with very competitive prices, and knowing the user's response (Opinion mining), in order to remove or modify unsuccessful products form the market.	Aidima	Digital	Spain	Universitat Politècnica de València

Annex 2: Trial instantiation data sheet (example from TRW trial)

Basic data	
Trial company name	TRW
Trial number	2
Trial sector	Automotive supplier
Smart / Digital / Virtual	Smart
Company size: SME or LE (Large Enterprise)	LE

Version history — TRW

		The modification concerns (x):					
Version number	(x)	Persons	GEs	SEs	IT indicators	Business indicators	Other, please specify
Vs 0.1 (the first)	x						
Vs 0.2							
Vs 0.3							
Vs 0.4							
Vs 0.5							
Vs 0.6							
Vs 0.7							

Background data

TRW

Business scenarios

Scenario 1	Reduction of accidents and incidents
Scenario 2	Increase the productivity
Scenario 3	

Information about the person(s) filling this table

	Name	Position	email address	Company	The main contact person (x)
Person nro 1	Ignacio Arconada		Ignacio.Arconada@TRW	TRW	
Person nro 2	Oscar Lazaro		olazaro@innovalia.org	Innovalia	x
Person nro 3					

Information about persons taking part in the V&V

IT providers and end users/trial teams

	Name	Position	email address	Company	IT provider (x)	End user / trial team (x)
Person nro 1	Alicia Gonzalez		agonzalez@innovalia.o	Innovalia	x	
Person nro 2	Inigo Aperribay		inigo.aperribay@trw.co	TRW		x
Person nro 3						
Person nro 4						
Person nro 5						
Person nro 6						
Person nro 7						
Person nro 8						
Person nro 9						
Person nro 10						

External stakeholders

	Name	Position	email address	Company	Role in FITMAN
Person nro 1					
Person nro 2					
Person nro 3					
Person nro 4					
Person nro 5					
Person nro 6					
Person nro 7					
Person nro 8					

GEs used in the trial (x)

(x)		Generic Enabler	Emphasised on:
		Applications/Services Ecosystem and Delivery Framework Chapter	Digital & Virtual
	GE1	Apps.Repository	
	GE2	Apps.Marketplace	
	GE3	Apps.ApplicationMashup	
	GE4	Apps.LightSemanticComposition	
	GE5	Apps.Mediator	
		Cloud Hosting Chapter	Virtual
	GE6	Cloud.DCRM - IaaS Data Center Resource Management GE	
	GE7	Cloud.SM - IaaS Service Management	
	GE8	Cloud.ObjectStorage - Object Storage	
	GE9	Cloud.SelfServiceInterfaces - Cloud Portal	
		Internet of Things (IoT) Services Enablement Chapter	Smart
X	GE10	IoT.Gateway.DataHandling - Esper4FastData	
	GE11	IoT.Gateway.ProtocolAdapter	
X	GE12	IoT.Backend.IoTBroker	
X	GE13	IoT.Backend.ConfMan	
		Data/Context Management Chapter	Digital
	GE14	Data.PubSub - CAP Context Broker	
	GE15	Data.SemanticApplicationSupport	

	Abbreviation	Name / Description
Other:		
Other:		

SEs used in the trial (x)

(x)		Specific Enabler	
x	SEI_1	Shopfloor Data Collection	Smart
x	SEI_2	Secure Event Management	
	SEI_3	Unstructued and Social Data Analytics	Digital
	SEI_4	Collaborative Assets Management	Virtual
	SEI_5	Supply Chain & Business Ecosystem Apps	
	SEI_6	Metadata and Ontologies Semantic Matching	
	SEI_7	Collaboration Platf. BP Mgmt	
	SEI_8	Data Interoperabil. Platform Services	Digital & Virtual

	Abbreviation	Name / Description
Other:		
Other:		

Trial Specific Components used

	Name	A short description
Component 1		
Component 2		
Component 3		

Basic information about V&V Steps P1-4

TRW

	P1	P2	P3	P4
Self-certification used in each step P1-4 (x)				

Basic information about V&V Steps P5 and T1

TRW

Technical indicators chosen (x)

Indicators with **high or medium** priority

Name	Priority	Related to criterion	P5	T1 / Scenario 1	T1 / Scenario 2	T1 / Scenario 3
Openness Level	High	Openness	x			
Generic Enablers Usage Index	High	Versatility				
Average Generic Enablers Usa	High	Versatility				
Fault Detection	Medium	Correctness				
Module fault density	Medium	Correctness				
Data integrity	Medium	Correctness				
Interoperability Maturity Leve	Medium	Interoperability				
Authentication Mechanism In	Medium	Security				
Failure Avoidance	Medium	Fault Tolerance				
Availability	Medium	Recoverability				
Users' required IT backgrounc	High	Understandability		x	x	x
Learning time	High	Ease of learning (learna				
Time to expertise	High	Ease of learning (learna				
Operation time	High	Operability				
Users' attraction level	High	Attractiveness				
Users' engagement time	High	Attractiveness				
Users' satisfaction level regar	High	Attractiveness		x	x	x

Names of the **other** technical indicators chosen

P5	T1 / Scenario 1	T1 / Scenario 2	T1 / Scenario 3

Preliminary ECOGRAI instantiation data table / Step T2 TRW

TABLE 1 / SCENARIO 1	Reduction of accidents and incidents	
	Description	
Indicator	*The title of the PI*	Ratio: Number of accidents and incidents in the factory after/ before the DV/AV
Purpose:	*Why the measure is performed*	It enables to monitor and enhance the H&S prevention strategy
Objective	*The trial objective*	To reduce the accidents and incidents in the Trial
DV/AV	*The Decision/Action variables which allow to reach the objective*	To implement FASYs System
PI nature	*Quantitative or Qualitative*	Quantitative
Information needed	*The information needed to calculate the PIs*	H&S prevention department database
Processing (Formula)	*The formula to calculate the PI*	Value
Required evolution (Target)	*Evolution of the value of the PI that it is recommended*	8% before 12 months after implementation
The owner (Who measures)	*The person who is responsible of the domain in which the PI is implemented*	The prevention technicians or the H&S coordinator
Period	*The interval of time to evaluate the value of the PI*	Monthly, quarterly (for example)
Actions to react depending on the value of the PI	*Action that the owner that take to evolve in the right direction*	Increase prevention
Description mode	*Representation of the PI Example: Histogram*	Histogram

TABLE 2 / SCENARIO 2	Increase the productivity	
	Description	
Indicator	*The title of the PI*	Ratio: Number of employees feel well after / before the implementation of the DV/AV during
Purpose:	*Why the measure is performed*	
Objective	*The trial objective*	
DV/AV	*The Decision/Action variables which allow to reach the objective*	To implement FASYs System
PI nature	*Quantitative or Qualitative*	Quantitative
Information needed	*The information needed to calculate the PIs*	
Processing (Formula)	*The formula to calculate the PI*	
Required evolution (Target)	*Evolution of the value of the PI that it is recommended*	
The owner (Who measures)	*The person who is responsible of the domain in which the PI is implemented*	
Period	*The interval of time to evaluate the value of the PI*	
Actions to react depending on the value of the PI	*Action that the owner that take to evolve in the right direction*	
Description mode	*Representation of the PI Example: Histogram*	