D24.1
State of the Art of maturity models and change management in European manufacturing industry
M10 – V3.0

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DELIVERABLE PEER REVIEW SUMMARY (FROM V1.0 TO V2.0)

ID	Comments	Addressed (✔) Answered (A)
1	Improve introduction in the Executive Summary	✔
2	Lack of a glossary	✔
3	Various improvements and corrections to the text	✔

DELIVERABLE PEER REVIEW SUMMARY (FROM V2.2 TO V3.0)

ID	Comments	Addressed (✔) Answered (A)
1	Correction of some typos and terminology misalignment between deliverable and questionnaire	✔
2	Various improvements and corrections to the text	✔

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Executive Summary

This document provides description of the state of the art of maturity models and change management models and approaches, especially considering the need of European manufacturing industry to evolve towards services in order to keep competitiveness and bring innovation into the market.

The document is resubmitted in the present second release (first release submitted was labeled as V2.0, this second release is labeled as V3.0). The entire document has been revised and hereafter it is pointed out when the content of the deliverable is related with a new part introduced in this second release.

The document presents a structured analysis, done through a survey of approaches about maturity models and a literature analysis of change management issues and approaches. Objective and capabilities of such approaches are then highlighted.

Main results presented in this deliverable are related with:

- Comprehensive overview of the maturity models available in literature, with a specific focus on maturity model to assess issues related with delivery and management of services.
- Overview of the change management approaches, showing a large range of possible approaches.
- Presentation of the developed MSEE maturity model (introduced in this second release of the deliverable)
- Indication of the change management approaches to follow starting from the MSEE maturity model, thus the change management approach to be adopted within the MSEE scope

The present deliverable is developed in the scope of WP24. In order to structure the analysis and provide useful information for the following research activity of WP24 and with the objective to align the activity of the WP with the research activities ongoing in MSEE project, maturity models and change management approaches are classified according to the modeling approach coming from D11.1 of SP1 of MSEE project. Synthesis of the maturity models is then provided, highlighting the direction that MSEE research took to develop the MSEE maturity model in the scope of WP24.

Results from the point of view of the maturity model are:

- Analysis of state of the art maturity models available in the research community. In particular 10 proposals from literature are presented and classified according to MSEE perspective.
- Industrial feedback on such approaches, provided by MSEE end-users (introduced in this second release of the deliverable).
- Presentation of MSEE maturity model, detailing the tools that compose the model, namely the questionnaire, the maturity indexes and the maturity maps (introduced in this second release of the deliverable).

For what concern change management approaches, results are:

- Dissertation about concept of change management as discussed in the scientific community
- Presentation of main issues discussed in literature about change management
- Industrial brief feedback on such approaches, provided by MSEE end-users (introduced in this second release of the deliverable).
- Outline of draft approach that, according to the literature highlighted in this deliverable, seems suitable for MSEE project and compliant for integrating the MSEE maturity model with a change management approach (revised in this second release of the deliverable)

Glossary

Some definitions are here provided, giving quick background on the used terminology:

- MATURITY MODEL: "maturity" is the quality to be in a full development state. Maturity models, than, represent theories regarding organization capabilities and how they evolve step by step along a foreseen, desired and logical path of growth (Gottshalk 2009, Kazanjian e Drazin 1989).
- CHANGE MANAGEMENT: change management is a structured approach to shifting individuals, teams and organizations from a current state to a desired future state. It is an organizational process aimed at helping employees to accept and embrace changes in their current business environment.
- PAS – PROCESS AREAS: they are the processes that are evaluated according to a maturity matrix. The terminology derives from CMMI-based approaches. Each area consists of a homogeneous set of key practices, namely a set of processes, that can be assessed through questions asking about the practices, namely the way in which the processes are carried on.
- COMPANY - SINGLE COMPANY - MANUFACTURING ENTERPRISE (ME): It is a single enterprise working in manufacturing with the traditional structure (customers, suppliers). Usually there is a management and the structure could be centralised or decentralized depending on the type of management. In the MSEE project, single company, namely an ME is considered just when it is part of MSEs or VMEs. Also in this deliverable single company is addressed with the purpose to highlight practices and relate them with the possibility to collaborate in a MSE or VME.
- MSE: MANUFACTURING SERVICE ECOSYSTEM: A Manufacturing Service Ecosystem (MSE) is a non-hierarchical form of collaboration where various different organizations and individuals work together with common or complementary objectives on new value added combinations of manufactured products and product-related services. This includes the promotion, the development and the provision of new ideas, new products, new processes or new markets. Inhabitants of such an MSE could be big OEMs, SMEs and networked organizations from various branches, ICT suppliers, universities and research centers, local public authorities, individual consultants, customers and citizens.
- VME (VIRTUAL MANUFACTURING SYSTEM): A virtual enterprise (VE) is a temporary alliance of business partners that share skills or core competencies and resources in order to exploit business opportunities on the market. A VME can be considered as a spin-off (not spin-out) of the MSE but not only: some partners outside of the MSE can join the VME.

1. Introduction

1.1 Objective of the deliverable

The objective of the present document is to:
- discuss the approaches for the assessment of maturity;
- present MSEE maturity model;
- discuss methods to guide change management.

Support is needed in order to allow companies following a roadmap that includes indication for the improvement of: i) service lifecycle management processes, ii) the processes enabling companies to properly enter an ecosystem, iii) the processes to create innovation, iv) processes for proper collaboration and governance of an ecosystem in order to create a VME.

Two steps are needed:

- First step is the definition of a scientific metric for maturity, allowing to analyse practices of the companies in order to improve their capability to manage services and their collaboration in ecosystems.
- Second step is the definition of a change management approach, namely a way to define a roadmap and make the company able to follow it, providing the right information about tools to use.

This deliverable discusses the literature related with these scopes of research. Analysis of literature is a preliminary research activity that allows also the definition of the proper approaches. In this deliverable the MSEE maturity model is then provided, while future activity of WP24 will deal with the details of change management approach definition, starting from the analysis of the state of the art and the introduction of MSEE change management approach, herein presented.

1.2 Structure of the deliverable

The deliverable is structured in the following way. After this introduction of the objective of the document, scope covered by the research presented in the deliverable is highlighted, with specific concern to MSEE project.
Then, from section 3 the state of the art analysis is reported, starting from discussion about maturity models. The approach considered is literature analysis. Reference analysed are listed and some hints of each reference are provided into a summarizing table. Appendix 1 and Appendix 2 provide then details about 10 maturity models, namely proposals from the scientific community are there presented. The proposals are analysed according to two classification ways. One considers the application domain of the model, considering a classification approach compliant with the research carried out in SP1 of MSEE project. A second classification highlights specific features of the models (simplicity, objectivity, flexibility, adaptability (to a questionnaire), capability).
Section 4 is then dedicated to discuss the other main topic analysed in this deliverable: change management. Change management approaches are not so structured that can be classified as a

list of models. Thus, firstly an overall discussion about change management issues, analyzing available literature is reported. Then, main relevant aspects discussed in literature are discussed in the second paragraph of section 4. No specific classification of the approaches is provided, being the section structured as a discussion to provide literature background on the topic.
Till section 4 this second release of the deliverable is practically similar to the first release. From section 5 on, new information have been added, updating the results achieved within WP24.
Section 5 provides industrial feedback on what presented in the first release of the deliverable. MSEE end-users have been consulted in order to catch their feedback on the issues addressed.
Section 6 presents the MSEE change management approach, providing an introduction to it and then detailing the MSEE maturity model (playing a major role in the MSEE change management approach), established starting from the analysis of existing maturity model. Practical details on how to implement such maturity model to industry is showed. In Appendix 3 results of a first application of the maturity model to MSEE end users (Indesit, TP-Vision were selected in this phase) are presented. This results will be exploited during WP24 activity to fine tune the MSEE maturity model.
Section 7 provides then the conclusions of the deliverable highlighting which are the main useful results coming from the analysis for the MSEE project and, eventually lists the next research activities in the project on the topics discussed in this document.

2. Deliverable scope

2.1 The deliverable in the scope of WP 24 of MSEE project

The main aim of WP24, as described in the DOW of MSEE project, is the description of a State of the Art of maturity models and change management, especially the investigation of available approaches and election of appropriate Maturity Models in manufacturing Service Ecosystems, the analysis and evaluation Service-oriented change management for different actors in the Ecosystem.
WP24 mainly consists of three tasks. The following is a short description of the tasks; T24.1 and T24.2 are briefly described, because they are the ones more related with the present deliverable.

- T24.1 Description of a State of the Art of maturity models and change management
  The first task, led by POLIMI in cooperation with BIBA, I-VLAB, UNINOVA, deals with state of the art analysis. As stated in the DOW, in the scope of T24.1 a survey of approaches about maturity models and change management is conducted. In a second step of the task linkage between maturity models and change management will be created. Finally a generic model framework to be used in MSEE will be proposed.
- T2.4.2: Analysis of requirements and challenges of Service-oriented change management for actors in an ecosystem
  The second task, led by POLIMI in cooperation with BIBA, I-VLAB, UNINOVA, focuses more on the change management with respect to different actors that can operate in an ecosystem. Based on this, a service-oriented change management approach will be developed.

- T2.4.3: Specification and Development of a generic change management approach to analyze manufacturing service ecosystems

This document (D24.1) is mainly related with the above mentioned T24.1 and T24.2; the main objectives of the present document are:

- To agree on what Maturity assessment and Change management meanings within MSEE
- To analyze suitable formalism/approach to address the assessment of Maturity and the management of change for service innovation
- To present the MSEE maturity model as main part of the MSEE change management approach, detailing how maturity model and change management can be considered within the same frame.

This deliverable reviews the literature approaches, then, as a follow up, a maturity assessment approach is defined, namely the MSEE maturity model. The model allows to map the maturity of a company and an ecosystem in terms of service processes and capability of collaboration. To this end, information to complete this research vision came from: WP25 for what concerns issues related with ecosystem governance, WP21 for what concern innovation and SP1 for the aspects related with servitization and service lifecycle.

The aim is to analyse an actor that makes business related with services or not yet related with services and that intends to evolve in the servitization process, namely improving the service lifecycle processes. The approach takes into account the vision of a company and the vision of an ecosystem. The ecosystem is also particularly analysed for what concern the capability to innovate.

The analysis results in a map of the maturity, indeed graphically represented on Maturity Maps. The position of the company and the ecosystem on such maps allow to start the analysis of possible “trajectory” of change and thus enable the development of a change management approach, that will be also based on the state of the art analysis herein presented.

3. State of the art of maturity models

3.1 Definition of concepts - What does the scientific community mean for maturity and maturity models?

Maturity is literally defined as "the quality of being in a state of full development".
Under the assumption of predictable patterns, maturity models are theories on how the organizational capabilities evolve step by step, through a planned, desired or logical maturation (Gottshalk 2009, Kazanjian and Drazin 1989). This is the reason why the maturity models are also referred to models of the growth stage (see Prananto 2003). The first examples of maturity models include a hierarchy of human needs (Maslow 1954), economic growth (Kuznets 1965), and the progression of information technology in organizations (Nolan 1973). Nolan's stage model was considered useful and used by academics and professionals, and led to the birth of many maturity models based on a sequence of levels (Solli - Gottshalk and Saether 2010).
An example of application of a maturity model can be seen in Deloitte, company which has created an application management maturity model as a structured framework for identifying and evaluating opportunities for improvement in application management. An application management environment comprises of seven capability areas: strategy, organization, financials, talent, processes, technology and service delivery. Using the application management maturity model, Deloitte assessed four focus areas within each capability area, thus producing a final report which illustrated the maturity of each focus area and identified gaps (Deloitte, 2009).
Since their birth, maturity models have been criticized. First, they were defined as a sort of "step by step" procedure for development, which oversimplify the empirical reality, but that somehow can explain in few words what they are.
Benbasat (1984), whose studies are mainly oriented on the IS field, casts doubts on one of the basic guidelines of the stage-model, which is that the characteristics of each stage should be distinct and empirically testable. The empirical studies surveyed by Benbasat, on the other hand, state that various maturity criteria do not reliably move together, or even always in the same direction, thus refuting one of the requirements for claiming the existence of a stage theory. Benbasat, anyway, recognizes the potential of the stage model, whose major supporters affirm that maturity is not a static concept, and whose problems can surely be attributed to the fact that it was based on personal experiences in a very small number of organizations at what it has to be considered as an early point in the development of the IS field.
King and Kraemer (1984), similarly, affirm that the empirical bases of the stage-model are questionable, and some evidence is available that they are factually mistaken. The stage-model, related to the growth of computing in organizations, has had a powerful influence on the information systems field; its popularity is probably due to its bold approach to dealing with an highly complex phenomenon in a straightforward and clever manner. The model, even if the first treating of this topic in such a structured scheme, and recognized in some parts by practitioners and researchers, is incomplete in its attempt to capture the larger organizational context within which computing occurs, and it is not accurate in the accounting of the relationships between the various components in the context. However, the two authors

recognize that the model makes two significant contributions: first, it makes explicit the notion that the growth must be due to the influence of forces both inside and outside the organization, even if it doesn't give clues regarding their interplay and interactions while shaping computing; second, it introduces an intellectual powerful construct of dialectical
Interplay between freedom and constraint in the control of computing that yields periodic states of equilibrium. The stage-model, in some way, has therefore provided interesting and testable hypotheses for researchers to explore.
De Bruin and other authors, by the way, underline that the value in a generic methodology lies, rather than in a specific stage-model, in the ability to develop a model which is characterized by an high generalisability and standardization. Use of a standard methodology enables a state of model development to be reached and for incremental improvements to be made over time. The value to organizations of applying such a model resides in the ability to measure and assess domain capabilities at a certain point in time, thus achieving sustainability (De Bruin et al., 2005).
In addition, the maturity models tend to neglect the possible existence of multiple paths (for evolution) equally good (Teo and King 1997).
Regardless of application domains, most maturity models refer to multiple entity classes. According to Mettler and Rohner (2009), typical classes are the people, processes, or other objects from a specific application domain. Kohlegger (2009) distinguishes between objects, people and social systems. Another distinction relies on the resource based view of the firm (Wade and Hulland 2004), where the resources are classified into assets and capabilities.
According to Mettler and Rohner (2009), maturity models should be configurable as their internal and external characteristics may limit the applicability of the model in its standard version (Iversen et al. 1999). King and Kraemer (1984) suggest that maturity models should not focus on a sequence of levels toward a final state by default, but the factors that determine the evolution and change. Further criticisms relate to the multitude of maturity models are similar to the ones mentioned. Also the lack of satisfactory documentation of the design process is often mentioned (Becker et al., 2009, Becker et al. 2010, Iversen et al. 1999).

3.2 Purpose of use of Maturity assessment - For what maturity model is useful for

The maturity models that represent the theories of evolution "step by step", are meant to describe the basic steps and pathways of maturation. Consequently, it should be explained the characteristics of each phase and the logical relationship between the phases (evolutionary path).
As for their practical application, maturity models are required to state the level of maturity, current and desirable, including their measures for improvement.
The objective is to diagnose and eliminate the deficiency of capacity (Rummler and Brache 1990). In general, three specific objectives can be distinguished (Becker et al. 2009, de Bruin et al. 2005, Iversen et al. 1999, Maier et al. 2009):

- ***Descriptive*:** a maturity model has a descriptive purpose when it is applied to the assessments as-is, where entities' ability under current observation are evaluated against certain criteria (Becker et al. 2009). The maturity model is used as a diagnostic tool

(Maier et al. 2009). The maturity levels assigned are reported to internal and external stakeholders.

- ***Prescriptive:*** a maturity model has a prescriptive purpose when it allows identifying desirable levels of maturity and provides guidance on improvement measures (Becker et al. 2009).
- ***Comparative:*** a maturity model presents a comparative view when adopted to allow a comparative analysis (benchmarking) internal or external. Through analysis of historical data, the maturity levels of the business units and / or similar organizations can be compared with each other (de Bruin et al., 2005, Maier et al. 2009).

In the context of MSEE project, therefore, maturity models are tools that help assessing "the quality of a company and ecosystem, of being in a condition for which it is able to carry on properly service lifecycle management processes, collaboration activities and innovation processes". In this way, maturity models allow to consequently build roadmaps (for improvement of maturity and can be linked to (or being part of) change management procedures. These themes will be treated with more details in the next sections of this deliverable.

3.3 Classification of models available in literature

In this section literature analysis of methods, approaches and models related with maturity concept are analysed.

Main models referenced in literature have been revised and are the ones included in the following references (see next table). To give a quick feedback on the topics addressed by each scientific work, it is indicated when the reference specifically addresses specifically the following topics of interest for the analysis:

- Type of the maturity model treated in the reference;
- CMMI-based maturity model, with consequential use of a CMMI/maturity levels approach for the maturity assessment (the following sections of this deliverable will then provide further explanation detailing what CMMI approach is);
- Work on a maturity model which is just a compound of researches and studies conducted by experts, but can be considered as pure research, not tested with companies;
- Work on a maturity model which, together with a progressive research, is accompanied by some applications to real case studies, thus revealing practical applicability.

	Reference	Type of MM (if present):	CMMI-based	Pure research:	Applied to case studies:
1	Aberdeen Group 2007. The PACE framework in report Aberdeen.	PACE framework			√
2	Abideen Tetlay , Philip John 2009. "Capability Readiness for Product-Service Systems." 7th International Conference on Manufacturing Research (ICMR09) University of Warwick (UK), September 8th – 10th 2009.	CR			√
3	Babak Sohrabi, Mohammad Haghighi, Amir Khanlari (2010). "Customer relationship management maturity	CRM3	√	√	

	model (CRM3): A model for stepwise implementation". International journal of human sciences. Volume 7 issue 1.				
4	Becker, J., Knackstedt, R. and Pöppelbuß, J. (2009). Developing Maturity Models for IT Management – A Procedure Model and its Application. Business & Information Systems Engineering (BISE), 1 (3), pp. 213-222.	ITSM		√	
5	Becker, J., Niehaves, B., Pöppelbuß, J. and Simons, A. (2010). Maturity Models in IS Research. In Proceedings of the European Conference on Information Systems (ECIS), Pretoria Managing Service Quality 15 (2), pp. 142-155.				√
6	Benbasat, I., Dexter, A. S., Drury, D. H. and Goldstein, R. C. (1984). A critique of the stage hypothesis: theory and empirical evidence. Communications of the ACM, 27 (5), pp. 476-485.	Nolan's stage-model		√	
7	Burger et al. 2010. Service development for product services: a maturity model and a field research, European Association for Research on Services (RESER Conference), January 2nd 2011, Hamburg.	NSD	√		√
8	De Bruin, T., Rosemann, M., Freeze, R. and Kulkarni, U. (2005). Understanding the main phases of developing a maturity assessment model. In Proceedings of the Australasian Conference on Information Systems (ACIS), Sydney.	CMM	√	√	
9	Gottschalk, P. (2009). Maturity levels for interoperability in digital government. Government Information Quarterly, 26 (1), pp. 75-81.	The article develops a conceptual stages of growth model with six levels	√	√	
10	InnoScore Service Evaluating innovation for product-related services 2011 Annual SRII Global Conference Mike Freitag Service Development Fraunhofer IAO 70569 Stuttgart, Germany.	Innoscore® Service			√
11	Jian-hua Yang. "A balanced performance measurement scorecard approach for Product Service Systems". 2009 International Conference on Business Intelligence and Financial Engineering. School of Economic and management University of Science and Technology Beijing, China.	BSC			√
12	Jonathan Bachman, Daniel Ng, Sean	SOAMM			√

	Kline e Ed Horst (2005). "Service Oriented Architecture Maturity Models: A guide to SOA Adoption?". School of Humanities and Informatics Masters Dissertation in Computer Science, 25 Credits D-level.				
13	Kazanjian, R. K. and Drazin, R. (1989). An empirical test of a stage of growth progression model. Management Science, 35 (12), pp. 1489-1503.	Stages of growth model			√
14	King, J. L. and Kraemer, K. L. (1984). Evolution and organizational information systems: an assessment of Nolan's stage model. Communications of the ACM, 27 (5), pp. 466-475.	Stages of growth model		√	
15	Kohlegger, M., Meier, R. and Thalmann, S. (2009). Understanding Maturity Models. Results of a Structured Content Analysis. In Proceedings of the 9th International Conference on Knowledge Management and Knowledge Technologies (IKNOW '09), Graz, Austria.			√	
16	Maier, A. M., Moultrie, J. and Clarkson, P. J. (2009). Developing maturity grids for assessing organizational capabilities: Practitioner guidance. In Proceedings of the 4th International Conference on Management Consulting, Academy of Management (MCD), Vienna, Austria.			√	
17	Mettler, T. and Rohner, P. (2009). Situational Maturity Models as Instrumental Artifacts for Organizational Design. In Proceedings of the DESRIST'09.			√	
18	Minzoni M. (2004), "CMMI: optimize the process to improve the product" [published in italian:"CMMI: ottimizzare il processo per migliorare il prodotto"], Mokabyte, 90 – available at www.mokabyte.it.	CMMI	√	√	
19	Prananto, A., Mckay, J. and Marshall, P. (2003). A Study of the Progression of E-Business Maturity in Australian SMEs: Some Evidence of the Applicability of the Stages of Growth for E-Business Model. In Proceedings of the Pacific Asia Conference on Information Systems (PACIS), Adelaide.	Stages of growth model			√
20	Solli-Sæther, H. and Gottschalk, P. (2010). The Modeling Process for Stage Models. Journal of	Stages of growth model			√

	Organizational Computing and Electronic Commerce, 20 (3), pp. 279-293.				
21	Hain, S. and Back, A. (2009), State-of-the-art on Maturity Models for collaboration, Institute of Information Management, St. Gallen, Switzerland.	CMM	√	√	
22	Bird, R.C., Desai, M.J., Enzler, J.J and Taubman, P.J, "Kuznets Cycles" in Growth rates: the meaning, International Economic Review, vol. 6, No.2 (May, 1965), pp. 229-239.	Stages of growth model		√	
23	Mettler T., Rohner P. and Winter R. (2009), Towards a classification of Maturity Models in Information Systems, in *Management of the Interconnected World*, part 6, pp.333-340.			√	
24	De Bruin, T and Rosemann, M. (2005), Towards a business process management maturity model, Queensland University of technology, Brisbane, Australia.	Proposal of a business process maturity model	√	√	
25	McCormack, K. et al. (2009), A global investigation of key turning points in business process maturity, Business Process Management Journal, Vol.15, No.5, pp.792-815.	Key turning points in a business process maturity model	√	√	
26	Iversen, J., Nielsen, P.A. and Nerbjerg, J. (1999), Situated Assessment of Problems in Software Development, The DATA BASE for advances in Information Systems, Vol.30, No.2, pp. 66-81.	CMM	√	√	
27	Spanyi A. (2004), Beyond Process Maturity to Process Competence, www.bptrends.com.	Proposal of a business process maturity model	√	√	
28	Service performance Insight (SPI) 2011, Introducing the Service Maturity Model, www.SPIresearch.com, April 2011,	SPI			√
29	CMMI –SVC, v.1.3 (2010), Technical report, Carnegie Mellon.	CMMI-SVC	√	√	
30	Macchi M., Fumagalli L., Rosa P., Farruku K. and Gasparetti M. (2011), Maintenance maturity assessment: a method and first empirical results in manufacturing industry, Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Milano, Italia.	CMMI	√		√
31	Arsanjani A. and Holley K. (2006), The Service Integration maturity model: achieving flexibility in the transformation of SOA, International Conference on Services Computing.	SIMM/SOA		√	

32	Information Technology Infrastructure Library (ITIL), The University of Utah, www.it.utah.edu.	ITIL		√	

Over the last few years, a series of models related to the world of services have been defined and used, each with different characteristics. The objective of the review which will be proposed in this section paragraphs, is to present some models that allow making assessment of the practices of a company related with certain processes. The processes we focus on are related with manufacturing services.
The analysis will lead the research to find most suitable approaches to be then used in the MSEE project for the definition of a proper Maturity assessment approach to be used in the scope of the research of the project.
In order to be able to make a comparison among different approaches available in literature two classifications will be adopted.
The first one considers to classify models by some features, mainly related with the user-friendliness of the model, it also considers the possibility to develop a complete assessment approach (e.g. by a questionnaire). Such features are inspired by the classification approach proposed by McCall et al. (1977), but then tailored for the purpose of the analysis proposed in this document, being the original ones developed for another kind of purpose (i.e. software classification).
The features are:

- Simplicity: the model should be not complex and intuitively easy to use;
- Objectivity: the assessment of maturity must be objective and based on a structured process;
- Flexibility: the model must adapt to different companies;
- Adaptability (to a questionnaire): the model should be adaptable to a questionnaire in order to use the proposed evaluation method in a way that can be easy to disseminate;
- Capability: Evaluation of processes must be enabled by the model to make an assessment of the service processes of the company and act as basis for change management activity to guide the evolution of the different "steps" of maturity.

The characteristics listed above should not be considered as strict constraints, but as boarders for the area of choice of the model.
The review proposed in this section presents some models, emphasizing the key features and classifying them according to the compliance to the classification characteristics required to the model (see previous bullet points). Judgment is given according to the experience of MSEE researchers on this topic and through a qualitative evaluation (judgments are given like: low (e.g. flexibility), medium, high).
Then, last paragraph of this section propose a radar chart for comparison of the models according to the defined features.
A second point of view of analysis to be considered for the model presented in this section is the determination of the application domain of the maturity models. Indeed, it can be referred to the modeling issues addressed by MSEE project in SP1 (Sub-Project 1). More details can be found in MSEE D11.1.
Similar to MDA/MDI, the proposed MDSEA defines a framework for service system modelling around three abstraction levels.

- **Business Service Model (BSM),** which specifies the models, at the global level, describing the service running inside a single enterprise or inside a set of enterprises as well as the links between these enterprises. The description at this level is user oriented.
- **Technology Independent Model (TIM),** which delivers the models at a second level of abstraction independent from the technology used to implement the system. At this level models use the language of the domain: IT, Organizational/human and Physical means.
- **Technology Specific Model (TSM),** that combines the specification in the TIM model with details that specify how the system uses a particular type of technology (such as for example a software applications describe in a particular language, a specific Machine or specific person). At this level the precise elements that will be used in the real system are specified.

For purpose of creating a map for the classification of the scientific works revised and presented in this deliverable, the following table is provided, considering BSM, TIM and TSM levels. BSM level is also further decomposed in Strategic, Tactical and Operational levels to provide a better level of detail.

	Decomposition	BSM	TIM	TSM
PROCESS, INFORMATION, RESOURCES, ORGANISATION	Strategic	X		
	Tactical	X		
	Operational	X		
SUPPORTING MEANS			X type of support	
				x supporting tool

BSM is decomposed in Strategic, Tactical, Operational (it is a hierarchical decomposition). Then TIM is considered and refer to a technical view, while TSM is the realization view, namely how we realise the system.

The same happen when dealing about tactical and operational, thus going from strategic issues to more short-term and practical issues related with the operation of the service.

On others levels of abstraction it is possible then to detail the supporting means to realize the strategic, tactical and operational processes. Indeed, while BSM describes processes and organizational and resources (in general: a machine to do this), information, issues, TIM and TSM deal with the type of support and specific supporting tool (technology) that can be used to realized processes along a certain organization.

In next section, models will be analysed concerning maturity assessment. Each model will be evaluated according to its presentation given in scientific works. According to that material, models will be classified as good for BSM, TIM, TSM abstraction level, thus specifying the domain where we can use the models.

When BSM is covered, detail about Strategic, Tactical and Operational decomposition provided by the analysed model is specified, since this information is important to understand correctly the domain where the model is applicable.

On the other hand, when a model is able to cope with TIM and TSM abstraction level, there is no need of a further decomposition, because TIM and TSM have been directly related to "Supporting means" classification.
It is worth mentioning that this classification, practically provided ticking a proper box in a classification table, is subjective and given by MSEE researchers who have analysed the models.
On the other hand it must be considered that fully compliancy with BSM, TIM, TSM hierarchical decomposition cannot be always possible, being the models not developed for that. Thus, the reader must consider that the analysis of potential use is provided as an indication to understand how the model can be positioned with respect to a first positioning in the domain of application and coherent other research activity of MSEE (i.e. research activity ongoing in SP1).

3.4 Review of models available in literature

Models related with maturity assessment can be mainly classified as the one based on CMMMI approach (later explained in this section) and not CMMI-based. The main difference between being compliant to CMMI or not compliant to it is the way the maturity is assessed. Once referring to CMMI, an assessment method becomes more objective and generalizable. Details are provided later, but to introduce the issue is possible to state that CMMI approach allows to define how much structured is a process. No specific best practice is considered by this approach. The way best practices are considered is the selection of the processes to be analysed by the approach. Not CMMI-based approaches, instead, are often based on reference best practices and assess maturity through the compliance to such best practice. Nevertheless best practices are not always valid in all the sectors and this can generate poor generalizability of the models not CMMI-based.

The following is the list of the model analysed that will be described in the remainder:

Proposal number	Model name	Reference
1	CMMI for Services (CMMI-SVC)	Software Engineering Institute, CMMI® for Services, Version 1.3 CMMI-SVC, V1.3, Improving processes for providing better services TECHNICAL REPORT - November 2010
2	CRM3	Babak Sohrabi, Mohammad Haghighi, Amir Khanlari (2010). "Customer relationship management maturity model (CRM3): A model for stepwise implementation". International journal of human sciences. Volume 7 issue 1.
3	NSD	Burger et al. 2010. Service development for product services: a maturity model and a field research. Fraunhofer IAO, Stuttgart (Germany)
4	SPI	Service performance Insight (SPI),www.serviceperformanceinsight.com, 2011

5	PACE framework	Aberdeen Group 2007. The PACE framework in report Aberdeen.
6	ITIL	Cartlidge et al. 2007. An Introductory Overview of ITIL V3. Best Management Practice Partnership.
7	Capability Readiness	Abideen Tetlay , Philip John 2009. "Capability Readiness for Product-Service Systems." 7th International Conference on Manufacturing Research (ICMR09) University of Warwick (UK), September 8th – 10th 2009.
8	SOAMM	Jonathan Bachman, Daniel Ng, Sean Kline e Ed Horst (2005). "Service Oriented Architecture Maturity Models: A guide to SOA Adoption?". School of Humanities and Informatics Masters Dissertation in Computer Science, 25 Credits D-level.
9	SIMM	The SIMM: achieving flexibility in the transformation to SOA, A Arsanjani & K Holley 2006
10	Innoscore Service	Freitag, M. and Ganz, W. (2011), Innoscore® Service: Evaluating Innovation for Product-Related Services, SRII Global Conference, March 29th – April 2nd , Stuttgart, Germany.

Given this short introduction, CMMI approach is firstly presented, since then it is mentioned and used in different approaches identified in literature.

CMMI

The CMMI (Capability Maturity Model Integration) is a model to assess the maturity of a system. It comes from the Capability Maturity Model (CMM), that was developed by the Software Engineering Institute at Carnegie Mellon University in the '80s. The CMM identifies process areas (PAs), which are composed of a set of homogeneous practices. This model is based on the idea that improvement is achieved by making small steps, rather than making revolutionary changes. Due to the wide use of the model, it is possible to state that this idea was a good and appropriate one.
The Capability Maturity Model Integrated (CMMI), so the present version, was introduced in 2002 by the Software Engineering Institute. In the original version, it covers a range of activities related to software engineering, basic scope where CMMI has started to be adopted.
There are two possible representations of the CMMI approach (Minzoni, 2004):

- **Staged representation (SR):** 5 maturity levels (ML) are defined related to all activities that must be evaluated; for each activity process areas (PA) are defined and they must be improved in order to achieve the specific level of maturity. So, for instance, if a generic company is at Level 3 of maturity, it needs to improve a number of predefined process areas to move to Level 4. This means that the staged representation provides a roadmap for improvement, in which each stage / maturity level contains a set of process areas that indicate where the company should focus to enable improvements. In the staged representation, the overall results are summarized in a single level of maturity, while in the continuous system has defined a profile of skills: for each process area analyzed, it reached a certain level of maturity, all values obtained from a company represent a set of maturity. Stage representation must follow a predefined path. In the processes of software engineering is a proven path (offered by the model) to refer to, but, in our case a more flexible solution could be

advisable. A generic path, so to adapt to different industrial sectors in which the companies operate, seems more appropriate; different sectors lead to meet different needs, precluding the use of a single path for improvement. On the other way a path for improvement and development can be defined when considering the path for servitization development and when referring the path to the development that are possible thanks to the adoption of the results of MSEE project (i.e. MSEE platform)

- **Continuous representation (CR):** levels of capacity (CL) are defined, instead of maturity levels. A CL is a measure assigned to a single area of the process: in this way, companies have maximum flexibility in choosing which processes to focus and improve. The adjective "continuous" means that there are phases in which company should focus on different objectives and follow different procedures to support the development of each process area. Thus, in this representation the objectives are not fully defined. Here, each process has a different ability levels, and together form the so-called Capability Profile. The continuous system representation offers maximum flexibility. It focused on the priority of processes and on their alignment with business objectives. The staged representation focuses on organizational improvement, while the CR provides less visibility, referring to individual process areas.

In Appendix 1 the four CMMI based approaches (proposals coming from literature) are presented. Each table is formatted in order to provide main information retrieved by literature document about the models. Information about the previous mentioned classification is also provided in the tables.

In Appendix 2 six main proposals refer to not-CMMI based approaches (proposals coming from literature) are reported. As for the CMMI proposals, each table is formatted in order to provide main information retrieved by literature document about the models. Information about the previous mentioned classification is also provided in the tables.

3.5 Comparison of the state of the art approaches

Comparison among different approaches available in literature are summarized according to the different features identified. The next radar chart provides this comparison.

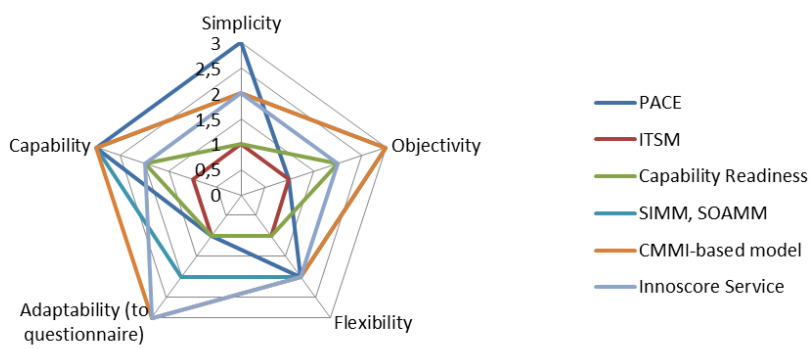

Figure 2: Comparison among the maturity models: radar chart showing the qualitative judgment: High (3 point), Medium (2 points), Low (1 points) as levels for the features analysed.

From the analysis of the models so far described, especially from the radar chart above presented, CMMI-based model show to be more complete than other models, in the sense that CMMI-based models are the ones with almost the highest score (in the radar chart the overall score is represented by the area defined by the lines connecting the score level on the different axis).

Finally, it is possible to provide some comments about the concept of maturity.

- The maturity levels may be associated with different elements, which are process areas, critical success factors, performance, etc ...
- In some models (e.g. SOAMM) the concept of maturity is closely linked to the visibility of processes and the presence of a good data management.
- The majority of models using the logic CMMI structures the maturity into five levels. Practically, all the models refer to business processes. Thus, a referencing business model, even if not explicitly mentioned, is considered in almost all the models, in order to build the maturity assessment upon that reference. It means that Process Areas (PAs) must be identified to build a CMMI-based maturity model.
- The information technology, organization and management are key areas to be investigated and to which pay special attention to assess the development and implementation of a product service system.
- The analyzed models focus on the service (mainly management and delivery) and do not specifically address the design of the service itself: this element, however, must be considered when building the MSEE maturity model, that is all the service lifecycle management processes must be considered..

The MSEE maturity models have to encompass the proper characteristics to address both company point of view and ecosystem point of view, with a particular focus on innovation aspects.

4. State of the art of Change Management issues to be considered

4.1 Definition of concepts - What does the scientific community mean for change management?

Change management is a principle of handling the transition from one state to another. Change management is a structured approach to shifting individuals, teams and organizations from a current state to a desired future state; it is mainly intended as an organizational process aimed at helping employees to accept and embrace changes in their current business environment. Since today's world is constantly changing and the pace seems to be almost exponential (Green, 2007), change management practices are acquiring a fast growing importance in the development of strategy. While operating in a complex and turbulent environment, organizations need to change quickly in order to meet their strategic requirements, which can then be translated, with a top-down approach, in appropriate tactical and operative decisions.

Bernard Burnes (2004) indicates that the management of change is a complex subject that is based on a number of social science disciplines and traditions: hence the definition of the fundamental concepts of change management is difficult. He introduces three schools of thought that are the foundations on which the theory of change management stands: the perspective of individual schools, group dynamics and open systems (Burnes, 2004). Cameron & Green (2009) describe these topics in terms of individual change, change of team and organizational change. They argue, however, that any change results from the management of rights of individuals (Cameron & Green, 2009).

Richard Newton (2008) introduces change management as a set of processes, tools, techniques, methods and approaches to achieve a desired future state and in MSEE – WP24 research we mainly follow this point of view.

Understanding the actual situation in which the organization is located is an integrated part of change management. Thus maturity assessment can be considered the first step of change management approach.

4.2 Classification of change management approaches: typologies and methods of change management

After introducing the primary concepts related to change management, the next step is treating about different manners in which to classify it and its different approaches.

Burnes (2004) categorizes the approaches to change under the headings of planned and emergent.

Planned change: The planned changes can be managed using Lewin’s organizational change process framework (unfreeze-change-refreeze, 1943) or the more detailed, yet based also on Lewin, Kotter’s eight steps of change (1995). Both the models are addressed also in D22.1, but a brief description is reported below as well.

The Lewin's model, also known as "Force-field analysis", consists in three defined phases in which to manage the process of change:

- *Unfreeze*, in which the top management communicates the intention of disrupting the current strategy and change the way of operating in which the company is getting stuck;
- *Change*, where the process of change really gets shape. In this phase the management asks to itself, and to the workforce disseminated all over the divisions, questions like which forces can enhance the pressure to innovation and evolution and thus have to be created or empowered, and which ones are operating against the change and thus have to be removed or weakened;
- *Refreeze*, where the new achievements are gained and incorporated in a renewed culture.

The Kotter's model of change on the other hand, emerging from a study made among more than 100 companies of several dimensions and belonging to different sectors, leads to the creation of an eight-step path that companies have to follow in order to realize a successful planned change process:

1. Establishing a sense of *urgency*, examining market and competitive realities and identifying and discussing crises, potential crises or major opportunities;
2. Forming a *powerful guiding coalition*, assembling a group with enough power to lead the change effort and encouraging the group to work together as a team;
3. Creating a *vision* for change, in order to help to direct the change effort, and developing strategies for achieving that vision;
4. *Communicating* the vision and strategies, using every vehicle possible and teaching new behaviors by the example of the guiding coalition;
5. Empowering others to *act on the vision*, in order to remove the obstacles to change, while changing systems or structures that seriously undermine the vision and recognizing and rewarding employees involved in the improvement;
6. Planning for and creating *short-term wins*, planning for visible performance improvements, creating those improvements, recognizing and rewarding employees involved in the improvements;
7. *Consolidating* improvements and producing still *more change*, using increased credibility to change systems, structures and policies that don't fit the vision, hiring, promoting and developing employees who can implement the vision and reinvigorating the process with new projects, themes, and agents;
8. *Institutionalizing new approaches*, articulating the connections between the new behaviors and corporate success, developing the means to ensure leadership development and succession.

Emergent change: The "emergent change" school of thought challenges the previous theories by saying that there is not a situation where the organization is completely frozen; a complete change is the result of a series of small adjustments.

In that case, than, a continuous review through the Mc Kinsey 7-S Model (Strategy, Structure, Systems, Style, Staff, Skills and Shared values) is preferred and suggested. A remarkable amount of literature, regarding this topic, and talking about the success of Japanese firms related to the Western ones, underlines that their successful performance derives not only from the well-known soft skills, but also from their skills at hard decision making (structure, strategy, systems). That is due to the adoption, during the change period, of the *organizational*

learning process, by which knowledge about action-outcome relationships and the effect of the environment on these relationships is continuously developed (Duncan & Weiss, 1979).
Both schools of thought, planned and emergent, eventually take into account the fact that there are always external forces that impede or accelerate the change (Burnes, 2004). Paton and McCalman (2008) point out, however, that the key to managing change is not in a single school of thought, but you must understand their own situation and adapt as needed.
A secondary recent classification, suggested by Morgan (1986) and rearranged by Gomez Fernandez and Crespo Marquez (2012), follows the principle that the first critical step in designing and conducting a successful large-scale change is to understand the dynamics and performance of the company. It is important to model this performance, identifying relationships among structure levels and organizational members. The management of change has thus to be undertaken according to the organization type. Proper mapping with right indicators seems thus a good pre-requisites and maturity assessment can play a good role for this.
The most common organizational types individuated by Morgan are:

- *Machine*: when one part of the organization is changed, the others need to change accordingly, like it happens in an operating machine in order to function in the proper way (Cameron & Green, 2009).
- *Organism*: view of the organization as an open system, that adapts to changes in its environment and survive.

Links with the first type of classification are here visible: machine organization is fixed with certain, planned procedures to be followed in order to secure a correct development of the strategy whereas organism adapts itself to the environment following an emergent, continuous, evolutionary change.
Indeed, it is understood that a clear distinction is not possible in reality and that it is just possible to highlight preferable point of view to be considered. At glance, the approach for change management that is considered for MSEE, starts from the vision of the organization as Machine more than as Organism and consider the planned change more than the emergent one.

- *Political System*: organization characterized by competing interests, conflicts and power plays. Paton & McCalman (2008) see organizational politics as part of everyday life in companies. It is mostly about information power and coalition building and their ethics.
- *Flux or Transition*: organization that is not capable of affecting its environment nor is capable of transforming itself either. In such a situation a company is practically powerless to manage the changes it faces; the order of organization naturally emerges from chaos (Cameron & Green 2009, p.105).

Subsequently, once focused the type of organization treated, changes can be further divide in different types according to their impact on the organization. There are different models discussing this aspect:

- *Stace & Dunphy (1994)* describes the following levels of change: 1) Fine tuning as quick wins; 2) Incremental adjustment as sustainable improvement inside a department; 3) Modular transformation as transformation of departments; 4) Corporate transformation affecting all the organization;
- *Ackerman (1986)* distinguishes three types of change: developmental (improving skills or processes of an organization), transitional (punctual change from an actual

state to a known state) and transformational (radical change with importance changes in the organization);

- *Lorenzi and Riley (2000)* divide changes into micro changes, differences in degree (i.e. modifications, enhancements, improvements and upgrades), and mega changes, differences in kind (i.e. new systems or a very major revision of an existing one).
- Senior (1997) divides the strategies for change into soft and hard systems models.
- Also, there are academics who specialize in change management and whose approaches combine disciplines, for example, Strebel (1998) (the individual perspective and group dynamics), and Dawson (group dynamics and open systems).

Given the diversity of underlying disciplines, there is no single overarching theory of change management. Generally, anyway, the implementation of a change in an organization has to be undertaken, under the above issues, and has then to follow an adequate sequence of phases.
Burnes (2004) concludes that the key to success is in understanding what the organization is trying to achieve, the context in which it operates and the strengths and weaknesses of different approaches to change.
Summarizing it is important that a change management approach:

1) is able to identify the target objective of the organization
2) it is able to map the context. This can be interpreted as: i) the environment, market in which the company operates or the business model, with the type of processes the company is currently running
3) able to guide along different path, namely identifying weak and strength tools/methods to be applied.

4.3 Purpose of use of Change management concepts

Change management is a systematic approach to deal with change, both from the perspective of an organization and on the individual level.
Change management has at least three different aspects, including: adapting, execution & management of the change, freezing (reviewing and formalizing) the change.
For an organization, change management means defining and implementing procedures and/or technologies to deal with changes in the business environment and to profit from changing opportunities.
Moreover is worth considering that "*Technology, even though it plays an important role, is only one term in the equation that leads to economic success and sustainable growth for Europe. Human skills, the organizational structure, the medium- and long-term strategic goals … are at least as important"* as affirmed in the FACTORIES OF THE FUTURE PPP STRATEGIC MULTI-ANNUAL ROADMAP. This is also why, besides technological achievement, MSEE project addresses change management issues. Next steps for MSEE project consider the development of a change management instrument that allow to suggest to companies which means/tools to exploit to follow paths of change, meanwhile measuring their performances and results during the process of change itself (this is also why other research activities in SP2 of MSEE project specifically address issues related with definition and use of KPIs that are information that can be combined with maturity assessment information).
What we are briefly looking for, after a longitudinal literature analysis about the topic and a collaborative work within MSEE consortium, are the answers to the following questions:

i) Can business process implementation, and thus business processes change, be led as a systematic, repeatable process?
ii) What is needed from the process in order to help change leaders manage the change situation, keeping in consideration existing ecosystems, and achieving successful change?

As it was possible to understand from the above brief discussion about change management approaches, very different scientific works are available in literature and each of them highlights a slight different approach, because of its focus on different issues. Change management, in fact, can be applied in different processes, in different contexts and with different points of view and decomposition levels.
This postulate the requirement for MSEE project to define its own Change management approach to be developed to favourite the use of MSEE tools to support companies in coping within manufacturing service ecosystems.
Keeping in mind the following table, matching process and organization, supporting means, with the decomposition levels,

	Decomposition	BSM	TIM	TSM
PROCESS, INFORMATION, RESOURCES, ORGANISATION	Strategic	X		
	Tactical	X		
	Operational	X		
SUPPORTING MEANS			X type of support	
				x supporting tool

The following main literature evidences are reported. When appropriate their relation with the above table is provided.

1	Abernathy, W.J., Clark, K.B. 1985, Innovation: mapping the winds of creative distruction, Research Policy vol. 14, i.1, pp. 3-22.	BSM-all levels, TSM
2	Ackerman, A.L. 1986, Development, transition and transformation: the question of change in organizations	
3	Aladwani, A.M. 2001, Change management strategies for successful ERP implementation, Business Process Management Journal, vol.7, i.3, pp.266-275.	TIM/TSM + BSM-strategic
4	Alas, R., Organizational change from learning perspective, Estonian Business School, Estonia.	
5	Balogun. J. and Jenkins, M. 2003, Re-conceiving change management: A knowledge-based perspective, European Management Journal, vol. 21, no.2, pp.247-257.	
6	Bourne, M. et al. 2003, Why some performance measurement initiatives fail: lessons from the change management literature, Int. J. Business Process Management, vol.5, nos.2/3, pp. 245-265.	
7	Branch, K.M. 2002, Change Management, Chartered Institute of Personnel and Development.	
8	Bridges, W. 1991, Managing transitions: making the most of change, 3d edition, Lifelong Books.	
9	Bullock, R.J. and Batten, D. 1985, It's just a phase we're going through: a review and synthesis of OD phase analysis, Group and Organization studies, vol.10, no.4, pp.383-412.	
10	Burnes, B. 2004a. Emergent Change and Planned Change – Competitors or Allies? The Case of XYZ Construction, International Journal of Operations & Production Management, Vol. 24, No. 9, pp. 886-902 .	BSM-strategic

11	Burnes, B. 2004b. Kurt Lewin and Complexity Theories: Back to the Future?, Joumal of Change Management, Vol. 4, No. 4, pp. 309-325.	BSM
12	Burnes, B. 2004. Managing Change: a Strategic Approach to Organisational Dynamics, 4th edition. Harlow, Pearson Education. 623 p.	BSM-strategic
13	Burnes B. 1996, No such thing as...a "one best way" to manage organizational change, Management Decision, vol. 34, I.10, pp.11-18	
14	Cameron, E., Green, M. 2003, Making sense of change management, 3d edition, KoganPage.	
15	Christensen, C.M. 1998, Strategies for survival in fast changing industries, Management Science, vol.44, No.12, part 2 of 2, pp.207-220.	BSM-all levels, TSM
16	Cross, R., Managing collaboration at the point of execution: improving team effectiveness with a network perspective	BSM-tactic, TIM
17	Dawson, P. 1995, Beyond conventional change models: a processual perspective, Asian Pacific Journal ok Human Resources, vol.34, no.2, pp.57-70.	
18	Dunphy D. and Stace D. 1993, The Strategic Management of Corporate Change, Human Relations, vol.46, no.8, pp.905-920.	Strategies of change, BSM
19	Gibson, C.B., Birkinshaw 2004, The antecedents, consequences, and mediating role of organizational ambidexterity, The Academy of Management Journal, vol.47, no.2, pp.209-226.	BSM – lower levels, TSM
20	Glaser, R. and Glaser, C. 1992, Team effectiveness profile: how is your team working?	TIM/TSM
21	Goleman, D. 2000, Leadership that gets results, Harvard Business Review	
22	Gomez Fernandez, J.F. and Marquez, A.C. 2012, Management of Change, Maintenance Management in Network Utilities, Springer	
23	Green, M. 2007. Change Management Masterclass: A Step by Step Guide to Successful Change, London, Kogan Page Publishers. 273 p.	BSM – all levels TSM
24	Hamel, G. 2006, The Why, What and How of management Innovation	BSM-strategic
25	Heifetz, R. 1994, Leadership without easy answers	
26	Kalakota, R. and Robinson, M. 2001, E-business2.0: looking over a new horizon	
27	Kotter, J.P. 1996, Leading change	
28	Kotter, J.P. 1996, Leading change: why transformation efforts fail	
29	Leonard-Burton, D. 1992, Core capabilities and core rigidities: a paradox in managing npd	BSM – lower levels, TSM
30	Levy A. 1986, Organizational transformation: strategies, approaches, theories	BSM - all levels, TSM
31	Lewin, K. 1947, Quasi-stationary social equilibria and the problem of permanent change, Organization change: A comprehensive reader	
32	Lewin, K. 1958, Group decision and social change	
33	Lynch, R.F. and Werner, T.J. 1992, Continuous improvement: teams and tools	TSM/TIM
34	Mc Court, W. 1996, Discussion note: using metaphors to understand and to change organizations. A critique of Gareth Morgan's approach	
35	Morgan, G. 1986, Images of organization	
36	Nadler, D.A. 1981, Managing Organizational Change: An Integrative Perspective	BSM-operative, TSM
37	Nadler, D.A., Tushman, T.L. 1997, Competing by design: the power of organizational structure	
38	Newton, R. 2007. Managing Change Step by Step: All You Need to Build a Plan and Make it Happen, Harlow, Pearson Education. 243 p.	
39	Orlikowski, W.J. and Hofman, J.D., An improvisational model of change management: the case of groupware technologies	
40	Pascale, R. and Athos, A. 1981, The art of Japanese management	
41	Pateli, A.G., Giaglis, G.M. 2005, Technology innovation-induced business model change: a contingency approach	BSM-operative
42	Paton, R. A. & McCalman, J. 2008. Change Management: A Guide to Effective Implementation, London, SAGE Publications Ltd. 418 p.	

43	Peters, T. and Waterman Jr, H.R. 1982, In search of excellence	
44	Raineri, A.B. 2011, Change Management practices: impact on perceived change results	
45	Riley, R.T. and Lorenzi, N.M. 2000, Managing change: an overview	
46	Rosemann, M. and Brocke, J.v. 2010, The six core elements of business process management	BSM-strategic, (partially also) tactical and operative
47	Senge, P. et al. 1999, the dance of change: the challenges to sustaining momentum in learning organizations	
48	Senior (2006), Organizational Change	BSM-strategic,
49	Smith, K.S. and Tushman, M.L. 2005, Managing strategic contradictions: a top management model for managing innovation streams	BSM-strategic
50	Stace, D. and Dunphy, D. 1994, Beyond the boundaries: leading and re-creating the successful enterprise	
51	Stacey, R. et al. 2000, Complexity and management: fad o radical challenge to system thinking?	
52	Stajda, E. and Singhal, S. 2012, Engineering Change Management Overview and best Practices	BSM-strategic
53	Taskani, L.T. 2003, Measuring change management in manufacturing processes: a measurement method for simulation-game-based process development	
54	Thomas, S. 2006, Change management for Maintenance and Reliability professionals	BSM-strategic and tactical
55	Trkman P., Critical success factors of business process management	BSM-strategic (partially also) tactical and operative
56	Wadden, D. and Sohal, A.D. 1998, Resistance. A constructive tool for change management	BSM-strategic

5. INDUSTRIAL FEEDBACK ON THE REVISED APPROACHES

MSEE end-users (Bivolino, Ibarmia, Indesit, TP-Vision) have been addressed as representatives of different sector and different way to operate in the market and cope with service issues. They were asked to provide a feedback with respect to the research analysis previously reported. Their feedback has twofold purposes: 1) check which is the industrial status of practices, 2) check suitability of scientific approach so far proposed for practical applicability in industry.

The feedback is related to the evaluation of issues presented in the first release of the Deliverable. The feedback collected is the following:

- None of the MSEE end-users have previous experience on maturity models, nor knowledge on the main maturity models revised, even the ones very focuses on service management. This reveal the usefulness of the research on this topic, in order to introduce a tool that, as shown by scientific state of the art analysis, is well appreciated and used in research community
- End-users understand the value of the approach, even if they presently are looking forward to see the final results it can give (results on maturity assessement and consequent change management can be seen anyway in the medium-long term). Indesit and TP-Vision were the ones that have showed the larger interest in the approach and then they were mainly involved in the testing phase of the MSEE maturity model.
- End-user revealed their interest in an approach that allow to pass from the maturity assessment to the change management part, revealing the interest on the change management aspects. This will be specifically addressed by D24.2 (M18)
- Interest on change management approaches is also due to the fact that three end-users out of four does not adopt any specific change management approach. The only one partially declaring the use of certain approaches in the scope of MSEE topics is Bivolino, that anyway adopts them mainly for pure IT related changes.

Feedback have been also asked to the MSEE end-users on which are the influential factors to be considered when dealing with change management.

The following is the list of influential factors that have been collected, starting from a list of issues that were been presented to the end-users through the first release of the deliverable:

- Market constraints
- Strategy and Organization
- Type of change

Market constraints: from a marketing point of view, Williams (1982) discusses how introducing a product to a marketplace at the wrong time would result in a disaster for the organization. Furthermore, he states that attitude is one of the critical factors that must be taken into account when timing the introduction of a product and this can be also extended to the service. Weisbord (1988) has argued that in markets where the rate of change is in a state of perpetual transition rather than quasi-stationary equilibrium, the concept of refreezing is inappropriate and in this respect the Lewin's model could be considered dated. Similarly, innovations generate new knowledge, access to new markets, and increased customer

awareness, all of which enhance the existing product (Leonard-Barton 1992, Gibson and Birkinshaw 2004).
The innovation may be targeted to existing customers, new customers in defined markets (Abernathy and Clark 1985), or emerging markets (Christensen 1997).

Strategy and Organization: issues related with strategy and organizational aspects are also important for the change management, because they are related with aspects internal to the companies. Under the influence of technology trends, the most important information and communication technologies (ICTs), many current models of business organization (BMS) are called into question, and companies are facing the challenge of change. However, the creation of a radically new business model is a high risk strategy, and the probability that it is right is very low (Kalakota and Robinson, 2001). Companies typically choose to focus on a less risky strategy of improving, extending or renewing their strategy and business model. Organizations face many challenges from a strategic perspective: this is due to, for example, the lack of competition, entry of new operators on the market or long-term changes in the specific sector in which the company operates (Balogun & Jenkins, 2003). These changes are typically made through reengineering, restructuring, and mergers and acquisitions of other companies (Raineri, 2011). Organizational development, on the other hand, concerns the transition from a situation of the organization which is considered unsatisfactory to another which is better. Organizational development is a continuous process of change aimed at solving the internal problems of an organization through effective diagnosis and management of organizational culture. Without carefully considering this fundamental level, the roots of change will never take the foot and the long-term success will be unlikely (Thomas 2006).

Type of change: change can also be understood in relation to its extent and scope. Ackerman (1997) has distinguished between three types of change: developmental, transitional and transformational. Developmental change may be either planned or emergent; it is first order, or incremental. It is change that enhances or corrects existing aspects of an organization, often focusing on the improvement of a skill or process. Transitional change is punctual change from an actual state to a known state. Indeed, the concept of transitional change is widely used in organizational change literature (e.g. Kanter, 1983; Beckhard and Harris, 1987; Nadler and Tushman, 1989). Transformational change is radical or second order in nature. It requires a shift in assumptions made by the organization and its members. Transformation can result in an organization that differs significantly in terms of structure, processes, culture and strategy. It may, therefore, result in the creation of an organization that operates in developmental mode – one that continuously learns, adapts and improves.

6. Definition of the approach for change management (integrated with the MSEE maturity model)

6.1 Introduction to the approach for change management for MSEE project

The MSEE change management approach will be based on a maturity model specifically developed in the project (MSEE maturity model) and detailed in next section 6.2. The overall change management approach is based on the idea, coming from the literature analysed and presented in section 4 that it must:

1) map the processes that a company and its ecosystem are currently running, with specific concern to innovation processes and capability to manage correctly services along their lifecycle.
2) identify the target objective of the organization.
3) guide along the path (direction identified by the definition of the target objective), identifying weak processes to be improved and
4) guide along the path selecting appropriate tools and methods to be applied to improve the identified weak processes.

In this deliverable the research results achieved to satisfy the first 3 point above mentioned are presented within the present section 6, as part of the MSEE maturity model. In Appendix 3 example of use of this approach is presented.

The last point 4, above mentioned, will be further investigated, considering the state of the art of change management approaches discussed in previous section 4. The complete change management approach, thus including issues mentioned in the above point 4, will be presented in next deliverables of WP24. MSEE maturity model will be also constantly refined, till the end of WP24 research activity, according to the need of tailoring it as main part of the MSEE change management approach, also considering possible need of MSEE end-users.

6.2 MSEE Maturity Model

After analyzing existing literature methods, MSEE maturity model has been defined in order to face the scope of investigation of MSEE project. Existing model and actual state of the art on maturity assessment have been strongly considered in order to capture the main advantages of the available scientific material and create a model aligned with the current scientific state of the art.
The following conclusions were achieved, with related **decisions taken**:

- The analysis identified the most interesting maturity models and we achieve the awareness that CMMI approach seems one of the most suitable solution on which basing maturity model. Thus, **MSEE maturity model is based on CMMI approach**.
- Existing maturity models focus on servitization, but does not consider the ecosystem point of view. A more complete space of analysis should be then identified. This prevents to identify a unique maturity index. Instead, this suggests to look for a maturity assessment segmented through a multi-index profile. **Four maturity indexes**

have been identified and developed with proper metrics. They will be explained in the next section.

- Because Maturity models have been recognized to be not so well known in industrial context, it has been decided to complete the MSEE maturity model, considering also a graphical representation that should allow also a user-friendly possibility to understand the maturity assessment deriving from the use of the model. To this end, **the four indexes have been considered to be used as couple of coordinates to be graphically represented on two x-y graphs: they are defined as Maturity Maps.** They are detailed in next section.
- In order to collect the information to build the four indexes above mentioned, a questionnaire was developed, divided in 4 sections and with questions structured according to CMMI principles. Structure of the questionnaire is totally inspired by CMMI approach, while content of the questions derive from an opportune mix of sources. Inspiration for the development of the questions comes from CMMI-SVC (see Appendix 1 for details) and Innoscore (see Appendix 2 for details). Then specific ideas have been derived from the research carried out in WP14, WP21 and WP25 of MSEE project. The results is a maturity model compliant with the research objective of MSEE project. The questionnaire is the practical tool that allow the implementation of the MSEE maturity model and represent as well an original results, encompassing different issues in the scope of Innovation, Service Lifecycle management and collaboration in Ecosystem.

6.2.1 THE MATURITY INDEXES

The first step to develop a maturity metrics, according to CMMI-based approach, is the definition of the processes of interest. Specifically, process areas (PAs) must be identified.
The maturity assessment will be then based on the assessment of maturity of the single PAs. Appropriate combination of the maturity in different PAs can describe maturity on a larger scope. Definition of different indexes deriving from the combination of the maturity in different PAs allow then also to define a maturity profile that can be very useful as picture resulting from the maturity assessment that is done.
First of all, in order to identify the complete maturity profile that MSEE maturity model can provide, four indexes have been defined. They are:

A) **Service Lifecycle Management Maturity Index (SLM-MI):** index measuring the maturity level of service lifecycle management processes, defining the capability of a single company to manage such processes.
B) **Capability to Enter an Ecosystem Maturity Index (CEE–MI):** index measuring the level of collaboration processes with a network, defining the capability of a single company in living and operating within an ecosystem and specifically the capability of such company to enter an ecosystem.
C) **Innovation of the Ecosystem Maturity Index (IE-MI):** index measuring the level of maturity of innovation processes of the ecosystem, defining the capability of the ecosystem to manage the processes that allow the proper development of innovation.
D) **Capability to Create a VME Maturity Index (CCV–MI):** index measuring the level of maturity of collaboration processes within an ecosystem, defining the capability of

an ecosystem in operating with proper collaboration and governance and thus enabling the creation of a VME (Virtual Manufacturing Enterprise).

Each of the four above mentioned indexes is obtained grouping the maturity level of appropriate PAs, identified considering the main processes related with that maturity.

For index SLM-MI, the following process areas have been considered as representative of Service Lifecycle Management processes:

- Service Ideation
- Requirement Analysis
- Service Design
- Service Test
- Service Implementation
- Service Operation – that indeed considers the sub-PAs: Service Marketing, Service Sales, Service Delivery, Service Control, Service Re-Design/Dismissing

For index CEE-MI, the following PAs have been considered:

- Alignment of Goals
- Collaboration within an Ecosystem - that indeed considers the sub-PAs:, Management of trust and liability, Resource (Asset) allocation, Coordination and Integration

For index IE-MI, the following PAs have been considered:

- Provision of Conditions for Innovation
- Ideation – that indeed considers the sub-PAs: Recognition of opportunities, Idea generation, Idea assessment, Idea selection

For index CCV-MI, the following PAs have been considered:

- Common Strategy Development
- Ecosystem Governance and Decision Making
- Communication Collaboration and Trust
- Balance of the Ecosystem
- Operation and Management

Each PAs is evaluated with a maturity score. The combination of the score in the PAs give the maturity indexes above defined.
When applicable, PAs are assessed from different point of view of the process (strategic, tactic, operational).
This allows also to provide a maturity score, resulting in other sub-indexes. For instance, Index SLM-MI, above defined, can be segmented in SLM-strategic-MI, SLM–tactical-MI, SLM-operational-MI. SLM-strategic-MI is, for instance, defined as mean of the maturity level of all the PAs linked to SLM-MI and related to strategic level. This could be later on exploited when it is worth to define the level (strategic, operational, tactical) of certain type of processes that must be improved.
It is thus possible to create a maturity profile as combination of high level indexes (SLM-MI, CEE-MI, IE-MI, CCV-MI), completing the profile with specific maturity assessment of PAs and providing also evidences of the maturity segmented for strategic, operational and tactical

level. In Appendix 3 examples of report of maturity assessment through such indexes is provided.

The mentioned PAs have been revised among research partners, also considering alignment with WP14, WP21 and WP25 research activity. Moreover End-users have been consulted in order to get their feedback on the selected processes. The following are the results obtained from the MSEE end-users (TP Vision, Indesit, Ibarmia, Bivolino) on the four questions (each one related to one of the identified maturity index). Partners are indicated not explicitly with their name because of the public dissemination nature of this document D24.1 and the type of information included in the tables, deemed as confidential by some partners).

1) How much the following processes are important for your business?

Legenda:

Very important	Important	Important but we do not consider it in a complete way	Not important

	End-user A	End-user B	End-user C	End-user D
Service Ideation	Very important	Very important	Important but we do not consider it in a complete way	Important
Requirement Analysis	Very important	Important	Very important	Important but we do not consider it in a complete way
Service Design	Very important	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way
Service Test	Very important	Important	Important	Important but we do not consider it in a complete way
Service Implementation	Very important	Important but we do not consider it in a complete way	Very important	Important but we do not consider it in a complete way
Service Operation (marketing / sales, delivery, control, redesign/dismiss)	Very important	Important but we do not consider it in a complete way	Very important	Important

2) How much the following processes are important for your business related with the collaboration with your ecosystem?

	End-user A	End-user B	End-user C	End-user D
Alignment of Goals (Definition and alignment of common goals of the ecosystem)	Very important	Very important	Very important	Important
Exchange and share of information	Important but we do not consider it in a complete way	Important	Very important	Important but we do not consider it in a complete way
Share tangible assets (equipment/machines needed for the ecosystem business)	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way
Management of trust and liability	Important but we do not consider it in a complete way	Important	Important	Important but we do not consider it in a complete way
Management of external collaboration (out of the defined Ecosystem)	Important	Important	Important	Important but we do not consider it in a complete way

3) How much processes of the ecosystem (that your company drives) related to the creation of innovation are important?

	End-user A	End-user B	End-user C	End-user D
Provision of conditions for innovation (gaining insight to market/customer, example: market analysis and market opportunity evaluation)	Very important	Very important	Important	Important but we do not consider it in a complete way
Recognition of opportunities	Very important	Important	Important	Important but we do not consider it in a complete way
Idea generation (development of new idea) – considering a process done at ecosystem level and not only within your company	Important	Very important	Important	Important
idea assessment (evaluation of feasibility and value of the idea emerging by the ecosystem) – considering a process done at ecosystem level and not only within your company	Important	Important	Important	Important but we do not consider it in a complete way
idea selection (identification of the idea to bring on the market by the ecosystem	Very important	Important	Important	Important but we do not consider it in a complete way

4) How much processes of the ecosystem (that your company drives) related to collaboration, coordination and governance of the ecosystem are important?

	End-user A	End-user B	End-user C	End-user D
Common strategy development (for collaboration in the ecosystem)	Important but we do not consider it in a complete way	Very important	Important	Important
Ecosystem governance and decision making	Very important	Very important	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way
Communication, Collaboration and Trust	Important	Important	Important	Important
Process of balancing resources allocated and revenues within the ecosystem	Very important	Important	Important	Important but we do not consider it in a complete way
Operation and Management	Important	Important	Important but we do not consider it in a complete way	Important but we do not consider it in a complete way

6.2.2 THE MATURITY MAPS

MSEE maturity model is completed by a graphical representation that should allow also a user-friendly possibility to understand the maturity assessment deriving from the maturity profile given by the previously mentioned indexes. To this end, the four indexes have been considered to be used as couple of coordinates to be graphically represented on two x-y graphs: they are defined as Maturity Maps.

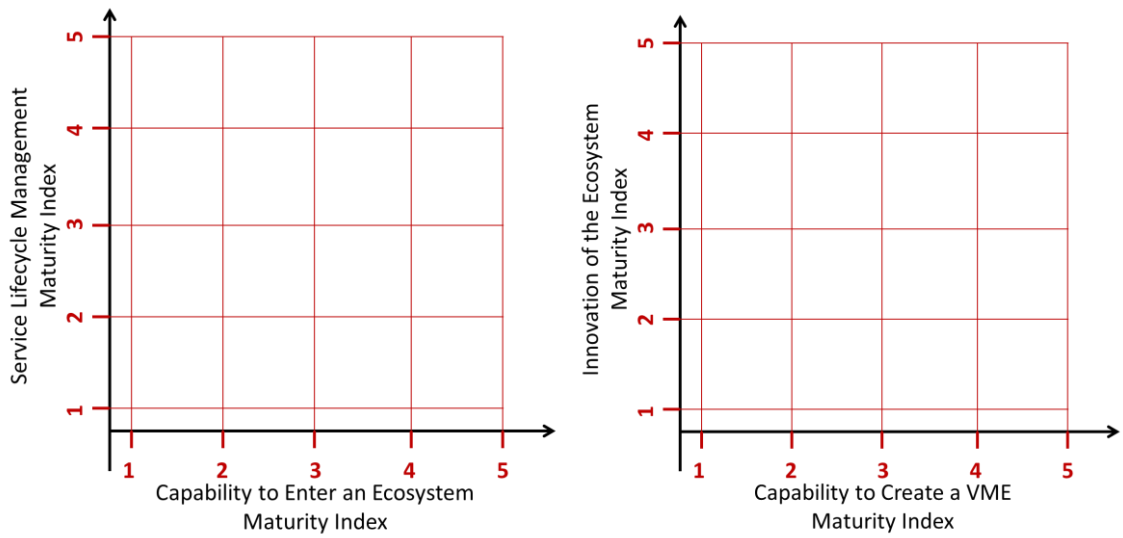

Figure 3 - Maturity Maps: on the left Maturity Map SLM-CEE, on the right Maturity Map IE – CCV

Maturity Map SLM-CEE is built considering SLM and CEE maturity indexes. This map express the capability of a company to carry out processes related with service lifecycle management while coping with collaboration activities within an ecosystem. It highlights how mature a company is in service lifecycle processes and how it is mature to enter en ecosystem, namely to contribute to create an ecosystem fostering servitization approaches.

Once understood the position on this map, it is possible for a company to highlight its direction for its future strategies.

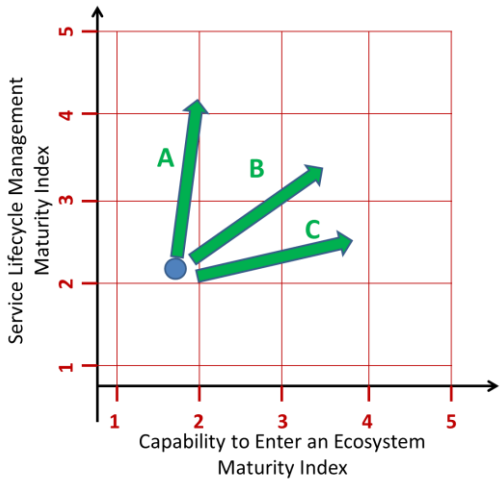

Figure 4 Strategic direction of maturity improvement highlighted on the Maturity Map SLM-CEE

As depicted in Figure 4, the maps allow to support the definition of strategic direction of maturity improvement. It thus acts as useful tool for interactions with company to understand on which processes the focus must be pointed out. In Figure 4, Arrow A highlights that the company will need an improvement in Service Lifecycle Management. This will later allow to understand the right change direction to adopt, e.g. following suggestions provided by MSEE Frameworks and Tools, e.g. some useful tools come from WP14 of MSEE project. Arrow C highlights that the company will need an improvement in the processes related with the capability of collaborating in a network, thus enabling its entering in an ecosystem. Arrow B represents a direction that need improvement on processes of both the type previously mentioned. This will then point to a more articulate change.

Maturity Map IE-CCV is built considering IE and CCV maturity indexes. This map expresses the capability of an ecosystem to carry out innovation processes while fostering collaboration activities in order to create a VME. It highlights how mature an ecosystem is in processes to create innovation and to create a VME, thus enabling to understand when an ecosystem is ready to develop innovation and market it through a VME perspective.

Once understood the position on this map, it is possible for an ecosystem (namely it is possible for the driver company that is using the map) to highlight its direction for its future strategies.

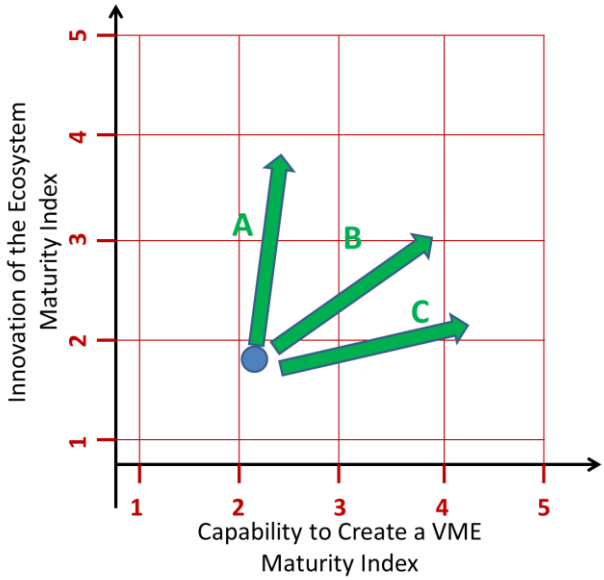

Figure 5 Strategic direction of maturity improvement highlighted on the Maturity Map IE-CCV

As depicted in Figure 5, the maps allow to support the definition of strategic direction of maturity improvement. It thus acts as useful tool for interactions with the company driving the ecosystem to understand on which processes the focus must be pointed out. In Figure 5, Arrow A highlights that the ecosystem will need an improvement in Innovation processes. This will later allow to understand the right change direction to adopt, e.g. following suggestions provided by MSEE Frameworks and Tools, e.g. the ones developed in WP21. Arrow C highlights that the ecosystem will need an improvement in the processes related with the capability of governance of the ecosystem, thus enabling the creation of a VME. This will later allow to understand the right change direction to adopt, e.g. following suggestions provided by MSEE Frameworks and Tools, e.g. the ones developed in WP25. Arrow B represents a direction that need improvement on processes of both the type previously mentioned. This will then point to a more articulate change.

6.2.3 THE QUESTIONNAIRE

In order to get the information to retrieve the maturity indexes related to each PAs, a questionnaire has been developed. The last version of the questionnaire is attached in Appendix 4. It is deemed that before ending of WP24 research activity the questionnaire may go under refinement and slight revision in order to fine tune the entire maturity assessment and get a proper alignment with the comprehensive MSEE change management approach.
The questionnaire is structured in sections.

- First section is related with general information about the services provided by the company and the type of business (questions from 1 to 6).
  It is considered that the questionnaire is filled in by one representative of a company, e.g. the service manager. She/He can also answers, on behalf of the ecosystem, the

questions requiring information on the MSE, if she/he is representative of the company driving the ecosystem.

Then each section of the questionnaire is related to the information needed to build the above mentioned indexes:

- Section A → SLM-MI (questions from 7 to 44)
- Section B → CEE–MI (questions from 45 to 56)
- Section C → IE-MI (questions from 57 to 64)
- Section D → CCV–MI (questions from 65 to 80)

Different number of questions depend on the details that must be addressed in order to provide a complete maturity assessment for the related index. Because maturity profile is provided with the four indexes separately and according to the way of presenting the maturity maps (as previously presented) the different number of questions in the section does not affect the overall results.
The number of questions have been considered in order to keep the questionnaire enough long to be considered a reliable tool for assessment, but short enough to allow a quick understanding of the analysed practices.

The questionnaire has been developed according to the following steps:

- Once identified the more suitable maturity assessment approach for MSEE research scope, a first draft version of the questionnaire was developed and circulated to the four end user, with the main aim to test with them the applicability of such approach to industry.
- Results collected by this first version of the questionnaire were not the main information at that stage of development. The feedbacks received from the end-users on the questionnaire itself were instead considered (understandability of the questions, length of the questionnaire, terminology used).
- Then a first release of the questionnaire (in the form very similar to the actual version) was prepared and delivered to Indesit and TP-vision to get from them a more detailed feedback and to start depicting their maturity profile.
- In parallel this first release was also circulate among the research partners of MSEE consortium with the aim to further refine and align the questionnaire to the ongoing research activity, mainly with the activity ongoing in WP21, WP25 and WP14.
- Second issue (the actual version) of the questionnaire was then prepared according to the feedbacks received from the above mentioned partners.
- Actual version of the questionnaire is the one that allowed to prepare the results presented in Appendix 3.
- Future revisions of the questionnaire are considered in order to fine tune the MSEE maturity model.

6.3 HOW TO USE THE PROPOSED APPROACH IN A PRACTICAL WAY (INTRODUCTION TO THE WIZARD)

As highlighted in D26.1 the MSEE Maturity Model will be implemented through a Wizard within the Innovation Ecosystem Platform.
The questionnaire introduced in the previous section will be transformed into an online questionnaire, while the indexes previously mentioned will be visualized within the Wizard in order to present the Maturity assessment as results of the filling of the questionnaire. Maturity Maps previously described will be also shown.
Then, on the basis of the Maturity assessment the user of the Wizard will be able to highlight on the Maturity Maps his perspective on the point of the maps he is willing to reach, thus defining her/his target objective. Based on this declaration the wizard will guide the user to identify the critical Process Areas that are presently the weakest and could be improved. PAs with lower maturity level will be highlighted. The user then decide which processed she/he is willing to improve. Then the Wizard points to the right research result of MSEE (Framework or Tools) in order to finally guide the user to select the best mean to actuate the change she/he needs to reach the situation declared through the position on the maturity maps.

7 Conclusions and Next Steps

This document provided state of the art analysis related with maturity models and change management approaches. Punctually the results achieved are:

- Awareness that literature is plenty of interesting maturity assessment approaches, thus revealing that a completely new maturity approach is not suitable to be developed, but proper development should start from interesting ideas elaborated in existing approaches.
- Awareness on the complexity of change management approaches and not availability in literature of precise models to be considered as background for MSEE project and thus need to specify an MSEE change management approach, integrating the MSEE maturity model as main part.
- Definition and presentation of the MSEE maturity model as integrated part of the MSEE change management approach .
- Application of the approach with MSEE end-users as first test (Appendix 3)

Future works in the scope of WP24 will consider:

- Definition of issues to be considered by the change management approach as important variable to be analysed and as important item to be addressed to allow maturity improvement, this will be detailed in D24.2 that will express the requirements for the change management approach.
- Definition of the complete MSEE change management approach, this will be detailed in D24.3, following the indication provided D24.2 and adding also the information coming from end-users experience done during MSEE project activity.
- Definition of specific pre-elaborated path for the evolution in the two-dimensional spaces defined by the Maturity Maps. Paths for the evolution that will be considered will refer to the cases of the companies involved in the project as end users (Indesit, Bivolino, TP-Vision, Ibarmia). This allows to consolidate a methodology to support also later use of MSEE results by other companies.

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APPENDIX 1

Proposal 1

<table>
<tr><td>Name of the model</td><td colspan="6">CMMI for Services (CMMI-SVC)</td></tr>
<tr><td>Type of model</td><td colspan="6">CMMI-based</td></tr>
<tr><td>General Description</td><td colspan="6">This model, called CMMI for Services (CMMI-SVC), provides a comprehensive set of guidelines to provide quality services to customers and end users and to apply CMMI best practices in a service system.
The CMMI-SVC provides a set of best practices for the provision of services and contains 24 process areas and in particular 7 are process areas specific to the services. These are:
1. Availability Management and Capacity (CAM)
2. Service continuity (SC)
3. Service Delivery (SD)
4. Incident resolution and prevention (IRP)
5. Service transition (SST)
6. Development of service system (SSD)
7. Strategy Management Service (MSDS)
The other process areas should be considered to achieve business performance satisfactory from all points of view (managerial, executive, operational, etc ...). These areas are: Configuration Management (CM), Analysis of the causes and resolution (CAR), decision analysis and resolution (DAR) Integrated management of labor (IWM), Measurement and Analysis (MA) Definition of the organizational process (OPD) Focus on organizational process (OPF), organizational performance Management (OPM), performance of the organizational process (OPP) organizational Training (OT), quality assurance of process and product (PPQA) quantitative management of work (QWM), Management requirements (REQM) risk Management (RSKM), supplier relationship management (SAM), monitoring and control of work (WMC) work planning (WP).</td></tr>
<tr><td>Peculiarity of the model</td><td colspan="6">CMMI-SVC provides a robust background to make maturity assessment related to services (management, delivery, other overall processes).</td></tr>
<tr><td>Important issues for MSEE project</td><td colspan="6">Due to the level of details provided by CMMI-SVC, it is worth keeping it as a kind of reference. Nevertheless CMMI-SVC complexity and definition with a somehow peculiar point of view, prevents to use it as a unique standard and suggest to further investigate on different CMMI (and not CMMI) based approaches.</td></tr>
<tr><td rowspan="2">Features</td><td>Simplicity</td><td>Objectivity</td><td>Flexibility</td><td>Adaptability</td><td>Capability</td></tr>
<tr><td>Low</td><td>High</td><td>Medium</td><td>Medium</td><td>Medium</td></tr>
<tr><td rowspan="2">Classification (BSM, TIM, TSM)</td><td colspan="2">BSM</td><td colspan="2">TIM</td><td>TSM</td></tr>
<tr><td colspan="2">√</td><td colspan="2">√</td><td></td></tr>
<tr><td rowspan="2">Classification (Strategic level, Tactical Level, Operational level)</td><td>Strategic level</td><td>Tactical level</td><td>Operational level</td><td colspan="2">Not Applicable</td><td>Not Applicable</td></tr>
<tr><td>√</td><td>√</td><td>√</td><td colspan="2"></td><td></td></tr>
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Proposal 2

<table>
<tr><td>Name of the model</td><td colspan="5">Customer Relationship Management Maturity Model (CRM3)</td></tr>
<tr><td>Type of model</td><td colspan="5">CMMI-based</td></tr>
<tr><td>General Description</td><td colspan="5">The Customer Relationship Management Maturity Model (CRM3), presented by Babak Sohrabi, Mohammad Haghighi, Amir Khanlari (2010), represents a recent implementation of an existing maturity model created by Gamm in 2005.
The maturity structure of this model is based on three dimensions: Critical Success Factors (CSFs), Stage of maturity, Evaluation Phase.
The categorization of CSF allowed to design different levels of maturity for the implementation of customer relationship management (CRM): these layers contain different CSF. Organizations must address each factor in order to reach a certain level of maturity. The CMMI approach adopted in this proposal consider 22 process areas (PA) and the six levels of maturity (i.e. the CMMI levels plus a level 0).
The various factors are assigned to maturity levels based on a statistical approach that represents a detail with respect to the conceptualization of the proposal that is highlighted in this section.</td></tr>
<tr><td>Peculiarity of the model</td><td colspan="5">The maturity levels are related with CMMI definitions, but they have been slightly personalized for this model proposal, including also a level 0, allowing better specifying lower levels of maturity. They are the following:
0) In Level 0 (starting level) the process of implementation of CRM is chaotic, and few processes are defined.
1) Level 1 considers the "awareness factor" as fundamental to the implementation of CRM: This level considers the strategy and cultural factors.
2) The level 2 (level management) considers the factors of change management.
3) In level 3 (level set) of the CRM implementation is documented, standardized and integrated into a standard process for organizations.
4) In level 4 (level quantitative management) process and CRM activities are controlled and managed based on quantitative models and tools.
5) In level 5 (optimized level) facilities for continuous improvement are established and factors related to the 'Information Technology (IT) and Knowledge Management (KM) are addressed.</td></tr>
<tr><td>Important issues for MSEE project</td><td colspan="5">The model is interesting because rather than PAs the focus is on CSFs and to this end, the factors that are considered are the following: Strategy, Cultures, Change Management, Process, People, Measurement, Technology, Knowledge Management.</td></tr>
<tr><td rowspan="2">Features</td><td>Simplicity</td><td>Objectivity</td><td>Flexibility</td><td>Adaptability</td><td>Capability</td></tr>
<tr><td>Medium</td><td>High</td><td>Medium</td><td>High</td><td>High</td></tr>
<tr><td rowspan="2">Classification (BSM, TIM, TSM)</td><td colspan="3">BSM</td><td>TIM</td><td>TSM</td></tr>
<tr><td colspan="3">√</td><td>√</td><td>√</td></tr>
<tr><td rowspan="2">Classification (Strategic level, Tactical Level, Operational level)</td><td>Strategic level</td><td>Tactical level</td><td>Operational level</td><td rowspan="2">Not Applicable</td><td rowspan="2">Not Applicable</td></tr>
<tr><td>√</td><td>√</td><td>√</td></tr>
</table>

Proposal 3

Name of the model	New service development (NSD)
Type of model	CMMI-based
General Description	New service development (NSD) is a model for the evaluation of the processes of the manufacturing companies to support product-service development (Fitzsimmons & Fitzsimmons, 2000). Proposing this approach, the authors attempted to overcome the limitation of some models already developed, too far to be used in operational advice and support companies. Indeed the way to overcome these problems should not be related to the proposal of new approaches, otherwise multiplication of approaches will happen. Each approach, indeed, will have different limitations. To overcome the mentioned limitations, a model, tailored on the specific needs of their research is proposed. The result is an interesting process of the overall development of a service, divided into six main phases (Burger, Kim, Meiren (2010)): • Phase I: brainstorming and idea evaluation (Idea Management), • Phase II: requirements gathering and analysis, • Phase III: conceptual development and service design, • Phase IV: testing, • Phase V: implementation, • Phase VI: the launch & roll-out. Phase I - The first step in the process of development of the service includes brainstorming and idea evaluation. The process begins with a collection of ideas for new services. The concepts are developed into preliminary ideas for appropriate services. Phase II - The second phase, requirements analysis, triggers the beginning of effective development of the project. The requirements from the point of view of the stakeholders are recorded and compared. Phase III - The third phase is the conceptualization. The concept development encompasses: the definition of the service (Scope of services, technical description), the organizational concept (processes, roles and resources, concept formation) and the concept of marketing (product policy, pricing policy, politics promotion). Phase IV - The concept, after being developed, must be tested. Phase V - The testing phase is followed by the implementation phase, namely, the conceptualization and testing work carried out in an earlier stage are translated into business practices. Phase VI - being launched on the market for new services includes mainly the external and internal communication and information measures. To successfully develop and design a service, a service or a product-PSS, it is important to follow a formal approach, a structured and systematic, using patterns, methods and tools. For example, the process model NSD described above is composed of six structured phases. The maturity of an organization is linked to the NSD process capability to start, assign, plan, execute, monitor and review the objectives of the project. The NSD will vary from organization's maturity in lower stages (processes chaotic and uncoordinated, low availability of resources and tools, lack of involvement of stakeholders), with higher stages (systematic and well structured processes supported by dedicated tools and resources, the involvement of customers and suppliers, etc.), according to definitions similar and related to CMMI approach levels of maturity. In each phase, the NSD process maturity in an organization can be described as follows, revealing the strong link with the CMMI levels: Maturity Level 1: initial state, Maturity Level 2: Repeatable, Maturity Level 3: Defined, Maturity Level 4: Managed, Maturity Level 5: Optimized
Peculiarity of the model	Combination of characteristic elements of each phase and maturity levels allow to assess the maturity of an organization for each key element of the NSD process.
Important issues for MSEE project	//

Features	**Simplicity**	**Objectivity**	**Flexibility**	**Adaptability**	**Capability**
	Medium	High	Medium	High	High

Classification (BSM, TIM, TSM)	**BSM**	**TIM**	**TSM**
	√	√	

Classification (Strategic level, Tactical Level, Operational level)	**Strategic level**	**Tactical level**	**Operational level**	**Not Applicable**	**Not Applicable**
	√				

Proposal 4

Name of the model	Professional Service Maturity Model
Type of model	CMMI-based
General Description	The SPI Research presented the Professional Service Maturity Model, designed to help the so called PSO (Professional Service Organization) to assess and understand their service performance. It provides visibility of critical business processes and performance measures, so that organizations can diagnose and improve their performance. The model provides prescriptive advice, so that organizations can identify their current level of maturity and see the steps needed to move to the next level. SPI Research has developed a model to analyze and segment the PSO in five distinct areas of performance. These five elements are called Service Performance Pillars, as they form the foundation for all professional services organizations. As structure of the model, pillars have some analogy with the Critical Success Factors identified by CRM3 model, previously mentioned. The five pillars are: 1. **Leadership**: is a unique vision of the future and the role that service organizations have in shaping it. A clear and compelling strategy provides a benchmark for the organization and galvanizes action. The objectives of the organization and performance may vary depending on the service strategy used, if it is based on primarily support the sale of products, on increased revenue by service or profit. 2. **Finance and Operations:** represents the ability to manage profits and losses arising from the services and generate revenues and profits, developing repeatable operational processes. 3. **Human Capital Alignment:** is the ability to attract, recruit, retain and motivate a team of high-quality advice. Human capital is the essence, the image and reputation of the company. 4. **Execution Service:** are the methods, processes and tools to effectively plan, implement and measure the quality of the service delivery process. The execution of the service involves a number of factors. Indeed, this pillar encompasses many processes, including: resource management, planning and quality control, knowledge management and development of tools and methodologies. 5. **Relationships with customers (marketing and sales):** is the ability to communicate effectively with employees, partners and customers to create, win and close business deals. Effective management of customers leads to improved relationships to better understand customer needs. The model is based on the Capability Maturity Model (CMM). The main features for each level are: Level 1 - Initial "Heroic": At the first level of maturity, the processes are fluid and ad hoc. The business environment is chaotic and opportunistic, and the focus of a PSO is mainly on acquiring new customers and creating new contacts and references. The success depends on the competence and heroics of the people within the organization and not by the use of processes, methods or tools. The practices and procedures are informal and the quality is based on individual experience and aptitude. Level 2 - Flown "Functional Excellence": The second maturity level processes start to become repeatable. The processes are carried out in different functional or geographic areas, but are not yet documented and coded for the entire organization. The basic processes are established for the five pillars, but they are not yet universally accepted. Operational excellence and improved processes can be identified within functions, but not across different functions. Level 3 - Deployed "Project Excellence" at maturity level 3, the PSO has created a set of standard processes and principles of operation for all the main pillars of service performance, although some processes may be omitted. At this level of project delivery methods and quality control are applied throughout the organization. Level 4 - Institutionalised "Portfolio Excellence" at maturity level 4: the management uses precise measurements, metrics and controls to effectively manage the PSO. Each service performance pillar contains a detailed set of operating principles, tools and measures. The organization of this level set quantitative and qualitative targets for customer acquisition, retention and penetration, as well as a complete set of financial and operational controls and quality measures. Level 5 - Optimized "Collaborative" to the maturity level 5 leaders are focused on continuous improvement of all elements of the five pillars of performance. A controlled process is used to measure and optimize performance gains through technological improvements and innovations. They have defined goals of the organization's improvement process.
Peculiarity of the model	//
Important issues for MSEE project	Interesting issue pointed out by this proposal is the possibility to develop a Roadmap for service excellence. This issue will be further analysed in another section of this document, related to change management where issues related to roadmapping approach will be provided.

Features	**Simplicity**	**Objectivity**	**Flexibility**	**Adaptability**	**Capability**
	Medium	High	Medium	High	High

Classification (BSM, TIM, TSM)	**BSM**	**TIM**	**TSM**
	√	√	

Classification (Strategic level, Tactical Level, Operational level)	**Strategic level**	**Tactical level**	**Operational level**	**Not Applicable**	**Not Applicable**
	√				

APPENDIX 2

Proposal 5

Name of the model	PACE (Pressure, Action, Capabilities, Enablers) model									
Type of model	Not CMMI-based									
General Description	The Aberdeen Group published in 2007 one framework of strategies for best-in-class approaches: in the report, PACE (Pressure, Action, Capabilities, Enablers) model is proposed. The model allows to consider a framework as a reference point. In this way, a company can compare its situation with such framework, detailing the pressure information from companies considered as "best in class". The PACE framework, which considers some general issues can be reviewed and applied to the provision of services. In this sense, the analysis developed in the MSEE project allows to provide the following interpretation: • **Pressures:** The pressures come from customer requests and their service expectations. • **Actions:** The actions include accuracy and consistency across all channels, monitoring, feedback and greater access to information through better integration of data. These actions can lead to a reduction in the time management of customer contacts. • **Capabilities:** skills to provide the best possible customer service. Among the other, there are the ability to capture, store and provide feedback data in real time. • **Enablers:** they are often of technical nature, and those tools are used to support the customer and optimize the service. PACE framework does not define maturity levels, like the CMMI-based maturity models, but depicts three different maturity classes: Best-in-Class companies, Industry Average companies and Laggard organizations. The main idea is that, depending on the maturity class and the pressures to which it is subjected, a company can focus on specific targets for improving their business.									
Peculiarity of the model	PACE can be classified as a dynamic model: the framework not only provides a score, but suggests an evolution and it can be further developed to focus on possible future improvements regarding the provision of services.									
Important issues for MSEE project	//									
Features	**Simplicity**		**Objectivity**		**Flexibility**		**Adaptability**		**Capability**	
	High		Low		Medium		Low		High	
Classification (BSM, TIM, TSM)	**BSM**						**TIM**		**TSM**	
	√						√			
Classification (Strategic level, Tactical Level, Operational level)	**Strategic level**		**Tactical level**		**Operational level**		**Not Applicable**		**Not Applicable**	
	√		√							

Proposal 6

<table>
<tr><td>Name of the model</td><td colspan="5">The IT Service Management (ITSM)</td></tr>
<tr><td>Type of model</td><td colspan="5">Not CMMI-based</td></tr>
<tr><td>General Description</td><td colspan="5">The Information Technology Infrastructure Library (ITIL) is a set of guidelines inspired by the practice in IT Service Management (IT Service Management). ITIL is published in a series of books that follow an approach based on the life cycle of the service. Although it was developed in the eighties, ITIL was not widely adopted until the mid-nineties. This wider adoption and awareness has led to the issuance of standards support, including ISO / IEC 20000 (formerly British Standards | BS 15000), international standard that covers many of the elements of ITIL for IT service management.
The IT Service Management (ITSM) is a concept is related but not equivalent to ITIL. ITIL contains a section specifically dedicated to "'IT Service Management": the combination of books on Service Support and Service Delivery which is a specific example of a framework ITSM. ITIL (v3 – June 2007) is composed of five main texts, named: Service Strategy, Service Design, Service Transition, Service Operation, Continual Service Improvement. The basic processes and their sub-processes are:
1) Service Strategy: focuses on helping IT organizations improve and develop long-term is based largely on a market-oriented approach. Key topics covered include the definition of the service, the business-case development, service activities, market analysis, types of service providers.
2) Design Service: provides guidance for the design of IT services, processes, and other aspects of service management. The design within ITIL is understood as the understanding of all relevant service delivery technology, and avoid focusing only on the design of the technology itself.
3) Service Transition: provision of services required by a business.
4) Service Operation: aims to provide best practices for the delivery of agreed levels of services for customers and end users. It is the part of the lifecycle where the services and its value is delivered. Monitoring of the problems and balance between service reliability and cost are also considered.
5) Continual Service Improvement (CSI) is designed to align and realign IT services to changing business needs by identifying and implementing improvements that support business processes. It incorporates many concepts expressed in the Deming Cycle of Plan-Do-Check-Act.</td></tr>
<tr><td>Peculiarity of the model</td><td colspan="5">//</td></tr>
<tr><td>Important issues for MSEE project</td><td colspan="5">Provides the processes that are worth to be analysed when dealing about services.</td></tr>
<tr><td rowspan="2">Features</td><td>Simplicity</td><td>Objectivity</td><td>Flexibility</td><td>Adaptability</td><td>Capability</td></tr>
<tr><td>Low</td><td>Low</td><td>Low</td><td>Low</td><td>Low</td></tr>
<tr><td rowspan="2">Classification (BSM, TIM, TSM)</td><td colspan="3">BSM</td><td>TIM</td><td>TSM</td></tr>
<tr><td colspan="3">√</td><td>√</td><td>√</td></tr>
<tr><td rowspan="2">Classification (Strategic level, Tactical Level, Operational level)</td><td>Strategic level</td><td>Tactical level</td><td>Operational level</td><td rowspan="2">Not Applicable</td><td rowspan="2">Not Applicable</td></tr>
<tr><td>√</td><td>√</td><td>√</td></tr>
</table>

Proposal 7

<table>
<tr><td>Name of the model</td><td colspan="5">Capability Readiness for Product Service System</td></tr>
<tr><td>Type of model</td><td colspan="5">Not CMMI-based</td></tr>
<tr><td>General Description</td><td colspan="5">The Capability Readiness for Product Service System (Abideen Tetlay, Philip John 2009) is a model that allows assessing and determining whether the elements of a PSS are implemented and maintained, thus the maturity to keep these elements working.
"The Capability Readiness (CR) determines whether the product has the ability to satisfy the capabilities of the product in a given context, in its operational environment and within the abilities requests and its objective and purpose" (Tetlay and John, 2009).
When using the term "product", it refers to a set of products and services, or a system of products and services. It is important to distinguish the product produced by the PSS / engineered which is composed of a conventional development. This is a fundamental distinction between "Readiness Capability" and "System Readiness." The system readiness is concerned only with the product produced and engineered, while, the capability readiness is concerned with a system of products and services, namely the PSS.
In terms of evaluation and measurement of readiness capability, we must consider three things: "the assumption" (based on hypothesis, conjecture and anecdotes), the "expected" (based on historical analysis or the development of simulations) and the "current" (based on real life and real-time) result of the behavioral aspects of a product using both qualitative methods and techniques (not formal) and quantitative (formal methods).
Capability different elements must be maintained in order to successfully deliver PSS.
The degree of Capability Readiness can be considered closer to the contractual relationship between the customer and the supplier. In this case the supplier than the customer is increasingly taking responsibility for the capability element.
Therefore, manufacturers must be able to provide a system of products and services that can meet the needs of clients, through the elements of capacity. An assessment of the readiness capability information consider if these elements are implemented. The elements of capacity should be defined and a way to determine these elements is to identify the context of use of the PSS.</td></tr>
<tr><td>Peculiarity of the model</td><td colspan="5">//</td></tr>
<tr><td>Important issues for MSEE project</td><td colspan="5">//</td></tr>
<tr><td rowspan="2">Features</td><td>Simplicity</td><td>Objectivity</td><td>Flexibility</td><td>Adaptability</td><td>Capability</td></tr>
<tr><td>Low</td><td>Low</td><td>Low</td><td>Low</td><td>Medium</td></tr>
<tr><td rowspan="2">Classification (BSM, TIM, TSM)</td><td colspan="3">BSM</td><td>TIM</td><td>TSM</td></tr>
<tr><td colspan="3">√</td><td>√</td><td>√</td></tr>
<tr><td rowspan="2">Classification (Strategic level, Tactical Level, Operational level)</td><td>Strategic level</td><td>Tactical level</td><td>Operational level</td><td rowspan="2">Not Applicable</td><td rowspan="2">Not Applicable</td></tr>
<tr><td>√</td><td>√</td><td>√</td></tr>
</table>

Proposal 8

Name of the model	Service Oriented Architecture Maturity Model (SOAMM)					
Type of model	Not CMMI-based					
General Description	In 2005 Jonathan Bachman, Daniel Ng, Sean Kline and Ed Horst proposed The Service Oriented Architecture Maturity Model (SOAMM). The maturity model is made up of 5 levels of maturity, but not related with the CMMI approach. For each level, the authors define the most important performance. Level 1 of maturity "Initial Service" focuses on new features and can be considered as an initial learning phase. The authors proposed also an architectural point of view, introducing an Enterprise Service Bus (ESB) as middleware to connect the services between different applications using service interfaces. Nevertheless, this detail is out of scope of the present analysis. Level 2, called "Architected Services" can be achieved, increasing the number of features of the services, introducing new ones. The goal is to make services reusable, and defining standards for SOA companies. The output of this level should be a model that includes the relationship between SOA services, sub-components, policies, and customers. By Level 3, you can reach level four by two possible strategies: internal business processes or focuses on process improvement with external partners. The main objective of the third level is the connection between business and technology. At Level 4, "Measured Business Services", service performance can be measured in real time. Level 5, "Optimized Business Services", provides automation of business processes: this level provides the opportunity to make the company self-organized.					
Peculiarity of the model	//					
Important issues for MSEE project	This model is very different from the other. Nevertheless it seems interesting because related to an architecture for services, that is interesting due to its possible similarity with MSEE platform.					
Features	**Simplicity**	**Objectivity**	**Flexibility**	**Adaptability**	**Capability**	
	Medium	High	Medium	Medium	High	
Classification (BSM, TIM, TSM)	**BSM**			**TIM**	**TSM**	
	√			√	√	
Classification (Strategic level, Tactical Level, Operational level)	**Strategic level**	**Tactical level**	**Operational level**	**Not Applicable**	**Not Applicable**	
	√	√	√			

Proposal 9

Name of the model	Service Integration Maturity Model (SIMM)
Type of model	Not CMMI-based
General Description	IBM has developed innovative techniques that facilitate the path in terms of SOA maturity model. These techniques should be considered and used by any organization that claims to improve business flexibility. SIMM (the word derives from the concept of Service Integration Maturity Model) (Heather Kreger, Tomy Carrato, Kerrie holley et al (2009)) is a model that uses the services as a structuring element to increase business flexibility. SIMM is a maturity model unique and different from models based on CMMI, because it does not only focus on process improvement, but it connects the business outcomes desired level of development along several dimensions. The differences between SIMM and other maturity models can be summarized as follows: • The SIMM operate in sectors such as IT and business interaction, organization and governance, methods, applications, architecture, information and infrastructure management. • The SIMM not only produces a numerical result as a result of an assessment, you also get a series of action items that should improve the organization in the various domains, in order to achieve a specific result of the business. • The SIMM assumes that a higher maturity is necessarily better for a given size. • It is possible and sometimes desirable to "jump" to an appropriate level, where there are the necessary prerequisites. This is possible: the SIMM focuses on the process and results across multiple domains. One of the basic principles of the SIMM is that the assessment of maturity focuses on people, processes, technologies and achieving effective results. It focuses on the transformation of an organization in a service-oriented society: it is focused more on results and benefits to be achieved at a level that process improvement. The SIMM uses indicators to diagnose the current situation, define the future state, identify weaknesses and exploit the attributes and indicators of higher levels of maturity to develop a roadmap to reach the final state. 7 levels are considered proposing an incremental maturity from level 1 to level 7 (eco-system integration): 1. Silo (data integration): the organization starts from proprietary integration and rather ad-hoc, making the architecture brittle compared to the change. 2. Integrated (application integration): the organization moves toward some form of EAI (Enterprise Application Integration), albeit with proprietary connections and integration points. 3. Modular (functional integration): In this level, the organization modularize most important and critical parts of its application portfolio. The integration between components is through their interfaces and contracts. 4. Simple services (process integration): the organization defines and exposes services for internal or external trading partners, however, acting as service provider or service consumer. 5. Composite services (supply-chain integration): the organization extends its influence on supply chain and ecosystem service. Service contracts are concluded between suppliers, consumers and intermediaries can build your own eco-system. Often the simple services of level four services are replaced by compounds that can be choreography. 6. Virtual services (virtual infrastructure): the organization creates a virtual infrastructure for running applications. To reach this level after the decoupling of the application, its services, components and flows. Now the infrastructure is more tuned in, and the notions of network and service network make it more agile. It externalizes its monitoring and management. 7. Dynamically reconfigurable services (eco-system integration): the organization has a dynamically reconfigurable software architecture. The maturity of service in an organization, can be evaluated through the following series dimensions that are essential indicators to build service-oriented organization. • Business: focuses on 'business architecture, or the business practices and current policies of the organization, and how business processes are designed, structured, implemented and executed. It also includes IT strategy and addresses the cost and flexibility of IT capabilities, business agility and service contracts. • Organization and Governance: focuses on the structure and design of the same organization and the necessary organizational efficiency. • Methods: Focuses on methods and processes employed by the organization for its IT and business transformation. This includes the maturity of the development of the software life cycle, software engineering practices and guidelines used for the design and development of a SOA. • Applications: application focuses on the style, the structure and functionality of applications, including attributes of reusability, flexibility, reliability and extensibility of applications. • Architecture: focuses on the structure of the architecture that includes the use of reference architectures, topologies and physical and logical integration techniques. • Information: Focuses on how it is structured, maintained, cleaned and shaped the information. It deals with methods of access to corporate data, their collection and their management.

<table>
<tr><td></td><td colspan="6">• Infrastructure: Infrastructure is focused on functionality, including service management, IT operations, management and administration of IT etc. ...</td></tr>
<tr><td>Peculiarity of the model</td><td colspan="6">//</td></tr>
<tr><td>Important issues for MSEE project</td><td colspan="6">Interesting model that also consider reconfigurable services in the scope of eco-system integration. It is also particularly interesting because cover BSM, TIM and TSM levels.</td></tr>
<tr><td rowspan="2">Features</td><td>Simplicity</td><td>Objectivity</td><td>Flexibility</td><td>Adaptability</td><td colspan="2">Capability</td></tr>
<tr><td>Medium</td><td>High</td><td>Medium</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td rowspan="2">Classification (BSM, TIM, TSM)</td><td colspan="3">BSM</td><td>TIM</td><td colspan="2">TSM</td></tr>
<tr><td colspan="3">√</td><td>√</td><td colspan="2">√</td></tr>
<tr><td rowspan="2">Classification (Strategic level, Tactical Level, Operational level)</td><td>Strategic level</td><td>Tactical level</td><td>Operational level</td><td rowspan="2">Not Applicable</td><td colspan="2" rowspan="2">Not Applicable</td></tr>
<tr><td>√</td><td>√</td><td>√</td></tr>
</table>

Proposal 10

Name of the model	Innoscore Service
Type of model	Not CMMI-based
General Description	Innoscore Service (www.innoscore-service.de) is an intuitive and easy to use model; it represents a point of reference for manufacturers who want to improve their product-service system. It is based on EFQM (European Foundation for Quality Management)-Model. The Innoscore Service is a comprehensive model which allows to achieve a relatively high level of detail in the measurement of innovativeness of a company. There are nine major organizational aspects that spread through the innovation process. These allow you to measure, evaluate and enhance the innovative capability of a company in the development of product-related services. The nine aspects are: 1. Strategy: this includes the development of objectives in the medium and long term, and the 'processing of the steps to accomplish to ensure the achievement of these objectives. To ensure that the product-service system to be successful, you must use the correct approach, starting from pure strategic level. It becomes easier to create a common understanding of innovative product-service, if these are included in the strategy; 2. Innovative culture: includes cultural aspects of society regarded as particularly important for the process of innovation in the product-service. It describes the values, norms and ways of behaving in the company, and the atmosphere resulting from these operational aspects. Critical to the success of a PSS has become the support from top management that a strong service culture. The "service culture" includes monitoring of the client, so guess what he really needs. Are also essential training for the staff, who are an important part of the development of a PSS. 3. Technology: To be able to innovate, the technology must be used properly and dominated. The service connected to the product must be adapted to the technology: the development of related products and services requires adequate infrastructure and the efficient delivery of services. This is often based on the interaction of different computer systems. 4. Process: as in the case of the development of products, services also require the development process transparent and reproducible. This includes the definition of interfaces within the process. 5. Product and service: should be developed in harmony with current technological knowledge, production processes and available resources. The main factor that determines whether a product and service related thereto is successful, is if the customer wishes are satisfied or if the solutions developed are able to solve its problems. The service for the product must be specified exactly at the beginning of the development process. It is also important to describe in detail the concept of service and processes necessary to develop it. The resources used to provide the service must not be neglected. The appearance of "Product and service" also examines the processes of interaction between customers and employees, as well as the back-office processes. 6. Market: The market brings together supply and demand in the form of consumers (customers) and competitors. Customers, in particular, represent a source of ideas and can also be test-beds for new products and services. To leverage knowledge of purchasers, it is necessary to include customers in product development and testing of the service related to the product before launching it on the market. The "market" determines whether the company uses so-called service prototypes to test the demand for new services. 7. Project Management: refers to the leadership of a project, mainly through the planning, monitoring and guidance of a project. This section focuses on costs, time and quality: it becomes essential to determine if it is always possible to complete the development of products and related services within the time period involved. 8. Skills and knowledge: knowledge embraces all the information and skills that are used to solve a problem. The precise way in which knowledge is translated into action refers to the ability. The ability of an employee is the capacity to apply their knowledge to achieve their goals. The skills required to develop and deliver products and services must be built and further developed in a precise way. A decisive factor for the success of a PSS is that the staff be trained at the right time. 9. Facilities and network in this section, the term "network" refers to contacts with other organizations and businesses of the company. One objective is to integrate the expertise in the areas where the company is unable or unwilling to provide the necessary resources. An important example is the connection to other research institutions or universities. The appearance of "structure and network" determines whether the firm has in place a program of cooperation with universities or other research institutions.
Peculiarity of the model	

Important issues for MSEE project	You can measure the Service-Level of a manufacturing company and get a score of every dimension. An extensive testing of use of the model is available, providing a benchmark with German manufacturing companies (250 companies).				
Features	**Simplicity**	**Objectivity**	**Flexibility**	**Adaptability**	**Capability**
	High	High	Medium	Medium	Medium
Classification (BSM, TIM, TSM)	**BSM**			**TIM**	**TSM**
	√				
Classification (Strategic level, Tactical Level, Operational level)	**Strategic level**	**Tactical level**	**Operational level**	**Not Applicable**	**Not Applicable**
	√				

APPENDIX 3: Application of the MSEE Maturity Model (Due to confidentiality of the information, Appendix 3 may not be available for public dissemination)

Note: Results are draft and are proposed as first analysis in order to show the applicability of the MSEE maturity model. Questionnaires have been filled in by representatives of the companies. This preliminary results have been discussed with representative of the company and allowed to obtain feedback for further revision of the MSEE maturity model that will be fine tuned during WP24 research activity in order to match and properly reflect the real situation of the company and the ecosystem under concern. MSEE end-users thus will allow to refine and validate the model, that will be then later on available to be used even out of MSEE project scope. Hereafter, results of the assessment is not explicitly distinguished between the two end-users that participated to the assessment in this phase (Indesit and TP-Vision), due to confidentiality of the information that are at the moment preliminary. Proper results of the maturity assessment through the MSEE maturity model will be provided in other WP24 deliverables. According to these considerations, the following data are to be considered indicative in their absolute values, but demonstrate the applicability of the model..

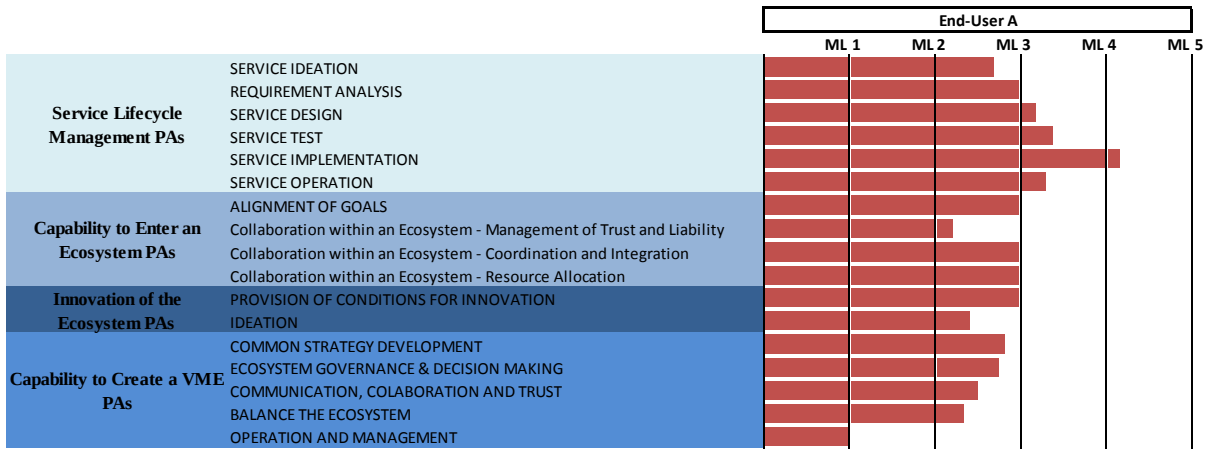
Maturity Index	End-user A	End-user B
Service Lifecycle Management Maturity Index	3,3	3,0
Capability to Enter an Ecosystem Maturity Index	2,6	3,7
Innovation of the Ecosystem Maturity Index	2,7	3,4
Capability to Create a VME Maturity Index	2,3	2,6

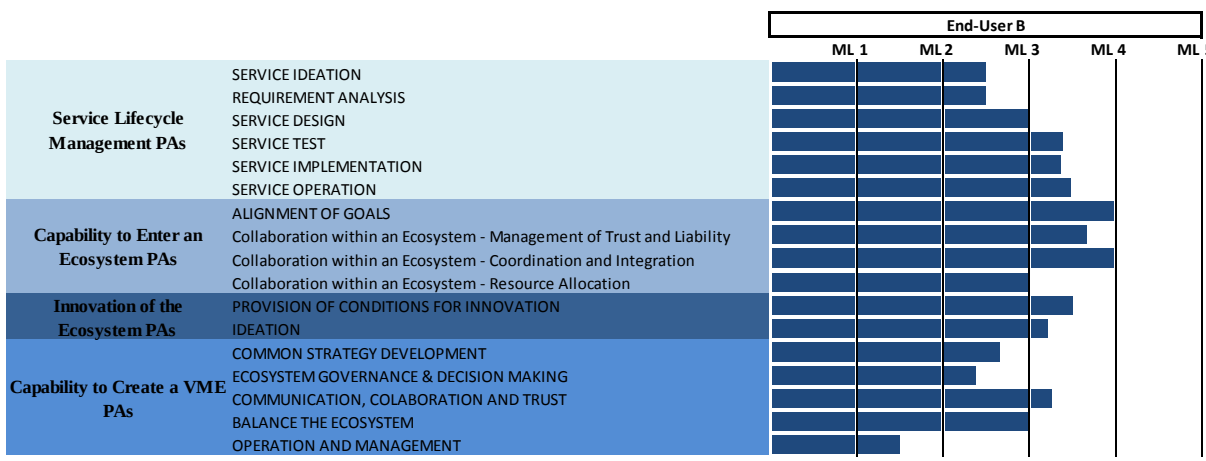
	End-user A			End-user B		
\Maturity Index	**Strategic Maturity Index**	**Tactical Maturity Index**	**Operative Maturity Index**	**Strategic Maturity Index**	**Tactical Maturity Index**	**Operative Maturity Index**
Service Lifecycle Management	3,2	3,6	3,3	3,0	3,0	2,8
Capability to Enter an Ecosystem	2,4	3,0	2,3	3,4	4,5	3,8
Innovation of the Ecosystem	2,6	3,0		3,4	3,0	
Capability to Create a VME	2,2	3,0	1,8	2,8	2,5	2,1

Note: 1) according to the metrics adopted, Innovation of the Ecosystem Maturity Index has not been developed, being considered innovation processes not at such level.

2) Strategic, Tactical and Operative perspective have not the same weight on the overall indexes. this is why the index at higher level is not the mean of the indexes at Strategic, Tactical and Operative level. Strategic perspective have been considered to have a larger importance on the higher level indexes.

Details on the Process Areas





This enable the discussion on which PAs should be improved and triggers a change management in the company and in the ecosystem to foster the improvement of the processes. This results thus represent the indication on which processes to focus and open the possibility to apply the last step of the MSEE change management approach, namely the identification of the tools to apply to carry on the change.

Level of detail, namely maturity level showed at PA level or sub-PA level is flexible, depends on the type of information (aggregated or analytical) to be represented and to the importance that some sub-PAs can assume. At the moment, for instance, each sub-Pas referred to "Collaboration within an Ecosystem" PA was given the same importance as the one given to the PA "Aligment of goals" as results of the discussion with research partners and end-users. On the other hand other PAs (e.g. Service Operation) have been considered in an aggregated way. Metrics resulting from this decision of course affect the overall maturity profile. This is why attention will be paid to this part of the maturity model in order to properly fine tune the metrics adopted.

APPENDIX 4: The MSEE maturity questionnaire

MSEE Maturity Model - Questionnaire

NOTE for the respondent:
Companies may be willing to answer the questions by choosing more than one alternatives. In order to make the survey more adaptable in these terms, we allow the respondents to opt for two consequent choices as maximum. The maturity level related to that specific question will be than calculated as an average of the two levels correspondent to the choices themselves.

INTRODUCTIVE/ANAGRAFIC SECTION

1. **What kind of services are provided by your firm?**
    a. No services are provided.
    b. Product support services are provided.
    c. Support services based on the life cycle of the product are provided.
    d. Service for product differentiation are provided.
    e. Provided services are sold separately to the product.

2. **How much is the service important in your organization?**
    a. It is not important, the focus is on the product.
    b. Focus is on the product, to which sometimes services are added.
    c. Focus is on the product and on the supporting services.
    d. Focus is on the integration product/service.
    e. Focus is on developing specific solutions for the clients or on PSS.

3. **Which objectives do you want to improve or prioritize while developing a product-service integrated solution?**
    a. We want to increase productivity just in the production of the physical product, we do not really care about services; another relevant goal can also be reaching consistency in meeting budget and schedule.
    b. We want to increase productivity in both the fields (product and service), but we want to reach this goal while managing them separately, and we care more about product quality and costs.
    c. We try to match product and service activities in those situations where it is possible to gain a buy-in in the process effectiveness and efficiency .
    d. We want to develop service related to products in order to improve and optimize the use of resources across the organizations (i.e. interdependent and inter-functional project teams) and improve the performance of a supply chain which involves multiple suppliers.
    e. Our goal is to provide “the use” of a product in order to facilitate the development (and thus reduce the production time) of new functionalities, features and adaptations to new technologies, while prioritizing customer and end-user satisfaction.

4. **Which are your business objectives?**
    a. Deliver products within budget and on time.
    b. Improve product quality by a specified percent in a specified timeframe.

c. Improve time-to-market for new product or service system component releases by a specified timeframe, while improving productivity of the incumbent ones.
d. Maintain customer satisfaction ratings.
e. Reduce customer total cost of ownership by a specified percent in a specified timeframe; decrease the cost of maintaining legacy products by a specified percent in a specified timeframe.

5. How does your company provide its organizational set of standard processes?

a. No sets of standard processes are provided.
b. A set of standard processes is provide just at an organizational level.
c. Sets of standard processes are proposed per each business area, product line or standard service. For each process, process roles, process performance objectives, input and entry criteria, output and exit criteria, product and process measures are provided.
d. The focus of the different sets of standard process is on the applicable standards, methods, procedures, tools and resources.
e. Attention is paid on the internal and external interfaces among different processes, and on their interdependencies. Standard processes are studied and ideated in order to stress a continuous improvement.

6. How is the product sold in your company?

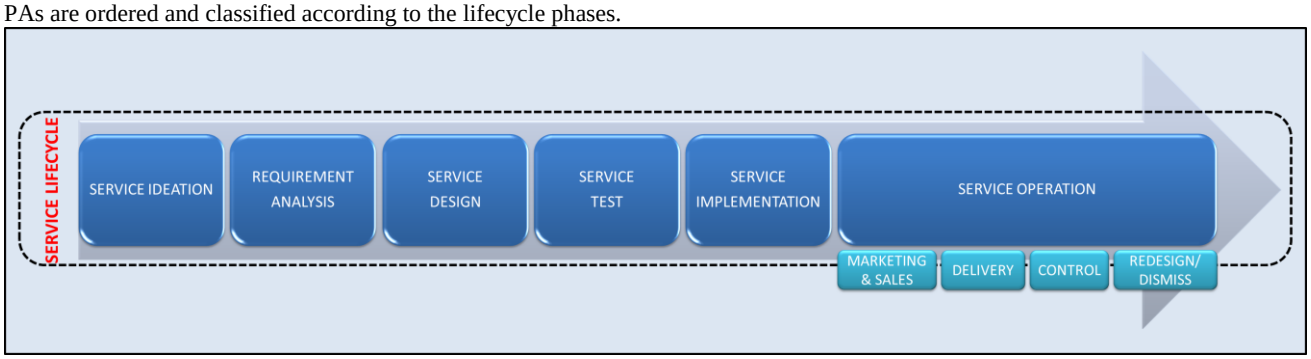
a. The product is sold without any support service.
b. The product is sold with support services for its use in a given period of time.
c. The customer buys the product use for a given period of time. The property of the product is kept by the supplier. (D.)
d. The service is sold as a substitute of the product for a given period of time.
e. The service is sold as a substitute of a product; the customer buys the “use of a product”, and the cost of the item equals the total cost of ownership. The product-service output is projected in order to last as more as it can, paying attention to sustainable issues as well.

A. COMPANY {Service Lifecycle Management Processes} SECTION

How company is mature in managing the Service Lifecycle

In order to evaluate the maturity index COMPANY {SLM}, we used a CMMI approach (see Appendix about methodological approach to prepare a CMMI-based questionnaire). The model permits the evaluation of the maturity of the company in developing a product-service solution thanks to the division of its processes in defined process areas (PAs), see figure below.

PAs are ordered and classified according to the lifecycle phases.



The actual levels of maturity reached by the company in the different PAs, and revealed through this section of the survey. Questions are classified according to the three different levels of the **business service model (BSM)**: strategic, tactical and operational level.

A.1 SERVICE IDEATION

7. **Is your company provided with an evaluation process to analyze possible decisions upon services, after an analysis of alternatives against established criteria? If yes, how is it organized and structured? (BSM strategic; the focus here is mainly on the selection of elements to include in standard service decisions frameworks)**
    a. Evaluation process is never applied; guidelines are never defined, evaluations are occasional and isolated, alternatives are chosen on the basis of not generally defined criteria, which can be numeric or not according to the contingency.
    b. Guidelines are established to determine which issues should be subjected to a formal evaluation process, but just relatively to medium-to-high risks or when issues affect the ability to achieve work objectives in terms of services. Some evaluation criteria are thus determined in these critical cases (but not in the other ones) and specific methods are still generically not defined.
    c. Guidelines are always traced, thus allowing to decide when to use formal evaluation processes to address unplanned issues, if critical. Further, a scope of each alternative is defined, allowing a following appropriate decision, with high probability of selecting a solution that meets multiple demands of relevant stakeholders. Evaluation criteria are still confused though, they could be numeric and non-numeric, but the company is not able to decide which ones to use in what case systematically.
    d. In addition with what already stated in answer c., the company specifies the type of evaluation criteria, which are predominantly quantitative and numeric, in order to guarantee objectivity and formality of analysis.
    e. Formal evaluation process, evaluation criteria, methods and alternatives are precisely clarified relatively to each service issue; each recommended alternative is accompanied by documentation of selected methods, criteria, alternatives and rationale for the recommendation. The documentation is than distributed to relevant stakeholders, and provides a record of the formal evaluation process and rationale, which are useful to other work groups that encounter a similar issue and to further improvements in the future.

8. **Which evaluation criteria, if any, are used in your company to assess different service idea alternatives? How are they ranked? (BSM operative)**

a. No specific evaluation criterion is defined, a list or range of choices is occasionally prepared according to the specific issue.
b. Service alternatives are mainly weighted on the basis of their limitations and enablers, as related to the integrated offer we have in mind.
c. The most important evaluation criterion we adopt is the real business value that, compared to the disadvantages, the service solution can give to our offer.
d. Immediately after the business value one, other criteria, as the consideration of the impacts on priorities and linked risks of the various service solutions, are explored. We also establish non-numeric values or formulas in order to relate each evaluation parameter to a numeric weight, and thus assess its criticality.
e. In order to achieve a long-term oriented evaluation, total cost of ownership, lifecycles costs and environmental impacts derived from service choices are considered as well. We also document our rationale for the following selection and rejection of evaluation criteria, in order to allow future immediate use.

9. **Which tools does your company use to weigh the service alternatives against evaluation criteria? (BSM operative)**
    a. No specific tool is applied methodically.
    b. Judgment provided by an expert or a group of experts (e.g. Delphi method).
    c. Engineering and manufacturing studies, surveys, business opportunity studies.
    d. Cost studies, extrapolations based on field experience.
    e. In addition with one of the tools mentioned in answer d., we take into account the user review and his comments.

A.2 REQUIREMENT ANALYSIS

10. **Which kind of approach, if present, is applied in order to monitor and analyze service capacity and availability against thresholds? (BSM tactical)**
    a. No approach is developed, the monitoring activity is limited to isolated interventions.
    b. Service resources are monitored against thresholds, descriptions of normal use and service system performance.
    c. In addition to what stated in answer b., service response times are monitored as well.
    d. The monitoring approach described above is integrated with breaches of thresholds and exception conditions, thus introducing possible indications of incidents. Corrective actions to be taken are also defined: they could be adjustments to resources and services to prevent performance problems or improve service performance (rebalance of the workload, improvement of capacity and/or availability in order to enhance productivity, effectiveness and efficiency, adjustment of service requirements, introduction of demand management techniques).
    e. The company, together with the quantitative monitoring system, provides an estimation of future changes (either growth or reduction) in the use of resources and services (trend analysis, analytical modeling, simulation modeling, baseline models, application sizing, service system representations). A storage of capacity and availability data, specifications, analysis results and monitoring data is also provided.

11. **How are service capacity and availability reports for stakeholders structured? (BSM operative)**
    a. No specific format and contents are defined, reports are developed occasionally.
    b. The company develops reports containing data regarding performance and use of resources and services.
    c. The capability and availability reports, together with the quality and performances, direct their focus on the service time.
    d. The report contains exception conditions in the service system and breaches of service requirements; availability, reliability and maintainability of resources and services data are also provided.
    e. Documents include an area destined to data from monitoring against growth in resource and service use.

12. **Which criteria do you use to determine the most effective source of knowledge or skill acquisition modality for your employees? (BSM strategic)**
    a. No specific criteria are present, we do not train our employees, they just follow a natural self-training process.
    b. When we train skills, we look at their applicability to work or process performance objectives and to business objectives.
    c. When we train skills, we look at their applicability to work or process performance objectives and top business objectives. We also look at the availability of time to prepare for project execution.
    d. Together with what stated in answer c., we also give importance to the possibility of creating, through these skills, of in-house expertise to be streamed across the organization.
    e. We also pay attention to the availability of training from external resources (i.e. customer provided training).

13. **Which are, among the followings, the evaluation and acceptance criteria that you use to identify products and services requirements? (BSM strategic)**
    a. We do not use specific evaluation and acceptance criteria.
    b. Appropriateness to implementation, quality attribute priorities.
    c. Tidiness to business values, completeness.
    d. Traceability, verifiability (i.e. testability), unique identification.
    e. Priorities for customers, consistencies with service system architecture.

A.3 SERVICE DESIGN

14. **Which supporting design techniques do you adopt to enable configuration management practices? (BSM tactical)**
    a. No supporting design techniques are adopted.
    b. Design to cost.
    c. Design to assembly.
    d. Design for recycling, design for environment.
    e. Design for serviceability.

15. **Which of the following tools are used during the new service development process? (BSM operative)**
    a. Generic guidelines for successful PSS.
    b. In addition to what stated in answer a., other tools are used such as SWOT analysis and exploration of customer needs.
    c. In addition to what stated in answer b., other tools are used such as the identification and mapping of stakeholders and the stakeholder involvement planning.
    d. In addition to what stated in answer c., other tools are used such as assessing of customer acceptance, screening the System's Profit Dynamics and a sustainability design orienting (SDO).
    e. In addition to what stated in answer d., other tools are used such as Scenario Building, System Mapping.

16. **How is a new service designed in your company? (BSM tactical)**
    a. There is not a standard process.
    b. There is a standard process in every business unit, but it's not shared by the entire organization.
    c. There is a standard process documented and shared by the all organization.
    d. There is a standard process controlled and managed with quantitative and qualitative tools for the forecast of process performance.
    e. There is a standard process controlled and managed with qualitative and quantitative tools in order to measure and optimize the performances through technological and innovative improvements.

A.4 SERVICE TEST

17. **Which validation techniques do you use to examine whether the chosen service systems and components are the proper ones or not? (BSM tactical)**
    a. Pilots of training material.
    b. Functional demonstrations (e.g., service delivery run-throughs, end-user interface demonstrations).
    c. Prototype demonstrations.
    d. Discussions with users, perhaps in the context of a formal review.
    e. Cycle reviews for incremental development and tests of services and service system components by end users and other relevant stakeholders.

18. **Are you testing the service model (BSM strategic)?**
    a. No.
    b. Only a few functions of the service model with integrating the customer.
    c. Some functions of the service model with integrating the customer.
    d. The majority of the functions of the service model with integrating the customer.
    e. All the functions of the service model with integrating the customer.

19. **Are you testing the process model of the service (BSM strategic)?**
    a. No.
    b. Only a few parts of the process model without integrating the customer.
    c. All parts of the process model without integrating the customer.
    d. Only a few parts of the process model with integrating the customer.
    e. All parts of the process model with integrating the customer.

20. **Are you testing the resource model of the service (BSM strategic)?**
    a. No.
    b. Only a few parts of the resource model without integrating the customer.
    c. All parts of the resource model without integrating the customer.
    d. Only a few parts of the resource model with integrating the customer.
    e. All parts of the resource model with integrating the customer.

A.5 SERVICE IMPLEMENTATION

21. **Is this service checked by controlling the service incidents, and how? (BSM strategic)**
    a. No specific policies are applied.
    b. The focus is on the minimization of the impact of a service incident.
    c. The focus is addressed to the removal of an underlying cause or causes.
    d. The company monitors the condition of series of events causing an accident, while minimizing its impact, monitoring its status and tracking its progress, escalating if necessary. Quantitative criteria of evaluation of the severity of the incident are used, and responsibilities are previously established. Care is token of generically timely and effective interventions.
    e. The company, while working on some of the issues mentioned in answer d., identifies workarounds that enable the service to continue and be adopted according to the criticality of the issue (covering, for example, the less damaging flaws). One or more mechanisms that customers or end users can use to report incidents are available. Evaluation criteria that define when an incident should be closed are documented for further development or usage. A data storage system, with a collection of historical data covering addressed incidents (underlying causes, known approaches used and occasional workarounds implementable), is also provided.

22. **Are any tools used to control, track and address service incidents? (BSM operative)**
    a. We just wait for incidents to occur before activating a specific intervention.
    b. We identify incidents that are in scope, detecting them through the analysis of anomalies in collected data.
    c. In addition to what stated in answer b., we adopt an automated detection system with all the data useful for the resolution of the issue.
    d. We just do not wait for incidents to occur, but we also take care of what is reported from end users and customers. We thus give a look to incidents reported by the customer to a help desk by phone, by the end user in a web form, and by a systematic monitoring of external resources of information (e.g. RSS feeds, news related to services, websites). Capability, performance or availability issues are used as signals of potential incidents.
    e. We periodically categorize and record information about the incidents (name and contact of the person who detected the incident, description, category, date and time of occurrence and detection, closure code and information, relevant characteristics of the situation in which the incident occurred). This information are shared among customers, users, people who report the incident and responsible for their resolution, and high importance is given to the level of customer satisfaction as a driver which guides the activity of incidents resolution.

23. **Which kind of support is used to conduct a timely and effective detection of incidents and causes of incidents? (BSM tactical)**
    a. No specific support is fixed, type of resources are defined on a case-by-case basis.
    b. A person responsible for the detection and resolution of the incidents is elected, and his main task is to collect and analyze a range of data, usually referred to some qualitative or quantitative evaluation criteria of severity which he has to fix and use.
    c. A person systematically analyzes data, causes of occurrence and incidents while using a software which is a sort of supporting and automated detection platform.
    d. People and work groups are established according to the risk, criticality and severity linked to the incidents; they can vary from network support groups to server support teams, Human Resources to Legal department or Public Relations teams, and so on.
    e. Groups, people and teams dialogue among each other, favoring interaction and recording of common best-practice, and helping each other, especially in recurring situations.

24. **Which tools or kinds of equipment are available to support the work environment? (BSM operative)**
    a. Office software.
    b. Office software, project management tools, test and evaluation equipment.
    c. Office software, project and service management tools, test and evaluation equipment, requirements management tools.
    d. Office software, project and service management tools, test and evaluation equipment, requirements management tools, incident and request management tools.
    e. Office software, project and service management tools, test and evaluation equipment, requirements management tools, incident and request management tools, decision support system.

25. **Which quality and process measurement attributes do you usually measure in order to guarantee a proper quantitative management of the work? (BSM operative)**
    a. Costs of single operations or transactions.
    b. Costs of single operations and transactions, plus percentage of defects removed by product verification activities, defect escape rates.
    c. Cycle time, percentage of rework time.
    d. Mean time between failures, critical resource utilization.
    e. Total lifecycle cost, incidents for services delivered to the customer, number and severity of defects in the release of the product, number and severity of customer complaints concerning the provided service.

26. **How do you keep trace of your quality and process performance objectives? (BSM tactical)**
    a. We conduct analyses on the product or service architecture in order to gain data related to the costs, and we check the output basic requirements.
    b. We control the organization's quality and process performance objectives.
    c. We consider business objectives.
    d. We monitor the customer's quality and process performance objectives.
    e. We directly discuss with customers and potential customers regarding quality and process performance objectives.

27. **Which criteria do you use to evaluate process alternatives in order to identify the most suitable to your objectives? (BSM operative)**
    a. Product line standards, efforts and resources consumed.
    b. Quality and process performance objectives.
    c. Familiarity with alternatives similar in composition, existence of process performance models that can be used in evaluating an alternative, laws and regulations.
    d. Simulation models, maybe supported by suitable informative software or systems.
    e. Standard service and service levels, lifecycle models, stakeholder's requirements.

A.6 SERVICE OPERATION

28. **Do you order marketing information papers?**
    a. No.
    b. Only internet.
    c. Information in the newspaper, Flyers.
    d. Internet and information in the newspaper, Flyers.
    e. Gimmicks, Internet, Newspapers, Flyers.

29. **Which are the evaluation criteria which lead your choice upon which supplier to select for your purchases? (BSM strategic)**
    f. Supplying cost derived from operating with each potential supplier.
    g. Supplier's performance records on similar works.
    h. Engineering and management capabilities, availability of staff and facilities to perform the work.
    i. Engineering and management capabilities and geographical location of the supplier.
    j. Customer satisfaction with similar products delivered by the supplier.

30. **Which kind of data or tools, related to customers or end users, do you use in order to facilitate the service delivery? (BSM operative)**
    a. No specific data are used, because we do not deliver specific services to our customers and end users.
    b. Statements of work and related solicitation materials.
    c. Telephone calls received by the service assistance office.
    d. Customers and end users' survey results.
    e. Customers' supplied plans and goals outlining their expected use of services.

31. **Which kind of maintenance policy, if applicable to your service, do you use on your service system? (BSM strategic)**
    a. Corrective maintenance: correction and reparation of components in the service network that degrade the operational capability of the service system.
    b. Preventive maintenance: prevention of service incidents and defects from occurring through pre-planned activities to be executed in pre-defined moments.
    c. Predictive maintenance: prevention of service incidents and defects through pre-planned activities in variable moments, according with the prognosis of the services and products' behavior along with their utilization.
    d. Adaptive maintenance: adaptation of the service system to a changing or different service delivery environment.
    e. Optimized maintenance: development or acquisition of additional or improved operational capability of the service system.

32. **Which elements are included in your service transition plan, if any? (BSM tactical)**
    a. Linked costs of service system components identified as ready for the transition.
    b. Linked costs and resource constraints and restrictions.
    c. Costs, resources and training of service delivery and support staff, while checking a range of deployment acceptance criteria.
    d. Costs, resources, training and installation and integration of service system components within the delivery environment.
    e. Together with what stated in answer d., phasing of the deployment over time in order to satisfy operational dependencies between service system components and communication of transition status and service changes to relevant stakeholders, meanwhile accepting and considering their suggestions.

33. **What is the level of specificity of physical resources used to deliver services? (BSM tactical)**
    a. No resources are used, we do not deliver any services internally, but we occasionally outsource them.
    b. Not specific resources (shared with other work products) are used to deliver some services.
    c. Resources shared with other work products are used to deliver services.
    d. Specific resources are used to deliver some services.
    e. Specific resources are always used to deliver services, involving customers and end users in an Agile environment.

34. Which service information and items do you generally monitor? (BSM operative)

a. Expected costs, payments, and funding schedules.
b. Service acceptance and quality criteria.
c. Service time of production and delivery.
d. Service availability, risk and contingency identification.
e. Acceptable impact on customers and end users' activities, customers and end users' roles and responsibilities, customers' supplied resources.

35. How are indicators used to evaluate the service performances? (BSM strategic)

a. No performance indicators are used.
b. Some specific performance indicators are used to evaluate cost and productivity of the resources.
c. A standard set of KPIs is used, considering costing and timing measures.
d. A standard set of KPI is used, considering internal and external measures and clientele orientation.
e. A standard set of KPI is used, considering internal and external measures, customer satisfaction and service continuity and continuous enhancement.

36. How is the customer satisfaction monitored? (BSM tactical)

a. Customer satisfaction is not promptly monitored.
b. There is a standard process to evaluate the customer satisfaction, but it's not shared by all the organization.
c. There is a standard process of qualitative analysis and monitoring.
d. The process of analysis and monitoring activities is supported by tools and quantitative models; tools help to store and retrieve data related to different processes or areas, when necessary.
e. Models are used to allow continuous improvement techniques and processes of analysis and monitoring; measurement data are reviewed with relevant stakeholders.

37. Which practices, if any, do you apply in order to monitor service continuity? (BSM strategic)

a. No specific practices are conducted, the staff devoted to service request periodically checks if everything is correctly executed, intervening in case of any problems or disruption, and through that gaining experience for the future.
b. Functional demonstrations are conducted, such as a test upon a backup file system, an exercitation of an alternative communication network to coordinate service delivery, or the switch to manual processes.
c. Prototype demonstrations and pilots of training materials are realized.
d. Tests of the service system and its component are also conducted by end users and other relevant stakeholders.
e. Tests of the service system and its component are also conducted by end users and other relevant stakeholders. The results of the tests are each time recorded and used for similar occasions, guaranteeing continuous improvement in the practice.

38. Which verification techniques do you use to examine if alternative service systems and components are being built correctly? (BSM strategic)

a. Occasional inspections.
b. Audits and peer reviews.
c. Architecture evaluations, analyses and testing.
d. Simulations.
e. Continuous integration (i.e., Agile approach to early identify integration issues).

39. **Which service parameters and resources are monitored and controlled in order to prevent service processes to diverge from the primary objectives? (BSM operative)**
    a. Service costs.
    b. Service tasks and quality; physical facilities are occasionally monitored.
    c. Service schedules, timing; staff, machines and processes are monitored on a regular but not frequent basis.
    d. Service availability; the security environment, together with its human and physical resources, is wholly monitored on a short-term frequent basis.
    e. Service complexity, continuity and progress; staff, processes, resources, environment, know-how and networks are constantly monitored.

40. **How is the action proposal for resolution of service problems structured and generated in your company? (BSM strategic)**
    a. Action proposals are generally non-structured, being reactively triggered by isolated events.
    b. Several action proposals are each time analyzed and compared, decision criteria are however not defined.
    c. Priorities of the different action proposals among which the company has to decide are systematically investigated (as the implications of not addressing the outcome, the implementation cost of the improvements to address the outcome and the expected impact on quality). The action proposal that has to be implemented is thus selected.
    d. Action plans for implementing selected action proposals are also realized: specific information like responsible for implementation, detailed description of the improvement, affected areas and implementation actions, people who have to be kept informed of status, schedule, costs, next date of review and rationale for key decisions are provided.
    e. While implementing an action proposal/plan, the company always takes care of coordination, always reviewing the results and tracking action items to closure. The responsible of the action proposal/plan also looks for similar causes that may exist in other processes and work products, and take action as appropriate.

41. **Which are the key performance drivers monitored by the company while improving a process, and prioritizing the improvements? (BSM operative)**
    a. Costs of the improvements.
    b. Costs and quality of the improvements.
    c. Costs, quality and execution time of the improvements, related efficiency and effectiveness.
    d. Opportunities of cross-fertilization among different improvements, optimization of the innovation process and standardization.
    e. Sustainability and continuity of the improvement processes, especially in order to guarantee a constant support to the end users.

42. **Which tools are used to assess and monitor organizational performances? (BSM tactical)**
    a. No specific tools are implemented, monitoring is occasional and not formalized.
    b. Documentation for a process performance model.
    c. Mapping of processes and sub-processes and relating them to quality and process performance objectives.
    d. Goal question metric and Quality Function Deployment (QFD).
    e. Balanced Scorecard.

43. **Which models are used to assess the most suitable processes that allow to reach the organizational performance objectives? (BSM tactical)**
    a. No specific models are used.
    b. Regression models.
    c. Discrete event simulation models.
    d. Monte Carlo simulation models.
    e. Complexity and System Dynamics models.

44. **Which kind of approaches does your company follow in order to objectively evaluate performed processes and work products or services against applicable process descriptions, standards and procedures? (BSM tactical)**
    a. No specific approaches are applied, product and services are not systematically followed along their processes.
    b. Distributed reviews and comments of work products and services are used.
    c. We adopt formal audits performed by separated quality assurance organizations, together with in-depth reviews of work at the place where it is performed.
    d. We prefer peer reviews which can be performed at various levels of formality, in order to gain flexibility, adapting our system of evaluation to the specific context and its needs.
    e. Together with formal processes reviews, we introduce process checks built into the processes such as a fail-safe analysis for processes when they are done incorrectly (e.g. Poka-Yoke).

B. COMPANY {COLLABORATION} SECTION

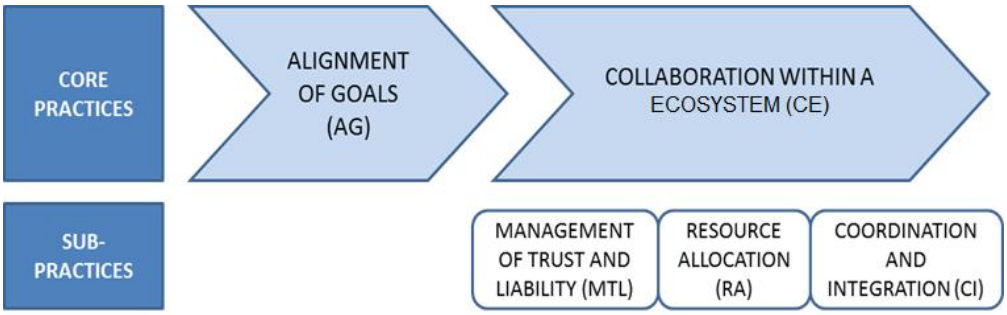
How a company is mature to enter an ecosystem

In order to evaluate the maturity index {COLLABORATION}, we used a **CMMI based** maturity model. This maturity model, not existent in literature, has been derived, together with the PAs compounding it, from a wide analysis conducted upon theories related to how companies have to organize themselves in order to favor integration and collaboration with other companies.

The model permits the evaluation of the maturity of company in successfully joining in a collaborative, integrated network; the maturity is assessed through the investigation of the following 5 process areas (PAs):

- Alignment of Goals (AG)= the driver has to assess the most important features of the projected innovation with the other partners of the ecosystem;
- Collaboration within an Ecosystem (CE)= the further up the value chain an innovation resides, the larger the number of intermediaries that must adopt it before it can reach volume sales. As the number of intermediaries increases, so does the uncertainty surrounding market success, and thus the importance of collaborative and networking mechanisms that need to be activated by the driver company.
    - Management of Trust and Liability (MTL)= getting to market ahead of the rivals is of value only if the other partners of the network are ready when the driver is ready, thus building up a system of reciprocal trust and liability;
    - Resource Allocation (RA)= resources/assets have to be managed in an holistic way. The driver has not to look to its needs only but it has to be constantly interested in needs and requests of complementors, intermediaries and niche players;
    - Coordination and Integration (CI)= the success of collaboration is based on a coordinate and integrated vision that should also result in appropriate practices/processes.

The PAs are designed to be mapped in the flow diagram that follows:



The actual levels of maturity reached by the company in these different PAs, and revealed through this section of the survey, allow to depict the maturity level for the capability of a company to collaborate with other ones within an ecosystem, that is the maturity of a company to enter an ecosystem.

B.1 ALIGNMENT OF GOALS

45. **Which decisions, related to the development of the final product-service solution, do you assess alone, and which ones are agreed with the other players of your ecosystem? (BSM strategic)**
    a. No specific decisions, related to the whole project initiative, are faced off with the collaboration of other partners of our networks.
    b. The company occasionally checks product feasibility parameters with the key members of the ecosystem, in order to avoid "non-productive holes" in the flow of the product-service solution due to incompatible components.
    c. The company regularly checks product feasibility parameters with its key complementors, in order to avoid "non-productive holes" in the flow of the product-service solution due to incompatible components. The company, as member of the ecosystem, activates the same checks relatively to the service which will have to be added, ensuring compatibility and synergic production and configuration of the two packages that will have to be combined.
    d. The company regularly checks product feasibility in respect to members' and service provider(s)' business processes. If necessary, it also assesses which sub-practices are important to be executed and which ones have to be executed alone, in order to assure better feasibility and performing synchronization across the ecosystem. It eventually activates processes of evaluation of the appropriateness of the value chain and thus of the intermediaries of the ecosystem.
    e. The driver regularly checks product feasibility in respect to complementors' and service provider(s)' business processes, together with an analysis of its sub-practices. It activates value chain appropriateness evaluations and it constantly assess customers feedbacks, benefits and compare its performances to the ones of the possible competitors.

46. **Which specific resources do you involve in the monitoring and management of your project initiative? (BSM tactical)**
    a. Isolated cost-benefit analyses.
    b. Design tools and machineries (i.e. CAD), occasionally employed to verify the current project performances according to the process adopted so far and the feasibility of the product with complementors' components.
    c. Design tools and machineries, periodical reports and group teams dedicated to the tasks.
    d. Design tools and machineries, periodical reports, group teams dedicated to the tasks and databases jointly updated with the collaboration of intermediaries as well.
    e. Design tools and machineries, periodical reports, group teams dedicated to the tasks and databases jointly updated with the collaboration of intermediaries as well. Life-cycle Cost, Life-cycle Assessment, informative services providing data related to costumers.

B.2 COLLABORATION WITHIN AN ECOSYSTEM

47. **How do you (or plan to) assure continuity, solve occasional accidents, and thus guarantee collaborative relationships along the value chain in which you are involved? (BSM strategic)**
    a. We are not into value chain continuity problems, we just pay attention to in-house continuity issues.
    b. We conduct a joint cost-benefit analysis with each service provider and intermediary along the value chain, within the ecosystem (if it is not convenient for the service provider and/or the intermediary to deliver the product, it will not be helpful) in order to set clear milestones and expectations and solve possible discrepancies.
    c. We conduct a cost-benefit analysis and assess who has problems of continuity and thus if and where to directly intervene.
    d. We conduct a cost-benefit analysis, assess who has problems of continuity, and where to intervene. We also track some performance indicators as effectiveness and efficiency along the value chain.
    e. Together with the control of the value chain thanks to cost-benefit analyses and occasional interventions, we are also involved in the "acceleration" the value chain: other core activities in which we are often involved are thus the coordination of the design, the anticipation of marketing campaigns and the management of channel incentives to make the intermediaries "locked-in" to the project.

48. **Which supporting tools do you utilize (or plan to utilize) to favor the final product-service system to easily flow along the value chain? (BSM tactical)**
    a. No specific tools are used to favor the continuity of the flux of the product-service system along the value chain.
    b. Cost-revenue analyses, external audits related to reciprocal transactions with partners/members of the ecosystem.
    c. Cost-revenue analyses, external audits related to reciprocal transactions with all the relevant members of the ecosystem.
    d. Cost-revenue analyses, external audits related to reciprocal transactions with all the relevant members of the ecosystem, which are allowed to audit our internal processes as well, Critical Path Methods and Program Evaluation and Review Technique across the whole flux.
    e. Together with the use of the tools listen in answer d., we provide constant comparisons on agreed time tables (for example recurring to Gantt Diagrams for the confrontation) and try to learn from feedbacks in order to acquire constantly raising competencies in make the product-service to flow along the network.

49. **How do you collaborate to guarantee reciprocal trust and responsibility across the ecosystem? (BSM operational)**
    a. We do not dedicate resources to these issues.
    b. We occasionally leave a group of employees in charge of internal audits and reunions with the other members of the ecosystem.
    c. We establish a fixed group of employees that will participate to a network inter-functional project team, constituted together with the other members in order to manage trust and responsibility issues. Those employees conduct also periodical internal audits.
    d. We establish a fixed group of employees that will participate to a network inter-functional project team, constituted together with the other members in order to manage trust and responsibility issues. Those employees also conduct periodical internal and external audits, and furnish data to other members willing to conduct external audits on the driver company.
    e. We establish a fixed group of employees that will participate to a network inter-functional project team, constituted together with the other members in order to manage trust and responsibility issues. Those employees conduct also periodical internal and external audits, and furnish data to other members willing to conduct external audits on the driver company. Database an Cloud Computing techniques are implemented, in order to share the collection and sharing of information and the continuous improvement from historical analyses of data.

50. **How do you (or would you) synchronize your business processes with the ones of the other members of the ecosystem and thus build up a trustworthy and responsible network? (BSM strategic)**
    f. No relevant monitoring activity is conducted on synchronization issues.
    g. The company agrees on a range of due dates which each member has to respect, and trusts on the support of the other partners of the ecosystem.
    h. The driver agrees on a range of due dates which each member has to respect, and arranges periodical exchanges of information in order to receive feedbacks regarding their performances.
    i. The driver delegates an inter-functional team which has to fix a range of due dates to be respected and maintained by all the members of the ecosystem, and periodically checks the activities, in order to reveal occasional synchronization matters.
    j. An inter-functional team group, delegated by the driver, but opened to the participation of exponents of other players of the network, fixes due dates and checks the activities, looking for in-house improvement opportunities which can help to enhance the synchronization with the external activities conducted by the other players.

51. **Which kind of support do you provide (or would you aim at providing when establishing the ecosystem) to the monitoring and solution of synchronization and timing issues? (BSM tactical)**
    a. Neither specific support nor resources are dedicated to synchronization and timing issues.
    b. A pool of designed employees draws up a report assessing time frames.
    c. A report assessing due dates is drawn up and periodically checked/modified.
    d. An inter-functional team group is dedicated to the solution of synchronization and timing issues.
    e. An inter-functional team group, opened to the participation of exponents of other players of the network, is dedicated to the solution of synchronization and timing issues. Historical data are also analyzed in order to reveal particular trends and derive ideas for enhancement of timing among partners.

52. **Which tools do you use (or plan to use) to monitor the synchronization degree of your activities with those of the other members of the ecosystem, and thus the respect of common agreements upon tasks? (BSM operational)**
    a. No specific tools are used.
    b. Scenario Analysis, reports assessing due dates that have to be maintained by each member.
    c. Delphi Method with all the functional managers called into play in the timing of production processes, based on documents assessing due dates, and which can thus be improved and added to a specific archive.
    d. Gantt Diagrams, Databases for the storage and records of data related to the issue, ICT Software for the collection of data, Team groups.
    e. Simulation Tools, Team Groups, Linear Regressions.

53. **How do you manage (or plan to manage) your resources, relatively to the other members of the ecosystem? (BSM strategic)**
    a. We focus the use of our resources on our core activities, without having a look to the processes of the other members or accepting any kind of assistance from them.
    b. In case of emergency, we agree to devolve part of our human resources to assist our keystone members. The common objective is to reach a good timing and synchronization in our business practices.
    c. We agree with the other keystone members to reserve part of our human resources, and some machineries if needed as well, in order to help them with urgencies and matters directly connected to the timely deployment of all the components of the product-service solution.
    d. We reserve not only part of our tangible and human resources, but also financial funds, exclusively to assistance activities across the ecosystem, obviously making sure to keep them busy also in those periods where no relevant problems are showing in the network (for example, with monitoring activities, periodical reviews of the network dynamics, and so on).
    e. We reserve not only part of our tangible and human resources, but also financial funds, exclusively to assistance activities across the ecosystem, obviously making sure to keep them busy also in those periods where no relevant problems are showing in the network. In addition, we destine this resources to the historical analysis of interventions and assistances accomplished across the ecosystem in the past, in order to enhance their competences and improve from past experiences.

54. **Do you utilize (or plan to utilize) specific communicative tools to exchange info with the other players of the ecosystem regarding internal and external needs of resources? (BSM operational)**
    a. No specific tools are used, because we focus the use of our resources on our core activities.
    b. We recur to e-mails, Skype calls or telephonic talks with the functional managers of the keystone member, in order to discuss upon emergencies and agree on the need of our intervention with a team of experienced workers.
    c. We manage to create a “resource report” (regarding the amount of tangible and human resources to destine to allocation across the ecosystem), which we annually update through reunions with the other partners/members of the ecosystem.
    d. We manage to create a “resource report”, which we annually update through reunions with all the other relevant players of the network, and which is occasionally updatable through the web, thank to the use of simple IT technologies such as Cloud Computing. We also provide a database, or a section

in our existing databases, dedicated to our resources, assessing their performances (utilization rate, availability, cycle time and so on).

e. We have an updatable "resource report", accompanied by periodical reviews and reunion with our partners. We use databases, employing them for historical analyses and/or planning simulation models in order to observe errors or lacks in our resource allocation systems, and thus derive opportunities for continuous improvement. This historical analyses are usually conducted by the human resources externally allocated, in order to maintain them busy and favor a direct contact with feedbacks related to their activities.

55. Which resources do you flexibly use in the ecosystem, for example destining them to processes other than the ones on which you are directly focused? (BSM operational)

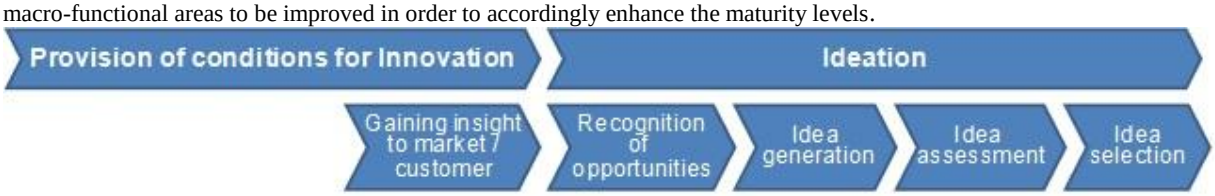
a. No resources are externally allocated.
b. We occasionally allocate groups of employees externally, especially in cases of emergencies or urgencies related to our direct complementors. External allocation is not flexible though, but just limited to isolated, non periodical events.
c. Regular external allocation of human resources, machineries and transports is managed accordingly to the "resource report" drawn up annually. This external allocation is still not flexible, but just limited to the occasions stated in the report and agreed by the partners.
d. Regular external allocation of human resources, machineries and transports is managed accordingly to the "resource report" drawn up annually. In addition, the allocation can be changed or modified according to the occasional modifications to the report made by the drivers or the other keystones. In order to facilitate a timing and synchronized execution of this activities, the driver may decide to share its database with the other partners as well.
e. Regular and flexible external allocation of human and tangible resources is provided. Data provided by databases are shared and analyzed collaboratively with the other partners to assess any possible kind of enhancement to bring in the current system.

56. How do you (or you plan to) coordinate and integrate your processes and activities with those of the other partners? How, in other words, do you create synergies between your processes and theirs? (BSM strategic)

a. We do not coordinate our business processes with those of the other partners of the ecosystem.
b. We take care of our internal development challenges, meanwhile occasionally agreeing appropriate business expectations with our members.
c. We take care of our internal development challenges, meanwhile periodically agreeing appropriate business expectations with our complementors and the service provider. A document assessing the ecosystem business expectations is filled in periodically.
d. We constantly check internal development challenges and periodically agree expectations according to capabilities and potentials of every relevant member of the ecosystem. We also study unintended causes of bad integration with the other players, such as regulatory delays, financial difficulties of one member or incentive problems across the value chain.
e. We constantly check internal development challenges and agree expectations according to capabilities and potentials of every relevant member of the ecosystem. We also study, on a continuous basis, unintended causes of bad integration with the other players, in order to respect the agreed expectations and improve on a regular basis. The monitored unintended causes comprehend regulatory delays, financial difficulties of one member, incentive problems across the value chain and leadership crisis. Overall performance reached throughout the ecosystem is constantly monitored .

C. ECOSYSTEM {INNOVATION} SECTION

The model and the procedure adopted to create this section are related to the ones adopted for the development of the maturity model in the scope of MSEE project. Process Areas (PAs), questions and structure are adapted in order to be related specifically to the innovation processes in an ecosystem. The questionnaire allows the maturity assessment of such processes.
Supposing that an ecosystem will be formed by companies – and especially service providers – very well equipped to cover the SLM phases, PAs are not ordered and classified according to the all common service life cycle phases. Since the underlying hypothesis is that the real gain producible by an ecosystem stays in the capability of always generating innovative ideas, PAs related to this section will be focused specifically on the Provision of condition for Innovation and Ideation phase, which should be considered the two macro-functional areas to be improved in order to accordingly enhance the maturity levels.



C.1 PROVISION OF CONDITIONS FOR INNOVATION

57. **How do you think you (as driver of the ecosystem) are analyzing your business context and market opportunities for the services the ecosystem can provide? (BSM strategic)**
    a. Customers are not involved, market is not analysed.
    b. Some potential customers are casually involved by the driver company to identify market opportunities.
    c. Potential customers are regularly interviewed by the driver company (or other members of the ecosystem) for market analyses and requirement definitions.
    d. Potential customers are involved in the analysis for new ideas for new service / product-service solutions.
    e. Some potential customers and new suppliers/partners are involved in a structured way in order to identify even the niche market opportunity. The way the potential customers are involved is continuously adapted to market context and services already available on the market.

58. **How broad (in the sense of "outside the box") are you analyzing your business context and market opportunities with respect to servitization? (BSM strategic)**
    f. Analysis concentrates on existing main groups of customers, no special focus on servitization.
    g. Analysis considers also groups of customers that currently have minor importance, no special focus on servitization.
    h. Analysis of existing customer group considers actively the options for servitization
    i. New potential customer groups are recognized and involved in the considerations be chance.
    j. There is a structured approach to consider servitization and to identify new business areas that could offer new business opportunities.

59. **How do you (as driver of the ecosystem) collect ideas from the other member of the ecosystem?**
    a. There are no defined procedure.
    b. One procedure is established, with few members of the ecosystem involved, usually the driver company and one main member, taking part to it.
    c. All the partners are involved and ideas are collected, but they are kept separated and managed only by the driver company (or eventually one main partner).
    d. All the partners are involved and ideas are collected and shared with the entire ecosystem in an inter-functional and interactive perspective.
    e. All the partners are involved and ideas are collected and shared with the entire ecosystem in an inter-functional and interactive perspective, the process is progressively optimized in order to improve the interaction within the ecosystem to collect new ideas.

C.2 IDEATION

60. **Are there (in the ecosystem) specific project teams working on the development of new service / product-service ideas? (BSM tactical)**
    f. There are no specific project teams.
    g. One project team only is organized, with few members of the ecosystem, usually the driver company and one main member, taking part to it.
    h. Different project teams are established for different projects or product-service ideas that have to be delivered, but they are kept separated one from each other, in a concurrent engineering perspective. Other players of the ecosystem take part to them.
    i. Different project teams, well represented by the various members of the ecosystem, are established with interfunctional and interactive perspective, meaning the different project teams interact according to a formalized process.
    j. Different project teams, well represented by the various players of the network, are established with interfunctional and interactive perspective, and one of these is dedicated to the evaluation and improvement of methodological aspects.

61. **Do you apply creativity techniques?**
    k. No such techniques are available as tools in the enterprise neither a employees trained in such techniques.
    l. If necessary external facilitators are involved.
    m. Some techniques are known (e.g. named in the intranet), if people want to apply them they have to get more detailed information from external sources (literature, internet).
    n. There is a set of defined and described creativity techniques available, however people are not trained in these techniques.
    o. There is a set of defined and described creativity techniques available and people are trained in these techniques.

62. **Is the ecosystem provided with an evaluation process to analyze possible decisions upon services, after an analysis of alternatives against established criteria? If yes, how is it organized and structured? (BSM strategic; the focus here is mainly on the selection of elements to include in standard service decisions frameworks)**
    f. Evaluation process is never applied; guidelines are never defined, evaluations are occasional and isolated, alternatives are chosen on the basis of not generally defined criteria, which can be numeric or not according to the contingency.
    g. Guidelines are established to determine which issues should be subject to a formal evaluation process, but just relatively to medium-to-high risks or when issues affect the ability to achieve work objectives in terms of services. Some evaluation criteria are thus determined in these critical cases (but not in the other ones) and specific methods are still generically not defined.
    h. Guidelines are always traced, thus allowing to decide when to use formal evaluation processes to address unplanned issues, if critical. Further, scope of alternative is defined, allowing a following appropriate decision, with high probability of selecting a solution that meets multiple demands of relevant stakeholders. Nevertheles, evaluation criteria are still confused though, they could be numeric and non-numeric, but the company is not able to decide which ones to use in what case systematically.
    i. In addition with what already stated in answer c., the company specifies the type of evaluation criteria, which are predominantly quantitative and numeric, in order to guarantee objectivity and formality of analysis.
    j. Formal evaluation process, evaluation criteria, methods and alternatives are precisely cleared relatively to each service issue; each recommended alternative is accompanied by documentation of selected methods, criteria, alternatives and rationale for the recommendation. The documentation is than distributed to relevant stakeholders, and provides a record of the formal evaluation process and rationale, which are useful to other work groups that encounter a similar issue and to further improvements in the future.

63. **Which evaluation criteria, if any, are used in the ecosystem to assess different service idea alternatives? How are they ranked? (BSM operative)**

f. No specific evaluation criterion is defined, a list or range of choices is occasionally prepared according to the specific issue.
g. Service alternatives are mainly weighted on the basis of their limitations and enablers, as related to the integrated offer we have in mind.
h. The most important evaluation criterion the ecosystem adopts is the real business value that, compared to the disadvantages, the service solution can give to its offer.
i. Immediately after the business value one, other criteria, as the consideration of the impacts on priorities and linked risks of the various service solutions, are explored. We also establish non-numeric values or formulas in order to relate each evaluation parameter to a numeric weight, and thus assess its criticality.
j. In order to achieve a long-term oriented evaluation, total cost of ownership/service contracts, lifecycles costs and environmental impacts derived from service choices are considered as well. We also document our rationale for the following selection and rejection of evaluation criteria, in order to allow future immediate use.

64. Which aspects do you discuss with the other partners while creating involvement in the new innovative service ideas? (BSM strategic)

a. We just discuss about the specifics of the service and which tasks each partner has to perform. Everyone thinks mainly to its tasks than.
b. We involve all the partners in legal aspects.
c. We consider legal aspects and, related to them, requirements each partner has to respect, in terms of time, costs and quality, helping each other in case of need.
d. We consider legal and monetary aspects and, related to them, requirements each partner has to respect, in terms of time, costs and quality, helping each other in case of need.
e. We consider legal, monetary and ecological aspects and, related to them, requirements each partner has to respect, in terms of time, costs and quality, helping each other in case of need.

D. ECOSYSTEM {CREATION OF A VME} SECTION

In order to evaluate the maturity index ECOSYSTEM {CREATION OF A VME}, than, we a CMMI based maturity model. The model here proposed has been derived, together with the PAs compounding it, from a wide analysis conducted upon theories related to the individuation of stages that have to be followed in order to configure a solid, sustainable and synergic ecosystem and, starting from that, create a VME (Virtual Manufacturing Enterprise).

The model thus permits the evaluation of the maturity of the ecosystem in successfully assuming the form of a collaborative, integrated network, resulting in a VME. The maturity is assessed through the investigation of the following 5 process areas (PAs), derived from the hypothetical stages that conduct to the creation of a solid ecosystem. The maturity is related to the capability of the ecosystem to create a VME.

- Common Strategy Development (CSD)= elaboration of a shared vision and, talking in terms of a network of organizations, an agreed Value Framework, from which a complete and clear value proposition, approved by all the members, has to spring;
- Ecosystem Governance and Decision making (GDM)= once built up an agreed Value Framework, the companies have to define and agree upon their roles, functions and governance rules, in order to enable the support and effective development of a common business idea. A perfect fit between the network under construction and the value framework previously developed has to be monitored and maintained as well;
- Operation and management (OM)= to achieve the common business idea, the partners of the ecosystem have to conduct several operational and managerial activities, such us financial organization or membership management activities; each member has to repetitively execute these practices, following an iterative process with the main goal of progressive improvement (*kaizen*). .
- Communication, Collaboration and Trust (CCT)= all the partners of the ecosystem have to stimulate, encourage, reinforce and check the communication in the network, in order to favor mutual collaboration; all partners have to show an ethical, open and responsible behaviour in order to promote common trust and collaboration.
- Balance of the Ecosystem (BE)= this PA includes sizing and optimization matters, relatively to internal and external flows of resources between the different members of the ecosystem.

These PAs are processes to be fulfilled in order to create a solid ecosystem, allowing the creation of a VME.

D.1 COMMON STRATEGY DEVELOPMENT

65. **Which basic perspectives of value guide the definition of a common value framework and value proposition inside your ecosystem, if any? (BSM strategic)**
    a. We do not share basic perspectives of value together as a unique, virtual enterprise. Each one of us has its business objectives and its value proposition and it acts in the network in order to obtain its own gain; we do not even work according to value proposition theory.
    b. The only one value driver we assess together is the warrantee of an economic stability of each member of the ecosystem.
    c. Together with the economic stability, we pay attention to share some common drivers and spread motivation across the network.
    d. Our guides to the definition of a common value framework are generally economic stability of each player and common drivers and motivation, but also a sense of reciprocity. We take care that in the ecosystem each member is willing to do something for another one because he knows that member would do the same for it.
    e. Economic stability, common drivers and motivation, reciprocity and sustainability. The ecosystem reaches such an integration and synchronization levels that it succeeds in operating efficiently and with low environmental impacts.

66. **How do you believe the value proposition of your company is "virtually" related to the one of the ecosystem, if the latter is present? (BSM strategic)**
    a. No common value proposition is assessed for the whole ecosystem.
    b. The value proposition of each player addresses the directly related users only, and it's driven by economic stability to be reached through an efficient collaboration with the other partners as well.
    c. The value proposition addresses directly related users and the organization itself, and the main goal, shared with the other members of the ecosystem, is to differentiate in the sector of competence through innovative offers.
    d. The value proposition specifically addresses the ecosystem: while trying to reduce costs of production and to develop innovative solutions, companies looks into the value gain conquerable by the other partners as well, collaborating in order to contemporary succeed as stand-alone entities and common group.
    e. The value proposition of each company specifically addresses the ecosystem, in the way explained in answer d., but the added goal that each relevant member wants to reach through collaboration and cooperation is environmental sustainability.

67. **Which supporting methodologies or mechanisms do you activate to create, realize and review a common value proposition, if any? (BSM tactical)**
    a. No specific supports are provided to assure collaboration through the ecosystem.
    b. Each company reserves a group of employees that sometimes are in charge of meeting or communicating with the exponents chosen by the other members, in order to assess common value drivers of future performances to be achieve alone and together through the ecosystem.
    c. The relevant members of the ecosystem choose a group of employees which will form, together with the other groups, a project team in charge of assessing a common value proposition and reviewing it, with a problem solving oriented approach. Freedom of entrance and exit of the various group is usually not given, because of the presence of a scarce reciprocal trust.
    d. The relevant members of the ecosystem choose a group of employees which will form, together with the other groups, a project team in charge of assessing a common value proposition and reviewing it, with a problem solving oriented approach. Freedom of entrance and exit of the various group is given, and the groups of the team collaborate with reciprocal trust.
    e. The relevant members of the ecosystem choose a group of employees which will form, together with the other groups, a project team in charge of assessing a common value proposition and reviewing it, with a problem solving oriented approach. Freedom of entrance and exit of the various group is given, and the groups of the team collaborate with reciprocal trust. Traceability of achieved results and problems solved is maintained in order to continuously modify and enhance the principles guiding the common value proposition. (O.)

D.2 ECOSYSTEM GOVERNANCE AND DECISION MAKING

68. **Are the roles of the members specifically defined in the ecosystem? In other words, are you clearly aware of the power and interests of each player of the network? (BSM strategic)**
    a. No roles are defined, companies taking part into the network do not occupy a clarified role.
    b. In the ecosystem, the role of the dominator, which will have coordination and communication functions as well, is known only.
    c. Together with the dominator some keystones (relevant players) are clearly stated and defined; they could be producers of components, service providers or other kinds of suppliers and clients along the value chain. Specifics and features of their relation to the dominator are defined as well.
    d. Together with the dominator all the keystones (relevant players) and some niche players are clearly stated and defined. Niche players contribute to the efficiency of the ecosystem and collectively create much of the value in a healthy ecosystem.
    e. Together with the dominator all the keystones (relevant players) and all the niche players are clearly stated and defined. Roles, power and interest of each member of the network are than assessed, and thus their behavior and relations with the others, in order to guarantee a balanced and equilibrated ecosystem.

69. **Are specific functions assessed for each member of the network? (BSM strategic)**

a. No functions are defined, because roles of members gathering in the ecosystem are still unknown.
b. Functions of the driver company are clearly stated: they could be producer of the core product or of the core service. In general it will be the developer of that part of the offer which it has decide to integrate, thank to the contribute of the other players, in order to obtain an innovative PSS.
c. Functions of driver company and some relevant players are assessed. In the ecosystem is now known who is the producer of the core product and/or service and who are the main intermediaries and ecosystem members involved.
d. Functions of driver company, all relevant players and some secondary members are assessed. In the ecosystem is now known who is the producer of the core product and/or service and who are all the intermediaries and members of the ecosystem involved. Specialized functions of some secondary members are defined as well.
e. Functions of driver company, all relevant players and secondary members are assessed. In the ecosystem is now known who is the producer of the core product and/or service and who are all the intermediaries and involved members of the ecosystem. Specialized functions of all the secondary members are defined as well.

70. **How do you verify that power and functions of each member are correctly aligned to the value framework and value proposition on which you are working as a united ecosystem? (BSM strategic)**
    a. We do not really monitor this issue, because we neither assess roles and functions nor a clear and shared value framework.
    b. We check if the way of working and the values exerted by each member are compatible with the ones demanded by the value proposition and framework under construction.
    c. Together with way of working and values, and thus compatibility of the member to stay in the ecosystem, we also check its power and commitment, trying to assess the fit between the implications of its role and function in the network and the value framework previously generated.
    d. Together with way of working and values, and thus compatibility of the member to stay in the ecosystem, we also check its power and commitment. If an alignment is not satisfactorily reached, occasional analyses could be conducted in order to understand how the interested members are good in recovering the gaps or in influencing and changing them through their power.
    e. Together with way of working and values, and thus compatibility of the member to stay in the ecosystem, we also check its power and commitment. If an alignment is not satisfactorily reached, further analyses are always conducted in order to understand how the interested members are good in recovering the gaps or in influencing and changing them through their power. Final observations of this analyses are than tracked and stored, in order to enable and improve continuous and reactive improvement of the network reflecting the value framework.

71. **Which instruments do you utilize to verify the equilibrium of the network which you are designing together? (BSM operational)**
    a. No specific instruments or methodologies are implemented, we are still in a primitive stage of development of framework and network, which makes the utilization of any kind of tool premature.
    b. We define KPIs for each stand-alone company and we compare them with the ones assessed relatively to the common value proposition. Indicators are mainly financial and economical.
    c. Together with the definition of local and global KPIs (mainly financial and related to the internal business processes) we conduct a participative stakeholders' analysis to assess power and commitment of each member and thus verify their fit in the network under configuration.
    d. Together with the definition of local and global KPIs (mainly financial, related to the internal business processes and to the customers) we conduct a participative stakeholders' analysis to assess power and commitment of each member and thus verify their fit in the network under configuration. Team groups, compounded by exponents of each member of the network are in charge of conducting internal audits of the various members to verify the veracity of the results of this analysis.
    e. Local and global KPIs, participative stakeholders' analysis, team groups and internal audits are all used and implemented. In particular, companies define financial, internal business processes, customer, learning and growth oriented KPIs. In such a way, an authentic Balanced Scorecard is utilized, in order to simultaneously translate the vision into operational goals, facilitate the communication of the vision and link it to individual performance, enable business planning and index setting and continuously guarantee feedback and learning, thus adjusting the local and network strategies accordingly.

D.3 COMMUNICATION, COLLABORATION AND TRUST

72. **How are communication and collaboration stimulated across the ecosystem? (BSM strategic)**
    1. We do not coordinate our business processes with those of the other partners of the ecosystem, we thus do not need to communicate and collaborate with them.
    2. Each member takes care of its internal development challenges, meanwhile occasionally agreeing appropriate business expectations with the other players.
    3. Each member takes care of its internal development challenges, meanwhile periodically agreeing appropriate business expectations with the other players. Documents assessing the ecosystem business expectations are filled in periodically. Diversified communication is thus provided across the network, even if still insufficient to enable collaboration among all the players of the network, but just the relevant ones.
    4. Members constantly check internal development challenges and periodically agree expectations according to capabilities and potentials of each player of the ecosystem. They also study unintended causes of bad integration, such as regulatory delays, financial difficulties of one member or incentive problems across the value chain. Diversified and sufficient communication, related to value framework and different roles of functions covered by the various members, is provided.
    5. Members constantly check internal development challenges and agree expectations according to capabilities and potentials of each player of the ecosystem. They also study, on a continuous basis, unintended causes of bad integration, in order to respect the agreed expectations and improve on a regular basis. The monitored unintended causes comprehend regulatory delays, financial difficulties of one member, incentive problems across the value chain and leadership crisis. Overall performance reached throughout the ecosystem is constantly monitored. Diversified and sufficient communication, related to value framework and different roles of functions covered by the various members, is provided, and constantly revised and updated.

73. Who is predominantly involved in the collaboration and communication mechanisms? (BSM strategic)

a. No one is involved, collaboration and communication network is still primitive or limited to isolated activities.
b. The dominator, with whom the other players of the ecosystem densely exchange information (mainly related to common aspirations and occasional changes to value proposition).
c. In addition to what stated in answer b., an involvement activity of all the intermediaries and ecosystem members is included and conducted.
d. In addition to what stated in answer c., the involvement activity is extended to users and customers.
e. In addition to what stated in answer d., a monitoring activity of the niche players is also realized by the other members, in order to insert them too in the cooperative network through collaboration and communication.

74. Which methodologies and supporting techniques does each member use to enable a cooperative strategy across your ecosystem? (BSM tactical)

a. No communicative and coordination techniques are implemented.
b. Internal audits, occasional reunions or teleconferences with the other relevant members.
c. Internal audits, periodical reunions or teleconferences with all the other members, periodical reports assessing the expectations to be maintained by each member to reach the overall business objectives.
d. Internal and external audits made by dedicated work teams, periodical reunions or teleconferences with all the other members, periodical reports assessing the expectations to be maintained by the company to reach the overall business objectives. Those approaches are all facilitated by the utilization of Cloud Computing applications.
e. Internal and external audits made by dedicated work teams, periodical reunions or teleconferences, periodical reports assessing the expectations to be maintained by each member to reach the overall business objectives, constant feedbacks provided to the other members, regarding the performances relatively to the agreed expectations. Those approaches are all facilitated by the utilization of Cloud Computing applications.

75. Which communicative and collaborative tools do you apply? (BSM operational)

a. No communicative and collaborative tools are implemented, we are still in a primitive stage of development of framework and network, which makes the utilization of any kind of tool premature.
b. Benchmark analyses, key drivers identification, discussion refinement, results and benefits for partners evaluation.
c. In addition to what stated in answer b., cost-revenue analyses and determination and monitoring of incentives related to intermediaries and ecosystem members.
d. In addition to what stated in answer c., participative aggregate marketing and advertisement campaigns, assessing the solution provided by the offer, the possible future enhancements to be developed and the benefits for users, are organized and publicized by the players of the ecosystem.
e. In addition to what stated in answer d., accounting indexes related to the niche players are thus defined and operational items measurement, such as their investments and profits, is thus performed.

D.4 BALANCE OF THE ECOSYSTEM

76. **How does each member manage its resources/assets, relatively to the other members of the ecosystem, in order to reach a balance of the ecosystem itself? (BSM strategic)**
    f. Each member focuses the use of its resources on its core activities, without having a look to the processes of the other members or accepting any kind of assistance from them.
    g. In case of emergency, the member agrees to devolve part of its human resources to assist the keystones member of the ecosystem, receiving in exchange the same kind of treatment from them. The common objective is to reach a good timing and synchronization in business practices.
    h. Each member agrees with the other keystones (typically complementors and service provider(s)) to reserve part of its human resources, and some machineries if needed as well, in order to help them with urgencies and matters directly connected to the timely deployment of all the components of the product-service solution. In exchange, the member receives the same kind of treatment from them.
    i. Each member reserves not only part of its tangible and human resources, but also financial funds, exclusively to assistance activities across the ecosystem, obviously making sure to keep them busy also in those periods where no relevant problems are showing in the network (for example, with monitoring activities, periodical reviews of the network dynamics, and so on).
    j. Each member reserves not only part of its tangible and human resources, but also financial funds, exclusively to assistance activities across the ecosystem, obviously making sure to keep them with the right workload also in those periods where no relevant problems are showing in the network. In addition, players destine this resources to the historical analysis of interventions and assistances accomplished across the ecosystem in the past, in order to enhance their competences and improve from past experiences.

77. **How does each member utilize specific communicative tools to exchange info with the other players of the ecosystem regarding internal and external needs of resources, and thus regarding the balance of internal and external fluxes? (BSM operational)**
    f. No specific tools are used, because each member focuses the use of its resources on its core activities.
    g. Each member recurs to e-mails, Skype calls or telephonic talks with the functional managers of the keystones and dominator, in order to discuss upon emergencies and agree on the need of interventions with a team of experienced workers.
    h. Each member manages to create a “resource report” (regarding the amount of tangible and human resources to destine to external allocation across the ecosystem), which it annually updates through reunions with keystones and dominator.
    i. Each member manages to create a “resource report”, which it annually updates through reunions with all the other relevant players of the network, and which is occasionally updatable through the web, thanks to the use of simple IT technologies such as Cloud Computing. It also provide a database, or a section in its existing databases, dedicated to this resources, assessing their performances (utilization rate, availability, cycle time and so on).
    j. Each member has an updatable “resource report”, accompanied by periodical reviews and reunion with partners. It uses databases, employing them for historical analyses and/or planning simulation models in order to observe errors or lacks in its resource allocation systems, and thus derive opportunities for continuous improvement. This historical analyses are usually conducted by the human resources externally allocated, in order to maintain them busy and favor a direct contact with feedbacks related to their activities.

78. **Which resources/assets does each member flexibly use in the ecosystem (for example destining them to processes other than the ones on which it is directly focused, in order to obtain and maintain a balanced network)? (BSM operational)**
    f. No resources are externally allocated.
    g. Each member occasionally allocates groups of employees externally, especially in cases of emergencies or urgencies related to its direct partners. External allocation is not flexible though, but just limited to isolated, non-periodical events.
    h. Regular external allocation of human resources, machineries and transports is managed accordingly to the "resource report" drawn up annually. This external allocation is still not flexible, but just limited to the occasions stated in the report and agreed by the partners.
    i. Regular external allocation of human resources, machineries and transports is managed accordingly to the "resource report" drawn up annually. In addition, the allocation can be changed or modified according to the occasional modifications to the report made by the dominators or the other keystones. In order to facilitate a timing and synchronized execution of this activities, the dominator may decide to share its database with the other partners as well.
    j. Regular and flexible external allocation of human and tangible resources is provided. Data provided by databases are shared and analyzed collaboratively with the other partners to assess any possible kind of enhancement to bring in the current system.

D.5 OPERATION AND MANAGEMENT

79. **How does the member guarantees a continuous enhancement of value framework, configuration, collaboration and balance of the ecosystem? (BSM strategic)**
    a. No enhancement is guaranteed to the ecosystem, once it has been configured for the first time.
    b. Enhancements are provided just in case of errors, incompatibilities or problems in the development process of the integrated offer.
    c. Enhancements to the cycle of design of an ecosystem are provided on a cyclical basis, in general every five years. Before modifying practices, in fact, players think that they have to be adopted for a range of time in order to become more expert.
    d. Enhancements to the cycle are provided on a cyclical basis, whose range progressively reduces as experience and reactivity of each member increase, reaching at most the year.
    e. Enhancement to the design of the ecosystem are provided on a continuous basis. The outputs of each cycle are the input of the next one.

80. **Which tools and techniques do you adopt in order to assure the progressive optimization and continuous enhancement of the network? (BSM operational)**
    a. Neither tools nor techniques are applied to assure continuous enhancement to the network.
    b. Quality Function Deployment (QFD).
    c. QFD and Simulation Tools, in order to constantly monitor the existing business process and reduce the time to market of a personalized, differentiated offer.
    d. QFD, Simulation Tools, Lean Manufacturing management techniques, applied to the Operations of the network.
    e. QFD, Simulation Tools, Lean Management, Life-Cycle Cost and Life-Cycle Assessment techniques applied to the entire network.

APPENDIX

For each one of the sections, questions have been developed for the survey, depicting the three different levels: strategical, tactical and operational. Questions are related to Process Areas (PAs) and each PAs can be then assessed for its maturity. In order to allow maturity calculation CMMI approach is adopted and to apply it, questions consider five possible choices, each one reflecting one grade of maturity of PA analysed. These five levels are:

- **INITIAL.** Ad-hoc and chaotic processes: the company/ecosystem does not provide a stable supporting environment. The success of the company/ecosystem depends on people competencies and heroisms, and not on the use of consolidated processes. Nevertheless, companies/ecosystems at this level of maturity generate solutions that work but usually can overtake their planned and documented budget or planned time.
- **MANAGED.** Work groups set up basis for the process under analysis, regulating project and work management. In this phase, basic techniques are applied and managed, but weak methodologies and tools are generally adopted. Processes are not executed according to well-defined frameworks or models. In this cases, often happens that distinct work groups define a strategy, create working plans, and monitor and control work in order to guarantee that a specific solution will be provided as designed, it might happen that this does not result in a synchronized and efficient way.
- **DEFINED.** Defined processes are adopted for the execution of tasks. These processes are well known and executed by the company/ecosystem as a whole and are ruled by norms, procedures, instruments and methods. These standard processes are established and enhanced over time. The key competencies for the success of the specific strategy are not completely exploited, and the comprehension of contents is limited to the most important issues. Consecutively, processes are not totally under control. In specific context, this stage of maturity can anyway be enough to reach good results.
- **QUANTITATIVELY MANAGED.** Quantitative objectives, regarding performances and quality of processes, are fixed and used as process management criteria. They are based on the company/ecosystem's needs. Quality and performances are statistically evaluated and monitored over the entire life of the processes. In this phase, processes are run with the use of specific competencies and good practices. Process are systematically comprehended, controlled and managed, while producing predictable results.
- **OPTIMIZED.** The company/ecosystem constantly enhances its processes, based on a quantitative comprehension of its business objectives and performing needs. The company/ecosystem is now able to continuously empower its processes (methods, instruments, resources), basing on a quantitative comprehension and qualitative evaluation of each component. The objective is to focus on the continuous improvement of its process performances, even through the technological empowerments and the use of an incremental and innovative approach.

According to what stated so far, each question of the survey assumes the following structure:

No. Question (Business Model Level)

a. Answer referring to an INITIAL maturity level.
b. Answer referring to a MANAGED maturity level.
c. Answer referring to a DEFINED maturity level.
d. Answer referring to a QUANTITATIVELY MANAGED maturity level.
e. Answer referring to an OPTIMIZED maturity level.