D25.3 – "Requirements for analyzing service ecosystems by business analysis tools"

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PEER REVIEW SUMMARY

ID	Comments	Addressed (✔) Answered (A)
1	Complete Executive Summary with main conclusions achieved.	✔
2	Justify the rational choice of combining GRAI method and the MSE Conceptual Model approach when extracting performance indicators	✔
3	Section 2.2.2. - Explain in detail the methodology that allow the exact identification of the PIs. Why these PIs are the good ones for this purpose? Are there others? Who identified these ones? Using which methods? What is the level of confidence on these PIs ?	**A -** The methodology is the previously defined combination of GRAI and MSE Conceptual Model. Regarding indicators, they have been identified from the perspective of a MSE coordinator who needs the basic (and useful) indicators about the performance of the ecosystem in order to take the correct decisions.
4	Explain how all the indicators defined are measured and quantified	✔ - Almost all of them have been detailed, and in some case, it has been stated that it will be defined inside and coming from WP24 – Maturity Model and Change Management
5	Too sharp and not argumented conclusion in the 'Requirements for the Business Tools of the future' point	✔ - Changed the statement leaving open space for other alternatives that are not so restrictive, and look for BI Tools customization instead of developing a new BI Tool from scratch.

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KPI	Key Performance Indicator
MSE	Manufacturing Service Ecosystem
PI	Performance Indicator
VME	Virtual Manufacturing Enterprise

1 Executive Summary

The aim of this document is to provide a reference about the requirements to measure the performance of a Manufacturing Service Ecosystem (MSE) using business intelligence tools. This deliverable is a continuation of the deliverable *"D25.2 – Requirements for analyzing service ecosystems by business analysis tools"*. As it was stated at the latter, currently there is not any business intelligence tool in the market to measure a MSE. This document provided an analysis of the existing tools in order to understand their characteristics and limitations and a wide range of potential PIs that should be taken into account to measure an existing ecosystem. Therefore, the current deliverable provides a deep analysis of the requirements to measure a MSE's performance which should be included in the business tools for measuring ecosystems. Additionally, the main PIs to be used to measure an existing ecosystem are described.

Firstly, the methodology followed will be described in detail. This is very important in order to know the reasons behind the selection of a concrete PI and discard another one. Secondly, the list of different PIs identified and obtained as a result of this methodology will be specified. The PIs will be categorized depending on the measuring targets they have. Additionally, the requirements for the development of business intelligence tools are collected, bearing in mind that these tools will measure a MSE and not only a single enterprise.

Last but not least, the conclusions achieved are described focusing on the currently difficulties for measuring an ecosystem of multiple companies. Although the PIs generated following the selected methodology are the main ones in order to monitor an ecosystem, the number of PIs used to monitor a concrete ecosystem can be increased in order to fulfil its requirements. Moreover, the requirements for the business intelligence tools of the future are addressed, taking into account the complexity of measuring an ecosystem of multiple companies. Since no current tool can measure an ecosystem, it is needed a customization of the existing ones.

This deliverable belongs to the *"WP2.5 – Service based Innovation Ecosystems"* of the MSEE project, which aims to define a framework for the service based innovation ecosystem to be considered as a reference. This framework includes concepts and ideas to be taken into account for their development.

To fulfil these objectives, the WP2.5 is divided in three main tasks, and this deliverable is part of the second one: ***"T25.2: Service ecosystems requirements for business analysis tools"*** which aims to define the requirements of new approaches and business intelligence tools which should be fulfilled for analysing service ecosystems since there is no tools providing this support right now.

2 Concept and methods for Manufacturing Service Ecosystem performance measurement

This section's aim is twofold; on the one hand, it analyses and explains important concepts related to Manufacturing Service Ecosystems that shall facilitate understanding the particular characteristics service ecosystems have, and thus, better orientate the analysis of the requirements for business analysis tools.

On the other hand, this section describes the method and approach that has been followed in order to identify the Performance Indicators (PIs) that will allow measuring the performance of MSE, and ultimately, define the requirements for business analysis tools when analysing service ecosystems.

2.1 Manufacturing Service Ecosystem concepts and characteristics

According to MSEE project, a Manufacturing Service Ecosystem shall be defined as *"a non-hierarchical form of collaboration where various different organisations 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 organisations from various branches, ICT suppliers, universities, and research centres, local public authorities, individual consultants, customers and citizens"* (MSEE_D25.1).

Hence, MSEE project is positioning MSEs, in terms of organisational structure, between a formally defined and governed network – such as a Virtual Breeding Environment (VBE) (Camarinha-Matos L.M., 2012) – and the "open universe" of all potential partners for collaboration. Consequently, and based on the above mentioned definition of a Manufacturing Service Ecosystem, several of its characteristics might be highlighted:

- Formalisation: partners recognise that they are part of an ecosystem. They must agree on a common objective (to develop innovative solutions/services in a defined domain). They sign an agreement to work together and to follow some rules. Due to the fact that each partner brings knowledge and added value in the MSE, it is normal to establish some rules to preserve and protect the shared knowledge.
- Type of relationship between partners: the ecosystem has a non-hierarchic character. Usually it is self-organised, most decisions are decentralized, thus, it is not "managed in the classical sense" by one of its members. Anyway, the partners must agree on the objectives and to adopt an appropriate structure to reach the objectives. However, some partners can take a more active part and facilitate coordination and decisions. Under these conditions the ecosystems which have defined objectives can use KPI to check the achievement of such objectives.
- Openness and stability: the ecosystem is evolving; some organisations leave the ecosystem while others join it. Joining and leaving require semi-formal conditions due to the fact that belonging to the MSE each partner gains knowledge and added value. In principle MSE as such is not doing business, although it has a vision, mission and objectives.

Moreover, the research carried out in Task 25.1 and Task 25.4 has resulted in the definition of a Conceptual Model for MSE and the description of its main components under the scope of Service Science Management Engineering (SSME).

The conceptual model took the basis of the above mentioned definition of a MSE and from this definition its components and specific characteristics were drawn at the Figure 1. The following figure shows the global view of the conceptual model of a MSE whose pillars, components and features will be described in detail in this section.

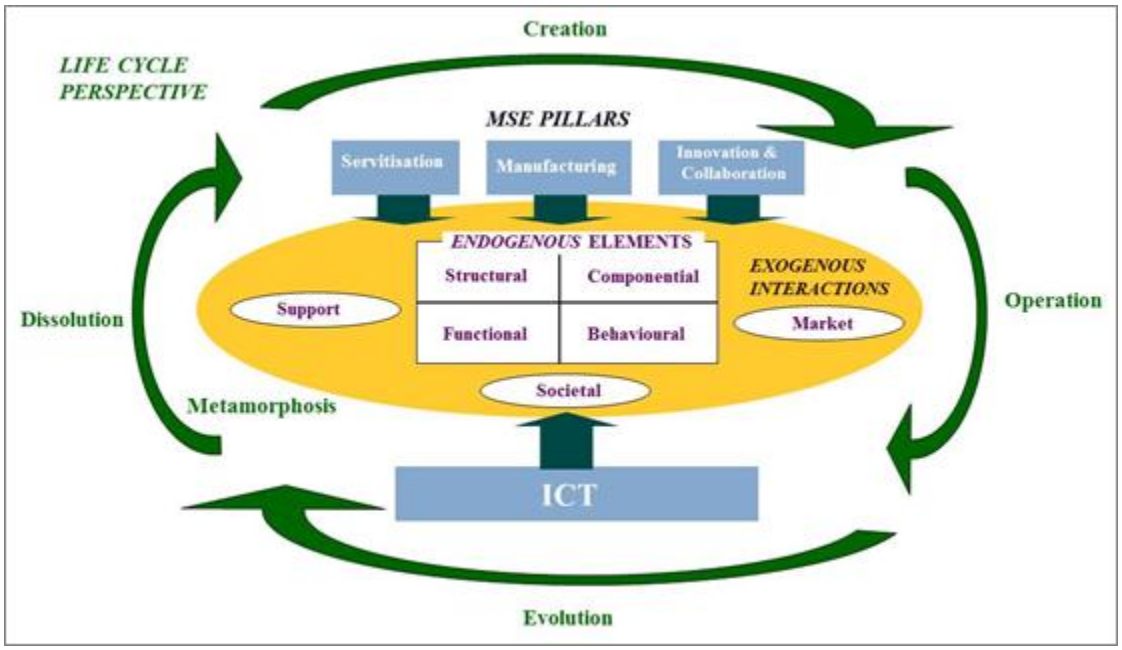

Figure 1: Graphic representation of Conceptual Model for MSEE

Aligned with the mission of MSEE's ecosystem (MSEE_D25.1) – "work in a collaborative way to create new innovative and added-value combinations of manufactured products and product-related services"-, the three pillars (innovation, servitisation and manufacturing) enable the ideation and development of new innovative services from a manufacturing environment, supported by endogenous and exogenous components of the ecosystem that will evolve along the ecosystem's lifecycle.

The main components of a MSE are described as follows and need to be taken into account when measuring the performance of service-based innovation ecosystems:

- Structural dimension (organisation and roles): structural components concern a MSE constituting elements, namely its participants and the roles they perform. They are classified taking into account their contribution to Innovation and Servitization and their function within the ecosystem is depicted based on the mentioned contribution.
- Componential dimension (assets and resources): it focuses on the tangible/intangible assets and resources that will facilitate the internal operability of the MSE and that will part of Virtual Manufacturing Enterprises (VME).
- Functional dimension (functions and processes): this dimension addresses the base

functions and processes related to the activities of a MSE. The main processes and sub-processes are service innovation management, service engineering management or VME creation and operation handling.

- Behavioural dimension (management and governance): it focuses on the principles, policies and governance rules that drive or constraint the behaviour of the MSE and it members. Governance rules and policies need to be elaborated in order to support internal regulations, contracts and agreements and trust management. Also, governance bodies need to be identified and assigned to monitor that the aforementioned policies and rules are being accomplished.

These components and the above mentioned characteristics constitute the core elements of a MSE and shall guide the definition of the objectives, decision centres and, ultimately, the Performance Indicators (PIs) of a Manufacturing Service Ecosystem.

2.2 Performance of Manufacturing Service Ecosystem

As it was described previously, one of the aims of this deliverable is to generate and select performance indicators (PI) in order to elicitate the requirements that business analysis tools should fulfil when targeting service ecosystems. The identification of these indicators needs to be conducted according a reference governance framework. To do so, the Conceptual Model aforementioned has been combined with the GRAI method.

The GRAI model has various fields of application, one of them being the choice and implementation of performance indicators systems. Therefore, in combination with other methods, it has been selected by the MSEE project to create governance reference framework for MSE (MSEE_D13.2) and, ultimately, identify performance indicators.

However, as it will be explained in the next section, the functional axis of the GRAI grid includes functions that correspond to production systems. Thus, these functions needed to be adapted to the Manufacturing Service Ecosystems, where the activities that are developed and the way in which are developed, are different. As a consequence, the MSE Conceptual Model has been the basis for the identification of these activities, including the collaborative

In order to use the GRAI grid the first step has been the definition of the activities that would feed the functional axis. It was, therefore, necessary to identify the activities that are developed in the scope of a Manufacturing Service Ecosystem. The basis for the identification of these activities has been the MSE Conceptual Model, which encompasses the key features, concepts and characteristics of a service-based innovation ecosystem.

2.2.1 GRAI Model and Manufacturing Service Ecosystem

The GRAI model (Doumeingts G., 1998) describes the control of any kind of organisation using a combination of System Theory and Control Theory, particularly, Hierarchical Theory. This model is composed of three main building blocks:

- The reference model, called GRAI model, which is a set of steps that model any production system. It is, therefore, generic and independent of the case upon which the method is applied.
- The second one is concerned by graphical modelling languages that enable to instantiate the concepts of the GRAI model to build the specific model of the studied

case.

- Finally, the third block is a structure and participative approach within which actors and steps are defined.

As explained in detail in Deliverable 13.2 (MSEE_D13.2) the GRAI model is composed by three principles:

- Control of the system;
- Decomposition of the control system in two sub-systems: the decision and the information sub-system;
- Decomposition of the decision sub-system according to two criteria, i.e. temporal and functional.

The control of the physical system is the result of decisions taken according to various functions. The decisions have various natures: strategic at long term (defining the objectives, tactical at medium term (defining the planning of resources) and operational at short term (to perform the actions).

The principles of GRAI approach allow to represent and to study the system at global level and at detailed level. One of the tools of the GRAI method is the GRAI grid. It takes up the hierarchical and functional approach and allows identifying the set of decision centres of the studied system. The concepts presented by the GRAI model are implemented in this grid in order to obtain a specific model.

The GRAI grid is a matrix presented with the managerial or control axis, representing the various levels of decision making in an organisation (strategic, tactical and operational). Moreover, the second functional axis describes the various activities of the product or service life cycle.

This GRAI grid has been the basis for the identification of objectives and decision centres for Manufacturing Service Ecosystems, allowing the further generation of PIs for MSE performance measurement.

In order to use the GRAI grid the first step has been the definition of the activities that would feed the functional axis. It was, therefore, necessary to identify the activities that are developed in the scope of a Manufacturing Service Ecosystem. The basis for the identification of these activities has been the MSE Conceptual Model; analysing the dimensions and the components of the MSE, the activities or functions that are key for the operation of the MSE have been identified:

- Membership management
- T/I assets management
- Service innovation management
- VME creation
- MSE governance

These have been the functions that have been used in the functional axis of the GRAI grid. As shown in the table below (Table 1), the GRAI grid has allowed identifying the objectives of

the MSE at different hierarchical levels. Therefore, the decision centres of the MSE, to which the performance indicators will be connected, have been determined.

	Membership management	T/I Assets management	Service innovation management	VME creation	MSE Governance
Strategic	Enrol the appropriate MSE members in order to fulfil its objectives	Provide MSE with the relevant capacity and knowledge	Create and exploit new business opportunities and ideas	Create sustainable and profitable VMEs	Efficient management of MSE and its members' interaction
Tactical	Manage MSE members	Manage T/I assets	Manage development of new ideas	VME formalization and monitoring	Monitoring of internal agreement and management of complaints and claims
Operational	Identify and recruit new MSE members	Rate all assets used by MSE members	Identify new business opportunities and ideas	Define requirements for the new service	Identify potential claims and complaints within the MSE

Table 1: Manufacturing Service Ecosystems GRAI grid

2.2.2 The use of Performance Indicators within Manufacturing Service Ecosystem

According to (Ducq, 2005) a performance indicator is "a quantified data which measure the efficiency of decision variables in the achievement of objectives defined at a considered decision level and in accordance with the defined business strategy".

From the decision level perspective different PIs might be considered:

- Strategic PIs: these are the indicators necessary to measure the performance of the whole control system, that is, the performance of the MSE.
- Tactical PIs: its aim is to measure the performance at middle-term.
- Operational PIs: these are required in order to measure the performance on a daily basis and, usually, at short-term.

KPIs are considered strategic PIs, as they allow measuring the parameters to know the achievement of the strategy and they provide the most important performance information to understand the performance of an organisation.

This deliverable has focused in the identification and classification of PIs according to the approach of the GRAI grid and has included the three types of PIs mentioned above. The next table (Table 2) represents the grid that has been used in order to identify these PIs. Having identified the objectives and decision centres of the MSE, the performance indicators that will measure their fulfilment have been generated and classified. These Performance Indicators will be further detailed and explained in the next section of this deliverable.

MSE functions	Objectives- Strategic/Tactical/Operational	Performance indicators- Strategic/Tactical/Operational
Membership management	S: enrol the appropriate MSE members in order to fulfil its objectives	S: ▪ Relevance of the assets provided by each MSE member ▪ Maturity of MSE members for collaboration
	T: manage MSE members	T: ▪ Number of entries in the MSE ▪ Number of exits from the MSE ▪ Number of MSE members involved in VMEs/number of MSE members ▪ Number of MSE members involved in idea generation/numbers of MSE members
	O: identify and recruit new MSE members	O: ▪ Number of new members recruited
T/I assets management	S: provide the MSE with the relevant capacity and knowledge in order to fulfil its objectives	S: ▪ Number of assets used in VMEs/total MSE assets ▪ Overall rating of MSE assets
	T: to manage MSE assets	T: ▪ Number of assets accepted ▪ Number of assets removed

	O: to rate all assets used by MSE members	O: ▪ Number of assets rated/number of assets used ▪ Number of assets used/number of MSE assets
Service innovation management	S: create and exploit new business opportunities and ideas	S: ▪ Number of new service ideas selected
	T: manage the development of new ideas	T: ▪ Number new ideas generated ▪ Number of new ideas assessed
	O: identify new business opportunities and ideas	O: ▪ Number of new business opportunities and ideas identified
VME creation	S: create sustainable and profitable VMEs	S: ▪ Number of profitable VMEs/number of created VMEs ▪ Individual VME lifetime
	T: VME formalisation and monitoring	T: ▪ Number of created VMEs ▪ VME profitability
	O: define requirements for the new service	O: ▪ Number of new service ideas assessed ▪ Number of new services designed

MSE governance	S: efficient management of MSE and its members' interaction	S: ▪ Evaluation of pending complaints ▪ Number of MSE members expelled
	T: monitoring of internal agreement and management of complaints and claims	T: ▪ Number of agreements not fulfilled ▪ Number of complaints not solved/number of complaints arisen ▪ MSE members that present more complaints ▪ MSE members that receive more complaints
	O: identify potential claims and complaints within the MSE	O: ▪ Number of complaints arisen between MSE members

Table 2: PIs identification GRAI grid

3 Main Performance Indicators for measuring the performance of a MSE

This section will describe all the PIs obtained as a result of the execution of the methodology described in the previous section. The PIs will be divided in different categories, depending on the measuring objectives they are facing, and each of them, will include all the different indicators divided in strategic, tactical and operational purposes.

3.1 Membership management

The aim of this PI is to manage the MSE members in order to have the most appropriated partners to fulfil the MSE objectives.

3.1.1 Strategic Target

The MSE will be successful depending on the members who have joined to it. Having the correct members is a guarantee of success. Even if this is not the only factor to ensure whether a MSE will be successful or not, it is the main one. Any MSE with the wrong members in, it will fail sooner than later.

This is why the target under a strategic scope of this PI is to "enrol the appropriate MSE members in order to fulfil its objectives".

Regarding the indicators to measure this PI, they are the following:

- Relevance of the assets provided by each MSE member: As it will be explained in the next sections, each partner will rate the assets he uses, so all the assets will be monitored. This feedback provides detailed information about the relevance of the assets from the ecosystem partners' point of view.
- Maturity of MSE members for collaborating: This indicator will be defined among the activities that are being carried out inside the specific work package of the project dealing with maturity models (*WP24 – Maturity Models and Change Management).*

3.1.2 Tactical Target

In order to fulfil the strategic target in a long term, it is vital to manage efficiently the activities performed by the partners towards the MSE such as the business opportunities identification, idea generations, the VMEs creation, etc.

As a conclusion, it can be stated that the tactical target of this PI is to "manage the MSE members".

With regard to the indicators to measure this PI, they are the following:

- Number of MSE members involved in VMEs/number of MSE members
- Number of MSE members involved in idea generation/number of MSE members
- Number of entries in MSE
- Number of exits from MSE

3.1.3 Operational Target

In the short term, the MSE will focus on identifying potential members for the ecosystem in order to fulfil the different needs and requirements of the ecosystem. Once the potential

partners have been identified, a deep analysis of each of them will be made, focusing on what they can provide to the ecosystem and, finally, maybe some of them will be recruited to join the ecosystem.

This is why the operational target is to "identify and recruit new MSE members".

As far as the indicators to measure this PI are concerned, it is the following:

- Number of new members recruited

3.2 T/I Assets management

The aim of this PI is to manage the different tangible and intangible assets provided by the different members of the MSE in order to ensure that the available ones are enough and appropriate to fulfil the objectives of the MSE successfully.

3.2.1 Strategic Target

The objective in the long term is to provide the MSE with all the required tools and knowledge in order to fulfil its objectives. These assets must be updated taking into account the needs and requirements of the rest of the members of the MSE; and the sector the MSE is focused on.

This is why the target under the strategic scope is to "provide the MSE with the relevant capacity and knowledge in order to fulfil its objectives".

Regarding the indicators to measure this PI, they are the following:

- Number of assets used in VMEs/total of MSE assets
- Average rating of MSE's assets: As it is explained in the operational target, all the assets will be rated by the partners who have used it. This indicator focuses on the averages of each asset to identify the best evaluated assets and the worst ones.

3.2.2 Tactical Target

In order to fulfil the strategic target, it is very important to manage efficiently the different assets provided by the members of the MSE. This management has to cover the acceptance and removal of the different assets depending on the rating the different partners provide about them after using each of them.

Therefore, the tactical target is to "manage the assets of the MSE".

As far as the indicators involved to measure this PI are concerned, they are the following:

- Number of assets accepted
- Number of assets removed

3.2.3 Operational Target

Regarding the short term, the MSE will focus on providing the rate and the evaluation of the assets by the members after using each of them. All the assets must be evaluated by the members who use them in order to have a deep analysis of them. This rating will be useful in order to fulfil the targets in longer terms because this rating will provide an objective point of

view about the assets which are considered important and interesting for the MSE and which are not.

This is why the operational target is to "rate all assets used by MSE members".

With regard to the indicators involved to measure this PI, they are the following:

- Number of assets rated/number of used assets
- Number of assets used/total number of assets with MSE

3.3 Service Innovation management

The aim of this PI is to monitor the ratio of business opportunities identified by the members of the MSE successfully, that is, how many have been identified; then they have generated a number of ideas of potential services; from these number of ideas, some of them have been selected to be developed; and finally, they have been developed.

3.3.1 Strategic Target

The MSE success will be measured by the number of business opportunities identified and exploited by its members. This is the main purpose of an existing ecosystem and is the strategic target also: "create and exploit new business opportunities".

Regarding the indicator involved to measure this PI, it is the following:

- Number of new service ideas selected

3.3.2 Tactical Target

In order to fulfil the strategic target, it is very important to manage the ideas generated by the MSE members efficiently. All the ideas generated must be analysed in detail in order to select the best ones, that is, those which provide more probabilities of success in the market.

Therefore, the tactical target is to "manage the development of new ideas". Furthermore, the indicators involved to measure this PI are the following:

- Number of ideas generated
- Number of new ideas assessed

3.3.3 Operational Target

As far as the short term is concerned, the MSE members will focus on the business opportunities identification. Each member should be involved in this issue because the success of the MSE depends on each of them. If any of them identifies a business opportunity, it should be shared with the rest of the partners to be analysed. This business opportunity will generate a wide range of new ideas to exploit it, and after a deep analysis, maybe one, two, etc. or even none, will be selected to be designed and developed as a new service, as it has been described in the previous subsections.

This is why the operational target is to "identify new business opportunities".

Regarding the indicators involved to measure this PI, it is the following:

- Number of business opportunities identified

3.4 VME creation

The aim of this PI is to monitor the VMEs creation within the MSE which provide a profit for the members and they are sustainable for a long period of time. If a new VME confirms not being sustainable, it will be cancelled. If this occurs, this VME will be considered as a failure by the MSE.

3.4.1 Strategic Target

As it was explained previously, the VME creation is part of the activity of a MSE. Furthermore, it can be considered as the most important activity of any MSE because the VME is the concretization of the service innovation, which is the ultimate aim of a MSE. But not all the VMEs will be successful and generate profits; it will depend on the business opportunity identified and the service idea developed through it (as it was explained in the previous PI, the idea selection to be developed is vital for the VME creation).

Therefore, the strategic target of this PI is to "create sustainable and profitable VMEs".

Regarding the indicators involved to measure this PI, they are the following:

- Number of profitable VMEs / number of created VMEs
- Individual VME lifetime: This indicator reflects how much time a concrete VME has "lived", that is, the time period between the creation of the VME and its extinction. This indicator provides information about how successful a VME is.

3.4.2 Tactical Target

The strategic target will not be fulfilled if the MSE does not provide the correct support for the formalisation of the VMEs and the monitoring of all the created VMEs. This is very important to detect VMEs which do not live up to the expectations generated and to decide about their dissolution.

This is why the tactical target of this PI is to "VME formalisation and monitoring".

As far as the indicators involved to measure this PI are concerned, they are the following:

- Number of profitable VMEs
- VMEs' profitability

3.4.3 Operational Target

Creating new sustainable and profitable VMEs process begins with a deep analysis of all the new service ideas generated previously. In the short term, the MSE members will focus on analysing and designing new services in order to generate VMEs to exploit them. This analysis will provide the requirements of the service to be fulfilled to generate the corresponding VME and then, be developed. However, it is likely that some of them, after the analysis and design process, will be dismissed and some others will be developed in a VME (as it has been explained previously). It is important to remark that a concrete service designed can be dismissed because it does not offer as many guarantees as others to be success and/or the MSE cannot fulfil its requirements. In this last case, the MSE could try to enrol a new member to fill the gap (as it was explained in the previous section 3.1).

To sum up, the operational target of this PI is to "define requirements for the new service", and the indicators involved to measure this PI are the following:

- Number of new services designed
- Number of new service ideas assessed

3.5 MSE governance

The aim of this PI is to manage the MSEs internally, that is, the fulfilment of the internal rules and policies to guarantee the correct coexistence of all the different partners and the interaction between them in the different activities of the MSE.

Within a MSE, there will be claims or complaints between the different partners about a wide range of reasons such as the use of an asset which does not fulfil the specifications set by the owner of the asset; the incorrect use of a partner's tangible asset by another partner; a partner who does not fulfil a common agreement between all the partners; etc.

Once a VME is created, it will have its own internal rules and policies. However, there will be also generic rules and policies for the MSE which have to be fulfilled by the partners also. This PI is focusing just on these last ones.

3.5.1 Strategic Target

As it was described previously, a MSE has its internal agreements, governance rules and policies that they must be fulfilled by all the partners with no exception. The fulfilment of these rules makes the interaction between the different partners possible and facilitates their involvement in the different activities that take place in a MSE.

Furthermore, it is likely that some complaints between partners occur because of the use of a concrete asset, a partner who does not fulfil an agreement, etc. These claims have to be managed efficiently to be reduced to the minimum and solved as fast as possible in order to avoid that a concrete problem could affect the performance of a VME and/or the MSE itself. Moreover, this management could imply taking some actions against a concrete partner if he receives a lot of complains from the other partners like his expulsion from the MSE in the last term.

Therefore, the strategic target of this PI is the "efficient management of the MSE members' interaction", and the indicators involved to measure this PI are the following:

- Number of evaluation of pending complaints
- Number of MSE members expelled

3.5.2 Tactical Target

Regarding the objective in the medium term, it is important to remark that not all the claims occurred in a MSE will end up in a formal complaint. Furthermore, it is expected that most of them will be handled by the own partners involved in the complaint and they can come to an agreement which satisfies both points of view.

Therefore, the tactical target of this PI is the "monitoring of internal agreement and management of complaints and claims".

Regarding the indicators involved to measure this PI, they are the following:

- Number of agreements not fulfilled
- Number of claims or complaints not solved/number of claims arisen
- Number of MSE members that receive more complaints
- Number of MSE members that present more complaints

3.5.3 Operational Target

In order to reduce the number of claims between partners, it would be wise to be proactive in identifying the potential problems within the MSE. The sooner a problem is solved the better for the internal relationships between the different partners and, as a consequence, for the MSE performance.

This is why the operational target for this PI is to "identify potential claims and complaints arisen between the MSE members" and the indicator involved to measure this is the following:

- number of claims and complains arisen between MSE members

4 Requirements for the Business Tools of the future

Business Intelligence tools can be defined as decision support and information management systems. They turn data into information and then into knowledge. Furthermore, this knowledge is showed to the user helping him to make the correct decisions.

As it was stated in the (MSEEE_D25.2) deliverable, there is a wide range of business intelligence tools available in the market for analyzing single companies. Although none of them suits to manage and analyze an ecosystem of multiple companies like MSE, they provide a set of functionalities which can be applicable also to ecosystems such as reporting, data warehousing, data mining, etc.

Since a new business intelligence tool is needed for the ecosystems' analysis, this should be as simple as possible in order to reduce the complexity of controlling multiple companies, but, at the same time, it should include the main characteristics described in the(MSEEE_D25.2), section *"2.2.4 – Characteristics for the implementation of business intelligent solutions"* which are summarized as follows (for further information about them, please refer to the deliverable):

- Physical dissemination of actors
- Loose relationships between members
- High turnover rate of members and roles
- Variety of members (partners not in the same business)
- Divergence of strategic or tactical objectives between members
- Confidentiality, privacy issues and data policies
- Legal issues (partnerships, exploitation of results)
- Finance
- Relation with the real world outside the ecosystem

Furthermore, this new tool should focus on the PIs described in the previous section "0 Main Performance Indicators for measuring the performance of a MSE" and on their different targets indicators depending on the long, medium and short term.

To sum up, the current business intelligence tools do not cover the requirements to analyze an ecosystem of multiple companies. This is why the existing tools should be updated and/or customized to analyse and monitor an ecosystem. Another possibility is to develop a new tool from the beginning but this solution would require a bigger effort. Due to the complexity of this management, this tool should be customized and simplified in order to unify the different companies' requirements. Furthermore, it should provide visual analytics interface integrated in a user friendly dashboard in order to facilitate the decision making process based on the results of the different PIs.

5 Concluding remarks

The aim of this deliverable is to present the requirements to analyze the ecosystems which will be created within the MSE project. To do this, a methodology has been followed in order to identify the main PIs related to the measuring the performance of an ecosystem; and, since no current business intelligence tool is valid to analyze an ecosystem, the requirements for the future business intelligence tool are presented.

Firstly, the main concepts related to Manufacturing Service Ecosystem have been explained in order to facilitate the understanding of the complex characteristics of the service ecosystems. Additionally, it has been described the method followed to identify the Performance Indicators (PIs): the GRAI Model; and its application process.

Secondly, the performance indicators to measure the success of a service ecosystem obtained by the application of the previous method have been described in detail. Furthermore, they have been categorized depending on the target they are focusing on. It is important to remark that these indicators have been identified to a generic ecosystem. If the monitored ecosystem requires, the list of indicators can be increased.

Last but not least, the requirements for the future business intelligence tools have been addressed in order to measure the service ecosystems' performance. These requirements focus mainly on the customization and simplification of the complexity of joining multiple companies in an ecosystem while the decision making system is provided in a user friendly dashboard which includes visual analytics interface.

6 References

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