SEVENTH FRAMEWORK PROGRAMME

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Glocal enterprise network
focusing on customer-centric collaboration

D1.3
Specification of preliminary performance indicators

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GloNet WP1
Requirements Analysis and Scenario Development

Deliverable data

Deliverable no & name	**D1.3 – Specification of preliminary performance indicators**
Main Contributors	*CAS, Steinbeis, IPLON*
Other Contributors	*PROLON, SKILL, UNINOVA, UvA, KOMIX*
Dissemination level (select)	*Public*
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Deliverable summary

Deliverable 1.3 is the final part of the requirement analysis and scenario development work package. The specifications of preliminary performance indicators result from individual contributions of the involved partners of the GloNet consortium. These contributions were all related to existing deliverables in order to provide effective performance indicators.
The main goal of this deliverable is to provide a preliminary set of meaningful indicators of the GloNet project, in order to enable a later evaluation of the project's success. Therefore, this deliverable takes existing resources into account and builds on them to provide relevant performance indicators. Furthermore, the definition and selection of KPIs provides a comprehensive understanding of the critical elements of the GloNet project.
The use case performance indicators focuses on comparing the current procedures of the use case to the expected procedures supported by the GloNet system. Quantitative indicators regarding revenue increases, cost reductions, time to market, logistics and ecological factors are used to measure the success of the GloNet platform.
The business scenarios KPIs provide rich descriptions, classifications and examples of scenario-specific performance indicators as well as generalized, abstract performance indicators which can be applied on any business scenario. The results are summarized in tables for each business scenario individually.
Technical aspects of the GloNet platform are covered by the technical performance indicators. These indicators are derived from convenient software quality standards such as ISO 9216 and ISO 25010, following the QME method. 45 metrics categorized into 8 categories and 32 sub-categories provide a comprehensive set of technical performance indicators.
The indicators for the impact of the GloNet project progress are documented in the impact creation performance indicators. Stakeholder-specific actions are defined and their created impact estimated.
This deliverable will serve as foundation for the evaluation and validation process of the GloNet project and extended/specified to operational key performance indicators.

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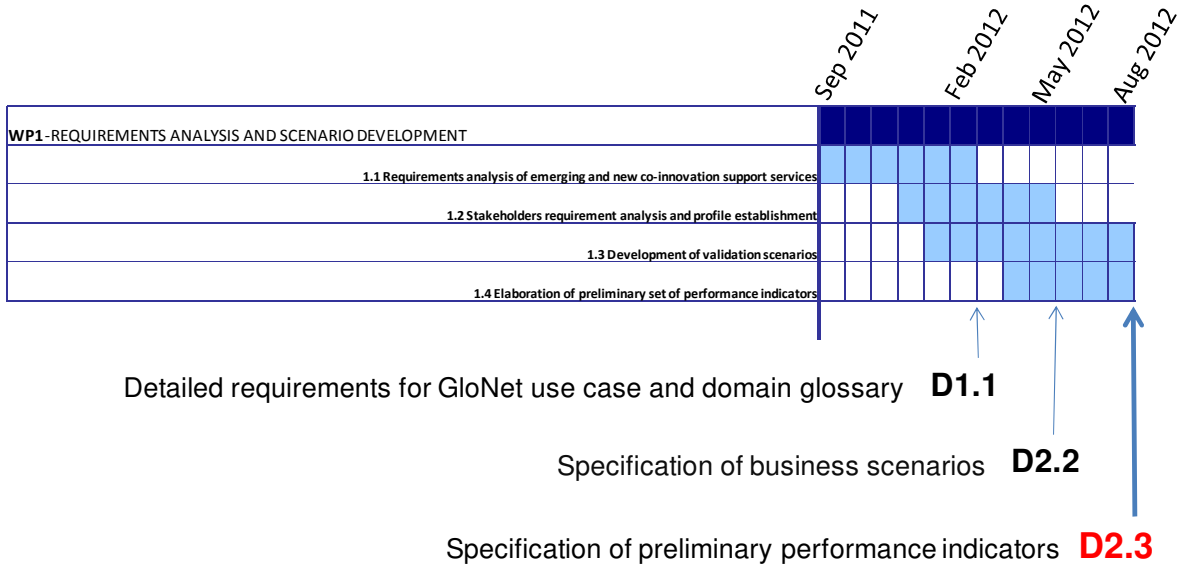
PROJECT-RELATED SUMMARY

This deliverable is part of WP 1 - requirement analysis and scenario development. The scope of this deliverable is to provide a set of meaningful indicators for later evaluation in WP 7 – evaluation – which will be extended to operational key performance indicators in deliverable 7.2.



D1.3 takes previous deliverables into account:

- Chapter 2 – use case performance indicators – is based on D 1.1 and mainly edited by IPLON with support from PROLON and UvA.
- Chapter 3 – business scenario performance – is based on D 1.2 and mainly edited by Steinbeis with support from SKILL and UNINOVA.
- Chapter 4 – technical indicators for the GloNet platform – is based on D 3.1 and mainly edited by CAS with support from KOMIX.
- Chapter 5 – impact creation indicators – is based on DoW and mainly edited by SKILL with support from UNINOVA

CAS as leader of this deliverable merged the individual contributions into the final document. It shall be noted that more specific (operational) indicators will be developed later in WPs 7 and 8.

1. INTRODUCTION

Key performance indicators are a type of performance measurement. They are usually used to evaluate the success of an organisation or an activity, which they are related to. Opposed to the stage-gate approach, which are oriented towards the achievement of milestones, key performance indicators can be used to measure the performance of repetitive tasks. For example, these KPIs can be the error rate within a production process or the rate of satisfied customers.
In order to evaluate the success of an organization, a business unit or a project, the measures of the performance indicators have to be assessed periodically. Therefore, performance indicators should be easy to understand and significant. In the process of definition, performance indicators on operations which can't be influenced should be avoided because you can't react to the results. Moreover, performance indicators are evaluated by comparing the measured values to target values to assess whether they match expectations. The selection of the right KPIs is an important issue regarding the understanding of the needs and weak points of an organisation. The selection of which KPIs are important depends on the organisation and the branch or the market the organisation reaches for. Due to the importance of identifying the right KPIs, this selection process has to be supported. This happens usually by applying management tools, such as the balanced scorecard and is often related to business improvement processes. In this deliverable we focus on defining KPIs rather than following the integrated process of the mentioned management tools, in order to reduce complexity. This is achieved by using a limited approach especially adapted to the collaborative environment. [1]

From an economic point of view, the complex and innovative customer-centric collaboration mechanisms introduced by the GloNet project require sophisticated performance indicators in order to make the outcome of the project measureable. From a technical point of view, the cloud-based GloNet platform requires abstract, technology-fitting performance indicators in order to ensure

- modularity and extensibility,
- multi-tenancy,
- scalability and availability,
- security and trust, and
- network access.

This deliverable aims at providing a preliminary definition of the required indicators. It is separated into 4 main chapters, each of them covering a different aspect related to the project's success.

Chapter 2 elaborates on the performance indicators of the photovoltaic power plant use case. Based on these indicators, chapter 3 comprises abstracted performance indicators and applies them to the eight different business scenarios identified in previous phase of the project. Chapter 4 defines technical performance indicators of the GloNet platform as specified. Finally Chapter 5 describes performance indicators, which measure the project's success based on its created impact in relevant groups of stakeholders.

2. USE CASE PERFORMANCE INDICATORS

Background

The Operation and Maintenance project of a 20MWp Solar PV Power Plant undertaken by a the iPLON partner in the Indian state of Gujarat is a perfect case study of where a collaborative network like those envisaged by GloNet can make a difference, and add value.

The power plant project is a part of the ambitious multi-developer park in Charanka (Gujarat) which upon completion will be Asia's largest in terms of installed capacity. The project is developed by Kiran Energy Solar Power Private Ltd. The EPC is undertaken by Larsen & Toubro (L&T) which is India's largest firm in this business. The location of the project is very close to the desert regions of Rajasthan and receives the highest solar irradiation in the country, and hence most ideally suited for solar power projects.

iPLON is responsible for the performance monitoring systems installed at the plant as well as the Operation & Maintenance of the project after its commissioning. Being a German company venturing into an emerging market like India, collaborative networking can be the key when it comes to effective integration of European technology into the Indian market, which also justifies the idea of employing this as a use case for GloNet.

In order to validate the success of the GloNet use case a distinct set of metrics (as performance indicators) are defined. Because of the need to develop a good understanding of what is important, performance indicator selection is closely associated with the use of various techniques to assess the present state of the business, and its key activities.

Among the chosen performance indicators we have selected the following dimensions, where a baseline with success indicators will be defined at the beginning of the project and after which a continuous evaluation process takes place.

Baseline Project Concept

The performance indicator analysis is performed for the use case of Charanka Solar Park Project that was implemented without the use of GloNet platform. However, being a member of the GloNet consortium with a clear understanding of its features and benefits, iPLON is in a position to visualize how the various stages in the project could have been influenced for better efficiency by the presence of GloNet results. The comparative measurements made in the process of this analysis are based upon this knowledge.

Key performance indicators

The key performance indicators are broadly categorised as follows.

1. Financial Indicators
    a. Increasing Revenues
    b. Lowering Costs
2. Operational Indicators
    a. Faster Manufacturing
    b. Faster Logistics
3. Product Development indicators
4. Environment and Energy indicators
    a. Lower Energy consumption
    b. Lower Carbon footprint

Financial indicators

The financial indicators of performance encompass the financial perspectives of measuring the performance efficiency of the GloNet project. These are primarily divided into two major indicators – Revenue and Cost.

Implementation of the GloNet system must catalyse an increase in the revenue of the members as well as contribute to lowering of their costs in completing the projects.

Increase in revenue

Summary:

- Improved product quality through co-creation and co-innovation creates an increased value for it in the market, leading to an increase in revenue.
- Adaptability through GloNet facilitates manufacturing of products that are better suited to address the specific needs of a customer and changing demands of the market. By delivering products that are readily employable into the project, companies are better placed to increase their revenue.
- GloNet facilitates collaborations between SMEs that can expand beyond a single project (notion of VBE). Through complementary partnerships that are facilitated by collaborative networking platforms like GloNet, SMEs can contest successfully against larger companies for new projects. This increases their market share.
- As the management and operative personal have the right Project Information (Customer requirements, delivery time ...) and have direct access to the end customer, there is no information loss on account of communication and hence time can be saved and productivity can be increased.
- GloNet as a platform for efficient business collaboration and virtual enterprising, significantly contributes towards shortening of the project completion time. This allows SMEs with limited resources to engage in more number of projects in a year, which has a positive effect on their annual revenue.

Actual Status:
The Charanka project was iPLON's first in India. Being a German company venturing out of the European Union for the first time, we had to take a lot of effort to understand the

business culture and norms in an emerging market like India. There were variations from the scope definitions on the contract to the client requirements, besides several other minor cultural shocks now and then. Better transparency in terms of the business norms in either countries (Germany and India) could have saved at least 1-2 months of extra time that was consumed by the project. This meant that iPLON as well as other stakeholders could not invest their resources in other projects, thereby impacting the annual turnover.

Final Status:
A collaborative networking system like the one planned in GloNet will ensure that there is better transparency between the stakeholders (who could be geographically and culturally based in different continents) in terms of the requirements, scope of each partner as well as a constant monitoring of the progress that will help each of them plan their resource allocation more efficiently. More importantly, for a SME in Europe to enter the Indian market, it is very critical to understand the differences in business as well as technical norms and specifications. GloNet can help bridge this gap, which could otherwise cost them several man-hours and needless travel. The difference made by GloNet will translate into an increase in revenue through more efficient execution.

Methods and Measurements:
1. Average Project Completion Time with GloNet can be reduced
   Thus increasing the number of projects per year and annual revenue significantly
2. Planned collaboration platform facilitates quicker adaptability and delivery to changing customer demands. This increases annual revenue notably

Lowering costs

Summary:
- Adaptability/re-configurability of products due to a modular approach and co-designing through constant interaction with the end customer in the Indian market allows the European SMEs a substantial lowering of the production and product customisation cost.
- Transparent information distribution between all stakeholders regarding project status allows them the control of planning their productions according to the available information, resulting in optimized production rates to minimise their inventory handling expenses.
- Cost efficient installation and integration of components into the system is possible by sharing the datasheets and specifications of all associated components.
- Virtual Enterprising with companies located near the project site facilitates lowering logistics expenses by enabling direct shipment of products. The presence of an establishment and partner near the site contributes to this benefit. The skills of an ideal partner of this kind will be determined by the requirements of the project. In this case, having someone with engineering expertise as well as programming knowledge allows additional technical support at the plant site when needed be.
- As the software system can run at an Application Provider (cloud), no costly servers or IT personal are necessary.
- Change Management is transparent to all actors in the project through the collaboration space. Thus the changes, which happen in all projects, can be done more effectively.

Actual Status:
There were many hiccups in the process of Charanka project that contributed additional expenses to all stakeholders. From iPLON's perspective, we gained significant lessons in this aspect. Firstly, the scope-distribution among stakeholders was not unambiguous in the contract resulting in avoidable repeated shipments from Germany to India, which significantly added to our cost as well as loss of time (which is again a cost). Also, the specifications of requirements were impacted by regional differences. While we perceived the needs as per the European standards that were familiar to us, the local standards in India did not align to them. This meant that iPLON had to reconfigure its products as well as add a new SCADA system for operator level plant monitoring at the project site. These developments caused an increase in the cost.

Final Status:
GloNet as a system for transparent information sharing related to every aspect of the project would have brought better clarity in terms of scope distribution as well as client needs. It would have also provided the medium for effective discussions with the various stakeholders before the shipping of products was done. Also, the network would have served as a medium to understand mutual norms better for more efficient collaboration and greatly reduce the cost involved in completing the project.

Methods & Measurements:

1. Presence of an efficient collaboration platform would have avoided the need for multiple shipment of components from Germany to India, which could have lowered the logistic expenditure very much
2. Virtual enterprising with local partners would lower the shipping expenses fairly
3. Transparent information sharing between the various stakeholders regarding specifications of various components used in the power plant could have reduced the number of days spent by German engineers in India and the overall costs significantly

Operational Indicators

With large-scale collaborations, operations can be a painful process especially when multiple parties are involved in the chain of research - production – distribution. The Operational Indicators are those parameters whose monitoring will ensure that with the use of a collaborative networking system like GloNet there will be better efficiency in these operational matters.

The two major operational performance indicators identified for GloNet project are rate of production and logistics. Better rate of production and faster logistics are indicators of better efficiency that can be established by using GloNet.

Faster rate of production/time to market

Summary:

- Accessibility to the right Project Information (Customer requirements, delivery time ...) and direct access to the end customer can boost the engineering results considerably
- Better adaptability and re-configuration of the product due to the modular approach to production can significantly reduce the lead time, resulting in faster rate of production.

- Increased reusability of production systems towards global interoperable factories allows a lowering of product manufacturing time for different projects.
- Distributed testing and sharing of test results between various stakeholders of a project enables quicker production rate.

Actual Status:
The same base line Project and the actual project defined earlier will be used.

Final Status:
The Results of GloNet Project defined earlier will be used.

Methods and Measurements:

1. Better understanding of the customer requirement through GloNet would have reduced the number of product customisation iterations between iPLON and L&T notably
2. Information sharing between stakeholders about testing results and datasheets of associated components reduces the lead time from production to installation at the Charanka project quite

Faster logistics

Summary:

- Better information sharing between the stakeholders in Europe and India regarding the local freight rules and documentation facilitates quicker and smoother movement of products and components.
- GloNet provides transparency and thus enhances clarity in terms of the regional technical norms regarding the project and helps mitigate any variation in business culture that could impact the supply chain.
- Virtual Enterprising with partners located around the project site facilitates direct shipment of products to project site where the various components can be assembled.
- Transparency of requirements and production details between various partners in a project optimises rate of production and distribution.

Actual Status:
The same base line Project and the actual project defined earlier will be used.

Final Status:
The Results of GloNet Project defined earlier will be used.

Methods and Measurements:

1. Significantly reduced number of days for products shipped from Germany to reach Charanka through iPLON's office in Chennai
   Considerably reduced number of days for products shipped from Germany to reach Charanka through partner office in Ahmedabad

2. Better information sharing between the various partners through GloNet would have avoided the multiple shipments of splice boxes from Germany, and the overall duration for logistics would have gone down fairly

Product development indicators

Research collaborations for product development can be crucial in significantly improving the quality of products and use of the best technology available globally. With a platform like GloNet there can be a smooth integration of the latest researched technology from the laboratories to the production systems in the industries.

The product development indicators monitor the contribution of GloNet in improving the efficiency of developing new products needed for the project.

Summary:

- GloNet helps in creating higher quality products with value added services by 100%, measured through the inclusion of new partners in the Virtual Enterprise and use of Open Innovation.
- Enhanced knowledge transfer and resource sharing between partners enables more effective product development.
- Direct interaction with the end customer facilitates more meaningful, market oriented research and development, and hence shortens the duration of product development cycle.
- The cloud computing system significantly contributes to faster data management and efficient processing.
- Collaborative networks like those promoted by GloNet also aid European SMEs in understanding the target customers in emerging markets better, and thus customise their products accordingly.

Actual Status:
The same base line Project and the actual project defined earlier will be used.

Final Status:
The Results of GloNet Project defined earlier will be used.

Methods and Measurements:

1. Product customisation for Indian market with GloNet would be reduced significantly

2. Open Innovation helps in reducing the duration of product development cycle substantially

Energy and environment indicators

A large-scale project has a significant impact on the environment in terms of utilization of environmental resources as well as emissions into the atmosphere. Most of the times, companies tend to ignore several indirect contributors to these factors. With GloNet a lot can indirectly be done to cut down emissions and energy consumptions, by engaging in virtual enterprises and cloud computing that demand much lesser use of energy.

The identified performance indicators under the Energy and Environment dimension are energy consumption and CO2 footprints. Lowering both these parameters indicates an environment-friendly project implementation.

Lower energy consumption

Summary:

- As the change management is more efficient through a collaboration environment, fewer meetings are necessary.
- The association of services to the physical product, through Internet (e.g. remote diagnosis), will also reduce the need to travel to the customer premises along the product life cycle.
- Virtual Organisations lower the number of physical establishments.
- More energy efficient production systems through co-innovation and knowledge sharing.
- Re-configurability and re-usability of production systems between partners lower energy consumption.

Actual Status:
The same base line Project and the actual project defined earlier will be used.

Final Status:
The results of GloNet Project defined earlier will be used.

Methods and Measurements:

1. Use of GloNet model for collaboration and resource sharing is expected to reduce the energy consumption for the Charanka project

Lower carbon footprint

Summary:

- Currently all products' parts produced by other partners are shipped to iPLON and from this company again to the customer. It makes more sense to ship directly to the customer where the assembly takes place, which is possible with a collaboration management system. This leads to a significant reduction in the CO2 footprint.
- The entire system is powered by cloud computing which is a lower CO2 footprint alternative.
- Virtual Organisations reduce the number of physical establishments resulting in lowering of CO2 footprints.
- Better co-ordinated production and reusability of system ensures that maximum efforts are taken to use the greenest technology that generates minimal production wastage.

Actual Status:
The same base line Project and the actual project defined earlier will be used.

Final Status:
The Results of GloNet Project defined earlier will be used.

Methods and Measurements:

1. Use of GloNet platform would have reduced the CO2 footprint in Charanka Project clearly

3. BUSINESS SCENARIO PERFORMANCE

Different approaches for KPI in GloNet

The following eight different use cases focus on different capabilities of the GloNet system. Therefore, they require individual classes of KPIs in order to provide meaningful KPIs for each use case. But since all use cases origin from the GloNet environment, the individual classes can be categorized by two approaches, namely abstract characteristics and use case focused characteristics. The abstract characteristics cover general goals of the GloNet project, whereas the use case focused characteristics cover context-sensitive goals.

A: Use case abstract characteristics
Product (Mass Customization)– Stakeholder (Open Innovation)– Organization (VE product development+services)

B: Different focus of use case
Enabler (Service provision space) – User (requirements)– Execution (collaboration solution space)

Furthermore, this means that not every of the use case specific KPI classes have to cover all goals of the GloNet project individually, but each goal is covered by at least one use case specific KPI class. The combination of these 2 approaches will result in individual use case specific subsets of KPIs as illustrated in Fig. 1:

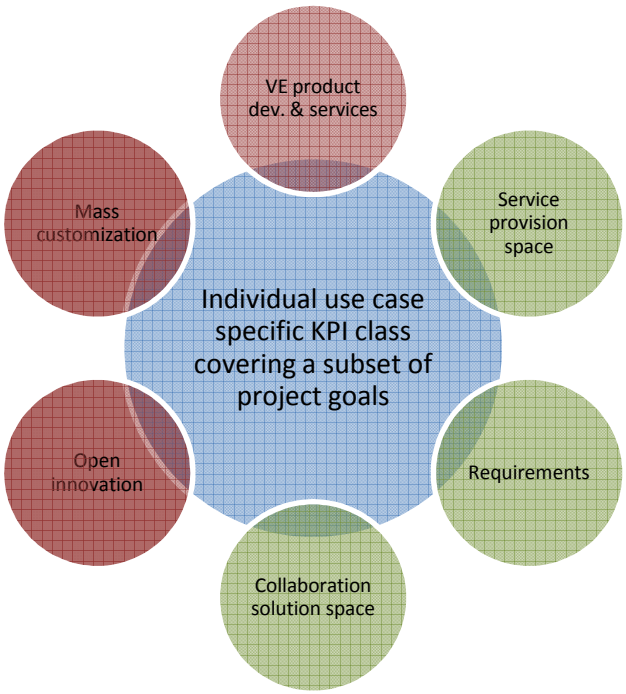


Fig. 1 Illustration of the combination of abstract characteristics and use case focused characteristics (red circles represent general goals of the GloNet project, green circles represent context-sensitive goals)

Content: Business Scenarios for GloNet (based on D 1.2)

1. Management of long-term collaborative network
2. Formation of goal-oriented collaborative network
3. Co-design and co-innovation support
4. Base operation and management of product servicing
5. Advanced supervision services for the collaborative network
6. Shared Resources Repository Management
7. Product portfolio management
8. Semi-automated Learning-based Decision Support.

Scenario 1: Management of Long-term Collaborative Network

A long-term Collaborative Network is an alliance of organizations adhering to a base long term cooperation agreement while also adopting common operating principles and infrastructures. These kinds of alliances are usually called VBEs (Virtual Organizations Breeding Environments). The main strategic goal is to increase preparedness of each member of the alliance towards rapid configuration of temporary alliances in response to market opportunities.
The **2 KPI classes** corresponding to scenario 1 reflect the proximity to partners and customers (intensity of collaboration), as well as to their relationships (quality of the activities).

1. The **intensity** KPI class assesses **the volume of involvement** with partners and customers. This KPI class is a quantitative count of collaborative projects. Example KPIs include the number of projects involving an external stakeholder versus the total number of projects within a department, or the number of joint research results like showcases, prototypes, etc.
2. The **quality** KPI class captures **the quality of collaboration** (subjective assessment) by customers or partners.

The following **KPI examples** shall give an idea:
• Difference between the planned budget for each line item to the actual budget measured (least deviation is rated to be the best);
• Successful (on-time) termination at a particular phase / gate;
• Data compliance at an agreed deadline;
• Scoring in employee satisfaction survey;
• Percentage by which the potential damage has been lowered by adequate measures against the bottom-line;

Scenario Goals	i*Goals	Business Processes	KPI class
Manage admission and withdrawal of members in/from the VBE	Joint VBE	Member Admission	1
	Leave VBE	VBE Member withdrawal	
Ensure that complete information about member's profile and competencies are available	Access to Members profile	Handling Member Profile	2
		Management of Members Profiles	
Provide access to a VBE Products Portfolio	Access VBE's Product Portfolio	Consulting VBE's Product Portfolio	1,2
Ensure secure access to VBE members	Access to Members profile	Member Admission	1,2
		Management of VBE Performance System	
Facilitate trust building among VBE members	Facilitate trust building	Management of VBE Performance System	2

Scenario 2: Formation of Goal-oriented Collaborative Network

A goal-oriented network is an association of individuals and/or organizations that strategically join their competencies to rapidly respond to a business or collaboration opportunity. In the case of new product orders or co-creation teams for innovative services, the goal-oriented collaborative network can be labelled virtual organization (VO).

This scenario deals with the efficiency of process execution in a collaborative network. It contains a set of auxiliary processes that support the operational structure of the network as a whole, or its constituent parts.

The **5 KPI classes** corresponding to scenario 2 are:

1. Quality and quantity of matching of requirements and competencies
2. Speed of formation of goal-oriented collaborative network
3. Quality of the risk management: reaching the targets of time, quality, budget
4. Quality of project management: deals with other project management tasks such as resource planning, conflict resolution, etc.
5. General risk sharing: is a partial answer to deal with the uncertainty of engineering.

The following **KPI examples** shall give an idea:

- Number of initiated projects compared to number of incoming projects
- Coverage of required tasks by members of a VO
- Time interval between formation proposal and formation agreement of VO

Scenario Goals	i*Goals	Business Processes	KPI class
VO plan and scheduling	Product order Start VO creation	Announce new product order Characterize new product order and plan goal-oriented VO	1,2
Select appropriate partners	Select VO partners Assess potential local partners availability Assess selected VBE members availability	Characterize new product order and plan goal-oriented VO Formation of goal-oriented VO	2,3
Negotiate towards agreement	Have agreement document Negotiate VO details	Formation of goal-oriented VO	1,3
VO set up	VO registration	Launch goal-oriented VO	4
Assess risks levels and expectations mgt	Assess expectations	Formation of goal-oriented VO	5
Ensure suitable agreement documents repository	Formation agreement Registration of electronic formation agreement document	Formation of goal-oriented VO	5

Scenario 3: Co-design and Co-innovation

This scenario aims at providing an environment that supports and promotes the collaborative design of products and services as well as the emergence of innovative solutions. It thus includes the aspects of:

- Mass Customization – offering value added services that improve the perceived product quality and prolong the product life cycle; fabricating products by a sustainable and versatile production process; and providing services based on innovation, knowledge and customer orientation.
- Emergence of new products/new solutions – identifying future needs, through collaboration between manufacturers and the customer and members of the customer's community (open innovation approach).

The combination of these 2 aspects leads to a "collaborative product engineering process" which can be measured with the following **3 KPI classes**:

1. Intensity of input into the collaborative engineering process
2. Throughput of ideas moved to the next phase of the collaborative engineering process
3. Output/business impact of ideas in terms of economic value.

The following **KPI examples** shall give an idea:
• Number of ideas;
• Number of ideas with business case developed;
• Number of ideas with demonstrator developed;
• Number of ideas handed over to development;
• Number of products/business scenarios with a positive rating by customers

Scenario Goals	*i* Goals*	*Business Processes*	*KPI class*
Co-design and co-development of products	• Product/Service co-design & development	• Co-design • Co-development	1,3
Guarantee customer satisfaction & VO partners satisfaction	• Customer satisfaction		
Provide co-innovation support	• Support co-innovation	• Co-Innovation	2,3

Scenario 4: Base operation and management of product servicing
This scenario covers the routine activities associated to servicing the product along its life cycle. In order to measure the success of product servicing within the product life cycle process, the following **3 KPI classes** may be used:

1. Process transparency, describes the degree of integration of product servicing within the VO
2. Efficiency of resource usage in a VO context
3. Effectiveness of service processes, from an external (customer) and internal (VO) perspective.

The following **KPI examples** shall give an idea:

• Degree of service integration, including common processes or process synchronisation between production and service offerings;
• Measurement of how efficient the resources are being used in transforming inputs to outputs (e.g. cost per operating hour)
• Measurement of customer perceived quality: measuring complaints, interviewing customers, mystery shopping.

Scenario Goals	*i*Goals*	*Business Processes*	*KPI class*
Product and services performance management	– Manage support services – Manage operational services	– Monitoring of base operation	1
VO evolution	– Manage VO evolution	– Management of VO evolution	1,2
Pursue new business services	– Manage support services – Manage operational services – Manage VO evolution	– Monitoring of base operation – Management of VO evolution – Management of Customer feedback	1,2,3
Historic data management	– Have VO updated data	– Management of historical data – Management of VO dissolution	1

Scenario 5: Advanced Supervision Services for the Collaborative Network

The purpose of this scenario is to explore the feasibility of advanced supervision services in the context of collaborative networks. The main idea underneath this scenario is to go beyond the traditional supervision and control systems by illustrating how "soft issues" of collaboration might be handled and supported by ICT. Therefore, services such as risk monitoring and proposition of corrective/preventive actions in collaborative networks, monitoring the collective emotional "health" of networks, and expectations assessment are considered. The ultimate purpose is to contribute to improve the level and "health" of collaboration.

The following **4 KPI classes** can be used in order to assess the quality of the supervision services:

- Monitor risks
- Propose corrective/preventive actions
- Expectations achievement assessment
- Monitor network collaborative health.

The following **KPI examples** shall give an idea:

- The efficiencies of the risk monitoring by cycle time from discovery of a control deficiency to risk acceptance decision.
- The expectations measured by % of risk expectations exceeding defined risk tolerance without action plans.
- # Incidents of non-compliance with regulations and voluntary codes concerning network collaborative health.

Scenario Goals	*i* Goals*	*Business Processes*	*KPI-class*
Monitor risks	• Monitor risks • Good risk management • Increase partnership quality • Members satisfaction	• Risk Monitoring and control	1
Propose corrective/preventive actions	• Propose corrective and preventive actions	• Corrective action • Preventive action	2
Expectations achievement assessment	• Assess expectations achievement • Increase partnership quality	• Expectations achievement assessment	3
Monitor network collaborative health	• Monitor collaborative health • Emotional equilibrium	• Collective emotions characterization and evidences configuration • Collective emotions monitoring and alerts generation	4

Scenario 6: Shared Resources Repository Management

The shared resources repository refers to all valuable elements that different VBE actors use and share providing properties of interest for others: general sharable information / knowledge (e.g. standardized product definitions and processes), software tools, lessons learned, etc. This scenario is directly linked with the intellectual property issue.
The intellectual property creation process is most likely one of the most formalized processes in industry that secure competitive advantage. This is a result of the fact that the process has to be closely aligned with legislation regarding intellectual property protection and in turn with the modus operandi of patent offices and other related authorities

The **6 KPI classes** corresponding to scenario 6:

1. The volume of potentially protectable inventions submitted into the IP pipeline;
2. Volume of IDFs passing a certain intermediate stage in the external protection or publication process;
3. Volume of patents granted and/or defensive publications.
4. Quality of granted patents;
5. Alignment of research activities with the IP strategy of the company
6. (Re)usability of resources

The following **KPI examples** shall give an idea:

- Number of invention disclosures;
- Number of first filings, defensive publications, trade secrets;
- Number of patents granted to the company;
- Economic value of the granted patent;
- Number of submitted inventions addressing the IP strategy.
- Number of shared resources
- Number of accesses on shared resources

Scenario Goals	*i* Goals*	*Business Processes*	*KPI class*
Represent quality resources	• Good quality resources • Members satisfaction	• Handle resources	1,2,6
Share resources inside VBE Network	• Share resources inside VBE • Access resources inside VBE • Promote resources sharing • Variety of resources	• Create catalog • Categories management • Handle resources • Manage incentives policies	2,3,4,6
Ensure resources protection	• Ensure resources protection • Members satisfaction	• Manage access levels	3,5

Scenario 7: Product Portfolio Management

The Products Portfolio contains all valuable information about each product developed in the scope of the VBE. The portfolio will include the following information for each product:

- Product Specification.
- Project Documentation.
- Historic data collected during operation.
- VOs that were involved in product life-cycle.
- Business Services associated to the product.

The access to product information depends on the level of access of the interested parties.

The scenario 7 can be assessed with the following **4 KPI classes**:

1. • Structure and quality of the product portfolio (i.e. certain market and technology areas);
2. • Visions related to the individual parts of the product portfolio and their quality;
3. • Roadmaps to achieve the visions and their quality;
4. • Implementation of the roadmaps and the quality of contributions from product management.

The following **KPI examples** shall give an idea:
• Vision paper for Research Programs from Program Manager available and approved by the management of the network partners;
• Extent to which projects contribute to the vision of a product portfolio;
• External subjective evaluations from the recognized experts in the research field: “normal” accomplishment (solved an unsolved problem/generated visibility around his/her research);
• Percentage of maximum score in Project Portfolio Score Sheet averaged over all program areas (creating and maintaining a well-balanced research project);
• Subjective evaluation of the vision documents of the individual research programs by internal or external reviewers (simplest way: vision documents are available or not);
• Subjective evaluation of the roadmap to reach the vision by internal or external reviewers (simplest way: the roadmap document is in place or not);
• Subjective evaluation of the scientific accomplishments, technical achievements, or technical impact by internal or external reviewers.

Goals	***i*Goals***	***Business Processes***	***KPI class***
Manage information about a product	• *Access to Products Portfolio updated* • *Good quality of information* • *Understandable product description* • *Have* product traceability	a. *Manage Products Portfolio* b. *Handle Products Portfolio*	1 2
Ensure differentiated and secured access to products information	• Ensure that product information is protected	c. *Consult Products Portfolio*	3

Scenario 8: Semi-automated Learning-based Decision Support

Daily operation of complex products results into gathering vast amounts of data and information, including: (i) collected data from various equipment, and (ii) information resulted from the processing of data in the environment. These elements build the ground for decision making on various aspects of the product. The purpose of this scenario is to assess the feasibility of building such semi-automated learning-based decision making support system for complex products. The two following cases are addressed

- Enhancing the products performance and monitoring its health, applying semi-supervised learning techniques.
- Assisting product engineering & ordering through provision of product configuration recommendations, applying semi-supervised learning techniques.

the following **4 KPI classes** can be used

1. Speeding up product design (operational indicator)

2. Enhancement of product quality (operational indicator)

3. Reducing costs through optimization of time/effort (financial indicator)

4. Increasing revenues through product enhancement (financial indicator)

KPI examples:
This scenario corresponds to more advanced/experimental services (based on machine learning) and thus it is not feasible yet to define concrete examples of KPIs.

Goals	***i*Goals***	***Business Processes***	***KPI class***
Enhance product performance through semi-supervised learning	*Automatic performance enhancement recommendation*	Pattern Mining on product performance	2
		Monitor product health and recommend enhancement	3, 4
Enhance product configuration through semi-supervised learning	*Automatic product configuration recommendations*	Case based reasoning on product configuration	1
		Recommend product configuration.	3, 4

4. TECHNICAL INDICATORS FOR THE GLONET PLATFORM

The purpose of these technical performance indicators is to define quality measurements for the GloNet platform. The definition of the software quality goals follows the software quality characteristics which are provided by the IEC/ISO 25010 for system and software quality.

Quality in Use

The ISO/IEC 25010 defines a quality in use model composed of five characteristics (some of which are further subdivided into sub characteristics) that relate to the outcome of interaction when a product is used in a particular context of use. This system model is applicable to the complete human-computer system, including both computer systems in use and software products in use [1].

Product quality

The ISO/IEC 25010 defines a product quality model composed of eight characteristics (which are further subdivided into sub characteristics) that relate to static properties of software and dynamic properties of the computer system. The model is applicable to both computer systems and software products. [1]

Goals

The purpose of this evaluation is to assess the extent to which the implementation of the GloNet platform research prototype that will be developed in the course of the GloNet project meets a number of software quality goals. As with the rest of the GloNet platform components, the definition of software quality goals to be met by the GloNet platform follows the definition of key software quality characteristics that is provided by the IEC/ISO 9126 and IEC/ISO 25010 standard for Software Quality (i.e. functionality, reliability, usability, efficiency, maintainability, portability):

- **Portability:**
  the ability of software to be transferred from one environment to another. Measures to be considered may include adaptability, installability and replaceability.
- **Maintainability:**
  the effort needed to make specific modifications to the system. Measures to be considered may include analysability, changeability and testability.
- **Security:**
  measures taken throughout the application's life-cycle to prevent exceptions in the security policy of an application or the underlying system (vulnerabilities) through flaws in the design, development, deployment, upgrade, or maintenance of the application. .Measures to be considered may include confidentiality, integrity and authenticity.
- **Reliability:**
  the capability of the software to maintain its level of performance under specific conditions. Measures to be considered may include maturity, fault tolerance, recoverability.

- **Functional suitability:**
  the existence of a set of functions with properties satisfying stated or implied needs. Measures to be considered may include functional suitability, computational accuracy.
- **Performance efficiency:**
  the relationship between the level of performance of the software and the amount of resources used, under stated conditions. Measures to be considered may include time behaviour, resource utilisation.
- **Compatibility:**
  the ability to execute a given program on different types of computers without modification of the program or the computers. Measures to be considered may include co-existence and interoperability.
- **Usability:**
  the effort needed for using the system. Measures to be considered may include understandability, learnability, operability, attractiveness.

Questions

As specified by the GQM method, the next step in the definition phase is specifying one or more questions in order to address each of the abovementioned measurement goals. As goals are defined on an abstract level, questions are refinements of goals to a more operational level, which is more suitable for interpretation. By answering the questions in a quantitative way, one should be able to conclude the degree to which each of the goals has been reached.
The aim is to pose questions that more closely reflect the kind of software quality attributes that would be expected from a research prototype implementation, rather than a commercial software product.
The following table (Table) summarises the questions to be posed for each of the GloNet platform measurement goals discussed in the previous section.

Portability
How much time does it take to port the platform to a different IaaS cloud platform?
Maintainability
How strong is the dependence between the discrete components of the GloNet platform?
How many functions can be reused in other components of the GloNet platform or in other software systems?
What level of effort is required to identify failure causes and corresponding parts of the platform?
How much effort is required to implement upgrades, bug fixes or modifications to changes of the environment?
What level of effort is required to test modifications of the GloNet platform?
Security

How many authentication methods does the GloNet platform provide to authenticate the identity of a subject or resource?
Reliability
What is the service time ratio of the GloNet platform?
How many system components of the GloNet platform are installed redundantly in order to avoid system failure?
Functional suitability
How complete is the functional implementation of the GloNet platform (compared to the functional requirements stated in the specification)?
Performance efficiency
How many online requests can be processed per unit of time?
How many users can access the system simultaneously at a certain time?
Compability
How accurately is the implementation of the data exchange formats determined between linking systems?
Usability
How much initial training is required to use the platform?
What proportion of pilot users signalize acceptance towards the GloNet platform?
What proportion of user interface elements can be customized in appearance?

Table 1

Metrics

The next step involves the definition of appropriate metrics. The metrics defined in the ISO 9126 and ISO 25010 standard typically give rise to quantifiable measures that can be mapped onto scales. The table below summarises the metrics corresponding to each of the goals and questions defined in the previous sections. For each question we provide:

A measurement method
A measurement formula
A rating scale and a desirable rating value

No.	Portability	
1	How much time does it take to port the platform to a different IaaS cloud platform?	Estimate the number of days it takes to port the platform from one IaaS platform to another.

		X=Number of days X > 0 (the lesser, the better)
	Maintainability	
2	How strong is the dependence between the discrete components of the GloNet platform?	Count the number of discrete components which can be changed without having an impact on any other component of the GloNet platform and compare to the total discrete components. X=A/B A=Number of components which can be change without having an impact on any other component B=Total number of discrete components 0<=X<=1 (the closer to 0, the better)
3	How many functions can be reused in other components of the GloNet platform or in other software systems?	Count the number of functions of the GloNet platform which can be reused in other components or in other software systems and compare with the total number of functions of the platform. X=A/B A=Number of functions which can be reused in other components or software systems B=Total number of functions 0<=X<=1 (the closer to 0, the better)
4	How much effort is required to implement upgrades, bug fixes or modifications to changes of the environment?	Estimate the duration necessary to implement upgrades, bug fixes or modifications to changes of the environment and compare to the number of upgrades, bug fixes and modifications to changes of the environment. X=A/B A=Duration necessary to implement upgrades, bug fixes or modifications B=Number of upgrades, bug fixes and modifications X>0 (the lesser, the better)
5	What level of effort is required to	Estimate the duration to test modifications of

	test modifications of the GloNet platform?	the GloNet platform and compare to the total number of modifications of the GloNet platform. X=A/B A=Duration to test modifications B=Number of modifications X>0 (the lesser, the better)
	Security	
6	How many authentication methods does the GloNet platform provide to authenticate the identity of a subject or resource?	Count the number of authentications methods provided. X=Number of authentication methods X>=0 (the higher, the better)
	Reliability	
7	What is the service time ratio of the GloNet platform?	Measure the actual operation time and compare to the scheduled operation time of the GloNet platform. X=A/B A=Actual operation time B=Scheduled operation time 0<=X<=1 (the closer to 1, the better)
8	How many system components of the GloNet platform are installed redundantly in order to avoid system failure?	Count the number of redundantly installed system components and compare with the total number of system components of the GloNet platform. X=A/B A=Number of redundantly installed system components B=Total number of system components 0<=X<=1 (the closer to 1, the better)
	Functional suitability	
9	How complete is the functional implementation of the GloNet platform (compared to the	Count the number of functions missing from the implementation and compare with the number of functions described in the

	functional requirements stated in the specification)?	requirement specifications X=1-A/B A=Number of missing functions detected in evaluation B=Number of functions described in requirement specifications 0 <= X <= 1 (the closer to 1, the more complete)
	Performance efficiency	
10	How many online requests can be processed per period of time?	Define a period of time and count the number of online request that are processed within this period of time. X=A/B A=Number of online requests B=Period of time X>=0 (the more, the better)
11	How many users can access the system simultaneously at a certain time?	Define a certain time and count the number of users that can access the system simultaneously. X=Number of users with system access X>=0 (the more, the better)
	Compability	
12	How accurately is the implementation of the data exchange formats determined between linking systems?	Count the number of accurately implemented data formats and compare to the total number of data formats exchanged. X=A/B A=Number of data formats regarded as being smoothly exchanged with other software or systems B=Total number of data formats to be exchanged 0<=X<=1 (the closer to 1, the better)
	Usability	

13	How much initial training is required to use the platform?	Estimate the number of days required to use the GloNet platform. X=Number of days required X > 0 (the lesser, the better)
14	What proportion of pilot users signalize acceptance towards the GloNet platform?	Count the number of pilot users who signal acceptance towards the GloNet platform and compare to the total number of pilot users. X=A/B A=Number of pilot users signaling acceptance B=Total number of pilot users 0 <= X <= 1 (the closer to 1, the better)
15	What proportion of user interface elements can be customized in appearance?	Count the number of user interface elements which provide appearance customization and compare to the total number of user interface elements. X=A/B A=Number of customizable user interface elements B=Total number of user interface elements 0<=X<=1 (the closer to 1, the better)

5. IMPACT CREATION PERFORMANCE INDICATORS

For the definition of impact creation performance indicators for industry and society the following actions have been realized:

1. Identification of the main stakeholders of the results of GloNet project
2. Definition of actions for the dissemination of project's results and impact creation in the social and industrial perspective
3. Definition of impact creation performance indicators.

In the next sections each of these industry dissemination actions are described in detail.

Identification of the main stakeholder

This identification is mandatorily the first step in the performance indicator creation process. However it is necessary to define different specific indicators for each one of the main stakeholders interested in the GloNet results. We defined the main stakeholders based on the deliverables D8.2 "Dissemination Strategy and FInES Cluster Collaboration Plan" and D8.41 "Policy Action Plan-Year 1". The following stakeholders have been defined:

- Industrial sector: developers, clients, internal critical suppliers, external critical suppliers and other entities (funding companies, government, etc)
- Policy Decision Makers
- Direction of cluster in public administrations
- Other projects related with GloNet domains
- Business associations and confederations
- Chambers of Commerce.

Since every group of stakeholders has its own characteristics, different dissemination means will be established and therefore different indicators will be defined.

Definition of actions

Dissemination of results and impact creation to the main stakeholders are two elements that, although different, are deeply related. While the dissemination refers to resources, ways and actions through which the obtained results of the project are going to address the main stakeholders, impact creation measures the results that have obtained the achievement of these dissemination actions. This means, impact creation measures indicate which and how many people have been informed sufficiently in order to lead to changes in their behavior. For example the number of recipients of a dissemination item.

In this sense, both dissemination and impact creation are two very important elements for the final success of a research project.
Accordingly, the definition of impact creation performance indicators will be realized on the base of the dissemination actions of the results in industry proposed in DoW and in the deliverable D8.2 "Finnish Dissemination Strategy and Cluster Collaboration Plan" and the new actions defined for the dissemination to policy decision makers and other business entities (Business associations and confederations, Chambers of Commerce, Clusters organizations, etc).

To design the set of actions, it has been necessary to analyze the best practices obtained as a result of several projects of similar to GloNet. The second source of dissemination actions has been the DoW produced for GloNet in which an initial set of actions was proposed in order to have an appreciable impact over the different classes of stakeholders interested in the results of the project.
Considering this and adding the specific stakeholders obtained in the previous deliverables, the following set of preliminary impact creation indicators has been defined.
The main actions proposed for the dissemination of the results between the different groups of recipients are defined in the following table, which includes the stakeholders defined in the industrial part of the project and those with the purpose to design a specific policy action plan:

Actions	Relevant Stakeholders									
	Developers	Industry	Public authority	Internal critical suppliers	External suppliers	Other Stakeholders	Clients	EC	Policy decision makers	Business associations, chambers of commerce, cluster organisations
Presentations during national and international conferences										
Regional workshop presentations										
Developer meetings										
Media										
Lectures										
Brochure										
Newsletter										
Website										
Other digital dissemination channels (youtube, …)										
Pilot demonstration										
Policy action plan										

Definition of impact creation performance indicators

As mentioned in the DoW, impact creation is a long term process which begins with the dissemination of the first results of the project and continues during the whole lifecycle of the project and even further. In this sense, it will be necessary to produce a new additional set of

both dissemination and impact indicators once new specific results have been obtained along the development of GloNet.
GloNet impact creation addresses mainly industrial "multipliers". This term refers to all groups of stakeholders defined in the previous section which, thanks to their roles and positions in society, can multiply the impacts of GloNet's results.
It's not realistic to hope that the consortium of the project can create a huge impact by itself, but it can favor and promote the creation of future impact across the development dissemination actions addressed to the main groups of stakeholders (multipliers).
In this sense, as target dissemination indicators, GloNet aims the following:

- Number of related business conferences in which GloNet is active: >= 2 per year
- Number of publication in industrial magazines: >= 4
- Number of publication in digital media: >= 2 per year
- Number of regional workshops targeting specific industry stakeholders:>= 4

It is planned that these dissemination actions will achieve the following impact creation performance:

- The development of 2 related business conferences in which GloNet is active per year and considering that at least 20 participants will attend to each one:
  >= 120 people informed.
- 4 publications in industrial magazines, that, due to the specific kin d of this magazines, probably will achieve more or less 5.000 people who read each one of this magazines, and so will achieve:
  >= 20.000 people informed.
- 6 publications in digital media, some of them we have already access which are related with people involved in ICT technologies, and usually have more than 2.000 people as subscribers, will create an impact of:
  >= 12.000 people informed.
- Involved stakeholders through impact creation mechanisms. This specific aspect is related with the possibilities which the industrial partners of GloNet already have along their own business and which are related with the possibility to explain GloNet characteristics and to realize new business opportunities:
  >= 50
- 4 regional workshops targeting specific industry stakeholders will permit create impact in:
  >= more than 80 people from different business organization and other industrial stakeholders

In general more than 8.000 people related to the involved stakeholders will be informed about GloNet results, and more than 30.000 people will be reached through the dissemination and impact creation mechanisms defined.
The following table offers a general view of the selected impact indicators and the value of each one of them.

ACTION	NUMBER	PEOPLE INVOLVED	NUMBER OF TOTAL IMPACTS
Publication in industrial magazines	4	5.000	20.000
Related business conferences	6	20	120
Publication in digital media	6	2.000	12.000
Involved stakeholders through impact creation mechanisms		50	50
Regional workshops	4	20	80
TOTAL			32.250

Table 2 - Total reach (businss related)

6. CONCLUSIONS

The preliminary set of indicators cover four different aspects of the GloNet project:

- **Use case performance indicators**
  Comparing the current use case processes to the future processes supported by the GloNet platform results in quantifiable improvements (e.g., time to market, cost reduction).
- **Business scenario KPIs**
  Eight different business scenarios were investigated and suitable KPIs defined. Examples of these abstract KPIs illustrate their importance and meaning.
- **Technical performance indicators for the GloNet platform**
  15 metrics measure the product quality of the GloNet platform. The categorization of the metrics ensures the comprehensiveness of the quality framework.
- **Impact creation indicators**
  The defined, stakeholder-specific actions and corresponding performance indicators provide a foundation for the impact creation evaluation.

All of the defined indicators are preliminary and will be further developed in the course of the GloNet project. They will result in operational performance indicators, which will be used for evaluation purposes of the GloNet Project.

7. REFERENCES

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