

BIFOCALPS Project

Boosting Innovation in Factory Of the
future value Chain in the Alps

Project Number: 510

D.T3.1.2: Set of qualitative impact indicators

<u>Deliverable code:</u>	D.T3.1.2
<u>WP T1 Responsible</u>	FhA
<u>Deliverable responsible</u>	FhA
<u>Due Date:</u>	01/18
<u>Submission Date:</u>	02/18
<u>Editors:</u>	Arko Steinwender (FhA), Christoph Biegler (FhA), Alessandro Sala (FhA)
<u>Authors and affiliations:</u>	Arko Steinwender (FhA), Christoph Biegler (FhA), Alessandro Sala (FhA), Andrea Zangiacomi (CNR), Massimiliano Bertetti (Polo Pn), Martina Agosti (ITALCAM), Lisa Hornberger (bwcon), Simona Knežević Vernon (TPLJ), Valerie Rocchi (INPG),

0



This project is co-financed by the European Regional Development Fund through the Interreg Alpine Space programme



	Arnaud Bocquillon (Viameca), Florian Maurer (FHV), Vesna Kozar (PRC)
<u>Dissemination Status:</u>	Public



EXECUTIVE SUMMARY

WPT3 aims at developing and validating an impact indicator system to track effective improvements after transfer and adoption of enabling FoF practices in manufacturing enterprises. The structure of the impact indicator system is presented in deliverable D.T3.1.1, providing a wide range of quantitative indicators to track effective impacts and improvements.

Besides offering a set of quantitative indicators, the impact indicator system also includes a qualitative assessment aiming at measuring the current status of an enterprise on its path towards the factory of the future. This paper focuses on the elaboration and presentation of indicators which are suitable to perform the qualitative assessment of the impact indicator system.



TABLE OF CONTENTS

1	INTRODUCTION.....	4
2	THEORETICAL BACKGROUND	4
2.1	Indicator system requirements	4
2.2	Critical success factors	5
2.3	Impact indicator system	8
2.3.1	Components of the impact indicator system.....	8
2.3.2	Basic structure	9
2.3.3	Indicators of the impact indicator system	11
3	IMPACT INDICATOR SYSTEM - QUALITATIVE INDICATORS.....	11
3.1	Structure	11
3.2	Definition of indicators	12
4	CONCLUSION	14



1 INTRODUCTION

Activities and deliverables

WPT3 covers three activities with five deliverables in total. This paper presents the first of three activities A.T3.1, including the deliverables D.T3.1.1 and D.T3.1.2. As described in the executive summary, activity A.T3.1 aims at defining key performance indicators in order to track effective improvements after successful technology and practices adoption towards the factory of the future (FoF). This activity builds upon the findings of WPT2, especially on the set of critical success factors identified, which enable the transition towards FoF. In order to track all relevant influencing factors, the impact indicator system has to include quantitative as well as qualitative measures. The following two activities A.T3.2 and A.T3.3 validate and test the proposed framework for the impact indicator system in dedicated workshops. An overview of the specific contents of each activity is given in Figure 1.

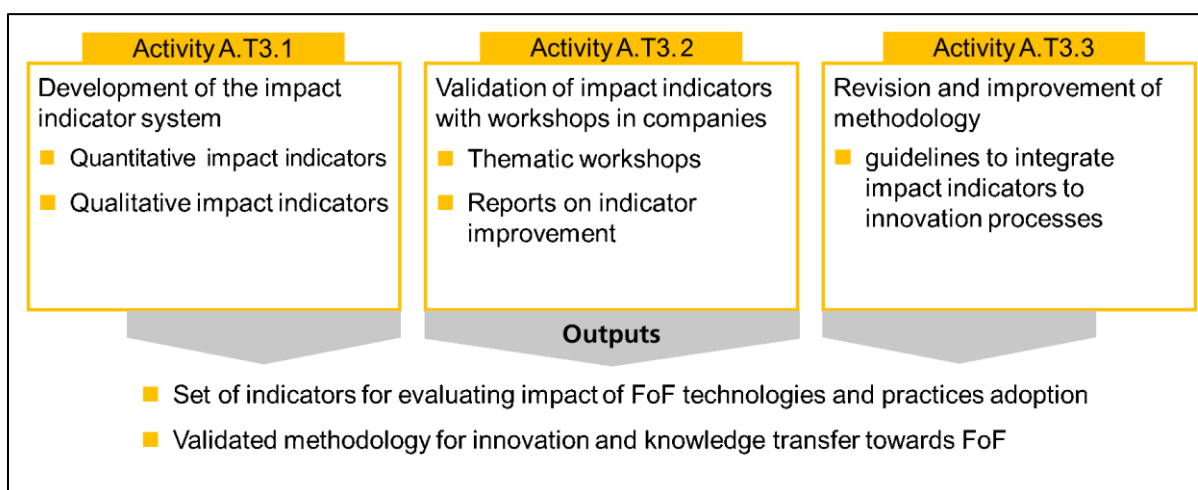


Figure 1 – Activities and deliverables in WPT3¹

2 THEORETICAL BACKGROUND

2.1 Indicator system requirements

As defined in the project description, the WPT3-impact indicator system is subject to a set of requirements, which have to be taken into account in the model definition. These requirements guarantee that relevant stakeholders and influencing factors are considered in the indicator system, while still ensuring a broad applicability of the model. The requirements are defined below:

¹ BIFOCAlps project description



- **Different perspectives:** The indicator system should consider multiple perspectives such as competitiveness, smartness, innovativeness, etc.
- **Different stakeholders:** The indicator system should also include all relevant stakeholders from suppliers to final consumers.
- **Different measurement modes:** Finally, different modes of impact evaluation should be considered to ensure the collection of all necessary information. This requirement is met by defining quantitative and qualitative indicators in the model. While quantitative indicators represent numeric measures such as the financial performance of a company or the number of employees in a division, qualitative indicators are useful in cases where important outcomes are difficult to capture quantitatively.

2.2 Critical success factors

As defined above, the impact indicator system is based on the results and findings of the preceding work package WPT2. The results of this work package include guidelines for fostering innovation processes towards the factory of the future as well as the definition of critical success factors, which represent main enablers for FoF practices- and technology adoption. The critical success factors cover the following criteria, as shown in Deliverable D.T2.2.1:

- CSF1: Strategy
- CSF2: Technology
- CSF3: Capacity for innovation
- CSF4: Ecosystems support for innovation
- CSF5: Skills and change management

In WPT2, each success factor consists of five maturity levels, which define certain requirements an enterprise has to achieve in order to advance in their maturity levels. Referring to the impact indicator system, these maturity levels allow the formulation of company-specific objectives, which can further support the decision-making process regarding future developments and investments. The full list of critical success factors together with the corresponding maturity levels is shown in Table 1.



Maturity level	<i>CSF 1: Strategy</i>
0	the company does not have any strategy
1	the company makes «forced» investments to test new technology and/or improve the performance of its products or processes(without a clear and defined strategy)
2	the company makes «intentional» investments to improve the performance of its products or processes
3	the company has a clear and defined strategy, questions its current and/or next business models and integrates technologies
4	the company has a complete 4.0 strategy and develops dedicated technologies
Maturity level	<i>CSF2: Technology</i>
0	the company does not invest in any 4.0 technology
1	the company invests in 3.0 technology to update its production system
2	the company tests or invests in some isolated 4.0 technology
3	the company integrates and uses 4.0 technology, it is an early adopter
4	the company anticipates new technologies and initiates new technology developments
Maturity level	<i>CSF3: Capacity for Innovation</i>
0	the company does not innovate
1	the company has an engineering office but no R&D department
2	the company develops some internal projects and use internal resources exclusively (it can collaborate with universities, technical and competence centres occasionally)
3	the company has a R&D department and participates in external national collaborative projects
4	the company has a R&D department and participates in external international collaborative projects



Maturity level	<i>CSF4: Ecosystems support for innovation</i>
0	the company does not have any FoF support
1	the company collaborates with «isolated» and heterogeneous actors and benefits from general support programs
2	the company is part of specialized technological networks and benefits from specialized support programs
3	the company is part of multi-actors ecosystems(clusters, platforms...) and benefits from complementary, original and incentive support programs
4	the company is part of structured (regional, national or European) multi-actors ecosystems and benefits from public policies and specialized support programs
Maturity level	<i>CSF5: Skills and change management</i>
0	the issue is not addressed
1	there isn't a identified person in charge of the digital transformation, the company addresses the issue after the implementation of the technologies
2	the company evaluates internal skills when the technology is being implemented
3	the digital transformation is managed by a identified person from the management, the company designs a plan before the implementation of the technologies
4	the company implements a Human Resource Planning (HRP), there is a new culture and mind set into the company

Table 1 - Critical success factors²

As defined above, the list of critical success factors not only include specific FoF-technologies but also necessary skills, requirements, practices and other steps a company needs to invest in, in order to develop itself to a factory of the future. Accordingly, these critical success factors can serve as direct inputs for the impact indicator system in order to link specific FoF investments with achieved outcomes. Regarding the successful transfer and application of the identified success factors and practices, WPT2 also provides a set of guidelines assigned to each success factor. These guidelines aim at stimulating the cross-fertilization of the best practices in order to enhance a successful and sustainable growth of manufacturing sector at all levels of value chain and in all Alpine Space countries involved in the project.

² BIFOCAlps A.T2.1 – D.T2.1.2



2.3 Impact indicator system

Deliverable D.T3.1.1 presents an impact indicator system to track effective improvements after successful adoption of FoF-technologies or practices. The impact indicator system represents a management tool, aiming at helping enterprises to analyse their status regarding FoF-progress as well as to measure the direct impact of FoF-technology and practices adoption. As described in Deliverable D.T3.1.1, the system is structured according to the IPOO-framework, linking specific FoF-related inputs to results and outcomes on various levels. While outputs and outcomes can be evaluated using a wide range of quantitative indicators, the input-section covers a qualitative assessment based on the critical success factors presented above.

2.3.1 Components of the impact indicator system

Process elements

1. Input indicators

According to the description of the IPOO-framework in Deliverable D.T3.1.1, input indicators capture resources, which enter the innovation process. As such, these indicators should include tangible as well as intangible assets of a company such as employees, equipment, information, expertise or financial resources. Correspondingly, input indicators can be seen as an extensive range of requirements enterprises need to improve in order to be successful in their innovation activities. In context of BIFOCAlps, these requirements can perfectly be summarised by the list of critical success factors defined in WPT2. In particular, these critical success factors can be evaluated using the set of guidelines proposed for each success factor in WPT2.

2. Process indicators

The IPOO-framework has a clear focus on the innovation process and R&D-related activities. On the contrary, the impact indicator system takes a broader view, putting the focus on innovation, but also in competitiveness, new technologies, overall efficiency, etc. Accordingly, process indicators in the impact indicator system can be summarised under the term *Operations & Innovation*.

3. Output indicators

Output indicators are necessary to evaluate the results of the processing system. As innovation is a key element of the analysis, such measures can be represented by innovative results of an enterprise including new products, patents, applications, processes etc. Enterprises also profit from intangible outputs such as the increase in knowledge or synergy effects, which have to be evaluated by qualitative measures.



4. Outcome indicators

By investing and adopting FoF-technologies and practices, enterprises expect to extend their market position, to be more sustainable and to gain overall competitiveness. These goals are usually tracked by indicators such as cost reduction, increase in market share or revenue growth. Generally, outcome indicators need to be in line with the mission of an enterprise. Therefore, results are frequently also measured from a customer's perspective. The impact indicator system offers a set of relevant outcome indicators with a focus on FoF-goals, which then can be adjusted according to specific objectives of the companies.³

2.3.2 Basic structure

Figure 2 shows the fundamental structure of the impact indicator system according to the specifications and the requirements defined above. As evident from the figure, each critical success factor has its own list of indicators which together form the inputs undertaken in the path towards FoF. The following three columns processing system, outputs and outcomes then mainly aim at evaluating the impact of CSF-related investments and improvements on different levels. After the structure is built, the next step is to determine relevant indicators for each column of the model.

³ BIFOCAlps – Deliverable D-T3.1.1



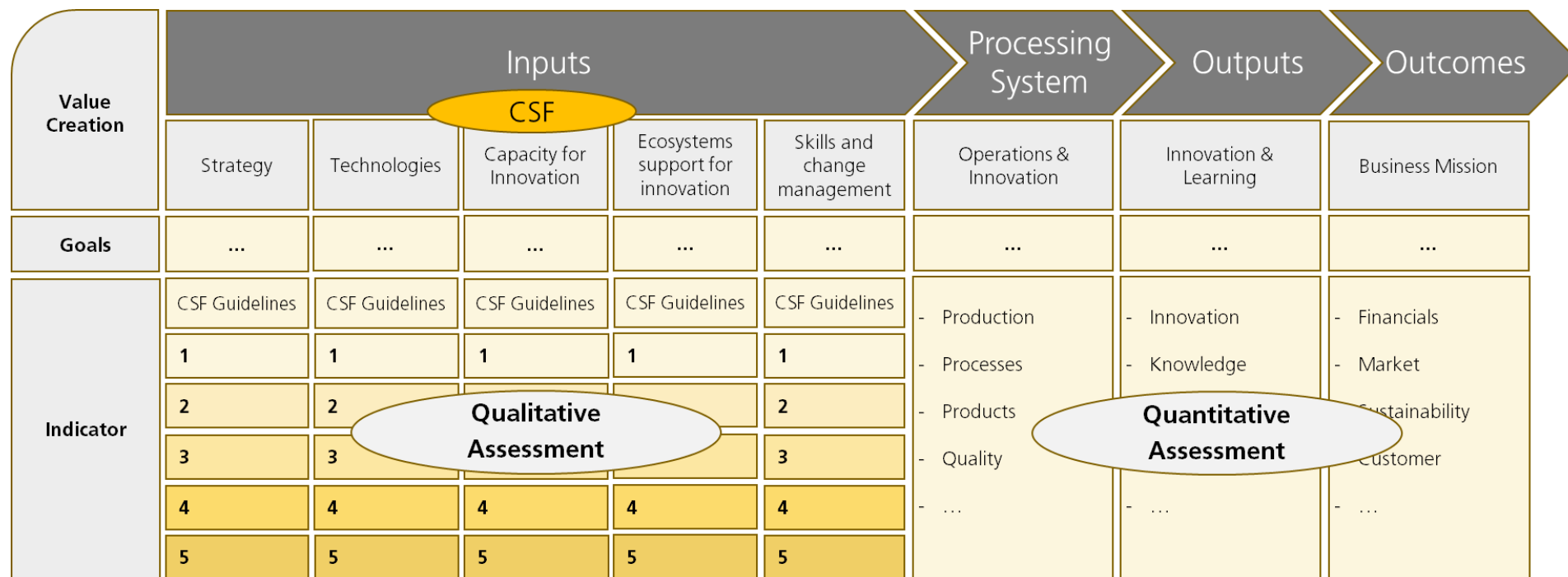


Figure 2 - Impact indicator system – structure⁴

⁴ BIFOCAlps – Deliverable D-T3.1.1



When used correctly, the impact indicator system offers a practical reference system to pave the way towards the factory of the future. By linking strategical inputs to outputs and outcomes, the indicator system creates a clear “line of sight” to desired results, which further helps to improve strategic and daily decision making. In combination with guidelines and success factors defined in WPT2 the impact indicator system additionally offers the possibility for a company to identify performance improvement opportunities that span traditional organizational structures and boundaries

2.3.3 Indicators of the impact indicator system

As shown in Figure 2, the impact indicator system is composed of a quantitative impact assessment following a qualitative evaluation of the path towards FoF. The quantitative impact assessment is described in detail in the deliverable D.T3.1.1, proposing a wide range of possible KPIs for every component of the indicator system. This paper focuses on the elaboration of the first part of the impact indicator system, covering an assessment of the CSF-maturity level in the input-category.

3 IMPACT INDICATOR SYSTEM - QUALITATIVE INDICATORS

3.1 Structure

The critical success factors described in chapter 2.2 offer a perfect starting point to evaluate the status of an enterprise on its path towards the factory of the future. The maturity levels defined for each success factor allow the derivation of specific goals and objectives for each company. On the other hand, these maturity levels are only restrictedly applicable in the impact indicator system, as they provide low information on how to achieve a higher maturity. Instead, WPT2 provides a set of guidelines assigned to each success factor, which express specific requirements a company needs to fulfil in order to successfully apply FoF-practices. Using these guidelines as the basis for the impact indicator system, besides evaluating their current progress enterprises also get the possibility to inform themselves about further needs for action.

In order to evaluate the proposed guidelines in the impact indicator system, the application of a scoring model seems to offer a suitable approach. A scoring model links a set of questions to a predefined rating scale, which experts can use to provide their assessment. For example, using a Likert scale, experts have the possibility to specify whether they agree or disagree with the implementation of a specific guideline in their company. The Likert scale can represent a various scale, which has to be defined by the interrogator. A scale with many answer options offers a more detailed analysis, while fewer answers keep the application of the model simpler,



as the experts have to decide between less answers. For the impact indicator system, a 5-point Likert scale is a suitable option, following the 5 maturity levels defined for each critical success factor. The questions in the survey can be formulated directly using the guidelines proposed in WPT2. As the evaluation in a scoring model mainly depends on subjective perception of a few experts, the assessment method is of qualitative nature.

Table 2 shows the definition of the Likert scale's elements used for the impact indicator system.

0	1	2	3	4
Strongly disagree	Disagree	Neutral	Agree	Strongly agree

Table 2 – Likert scale for the assessment of the guidelines

3.2 Definition of indicators

The qualitative assessment of the impact indicator system is therefore based on the set of guidelines defined in WPT2. The individual areas of the scoring model are shown below.

1. CSF 1: Strategy

Nr.	Guideline	0	1	2	3	4
G1.1	All stakeholders are aware of the benefits of the digital transformation					
G1.2	A new corporate culture is established in the company due to an intense communication strategy					
G1.3	The company has analysed its own strengths, weaknesses, opportunities and threats as to develop a suitable FoF-strategy					
G1.4	The implementation of the FoF-transition is controlled intensively by clear project management (defining priorities, duration, milestones, budget, risks, ...)					
G1.5	Our changes towards FoF are planned and performed in small, incremental changes					
G1.6	Our current and future business models are analysed deeply					
G1.7	Our FoF-strategy is defined for both products and processes					

Table 3 – CSF 1 scoring model



2. CSF 2: Technology

Nr.	Guideline	0	1	2	3	4
G2.1	Digital technologies are understood deeply regarding their TRL and reliability					
G2.2	A transparent and structured selection procedure of FoF-technologies is established in the company to secure the correct choice of investments					
G2.3	The evolutionary aspect of the FoF-topic is understood and the company is not affected by the „hype“					
G2.4	The IT infrastructure is ready to support FoF-technologies and guarantee the safety of data					
G2.5	The process of implementing FoF-technologies is clearly defined and considers pilot projects before deploying them to greater ones					

Table 4 – CSF 2 scoring model

3. CSF 3: Capacity for innovation

Nr.	Guideline	0	1	2	3	4
G3.1	We are supporting the implementation of FoF practices by internal R&D&I activities					
G3.2	We have a strong and dedicated R&D&I-department					
G3.3	We foster creativity to boost innovation by a strong idea management and entrepreneurship among employees					
G3.4	We have strong collaborations with other industrial companies and academic/research centres in the field of FoF					
G3.5	We strongly integrate the customer in our digital transformation plan in order to fulfil their needs					

Table 5 – CSF 3 scoring model



CSF 4: Ecosystems support for innovation

Nr.	Guideline	0	1	2	3	4
G4.1	We are strongly involved in professional industry networks in order to benefit from cross-sectoral fertilization					
G4.2	We collaborate steadily with research and technical centres in order to benefit from facilities and the latest innovation technologies and processes					
G4.3	We actively collaborate with universities in order to keep informed about FoF-oriented training and identify new talents					
G4.4	We often participate in FoF-oriented public programs					

Table 6 – CSF 4 scoring model

4. CSF 5: Skills and change management

Nr.	Guideline	0	1	2	3	4
G5.1	The employees' digital skills are sufficient for the new digital technologies					
G5.2	We invest in new highly qualified employees in order to successfully implement and manage new ICT-based solutions					
G5.3	We provide training programs for our employees in order to develop the required skills					
G5.4	The mind-set of our employees is open-minded to the path towards FoF					
G5.5	A change leader/department to manage the digital transformation in the company is defined					

Table 7 – CSF 5 scoring model

4 CONCLUSION

This deliverable presents the results of activity A.T3.1, providing a reference system to track effective improvements after transfer and adoption of enabling FoF practices in manufacturing enterprises. In particular, the deliverable presents the first part of the indicator system, covering the qualitative assessment of enterprises on the basis of the critical success factors.

