MONSOON

MOdel based coNtrol framework for Site-wide OptimizatiON of data-intensive processes

D7.5 –Initial Demonstrators Evaluation and Impact Report

Deliverable ID	**D7.5**
Deliverable Title	**Initial Demonstrators Evaluation and Impact Report**
Work Package	**WP7 – Demonstration and Evaluation in the Aluminium and Plastics Domains**
Dissemination Level	**PUBLIC**
Version	**1.0**
Date	**2019-03-19**
Status	**Final**
Lead Editor	**GLN**
Main Contributors	**Marco Dias (GLN), Vincent Maigron (AP), Massimo De Pieri (LCEN)**

Published by the MONSOON Consortium

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723650.

Document History

Version	Date	Author(s)	Description
0.1	2019-02-05	Marco Dias (GLN)	Table of Content
0.2	2019-02-27	Marco Dias (GLN)	Table of Content review and first Draft
0.3	2019-03-12	Marco Dias (GLN)	Description of chapter 2.2
0.4	2019-03-15	Vincent Maigron (AP)	Contribution for Aluminum domain
0.5	2019-03-15	Marco Dias (GLN)	Description of Chapter 3
0.6	2019-03-19	Massimo De Pieri (LCEN)	Few adjustments

Version	Date	Reviewed by	Summary of comments
1.0	2019-03-19	Ruben Schlutter (KIMW)	Accepted with minor corrections to spell checking and grammar
1.0	2019-03-19	Vincent Maigron (AP)	Accepted with minor corrections

Table of Contents

Executive Summary

This document constitutes the Deliverable D7.5 – Initial Demonstrators Evaluation and Impact Report of the MONSOON project (Grant Agreement No.:723650) and presents thefirst results of defined KPI's and the impacts on each domain business cases.

1 Introduction

This document is a first evaluation of the KPI framework defined in D7.1 from task 7.1. This task is a part of WP7, which is dedicated to stablishing tools to evaluate the effectiveness of the application of data-driven optimization methodologies developed by data scientists along with other tasks of the project and validation of the presented methodologies.

The goal of this document is to present an analysis of the hypotheses asthe first results based on the calculation of the KPIs and evaluate if the tool framework is adjusted to what is expected to achieve and deliver feedback in terms of improvements or changes according to the actual needs/requests, based on each domain (Aluminium and Plastic) business cases.

The KPIs were categorized into different clusters as it was described on deliverable D7.1: Domain-specific KPIs, Environmental KPIs, Circularity KPIs and Replicability KPIs.

1.1 Related documents

ID	Title	Reference	Version	Date
[RD.1]	Initial Evaluation Framework	D7.1	1.0	28-03-2018

2 Domain KPIs Evaluation Framework

2.1 Aluminium Domain

2.1.1 Evaluation of the results

Based on the iteration 1 related to the green anode productionand based on the evaluation framework defined in D7.1,here the following results are presented, based on data collected from September 2016 to June 2017:

Table 1 - Evaluation Framework applied to aluminium domain, (average green anode production, from September 2016 to June 2017, AluminiumDunkerque plant). Green lines represent the base layer, blue lines contain domain-specific KPIs.

KPI name	Reference flow	Unit	KPI value	Comments
Global Warming Potential	Anode	kg CO_2 equivalent	566	
Primary Energy Consumption	Anode	MJ equivalent	60,480	
Direct Energy Consumption	Anode	MJ equivalent	565	
Electricity consumption[1]	Anode	MJ	55	
Raw material consumption	Anode	kg	1082	
Recycled content	Anode	%	26.1	
Water Consumption	Anode	l	5,400	
Waste to landfill	Anode	kg	0.2	
Waste to recycling	Anode	kg	0.3	
Process yield	-	%	92	
Product Circularity Index	Anode	%	N/A	This KPI cannot be computed for intermediate products
Anode quality	Batch	%	8.5	Percentage of 30 minutes periods with lower anode density
Anode rejection rate	Anode	%	N/A	This KPI has not be computed during iteration 1[2]

[1] During iteration 1, only mixer electricity has been considered in the analysis

[2] Aluminium Dunkerque fixed the target value for this indicator at 2.5%; second iteration of the project will explore the opportunity to compute the KPI and to include it in the Final Evaluation Framework

Acidification Potential	Anode	kg SO_2 equivalent	9	
Natural gas consumption	Anode	MJ	510	

For the first iteration, as the focus has been put on the green anode production, two different process KPIS have been identified:

- green anode density variability;
- anode rejection rate.

The variability of the green anode density affects their behavior on the pots and can lead to instability of the pot and to anodic incidents.

For iteration 1, ADwas working on batches of anodes produced per 30 minutes' periods. A period is considered of lower quality if at least one anode produced has a density below 1. The KPI is therefore the number of such lower quality periods.

The other process KPI is the anode rejection rate. It is directly linked to the total amount of rejected anodes and represents the ability to produce good quality anodes with a big production volume.

2.1.2 Aluminium Domain Impacts

The MONSOONs platform, in the aluminium domain, and especially in the carbon area, is directly linked to the green anode quality. Indeed, the main objective is to predict a period of lower quality and to propose countermeasures.

When a period of low quality is predicted the algorithm details the possible causes of the non-quality period.
By doing so the MONSOON platform helps the process teams to focus on the parameters that are responsible forthe lower quality period. Meaning that the process teams are able tominimize the duration of an issue, and therefore the potential number of bad anodes produced.

This is a direct impact on the two process KPIs. The number of bad anode quality periods is reduced, and the anode rejection rate is lowered, leading to financial gain.

There are other advantages. Any rejected anode is reintroduced in the green anode production process. The anode blocks are crushed in a specific workshop to a required dimension before being reintroduced as green recycled product. Even if the impact of raw material is reduced thanks to the internal recycling process, this specific step is energy consuming and leads to inefficiencies along the production process.

By minimizing the rejected anodes, the MONSOON platform is helping in reducing the waste and also the energy consumption in this specific area. It also reduces the consumption of raw materials, because when

the processyield increases, as your rejection rate decreases, the same amount of anodes are produces with less materials.

The MONSOON platform is really helpful to improve the performance of the production line, by reducing the energy consumption, the raw materials and the amount of recycled anodes.

2.2 Plastic Domain

2.2.1 Evaluation of the results

Based on the iteration 1 defined on D7.1 related to the coffee capsule production, related to the evaluation framework applied to plastic concerning the year 2017, were presented the following results:

Table 2 - Evaluation Framework applied to plastic domain, (coffee capsules production, year 2017, GLN facilities). Green lines represent the base layer; blue lines contain domain-specific KPIs.

KPI name	Reference flow	Unit	KPI value	Comments
Global Warming Potential	kg of capsules	kg CO_2 equivalent	2.7	
Primary Energy Consumption	kg of capsules	MJ equivalent	87	
Direct Energy Consumption	kg of capsules	MJ equivalent	8	
Electricity consumption	kg of capsules	MJ	8	
Raw material consumption	kg of capsules	kg	1.26	
Recycled content	kg of capsules	%	-	
Water Consumption	kg of capsules	l	18	
Waste to landfill	kg of capsules	kg	-	
Waste to recycling	kg of capsules	kg	0.26	
Process yield	-	%	79	
Product Circularity Index	capsule	%	17	
Rejection rate	kg of capsules	%	3	

The presented results were focused on a sampling of one year of production, with the goal of defining a possible framework to calculate the environmental impacts concerning a specific scenario, complemented by specific KPI's.

The presented KPI values are related to a scenario of plastic parts produced in large scale. Compared to the other study domain, these results seem to be very low, but considering the effect of these final products in the environment, this represents very significant impacts.

The usage of plastic is being globally evaluated in terms of the mass consumptions and beside of the waste issues, the indirect costs to produce the raw materials reflect substantial concerns in terms of resources and energy consumptions and the environment balance.

The MONSOON tools can deliver improvements in terms of reduction of the unnecessary consumptions, based on the stoppages – the prediction of the possible stoppages can lead the operators and the management teams to avoid long periods of production breaks and plan them according to the needs and demands of the clients.

In fact, the presented KPI values are related to the actual production flow, which means there is still opportunity to improve these values if the predictive functions (to be developed by MONSOON) act directly on the reduction of the raw materials and energy consumptions.

Another topic that should be considered is the labor time: if the stoppages and the rejection ratesare decreased, it won't take 7 full days to complete the ordered quantities and so, the consumptions will decrease as well, based on 5 labor days.

The perspective of the MONSOON approach for the plastic domain it is also an opportunity to offer a value-added service to the clients, as well as to the suppliers: like described before there is a major concern about the plastic usage, and the plastic segment needs to present solutions in terms of decreasing the impact in the environment. The MONSOON should represent a methodology of actions to improve the eco-efficiency of the industrial companies in order to the decrease global warming and the ecological footprint.

Finally, and considering the suggestion described on D7.1, the graphical shape through a dynamic dashboard will help to instantly visualize the behavior of the production in terms of environment impacts and sensitize the co-workers to a better performance and more environment friendly.

2.2.2 Plastic Domain Impacts

In the case of the plastic domain, the results reflect a significant environment impact once the product scope is based on plastic parts. The study cases are only considering two scenarios of plastic part injection, but there are other products that follows the same procedures.

The improvements on the monitorization and control of the consumptions can lead to a better behavior concerning the sustainability of the processes and major contribution on the emissions to the Environment.

Analyzing the specific impacts of the coffee capsule production, the impact of the defined KPI's is related to the rejection rates: an improvement of the process control, it will represent also improvements on the rejection indicators and so, reduction of waste.

3 Conclusion and further improvements

This deliverable presents a first interpretation of the defined specifications for the initial Evaluation Framework of the MONSOON project.

The analysis of the KPIs calculation and its associated results reveals that the selected KPIs are aligned with the scope and the objectives are measurable, either to the industrial domains as to the proposed goals of the MONSOON project. However, along with the maturity of the developments, some improvements need to be considered to better characterize the scenario of each pilot.

It is certain that the MONSOON solution should be scalable to other domains / segments and the target is to perform a standard tool to be, then, personalized for different applications. However, the MONSOON solution as a service should be business-oriented and deliver functionalities that the end-user can easily visualize business impacts and address them to his procedures, in order to identify the causes and stablish actions to reduce those impacts.

The review of the Evaluation Framework (in D7.2) should reflect the refinement of the KPIs and consolidate the overall evaluation of performances of the MONSOON platform.

Acronyms

Acronym	Explanation
KPI	Key Performance Indicators

Table 3: Acronyms table

List of figures

Não foi encontrada nenhuma entrada do índice de ilustrações.

List of tables