

Efficiency and Sustainability (E&S)

Proposal Sheet

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Abbreviations

TCS	Teaching Case Study
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1 General Information

Activity Sector	Manufacturing, Industrial Engineering, Sustainability and Digital Transformation		
Keywords	OEE, Overall Equipment Effectiveness, Carbon Footprint, ESG, Digital Product Passport, Circular Economy, Industry 4.0, Production Analytics.		
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Public	Initial and alternative education ☒ Beginners ☐ Intermediaries ☐ Experts	Continuing education ☒ Beginners ☐ Intermediaries ☐ Experts	
Domain(s)	☐ CSR ☐ Economics ☐ Entrepreneurship ☐ Finance ☐ HRM ☒ Information Systems ☐ Law ☐ Marketing ☐ Political Sciences ☐ Strategy ☐ Supply chain & logistics	☐ Arts, Architecture, Design, Ergonomics ☐ Education Sciences ☐ Geography & Urban Planning ☐ Information & Communication Sciences ☐ Literature & Language Sciences ☐ Medical Sciences ☐ Physical Activities & Sport Sciences ☐ Psychology, Sociology, Philosophy, Demography	☐ Biology & Neurosciences ☐ Chemistry, Biochemistry ☐ Earth & Universe Sciences ☐ Electrical, Electronics ☒ Energetics ☐ Mathematics & Computer Science ☒ Mechanical Engineering ☐ Physics ☒ Processes
UN SDG	☒ 9 Industry, Innovation, and Infrastructure ☒ 12 Responsible consumption and production ☒ 13 Climate Action		
Place in the Circular Economy Model	☒ Raw materials ☐ Distribution ☐ Collection	☒ Sustainable design ☒ Consumption Reuse Repair ☒ Waste management	☒ Production ☐ Residual waste

2 Abstract

This Teaching Case Study concerns **Smart Manufacturing Solutions (SMS)**, a European manufacturer of intelligent electromechanical components, and focuses on the production of the Smart Industrial Drive Module (SIDM). Students examine how the company can improve manufacturing performance while reducing environmental impact, strengthening sustainability reporting and improving product traceability. The case covers four areas: Overall Equipment Effectiveness (OEE), Carbon Footprint, Environmental, Social and Governance (ESG) indicators, and the Digital Product Passport (DPP). All four analyses refer to the same manufacturing system. Using production data, students perform calculations, compare improvement scenarios and develop recommendations for improving operational efficiency and sustainability.

3 Pedagogic goals & prerequisites

Students should possess basic knowledge of manufacturing processes and be able to perform basic spreadsheet calculations. The overall aim of the case is to show how operational efficiency, environmental performance, sustainability reporting and product traceability can be analysed together in a manufacturing context.

After completing the case, students should be able to:

- calculate and interpret OEE, Carbon Footprint and selected ESG indicators;
- analyse production data from MES, ERP and IoT systems;
- identify the information required for a Digital Product Passport and assess data completeness;
- compare alternative improvement scenarios and discuss their technical, environmental and organisational consequences;
- formulate and communicate justified recommendations for improving manufacturing performance and sustainability.

4 Sustainability Goals

The case addresses sustainability in the context of manufacturing performance and industrial decision-making. Students analyse how improvements in production efficiency can reduce resource consumption and production losses, while Carbon Footprint calculations are used to identify the main sources of greenhouse gas emissions and assess possible reduction measures. ESG indicators extend the analysis to environmental, social and governance aspects of company performance, while the Digital Product Passport introduces the issues of product information, traceability and lifecycle management. Together, these activities show that operational efficiency, environmental performance and access to reliable product and production data are closely related in modern manufacturing. The case supports responsible production, resource efficiency and lower environmental impact and is particularly relevant to SDG 9, SDG 12 and SDG 13.

5 Case Description

Year of the problematic	2026	
Duration for students	Preparation: 2 hours	
	Implementation: 10 teaching hours	
Languages	☒ English	☐ Other:
Use case	☒ In class	☐ Examination TCS

Category	☐ C1: Case written in collaboration with a company which has given its consent for using its internal sources such as the company name, figures, photos, videos, and so on. Join the agreement sheet. ☐ C2: Case based on real company information and with the acceptance of the company to use its data, but names or figures (of company and persons) are modified to keep them confidential. Join the agreement sheet. ☐ C3: Case written using external public sources (annual report, websites, brochures, newspapers, ...) where names or verbatims of the protagonists are used. Join the agreement sheet. ☐ C4: Case based on real company using public information without the agreement of the company (generally, the names (company and persons) are changed to anonymous ones. Impossibility to make the link between the TCS and the company. ☒ C5: Imaginary case based on teacher’s experience who collected information from several companies in order to write a case study with a fictive integrative company. It can also be a compilation of different situations of several periods put together at the same time to form a pedagogic tool.
Number of pages: Statement / Annex	13 / 15
Number of pages: Teachers’ notes:	13
Diffusion licence	See cover page

6 Case Pack Components

6.1 General Documentation

Table 6.1: General TCS documents

Document name	Description	File name	# pages
Proposal Sheet	Teaching Case Study Description. This file can be published to inform potentially interested persons about the Teaching Case Study (this file).	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Proposal Sheet.pdf	8

6.2 Student’s Documentation

Table 6.2: Documents for students (to be shared when TCS is applied)

Document name	Description	File name	# pages
Case scenario	The document for students includes the case scenario, the assignment and all information necessary to complete the exercises.	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Base Scenario.pdf	30
Exercise – Carbon Footprint	Student exercise for calculating and analysing the Carbon Footprint and assessing emission reduction scenarios	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Exercise CF.pdf	3

Exercise – Digital Product Passport	Student exercise for developing and analysing a Digital Product Passport, including data completeness and product traceability	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Exercise DPP.pdf	4
Exercise – ESG Indicators	Student exercise for calculating and analysing selected Environmental, Social and Governance indicators	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Exercise ESG.pdf	4
Exercise – OEE	Student exercise for calculating OEE, analysing production losses and evaluating improvement scenarios	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Exercise OEE.pdf	4

6.3 Teacher’s Documentations

Table 6.3: Documents for teachers (not to be shared with students)

Document name	Description	File name	# pages
Teacher’s note	The document provides guidance for teachers on the organisation, delivery and assessment of the Teaching Case Study, including notes for each of the four exercises	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Teacher’s Notes.pdf	16
Introduction	The presentation to be used for the introduction to the TCS	SCABEE TCS Efficiency and Sustainability (E&S) (2026) - Introduction.pptx	