SHIFT2 DIGITAL GREEN

WORKSHOP

COMO ADAPTAR O MODELO DE NEGÓCIO PARA A TRANSIÇÃO DIGITAL E SUSTENTABILIDADE?

Promovido por: ISQ, TECMINHO Universidade do Minho Interface, CTCV, universidade de aveiro

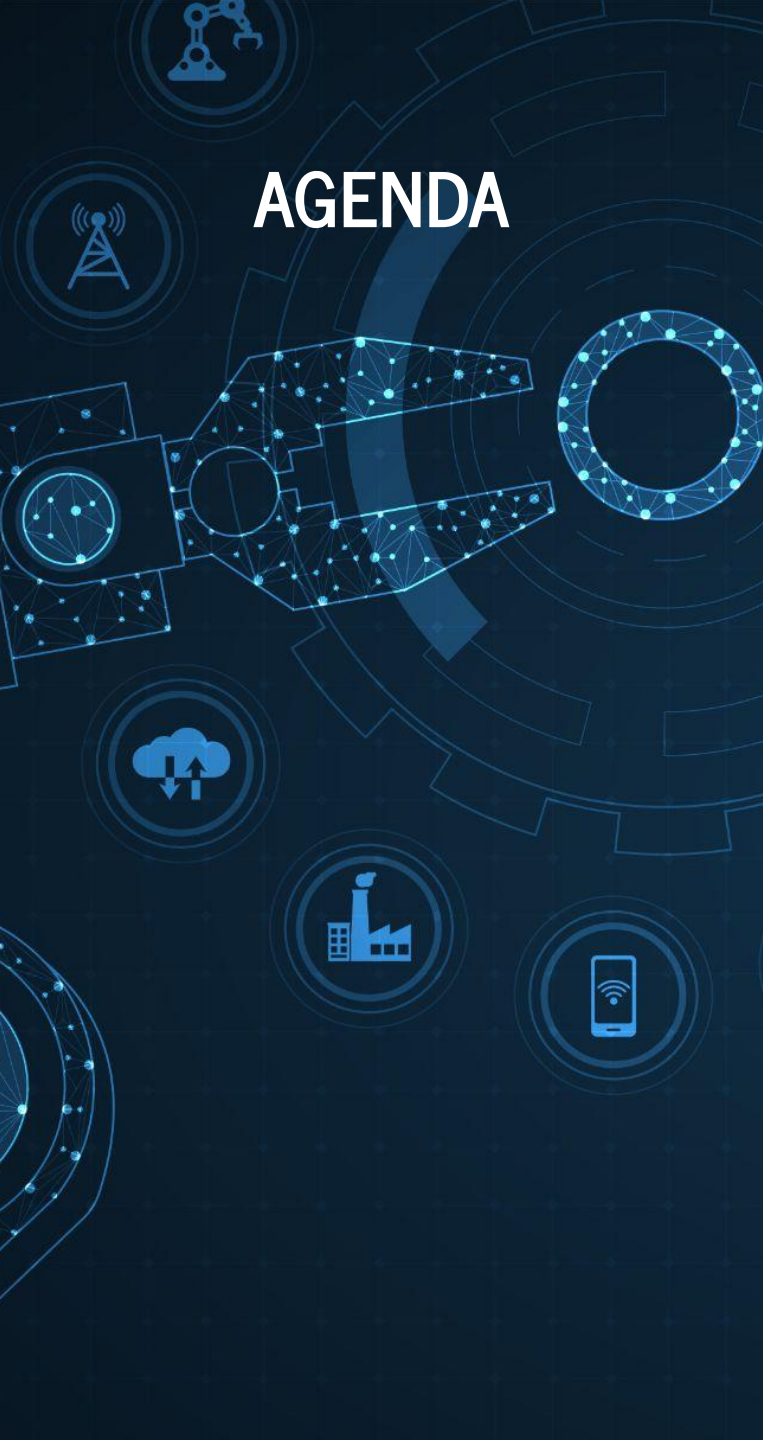
Apoio: FAMALICÃO MADE IN

Cofinanciado por: COMPETE 2030, PORTUGAL 2030, Financiado pela União Europeia

DIGITAL TRANSITION AT INDUSTRIES

Seeing the present and projecting the future.

Filipe Portela
University of Minho (Invited Assistant Professor)
IOTECH(Founder & CEO)

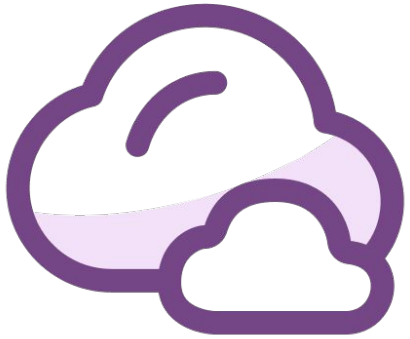


AGENDA

1. **INDUSTRY**
    a. Digital Transition
    b. Problems
    c. Industry 5.0
    d. Trends
2. **PROJECTS**
    a. be@t
    b. GIATex
    c. LCA
    d. All-in-One Solution

AI

Do not edit
How to change the design



Que palavras associa à transição digital?

Presenting with animations, GIFs or speaker notes? Enable our Chrome extension

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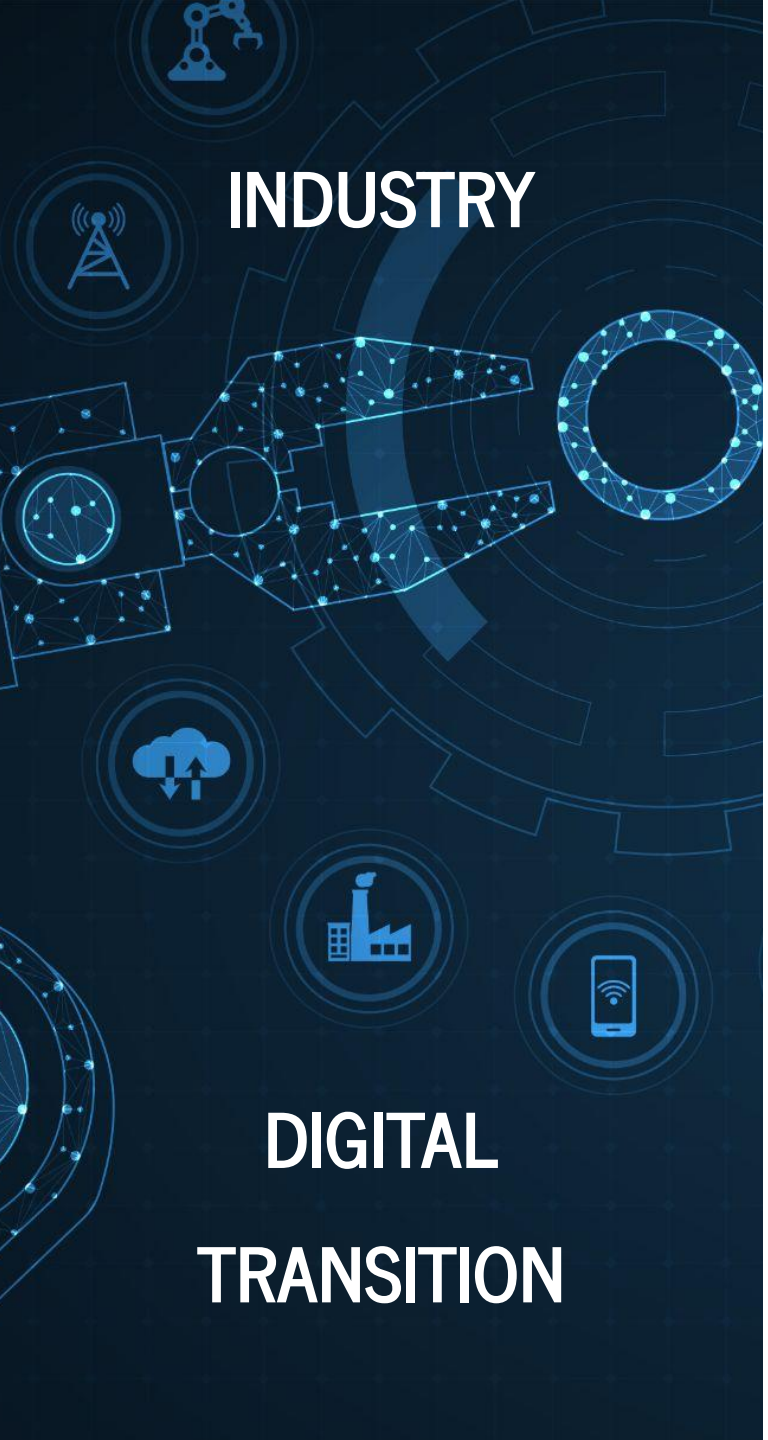
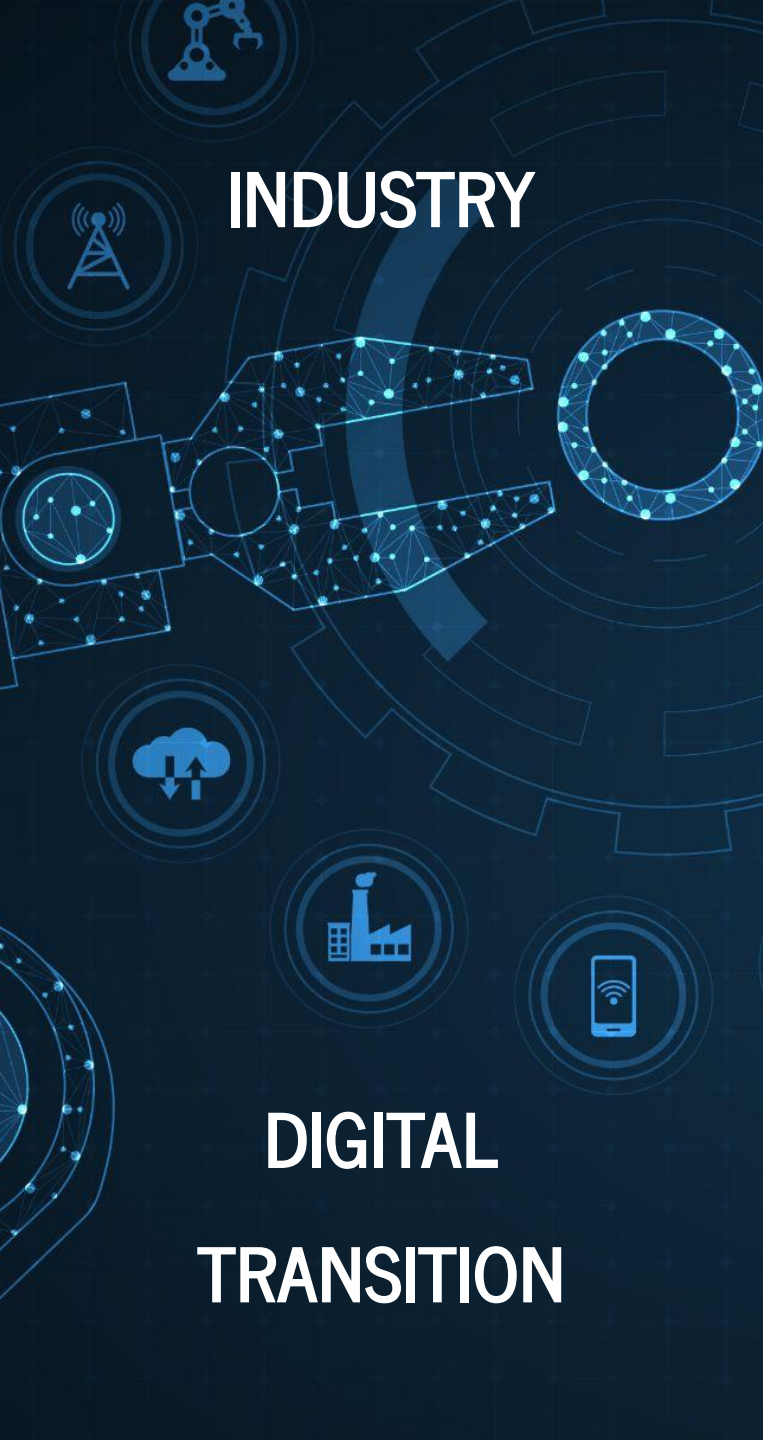


- ✓ The transition to a digital landscape is profoundly impacting industries, leading to **automation**, new **business models**, and enhanced **operational efficiency**.
- ✓ This digital transformation, often referred to as **Industry 4.0**, is characterized by the **integration** of **technologies** like **AI**, Internet of Things (**IoT**), and **cloud computing** into manufacturing processes.
- ✓ It enables **smart factories**, data-driven decision making, and personalized customer experiences, offering significant competitive advantages.
- ✓ Beyond the **impact**, managers are often left with many **questions** and **uncertainties**:
  - Is the digital transition truly **relevant** to my **industry**?
  - What **really matters** most in this process?
  - Where should I **begin**?
  - Will **digitalisation** actually solve my problems?
  - How difficult is it to create a **smart factory** and monitor all my **consumption**?
  - What are the **key challenges** facing industry today, and how can digital technologies help address them?



✓ **Key Aspects** of Digital Transformation in Industries:

1. **Automation and Efficiency:** Digital technologies automate tasks, optimize resource utilization, and streamline production processes, leading to increased efficiency and reduced costs.
2. **Data-Driven Insights:** The ability to collect and analyze vast amounts of data from production processes allows companies to gain valuable insights into market trends, customer behavior, and operational performance, enabling informed decision-making.
3. **New Business Models:** Digitalization allows companies to explore new revenue streams and business models by developing innovative products and services, offering personalized experiences, and creating connected ecosystems.
4. **Enhanced Collaboration:** Digital platforms and tools facilitate better communication and collaboration among teams, both within and outside the organization, fostering innovation and agility.
5. **Resilience and Sustainability:** Digital transformation can improve a company's resilience to market fluctuations and disruptions, while also enabling more sustainable practices through optimized resource management and reduced waste.

DIGITAL TRANSITION

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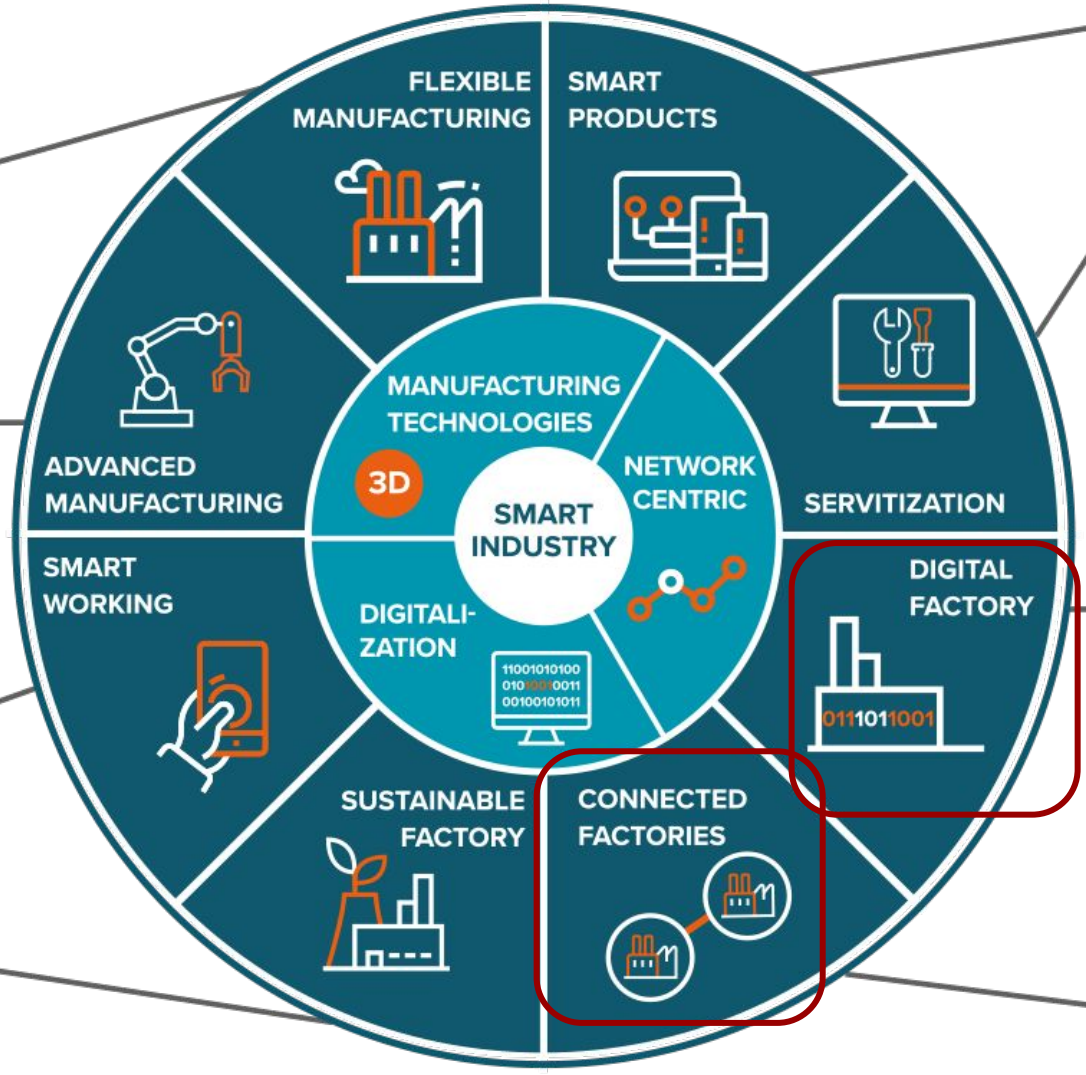


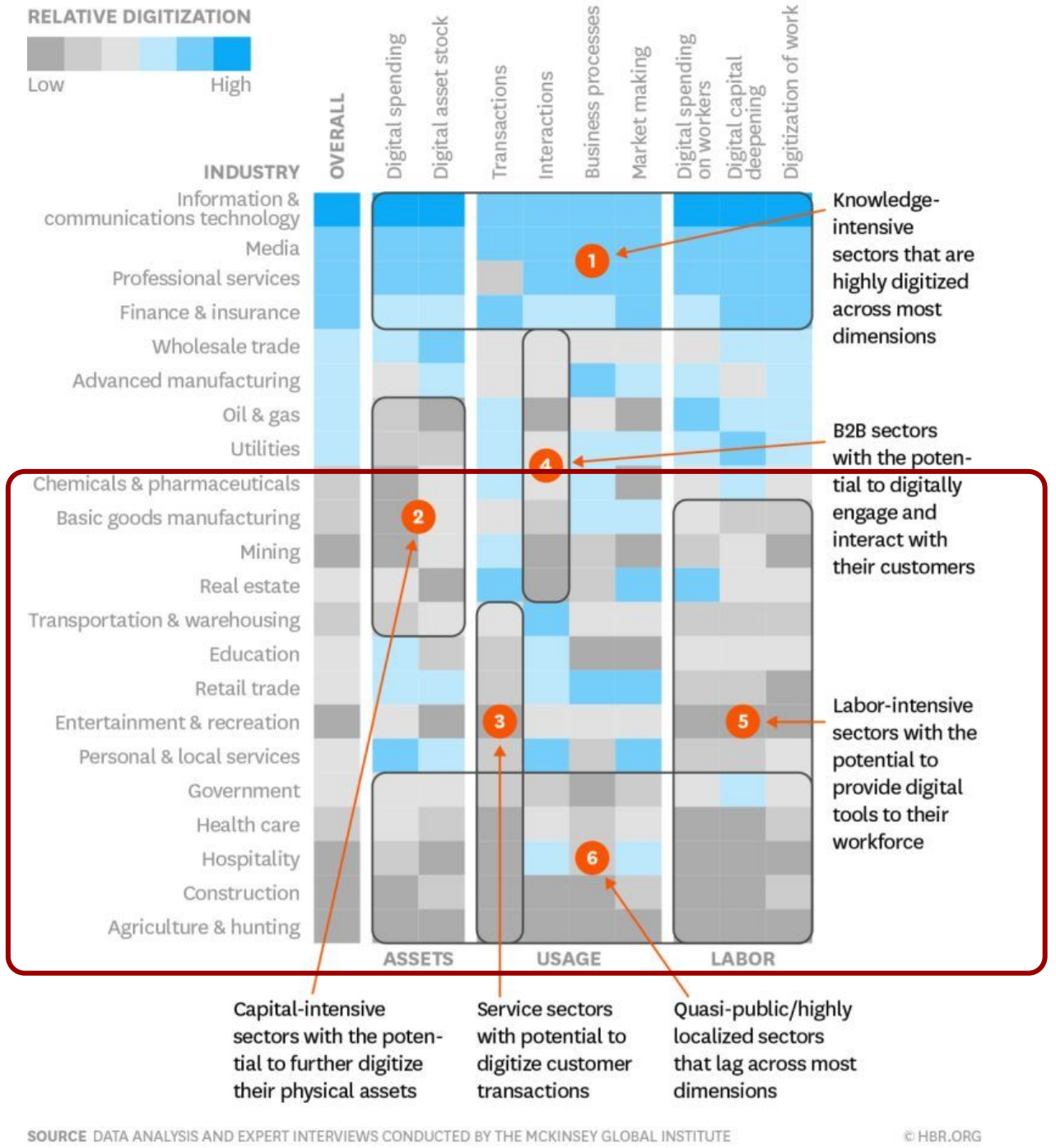
- Connect Supply Chain
- 3D printing
- Model Driven
- First time right
- Robotics
- Cobots
- Mobility
- Remote worker
- Mobile devices
- Digital twin
- Sustainability insight
- Reuse/refurbishing/recycling

- Connected products (IIoT)
- Self service
- Transition from product to service
- Condition-based/predictive maintenance
- KPI Dashboard
- Paperless Factory
- Artificial Intelligence (AI)
- Predictive analytics
- Autonomous decisions / sMPC
- Real-time information
- Data-Driven virtual prototyping
- Supply Chain Integration
- (I)IoT
- Public data sources

Source: Smart Industry, Smart Industry Roadmap

INDUSTRY

DIGITAL TRANSITION



SOURCE DATA ANALYSIS AND EXPERT INTERVIEWS CONDUCTED BY THE MCKINSEY GLOBAL INSTITUTE

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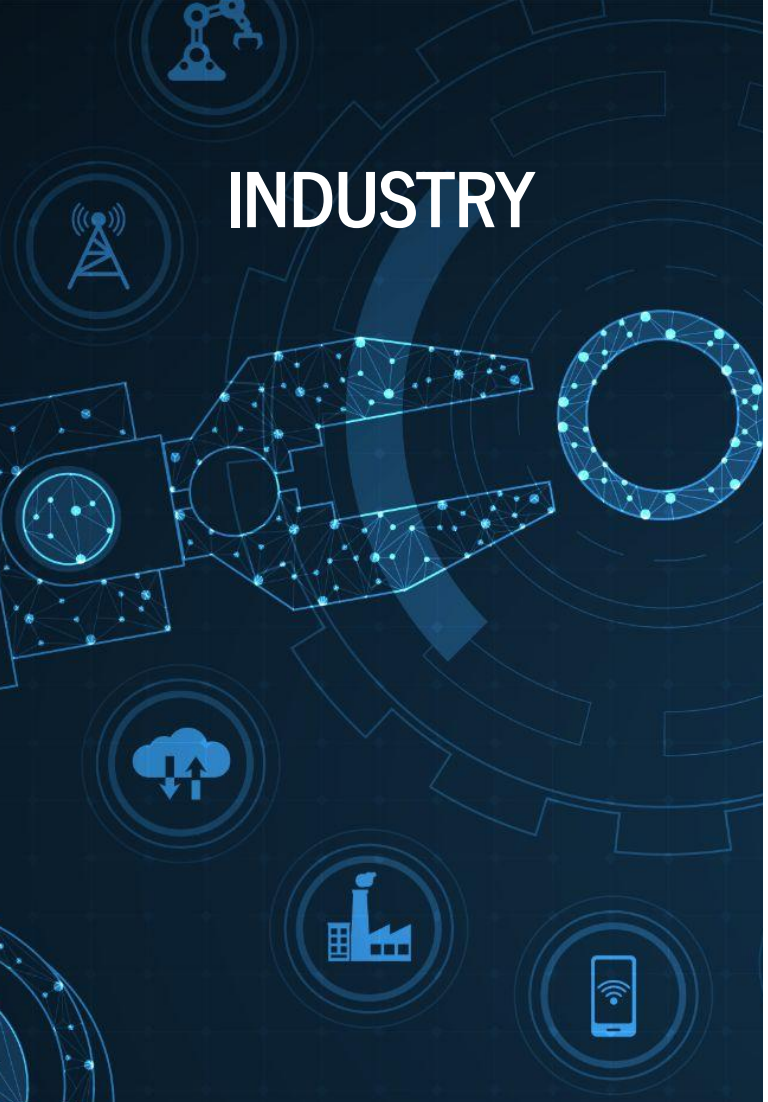
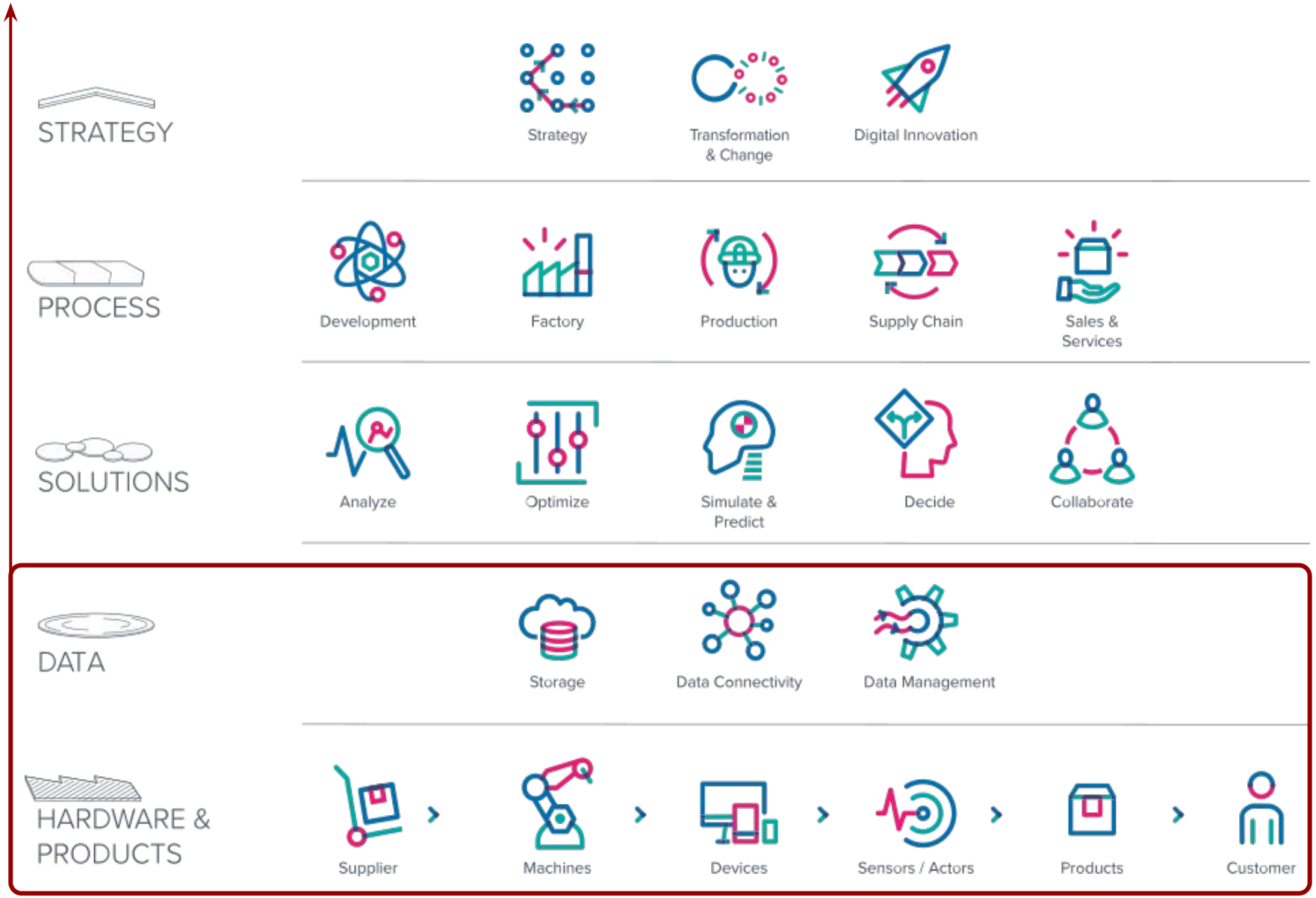
INDUSTRY

DIGITAL TRANSITION



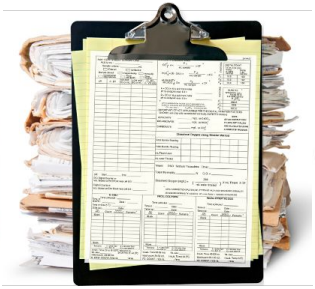


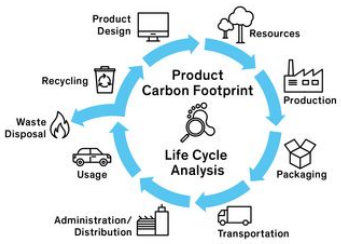
Source: waverleysoftware

INDUSTRY

PROBLEMS

- ✓ Industry produces many **wastes**, and industrial **symbiosis** is not efficient
- ✓ **Water consumption** in Industry is huge
- ✓ **Energy** with high **consumption** and costs and high rates of greenhouse **gas emissions**;
- ✓ **Data** are **inconsistently** and **manually recorded**
- ✓ **Processes** are **not optimized**, and data are not used to predict failures
- ✓ Product **LCA** is **challenging** to track and calculate
- ✓ Difficulties in having an **aggregated** view of **consumption**, noticing excess consumption or leakages and crossing invoices with actual expenses;
- ✓ Difficulties in meeting **European targets** to reduce annual energy consumption by 32.50% by 2030.





INDUSTRY - PROBLEMS

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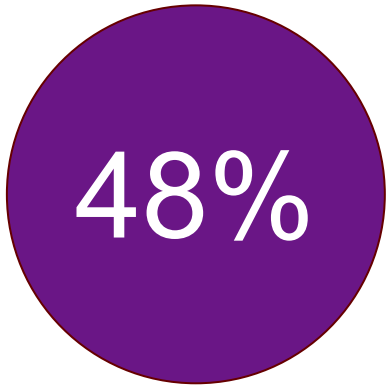


MANUAL DATA

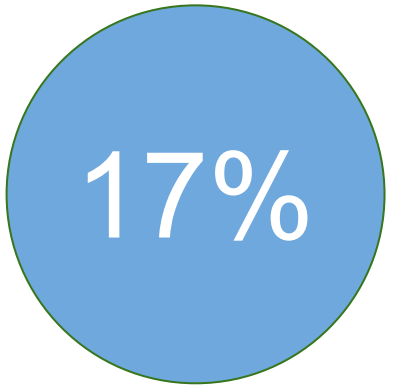
Percentage of **companies** (industries) that collect **data manually**

MACHINE BREAKDOWNS

Factory floor machine **breakdowns** caused by **human** errors

CO2 and WATER

Average Carbon **footprint** and **water** consumption of a **T-Shirt**

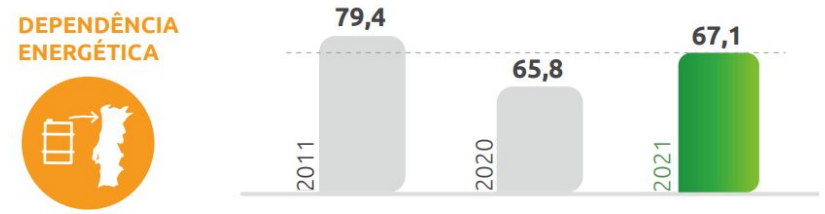


WATER CONSUMPTION

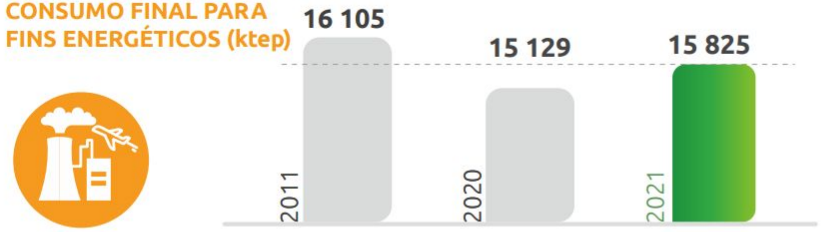
Industry **water consumption** from the **total** water withdrawal

INDUSTRY - PROBLEMS (PORTUGAL)

DEPENDÊNCIA ENERGÉTICA (%)



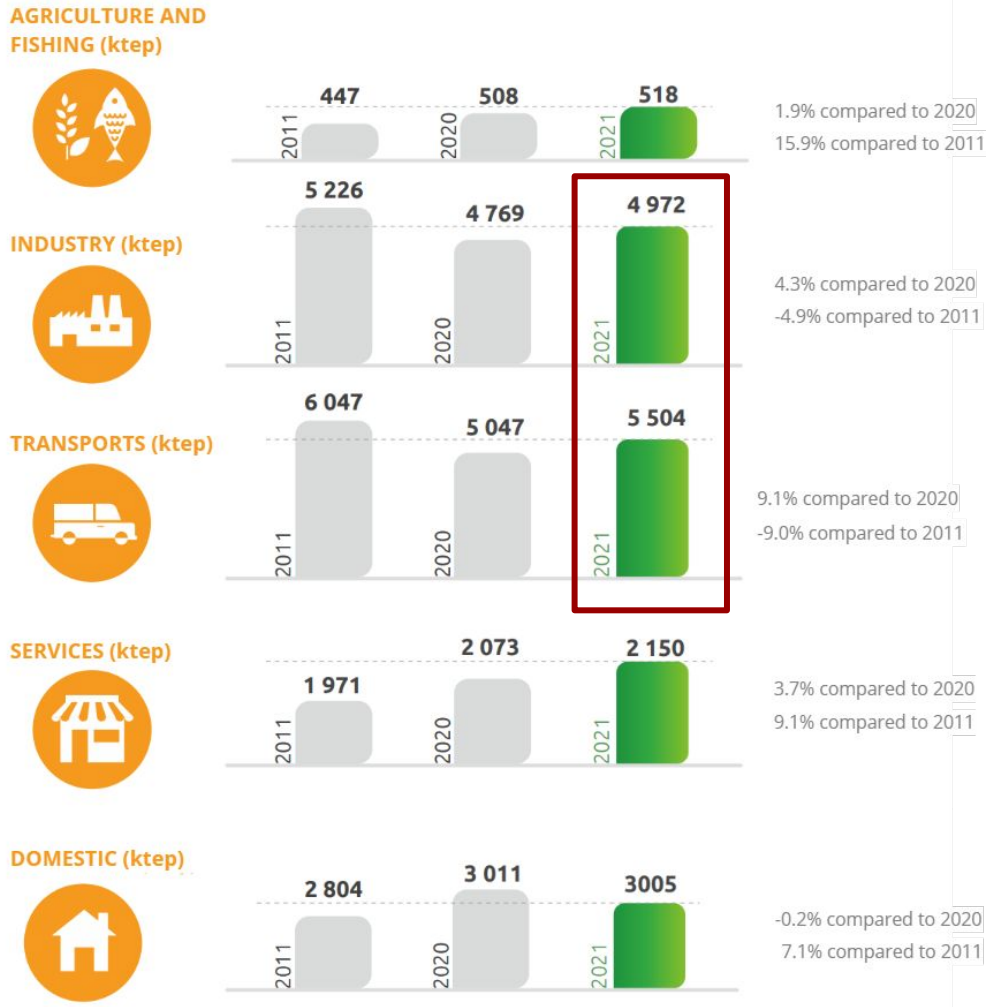
CONSUMO



4,6% face a 2020

-1,7% face a 2011

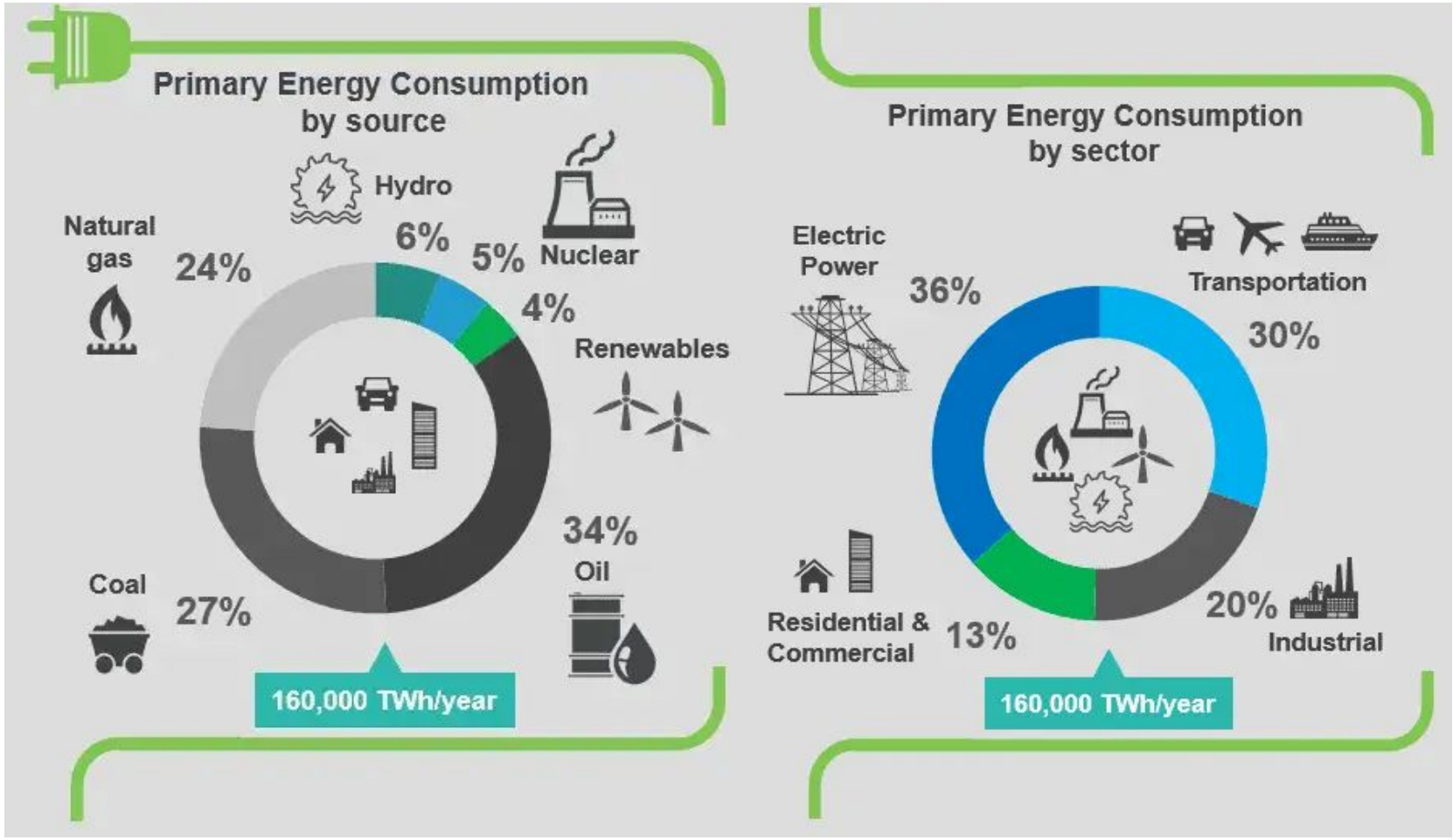
FINAL ENERGY CONSUMPTION BY ACTIVITY SECTOR



Source: Energy in Numbers (DGEG), 2023

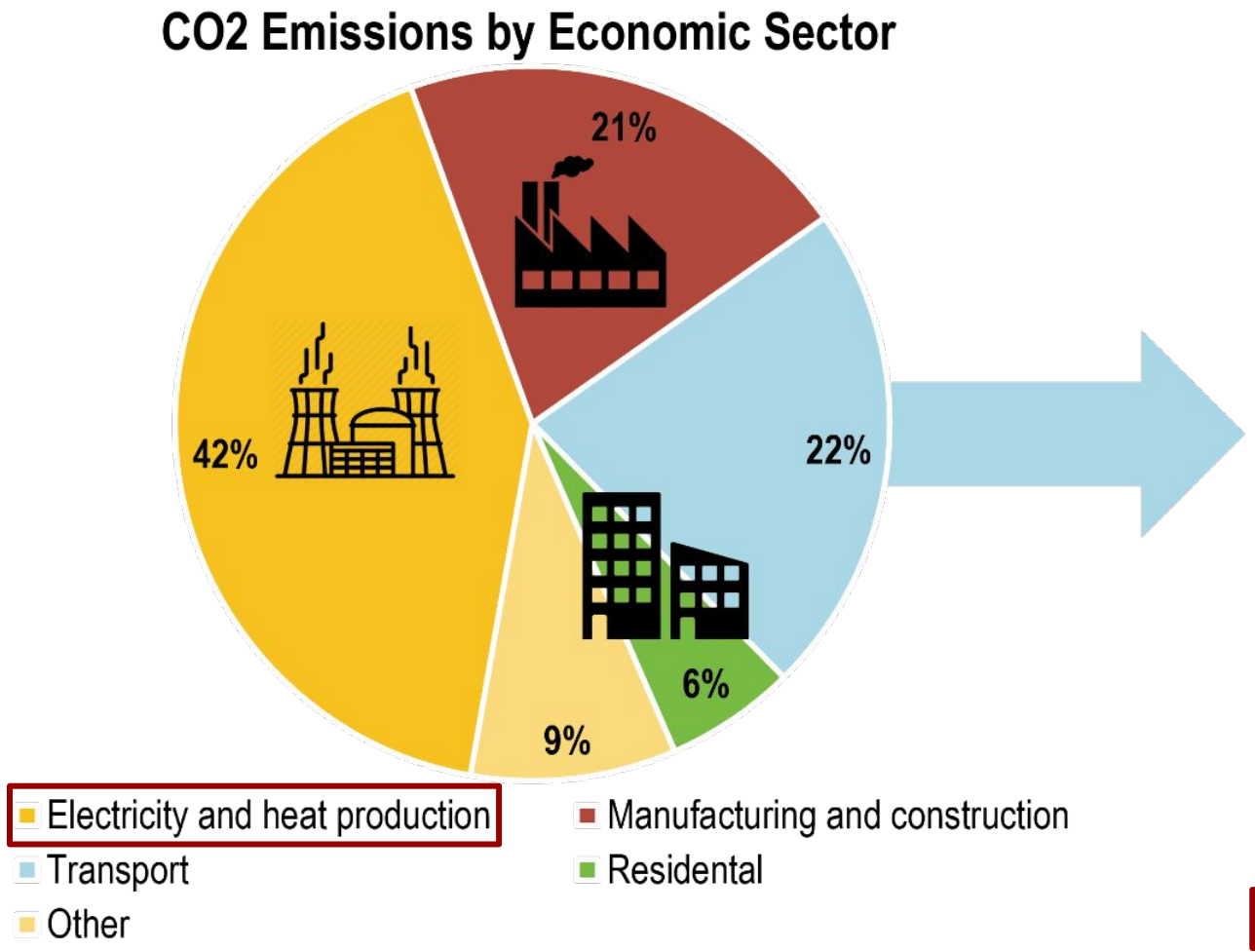
INDUSTRY

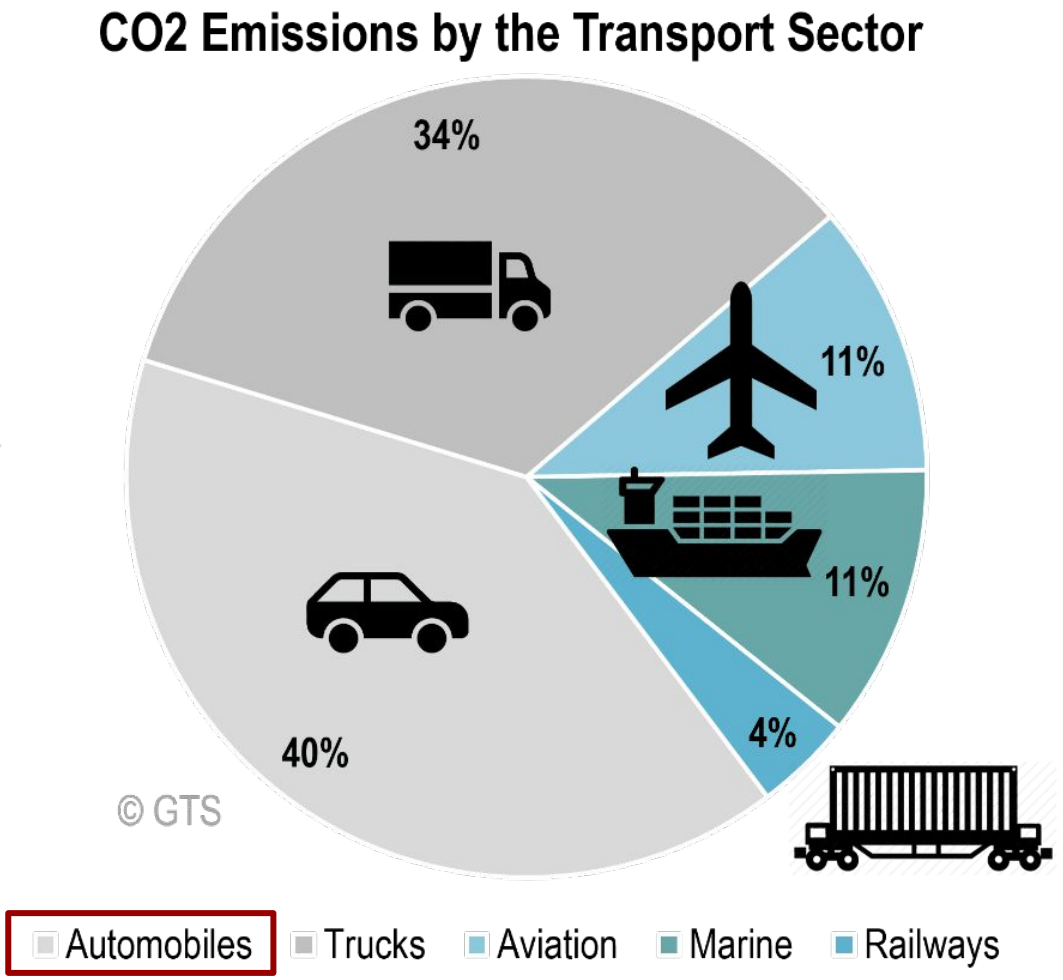
PROBLEMS



Source: IEA, 2020

INDUSTRY - PROBLEMS





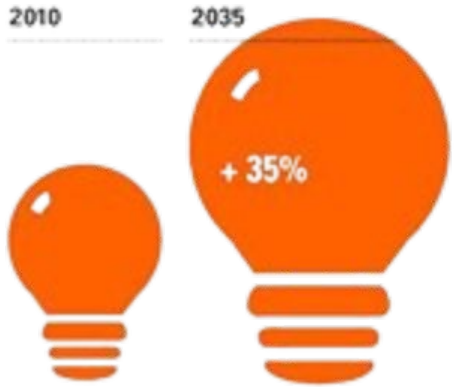
Source: IEA, 2014

INDUSTRY

PROBLEMS

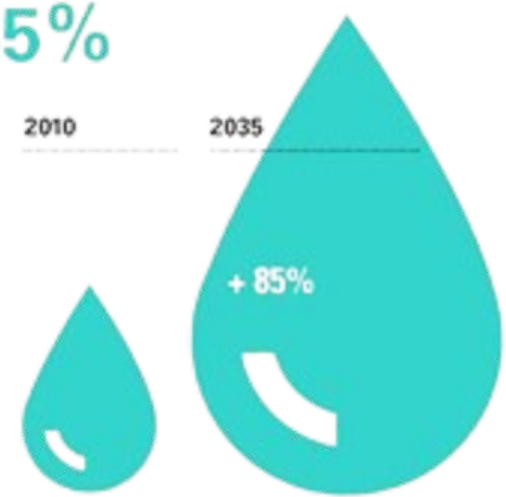
By 2035,
energy consumption will increase by

35%



which
will increase water consumption by

85%



increasing pressure on
finite water resources

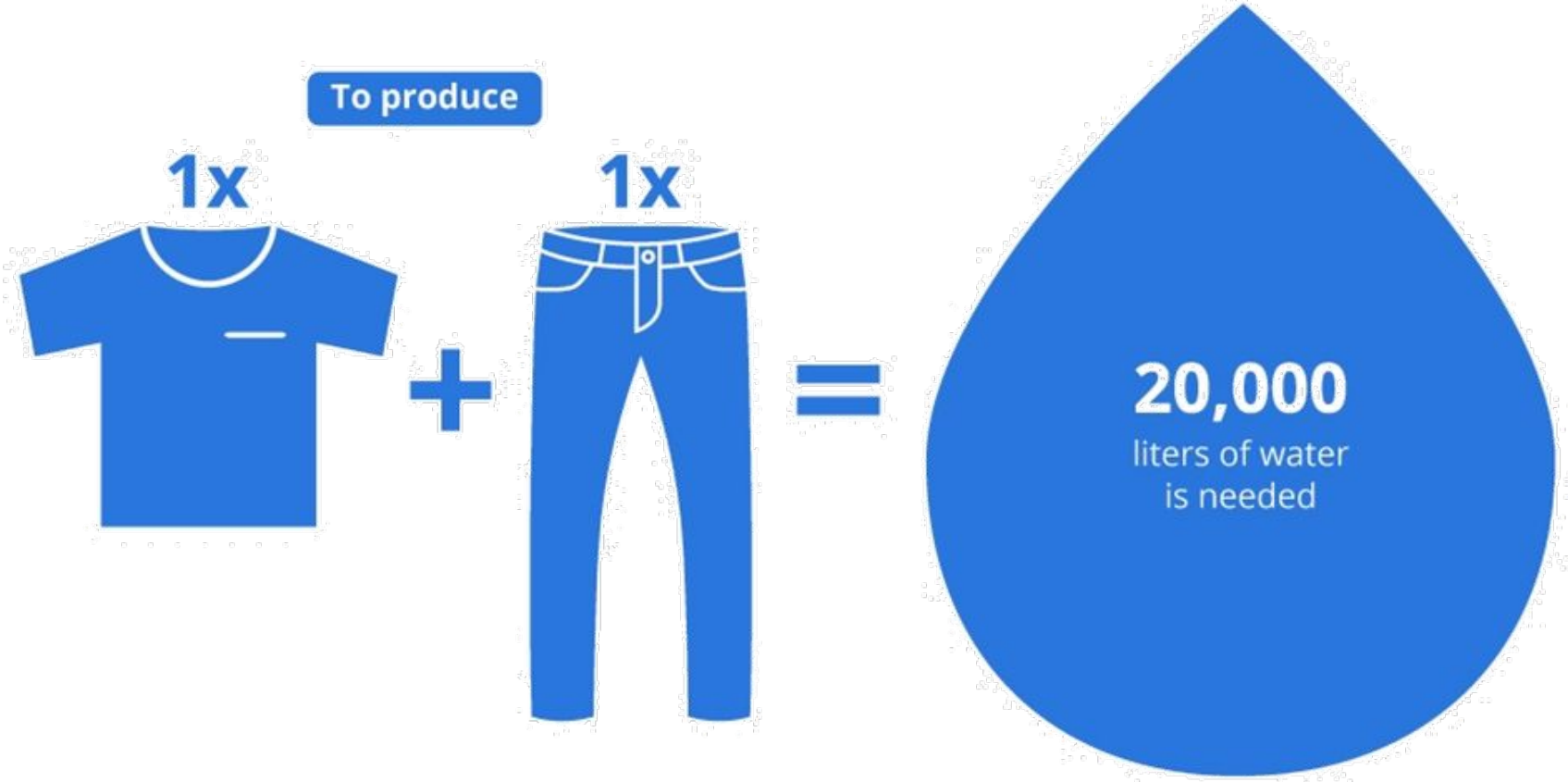
Source: IEA, 2012

INDUSTRY

PROBLEMS

The Insatiable Thirst of Fashion

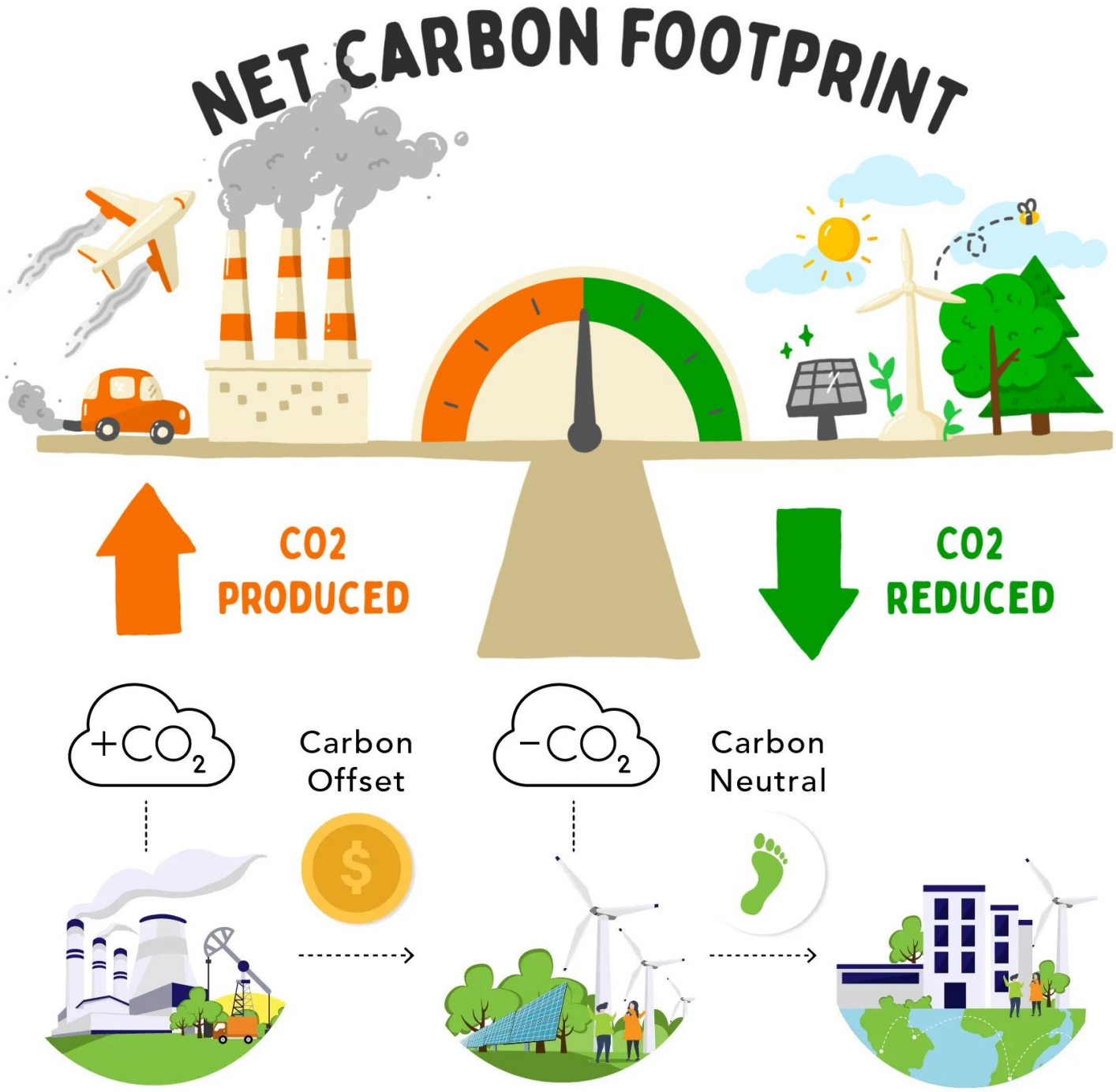
Estimated water required in the production of cotton clothing items*



Source: Oxfam, 2023

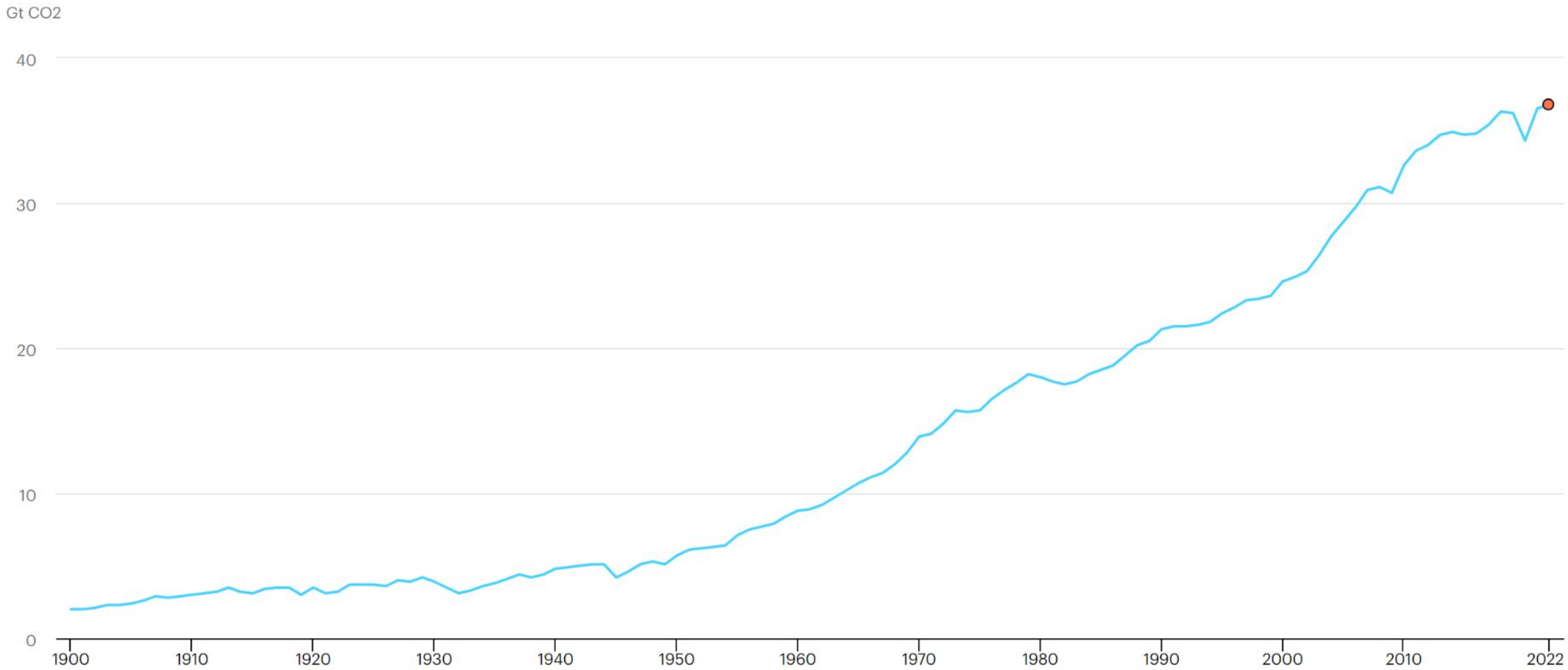
INDUSTRY

PROBLEMS



INDUSTRY - PROBLEMS

Global **CO2 emissions** from energy combustion and industrial processes

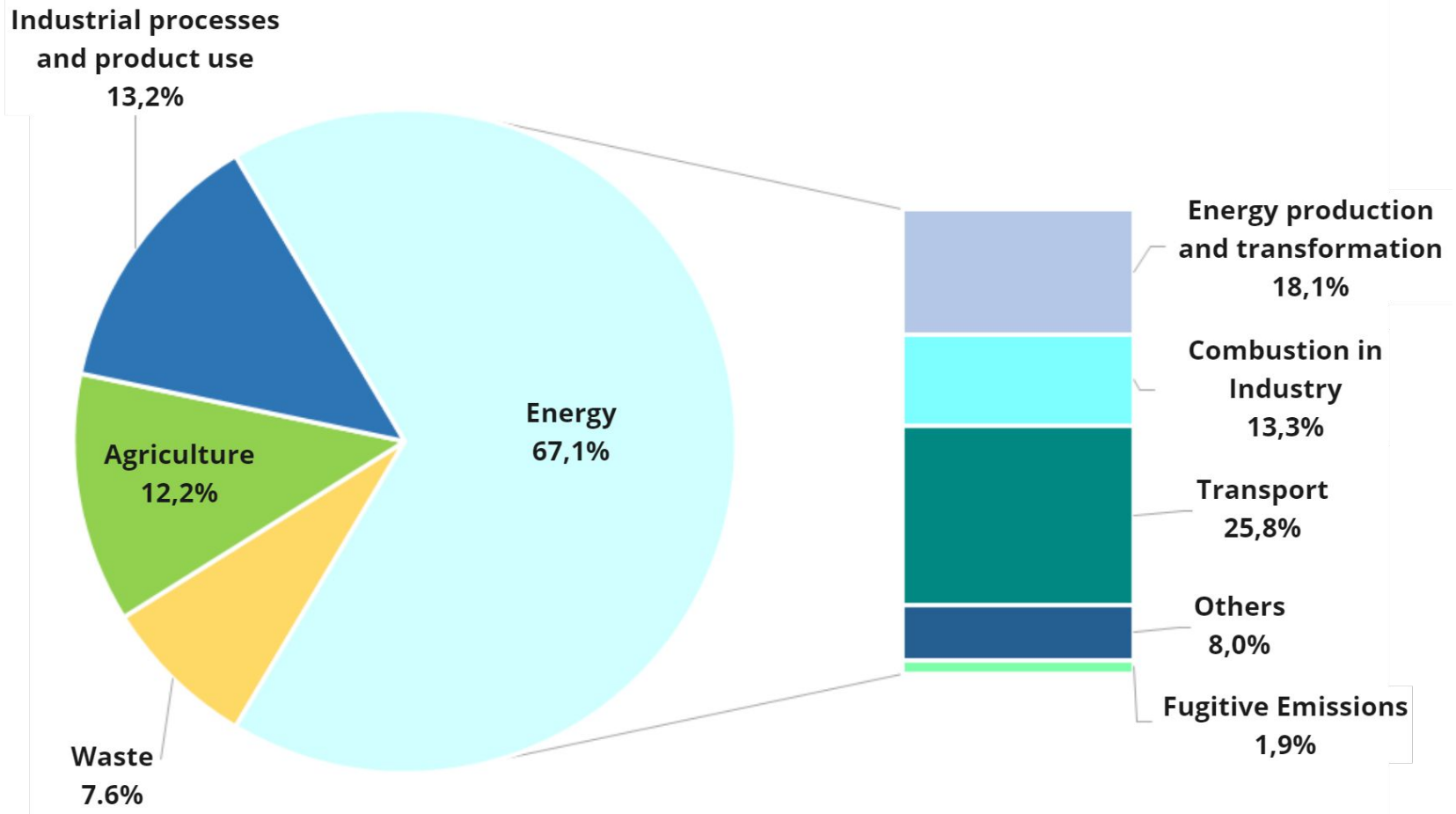


Source: IEA, 2023

INDUSTRY

PROBLEMS (PORTUGAL)

CO2 emissions by sector in **Portugal**



Source: Relatório de Estado do Ambiente (APA) 2020

INDUSTRY - PROBLEMS (PORTUGAL)

Electricity consumption by type of consumption (kWh) I Ratio kWh (kilowatt-hour)/ person.

Year	Total	House	not House	Industry	Farmer	Public Street Light	Publicx Buildings
2012	4.475,2	1.224,7	1.151,6	1.641,9	95,2	147,6	179,7
2013	4.413,9	1.175,4	1.160,7	1.626,6	88,3	140,3	194,2
2014	⊥ 4.428,8	⊥ 1.228,9	⊥ 1.104,3	⊥ 1.687,9	⊥ 79,5	⊥ 141,8	⊥ 146,4
2015	4.511,8	1.228,7	1.119,7	1.735,4	87,7	141,9	157,1
2016	4.572,9	1.249,5	1.148,4	1.748,5	86,4	140,9	158,3
2017	4.609,5	1.211,4	1.140,4	1.811,3	103,1	140,4	156,8
2018	4.731,1	1.281,0	1.152,8	1.845,8	105,5	136,8	161,6
2019	Pro 4.714,0	Pro 1.258,3	Pro 1.157,5	Pro 1.864,1	Pro 103,9	Pro 127,0	Pro 154,7
2020	Pro 4.552,0	Pro 1.314,5	Pro 1.049,2	Pro 1.796,5	Pro 99,0	Pro 122,0	Pro 131,2
2021	Pro 4.630,2	Pro 1.360,6	Pro 1.038,2	Pro 1.850,8	Pro 97,6	Pro 110,6	Pro 129,3

⊥ Quebra de série Pro Valor provisório

Source: DGEG/MAAC, INE, PORDATA, 2023

INDUSTRY 5.0

We are now entering the **fifth industrial revolution**

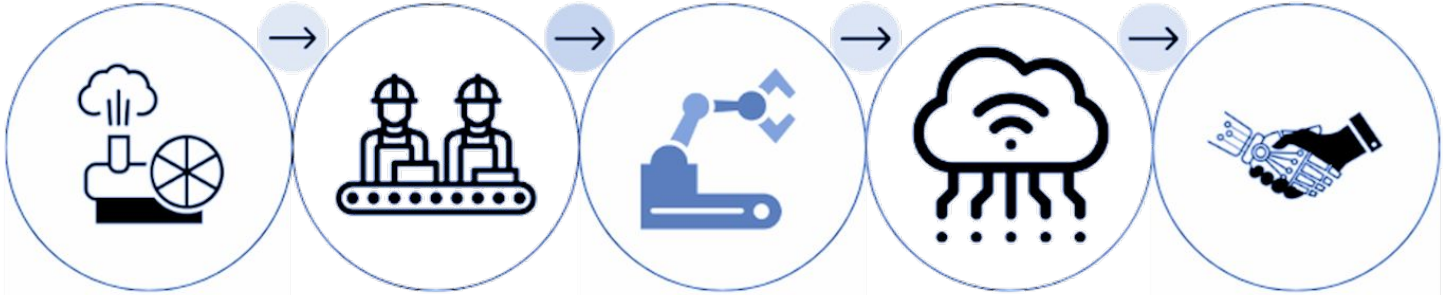
- ✓ Focus on **man** and **machines** working **together**.
- ✓ Based upon **personalisation** and the use of collaborative **robots**, workers are free to deliver value-added tasks for customers.
- ✓ This latest iteration goes beyond manufacturing processes to include increased **resilience**, a **human-centric** approach, and a focus on **sustainability**.

INDUSTRY 5.0

5.0

VS

4.0



Industry 1.0

Marked by mechanization and powered by water and steam

Industry 2.0

Assembly lines and electricity allow for mass production

Industry 3.0

Computers and electronics make automation possible

Industry 4.0

Advances in cyber-physical systems, IoT, and network communications

Industry 5.0

Human-robot collaboration, customizations, cognitive systems

Do not edit
How to change the design

Em que ponto se encontra a sua empresa / indústria?

Presenting with animations, GIFs or speaker notes? Enable our Chrome extension

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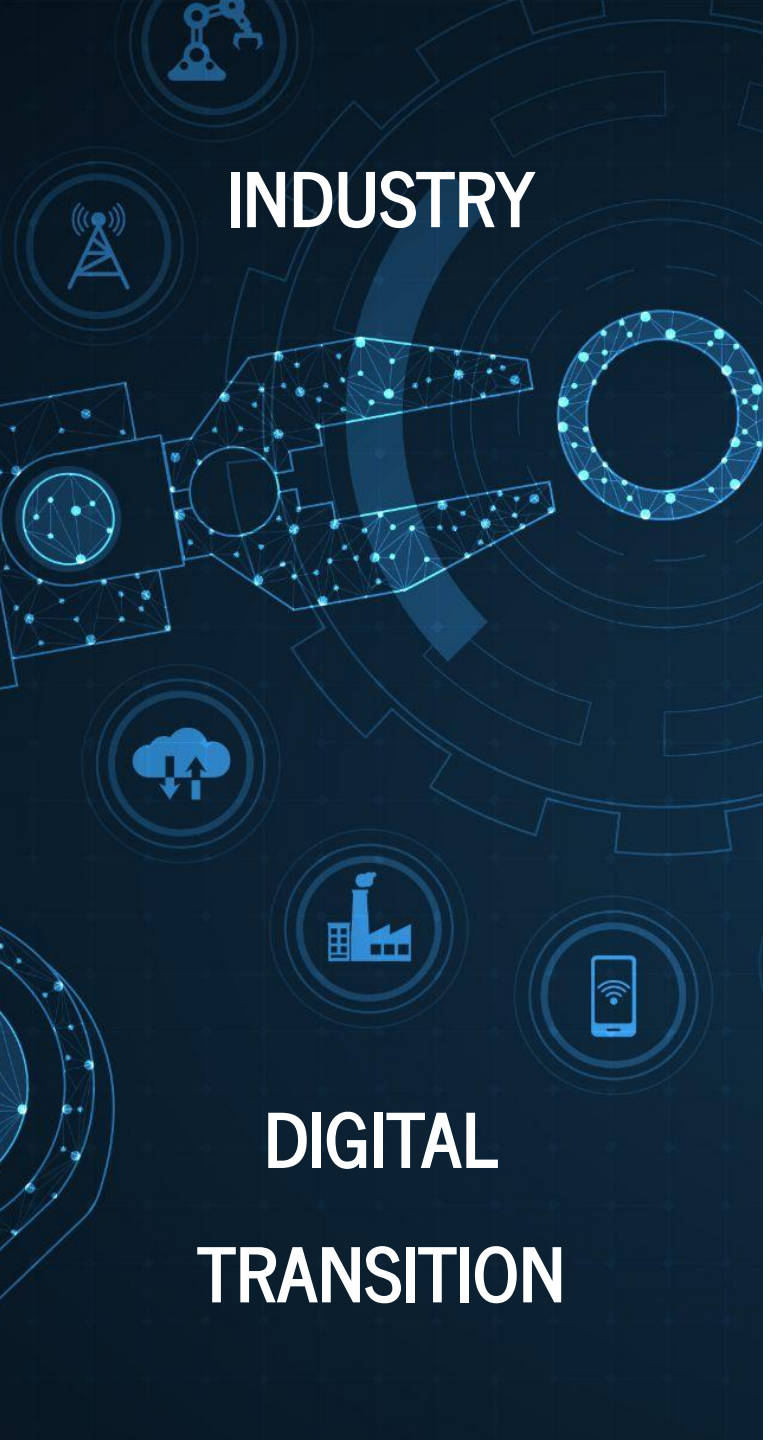
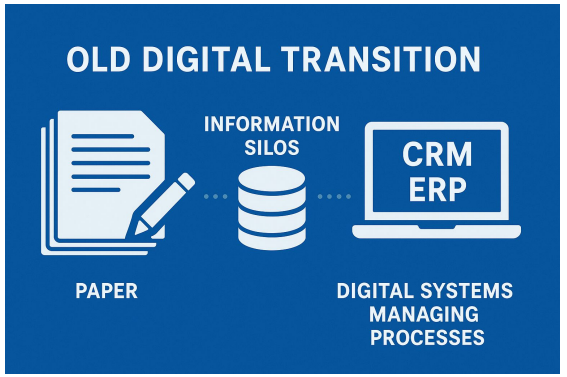
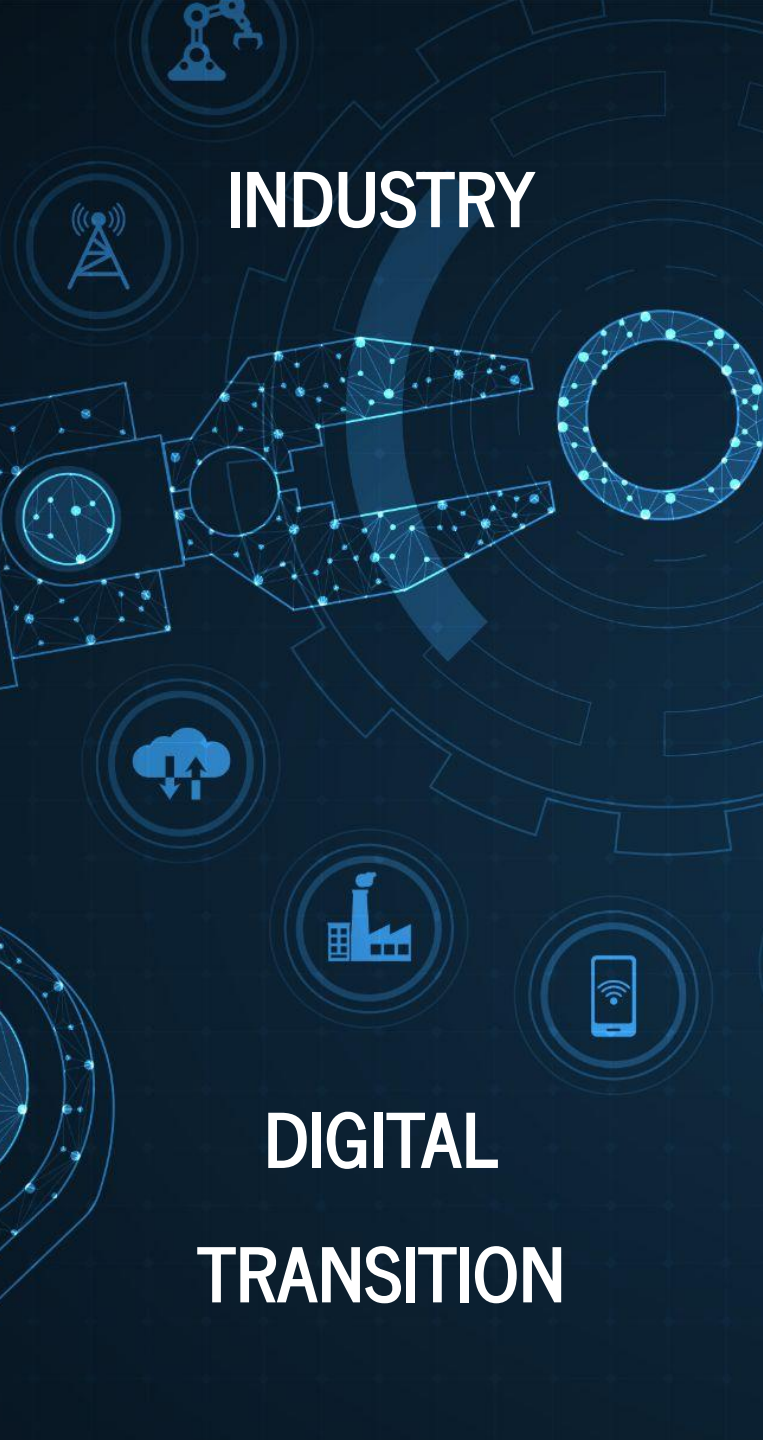


Are we ready to Industry 5.0?

- ✓ Despite **living in an era of advanced digitalisation, many companies remain stuck in an outdated industrial paradigm.**
- ✓ Systems like **CRM or ERP**, once seen as milestones of digital transition, should by now be considered basic infrastructure. However, the reality is that many organisations still operate at an **Industry 2.0/3.0 level**, relying heavily on **paper-based and manually processes**, **information silos**, **lack of interoperability**, and using **digital tools merely to replicate manual processes** rather than to transform them.
- ✓ This gap highlights the **urgent need** for a true **digital transformation—one** that integrates systems, enables real-time data flows, and supports smart, sustainable, and human-centric operations aligned with **Industry 5.0** principles.





CRM

- Customer Data
- Marketing Management
- Sales Management
- Quoting
- Sales Configurator

MES

- Manufacturing Execution
- Part Consumption
- Work Order Management
- KPI Tracking for Cycle Time
- Operator Training Qualified

- Order
- ECO
- Items
- xBOM's
- Inventory
- Alternates
- BOM Effectivity
- Routing
- Costing
- Supplier Items

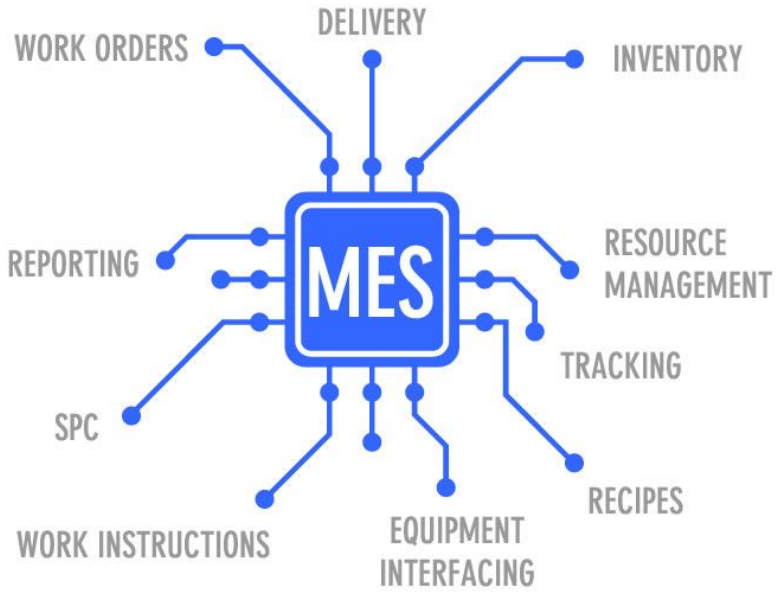
ERP

- Inventory Management
- Plant Maintenance
- Purchasing
- Financials
- Work Order Planning
- Supply Chain
- Sales Distribution

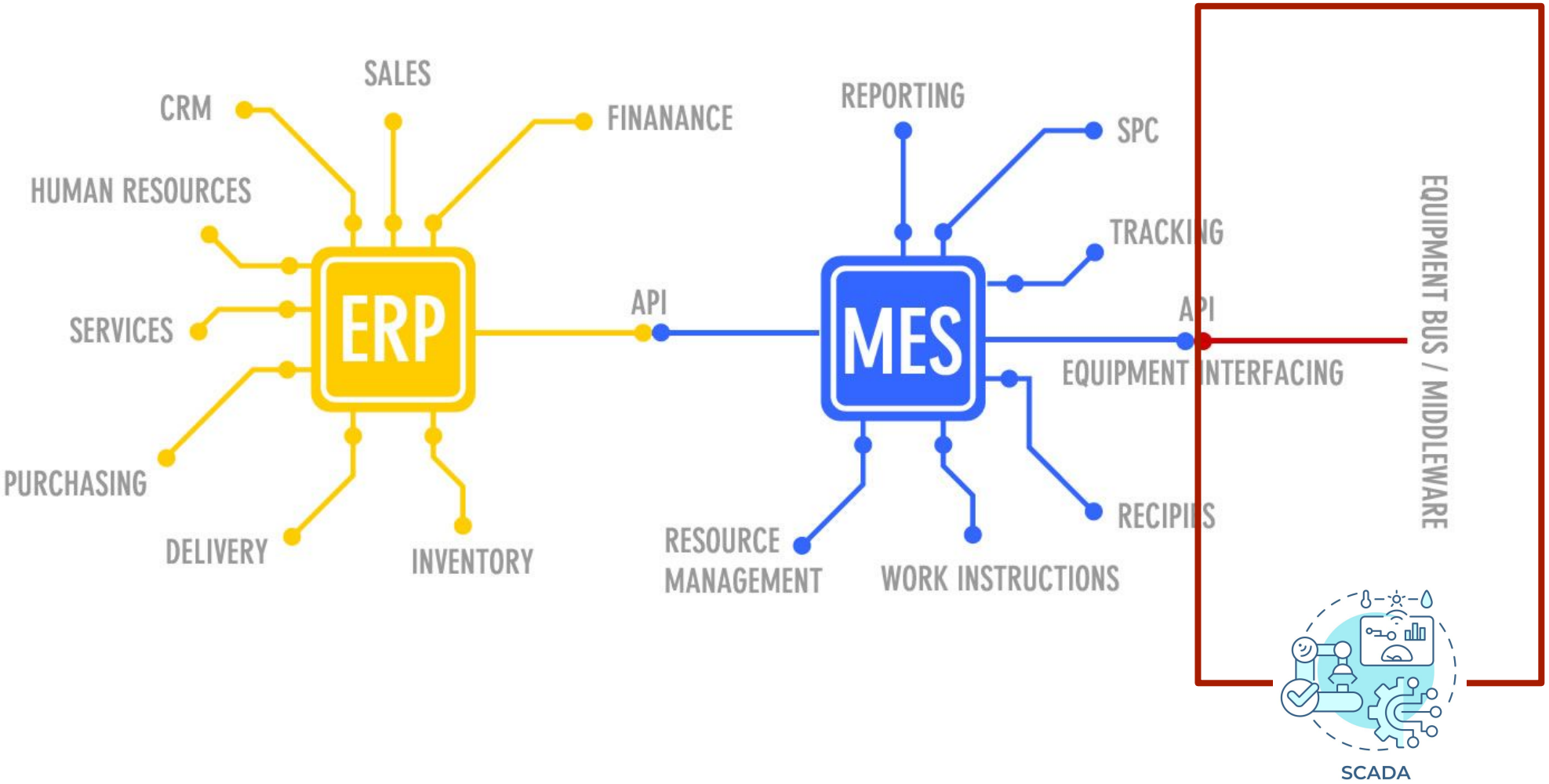
PLM

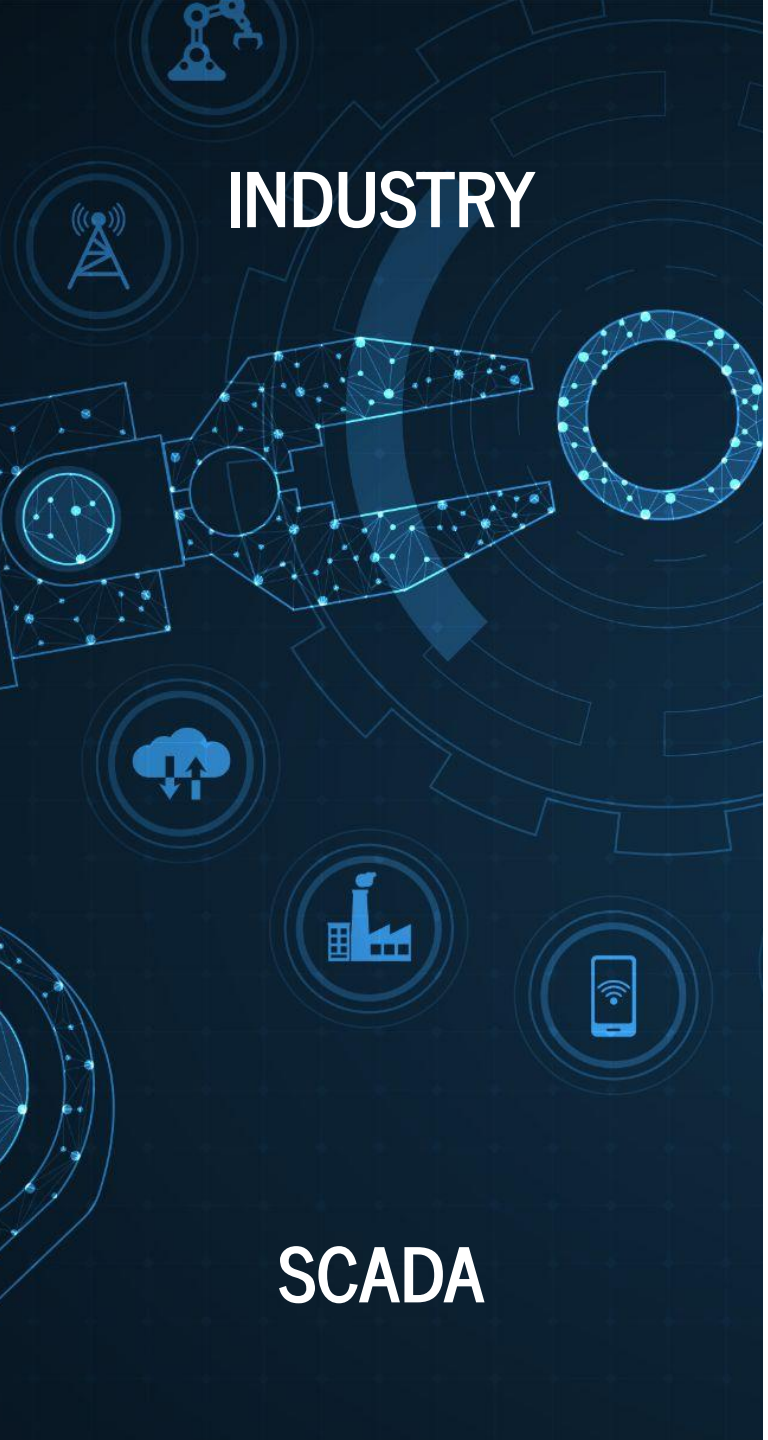
- Design Data
- Document Management
- Project Management
- Change Management
- Workflows
- Product Configurations
- Systems Engineering
- Technical Publications

INDUSTRY - ERP vs MES



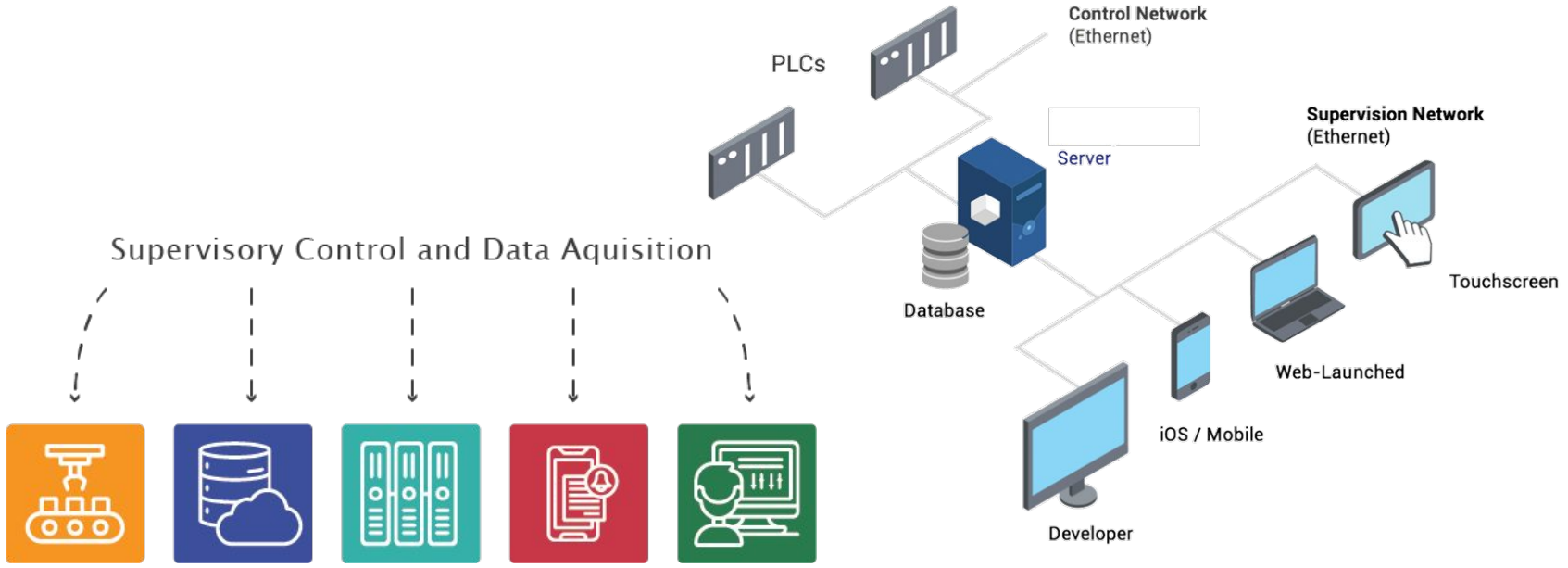
INDUSTRY - ERP vs MES





SCADA stands for Supervisory Control And Data Acquisition.

- ✓ It refers to systems used to **monitor**, **control**, **collect data**, and **send alerts** from industrial and infrastructure processes.
- ✓ SCADA helps keep complex operations running safely and efficiently by providing **real-time supervision** and **control.**
- ✓ It is essential to ensure proper **interoperability** between **MES** and **ERP** systems. Without this connection, all data must be entered manually, increasing the risk of errors and reducing the system's fault tolerance.



Do not edit
How to change the design

Utiliza algum destes sistemas de gestão na sua empresa?

Presenting with animations, GIFs or speaker notes? Enable our Chrome extension

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INDUSTRY

NOW

INDUSTRY

FUTURE

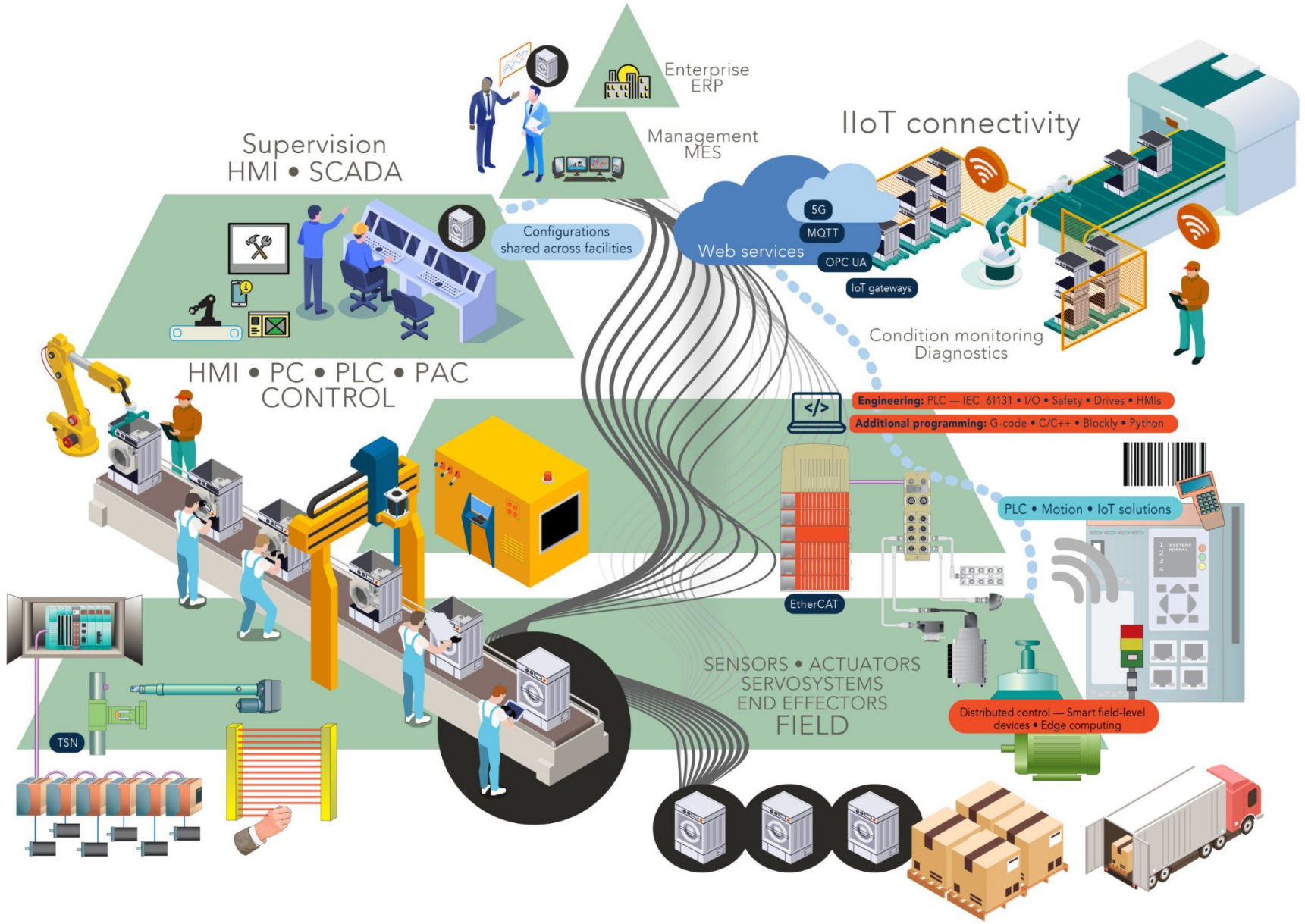
- ✓ **Smart Factories** integrates IoT, AI, and automated actuators for enhanced operation and management. This system enables real-time monitoring, process optimization, and predictive maintenance. Actuators play a crucial role, actively adjusting mechanisms in response to data insights, promoting energy efficiency, reducing waste, and boosting productivity for sustainable, streamlined manufacturing processes.
- ✓ **Energy Sustainability** emphasizes using sensors for monitoring and actively reducing energy consumption. This approach involves continuously analyzing energy usage patterns to identify and implement efficiency improvements. Optimizing energy use contributes to environmental sustainability and supports the shift towards renewable energy sources.
- ✓ **Industrial Symbiosis** is an approach where different industries collaborate to optimize resource utilization by exchanging materials, Energy, or waste. This practice creates a network where waste from one industry becomes raw material for another, reducing environmental impact and improving sustainability, efficiency, and cost-effectiveness in industrial processes.

INDUSTRY 5.0 TRENDS

- ✓ **Smart LCA** (Life Cycle Assessment) is a systematic approach for evaluating the environmental impacts of a product or process throughout its lifecycle. It incorporates intelligent data collection and analysis technologies, aiming to optimize sustainability by assessing resource use, emissions, and waste from production to disposal.
- ✓ **Smart Water Management** uses advanced technologies like sensors, data analytics, and automation to manage water resources efficiently. It aims to optimize water usage, reduce wastage, improve water quality, and ensure sustainable water supply, particularly in urban areas, through intelligent monitoring and management systems.
- ✓ **Predictive Maintenance** employs sensors and machine learning to foresee equipment failures and detect defects early. This method facilitates timely repairs, minimizing downtime and costs while extending equipment life. Essential in various industries, it enhances operational efficiency and reliability by preemptively addressing potential issues and defects.

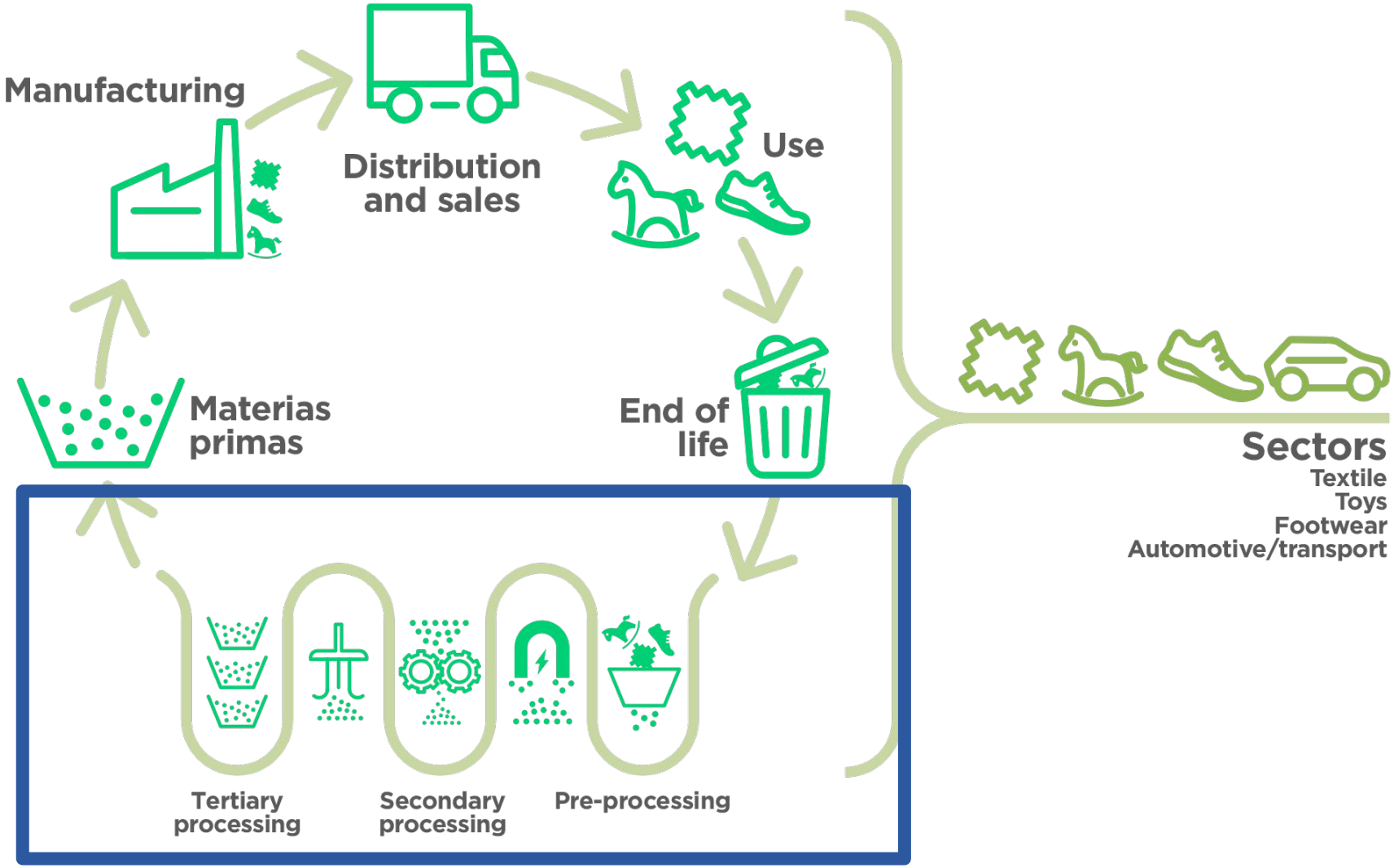
SMART FACTORIES

CONTROL AND ACTUATORS



INDUSTRIAL SYMBIOSIS

WASTES AS MATERIALS



SUSTAINABLE ENERGY

NEW ENERGY SOURCES

SUSTAINABLE ENERGY

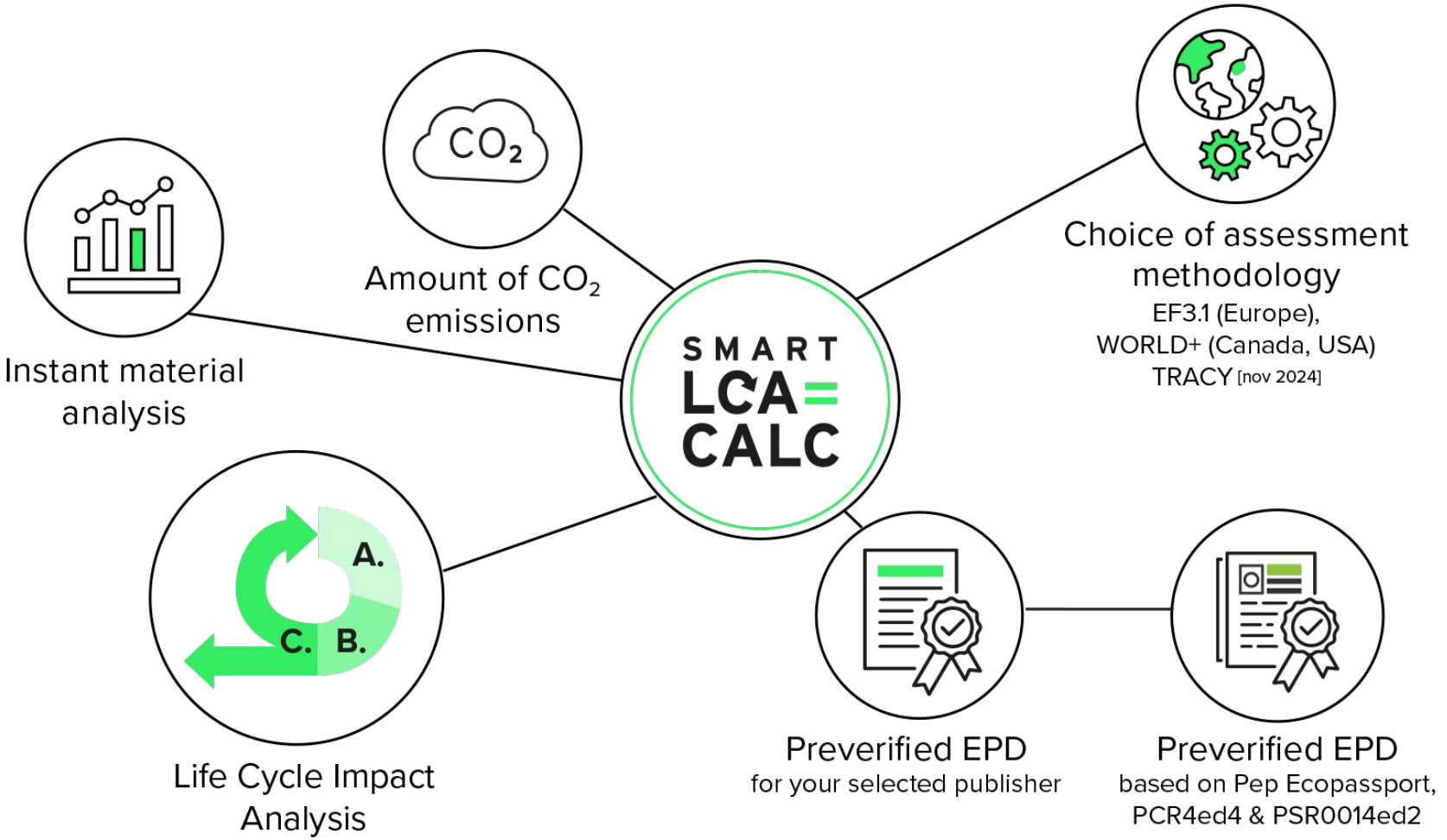
DATA COLLECTING

SMART LCA

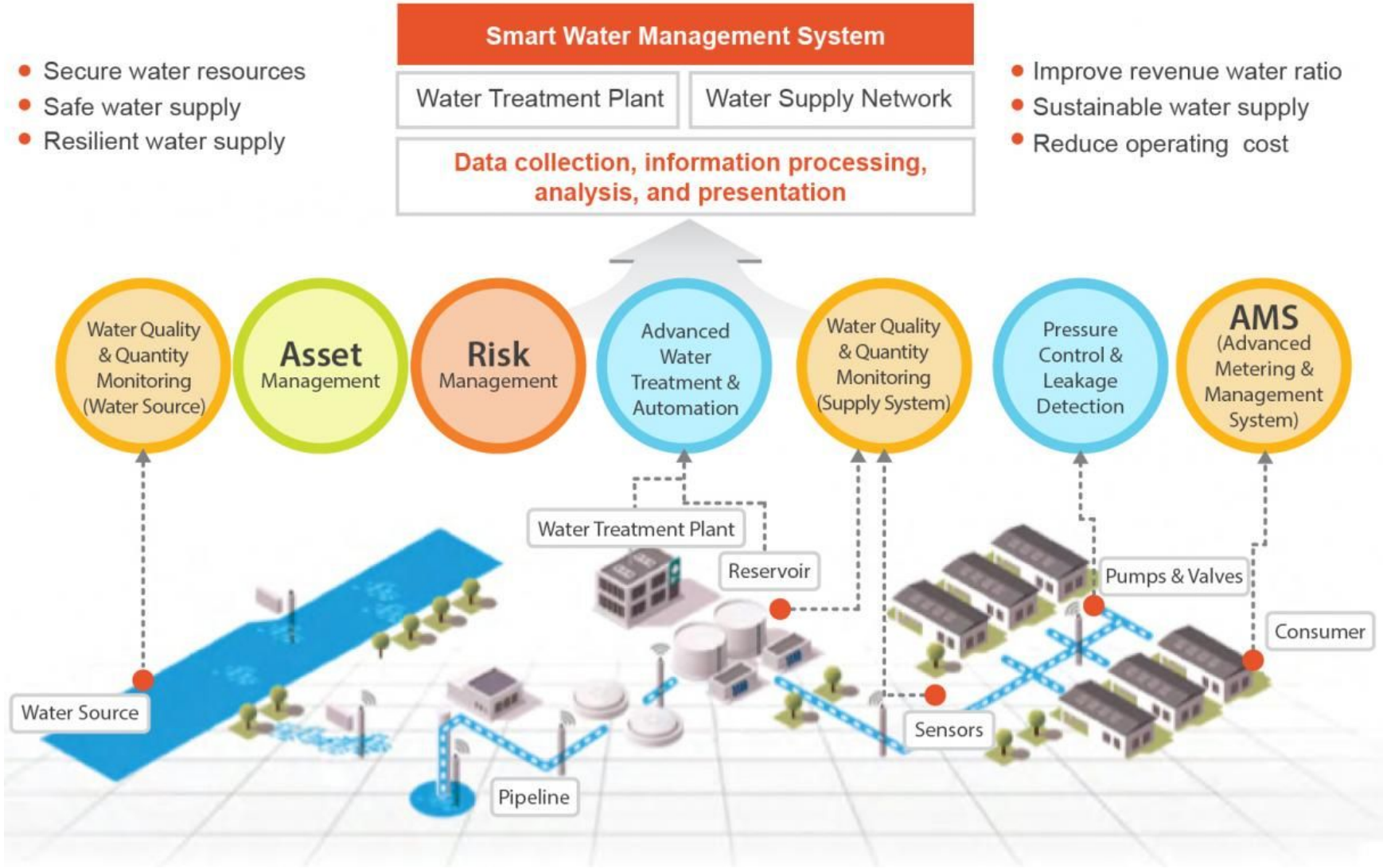
CO2 CALCULATE SYSTEMS

SMART LCA

CO2 CALCULATE SYSTEMS

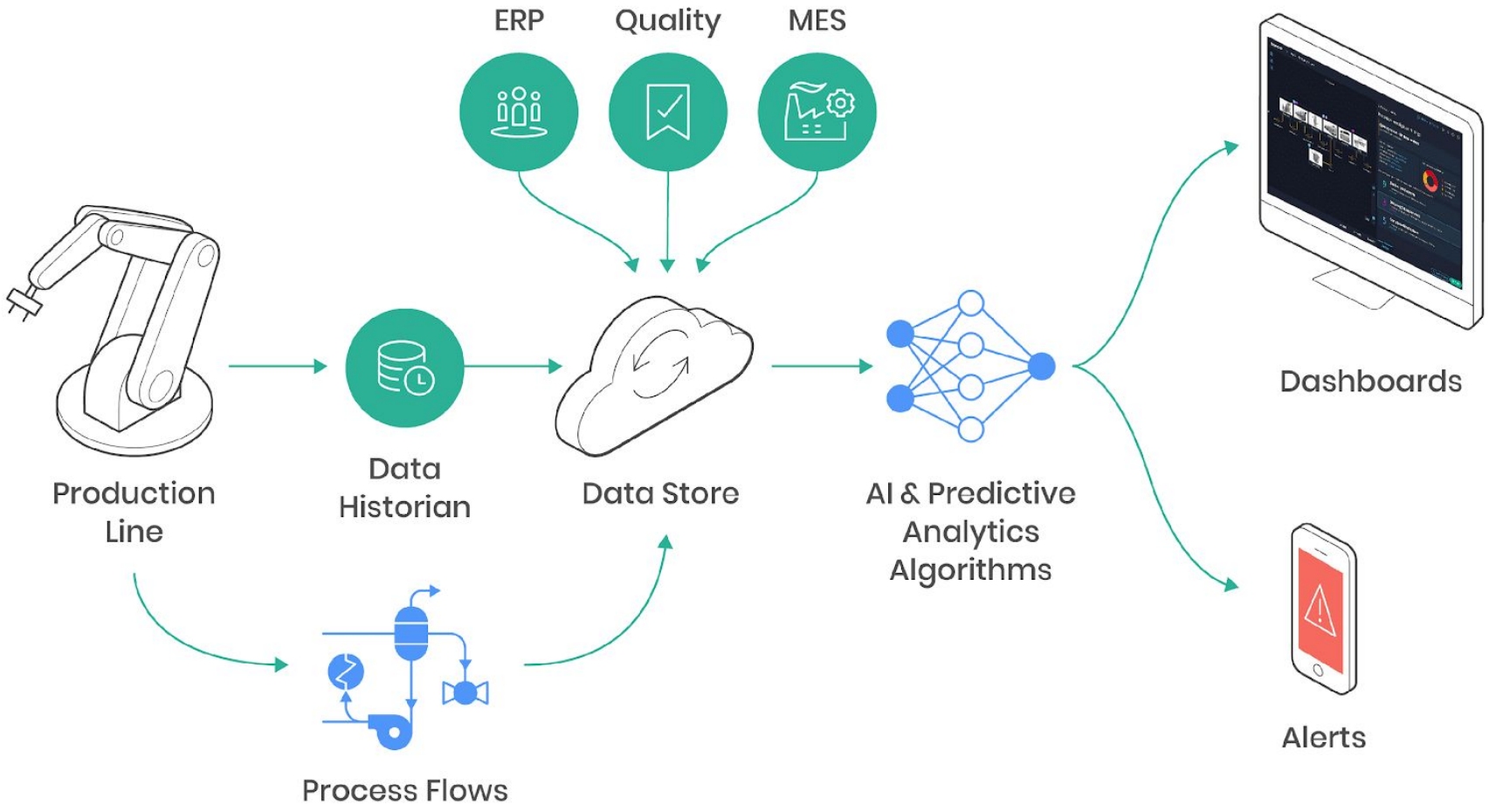


SMART WATER MANAGEMENT SYSTEMS



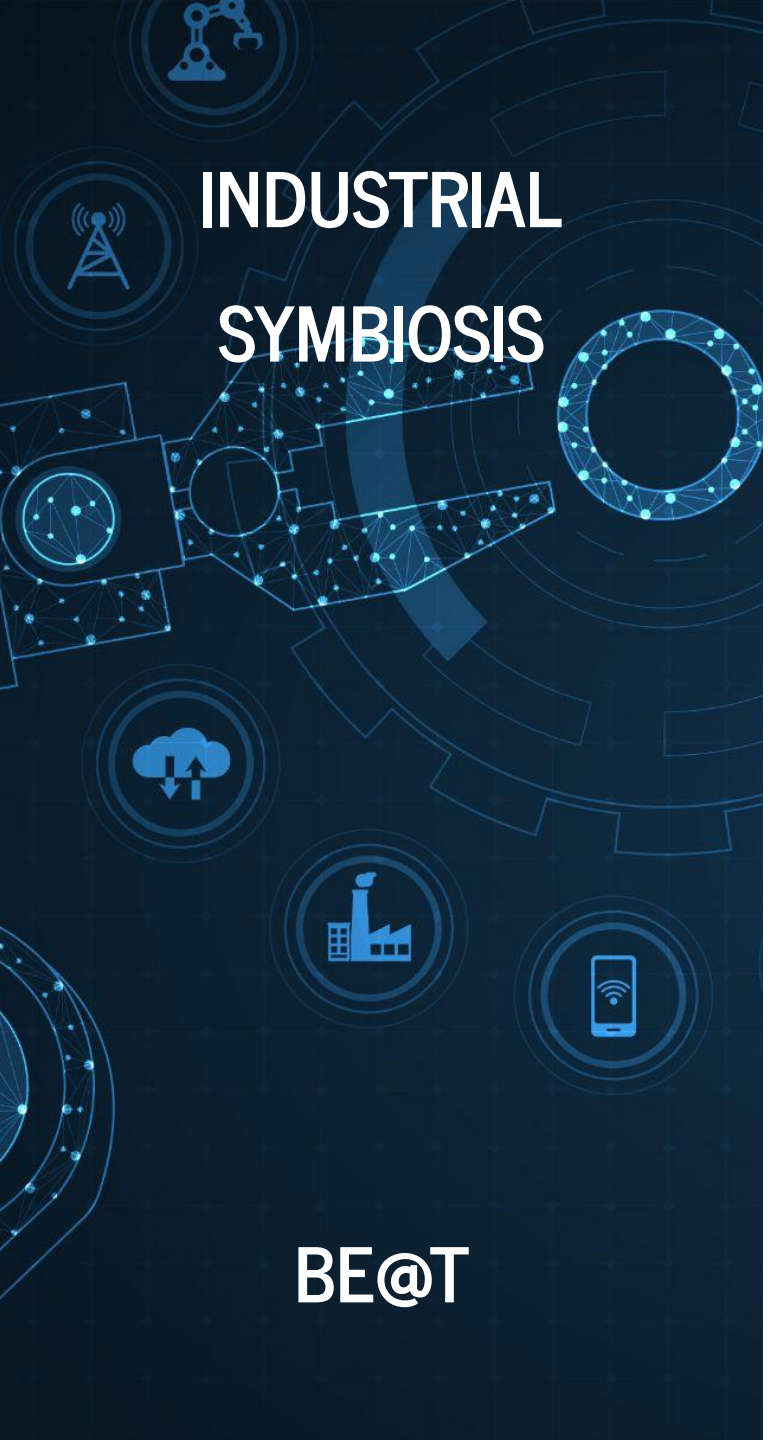
PREDICTIVE MAINTENANCE

DATA SCIENCE MODELS



CHANGING THE WORLD….
40%
20%
Control System
Performance
Daily Target
IO
Tech

beat
bioeconomy
at textiles
23



INDUSTRIAL SYMBIOSIS

BE@T

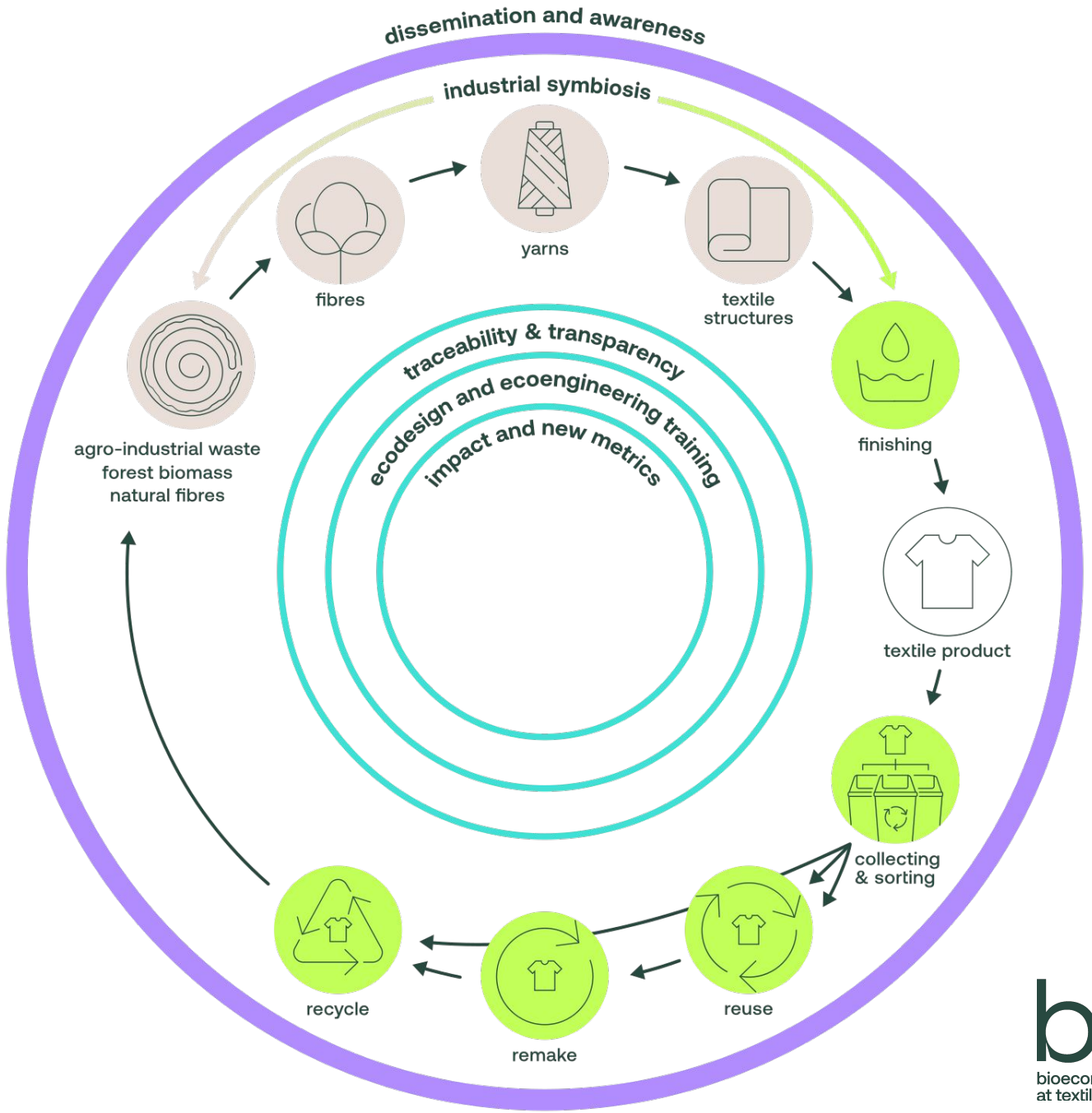
Be@t - Bioeconomy at textiles, aims to promote and value the **bioeconomy** for the **Textile** and **Clothing** sector, to accelerate the production of high-value-added products from biological resources as an alternative to fossil-based materials, namely:

- ✓ Develop **new products** and textile materials of biological origin, renewable and with better environmental labels;
- ✓ Explore innovative **eco-design** and **eco-engineering** approaches to ensure the circularity of textile products;
- ✓ Promote **reuse**, **collection** and **recycling** of textiles, as well as effective regional policies to implement circular value chains;
- ✓ Contribute to a **culture** of **sustainability** and responsible **consumption**.

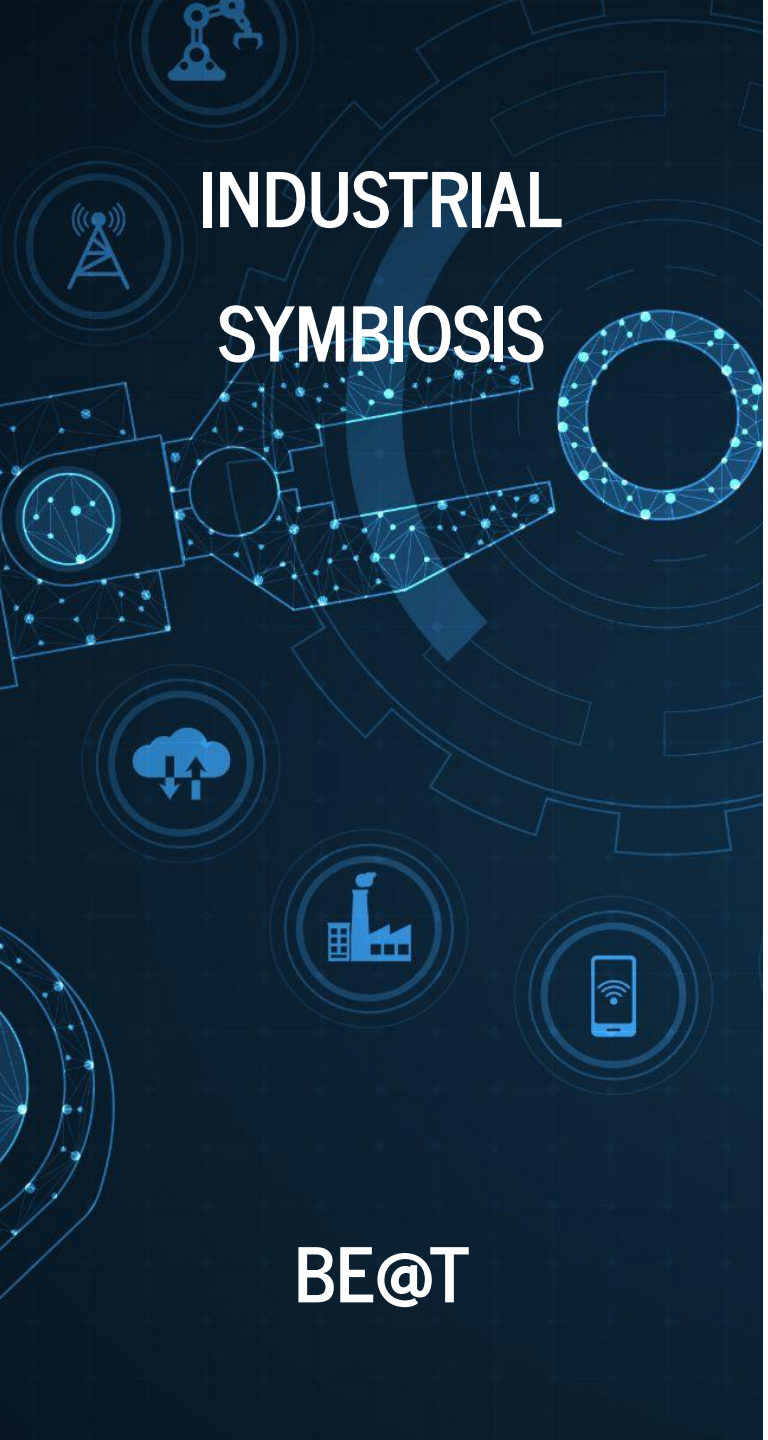
citeve TECNOLOGIA TÊXTIL
Bioeconomia
FUNDO AMBIENTAL
PRR Plano de Recuperação e Resiliência
REPÚBLICA PORTUGUESA
Financiado pela União Europeia NextGenerationEU
be@t bioeconomy at textiles

INDUSTRIAL SYMBIOSIS

BE@T



beat
bioeconomy at textiles



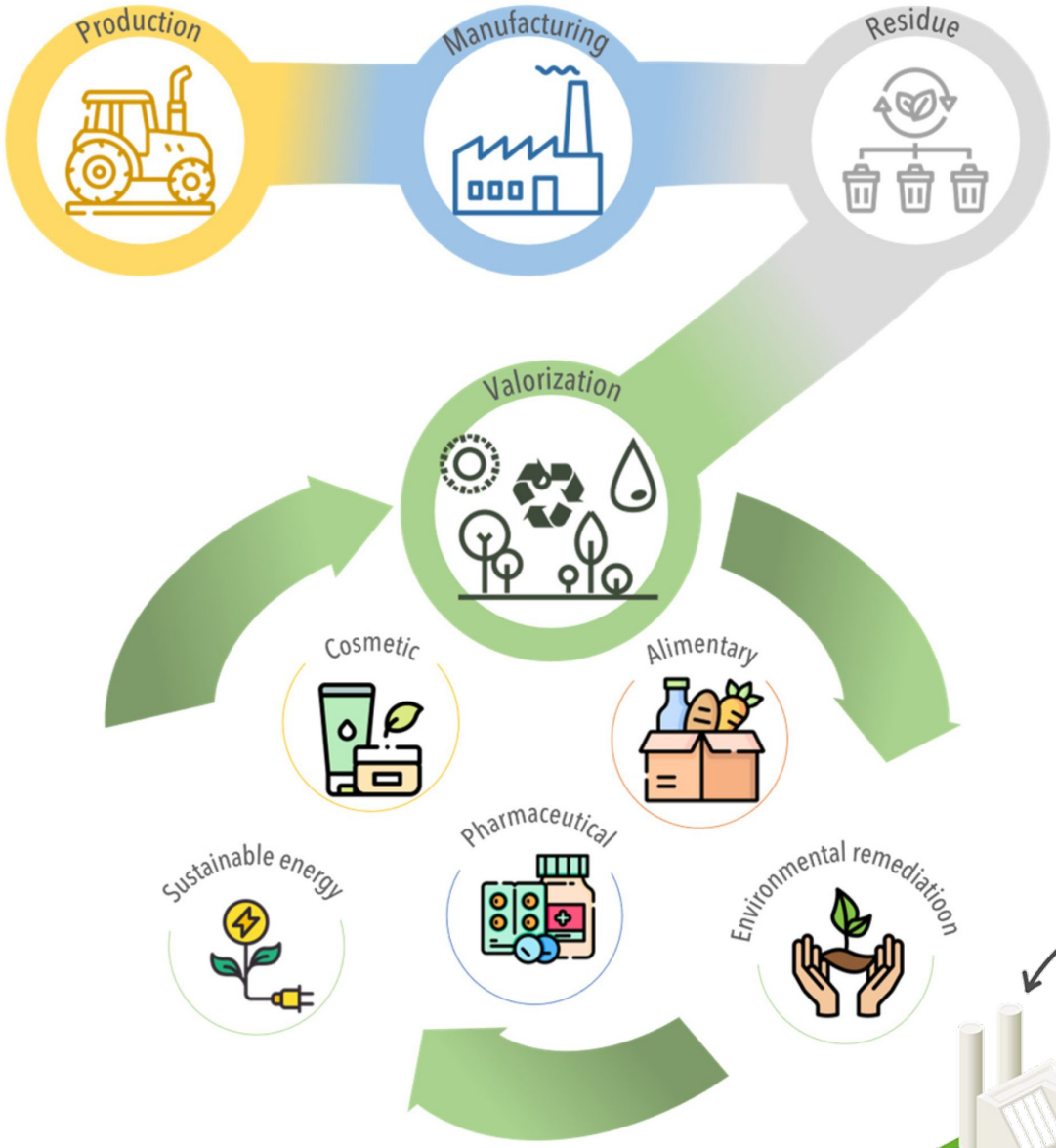
Team is developing an IT platform to foster **industrial symbiosis**, featuring:

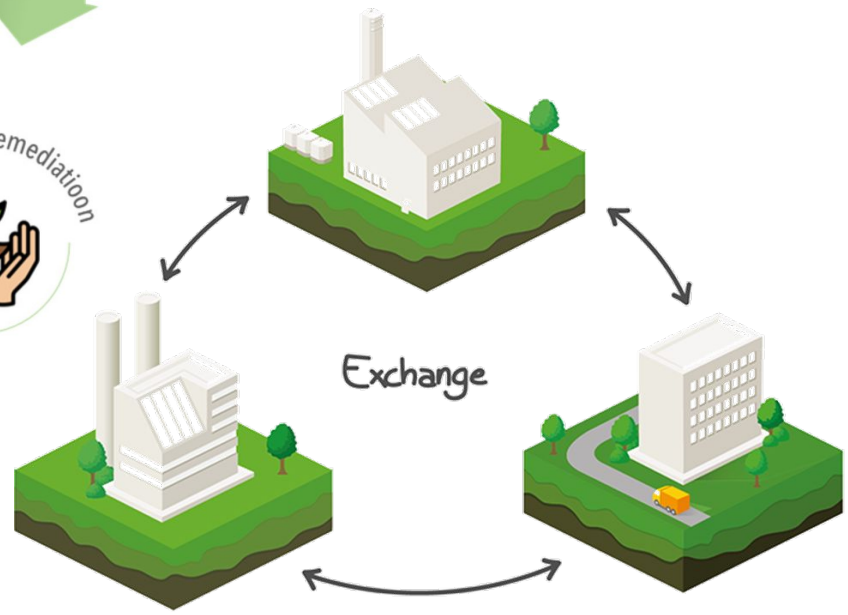
- ✓ **Intermediation** between companies
- ✓ Intuitive **Marketplace**
- ✓ Web / Mobile **App**
- ✓ **Intelligent** match **algorithm**
- ✓ Short **Supply Chains**
- ✓ Visualization of **environment** and **economical** impacts
- ✓ Info about **legal requirements**
- ✓ Suggest the best end to a **Waste** according to **Sustainability** rules
- ✓ 3 Types of **users**: consumers, producers and transportation companies
- ✓ **APA registration** for platform access verification

beat
bioeconomy
at textiles

INDUSTRIAL SYMBIOSIS

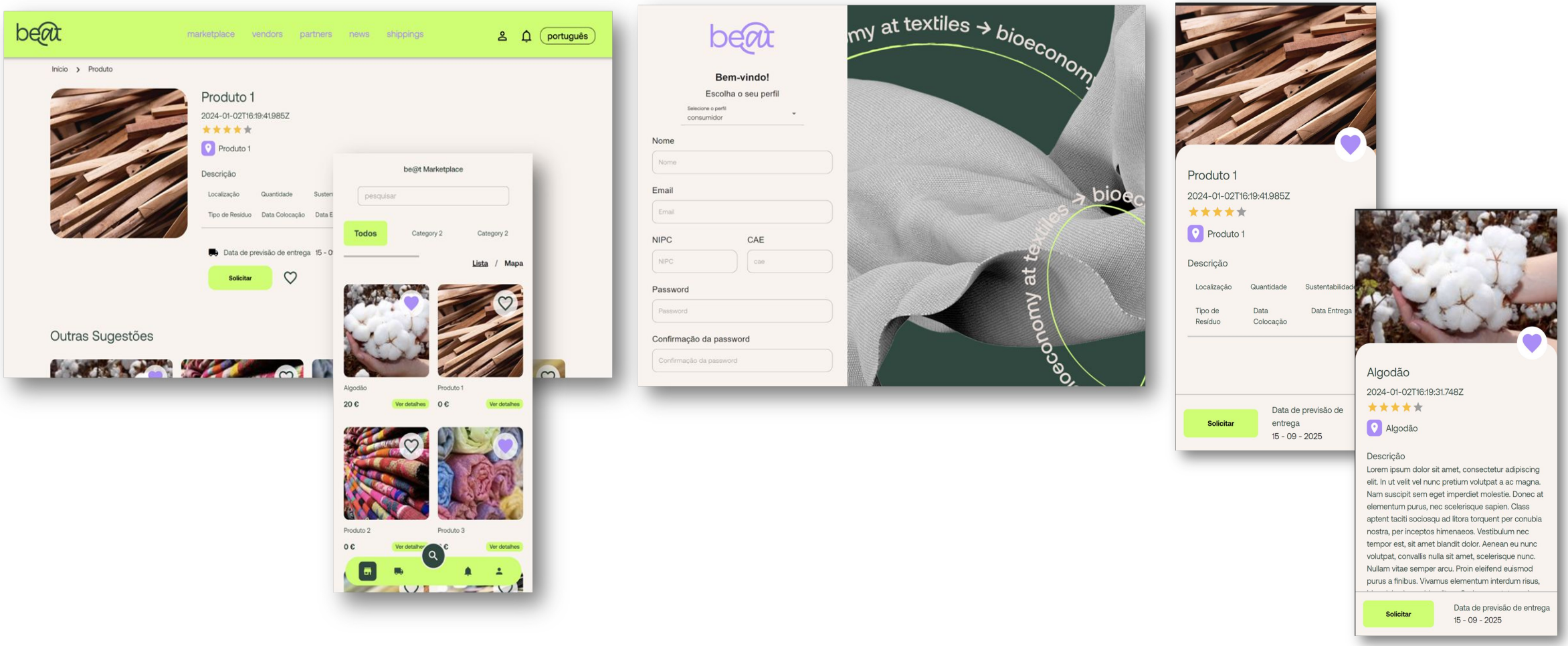
BE@T





INDUSTRIAL SYMBIOSIS - BE@T

IOTech



gia
tex

SMART WATER MANAGEMENT

GIATEX

The GIATEX project aims to respond to the **challenges** faced by textile manufacturing companies in terms of intensive **water consumption**.

Solution consists in developing **tools** and **technologies** that **allow** for a **reduction** in the specific **water** consumption in **textile** finishing companies through the adoption of **less water-intensive technologies** and the implementation of **intelligent monitoring** and process control systems.

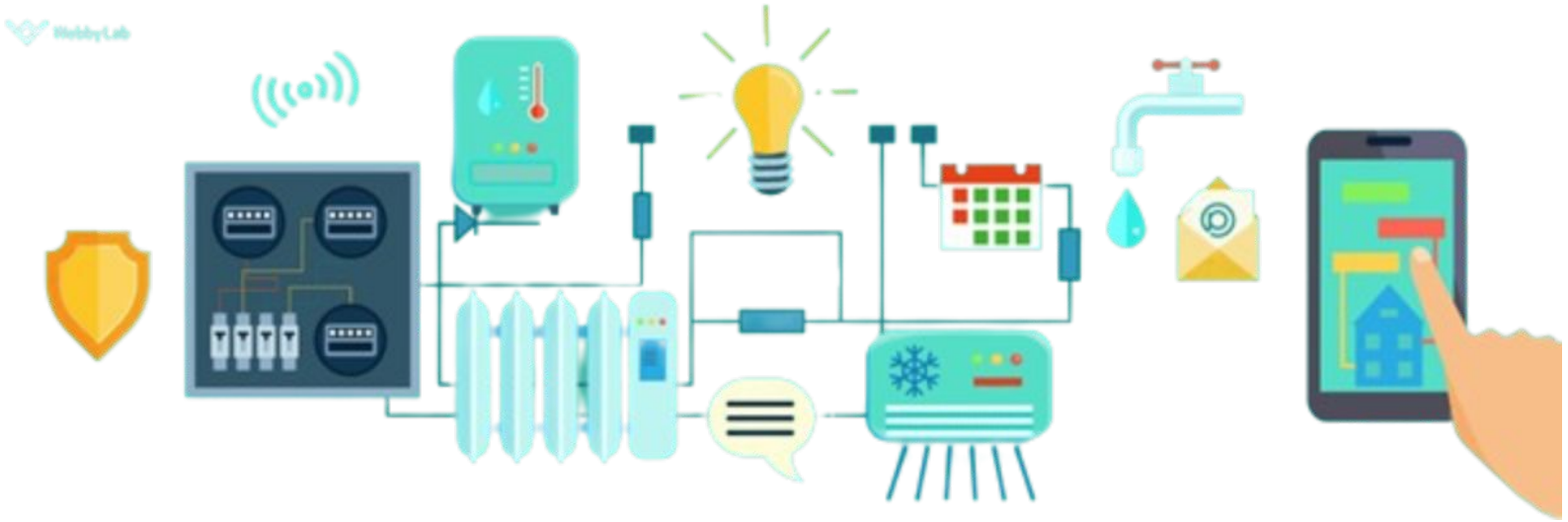
The aim is to develop a set of tools that will enable companies to:

1. **Reduce** specific **water** consumption (use of less intensive finishing technologies and adoption of treatment technologies that allow water to be reused)

2. **Support decisions** on the final destination of water (through the integration of process monitoring and **control systems** and a new water management support tool).

This contributes to **environmental sustainability** and more efficient **management** of **water** resources in the sector.

SMART WATER MANAGEMENT



GIATEX

SMART WATER MANAGEMENT

GIATEX

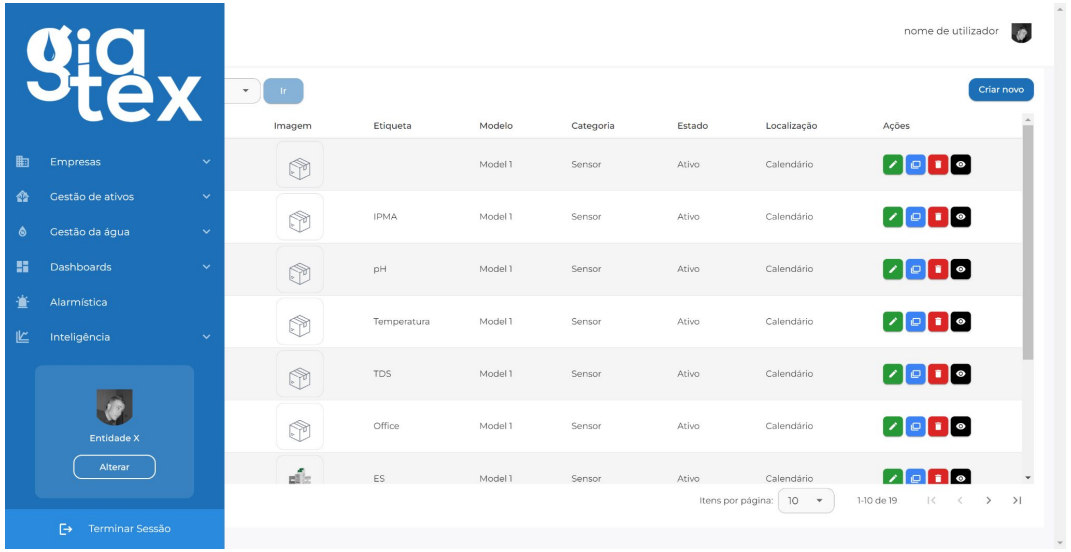
IT decision support tool for **water management**, featuring:

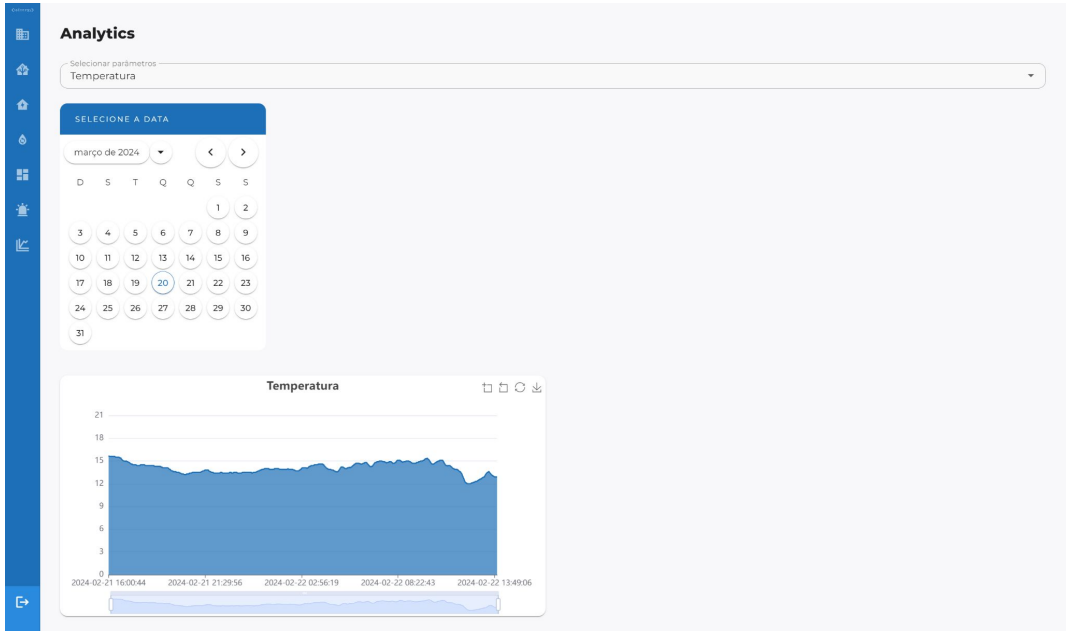
- ✓ **Monitor water consumers** in each process, section or machine of enterprises
- ✓ **Configuration** of **water** parameters to be monitored
- ✓ Takes into account the organisation's **business rules**
- ✓ **Mapping sensors** to machines/sections
- ✓ **Analytical dashboards**
- ✓ **Real-time** alert **systems**
- ✓ **Interconnection** with **company systems**

PRR Plano de Recuperação e Resiliência
REPÚBLICA PORTUGUESA
Financiado pela União Europeia NextGenerationEU

SMART WATER MANAGEMENT - GIATEX

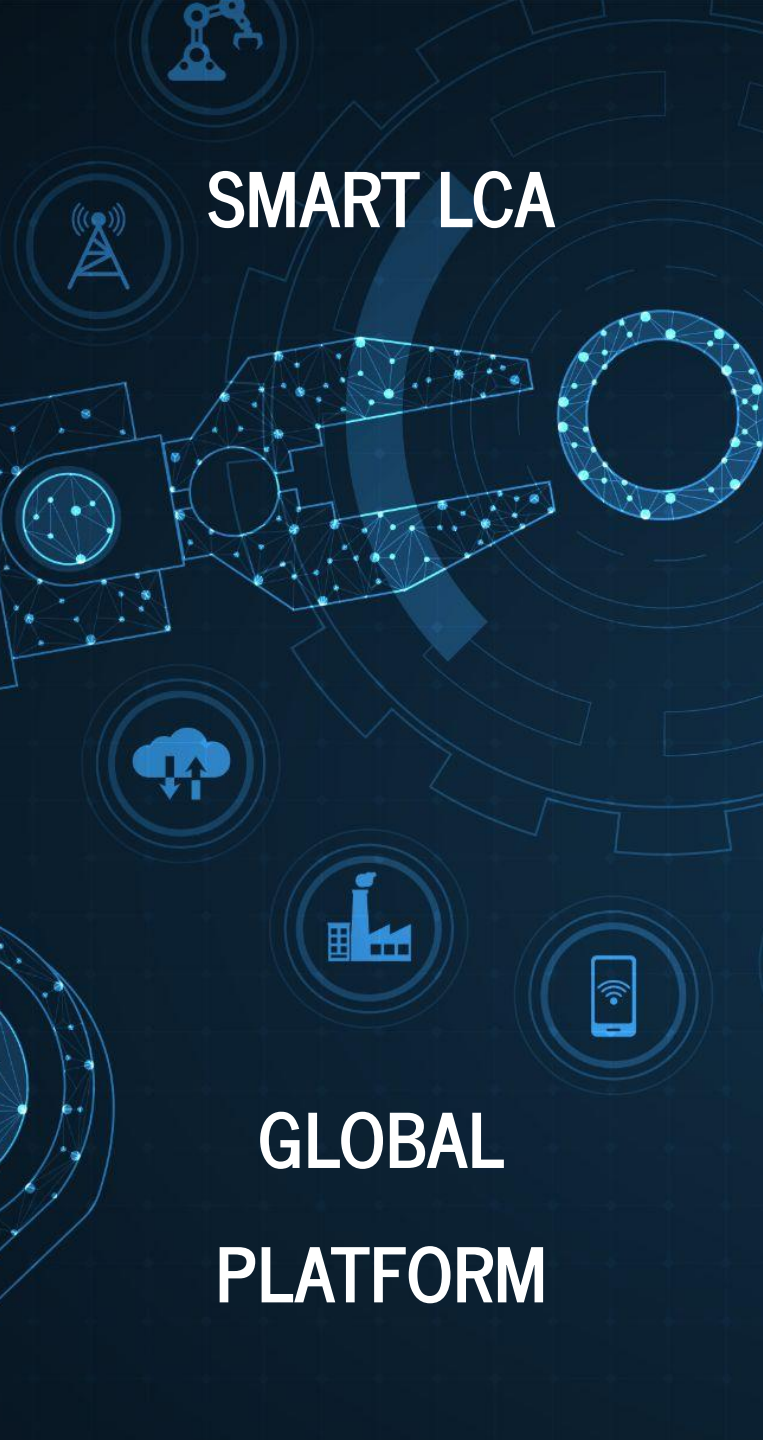
IOTech





```
18:11:11.503 -> TDS Value:42 ppm
18:11:11.730 -> Turbidity = 1594.80 mV
18:11:12.541 -> Temperature = 21.62 ºC
18:11:12.573 -> TDS Value:42 ppm
18:11:12.831 -> Turbidity = 1586.74 mV
18:11:13.606 -> Temperature = 21.62 ºC
18:11:13.671 -> TDS Value:43 ppm
18:11:13.898 -> Turbidity = 1589.96 mV
18:11:14.705 -> Temperature = 21.62 ºC
18:11:14.738 -> TDS Value:44 ppm
18:11:14.996 -> Turbidity = 1593.19 mV
18:11:15.773 -> Temperature = 21.56 ºC
18:11:15.838 -> TDS Value:45 ppm
18:11:16.064 -> Turbidity = 1590.77 mV
18:11:16.872 -> Temperature = 21.56 ºC
18:11:16.905 -> TDS Value:45 ppm
18:11:17.164 -> Turbidity = 1589.96 mV
18:11:17.939 -> Temperature = 21.62 ºC
18:11:17.970 -> TDS Value:45 ppm
18:11:18.228 -> Turbidity = 1586.74 mV
18:11:19.034 -> Temperature = 21.56 ºC
18:11:19.067 -> TDS Value:46 ppm
18:11:19.324 -> Turbidity = 1586.74 mV
18:11:20.101 -> Temperature = 21.56 ºC
18:11:20.132 -> TDS Value:46 ppm
18:11:20.391 -> Turbidity = 1585.93 mV
18:11:21.196 -> Temperature = 21.56 ºC
```

CO2
1
2
3
4
KEY
SUSTAINABILITY
LCA



SMART LCA

GLOBAL PLATFORM

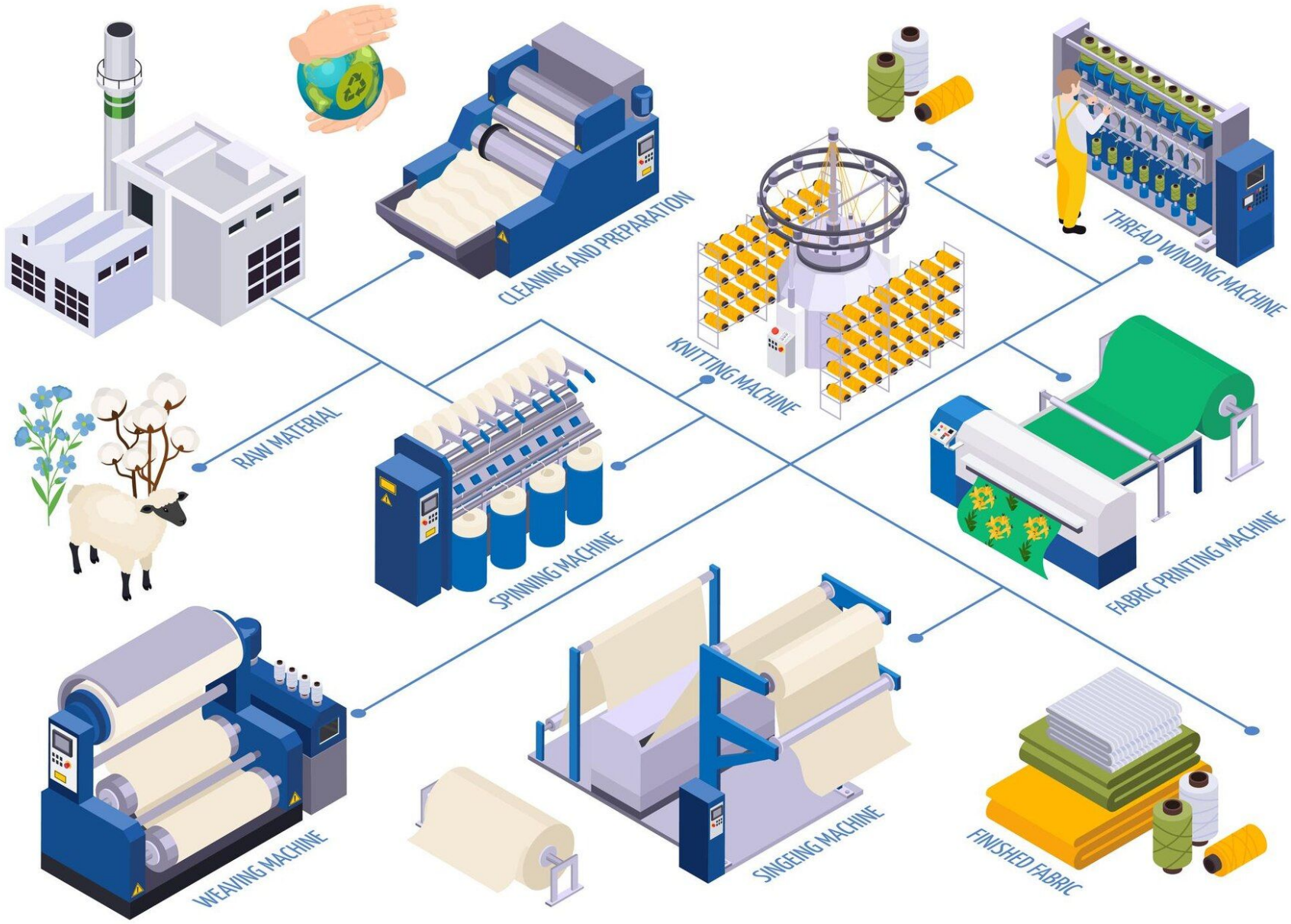
A **Life Cycle Assessment (LCA)** is defined as the systematic **analysis** of the potential environmental **impacts** of **products** during their entire **life cycles**.

This project has the main goal:

- ✓ valorise **digital resources;**
- ✓ developing of software to **monitor** and **collect data;**
- ✓ **reinvent** new **production routes** and, consequently, greener and more **traceable products**;
- ✓ **contributing** to the **digital passport** for textile products;
- ✓ real-time **energy consumption** monitoring throughout the production lifecycle and
- ✓ crossing energy data with the bill of materials (**BOM**);
- ✓ **calculating** the **LCA** of textile yarns.

SMART LCA

GLOBAL PLATFORM

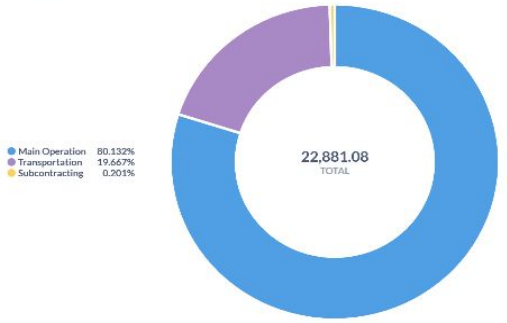


SMART LCA - Global Platform

IOTech

Order

Carbon Footprint



16,811
Quantity (kg)

2,187.89
Energy (kWh)

18,335.05
CO2 (kgCo2e)

1,466
Waste (Kg)

0.95
SubContracting - Energy + Gas (kWh)

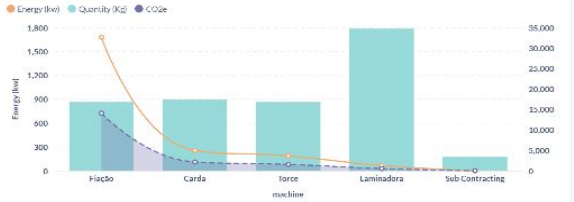
16.35
SubContracting - CO2e

4,848
Transportation - Distance (KM)

4,500
Transportation - CO2 (kg)

CO2 by Operation

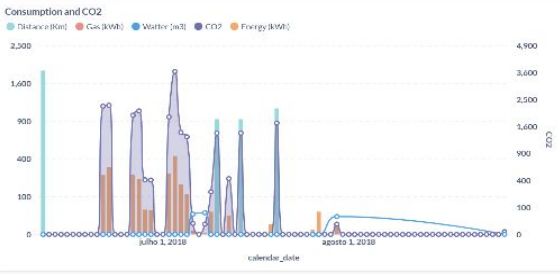
Machine Consumption



Transportation - Order

Map

Consumption and CO2



Main operations

year	calendar_date	customername	weekend	order	material	machine	type	Quantity Total	Quantity	power	co2	CO2 Avoid Emissions	Green Power	power_kg	co2_kg
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5LAM2	Laminadora	520.00	515.00	1.34	9.76	1,576.76	1.24	0.0026	0.0189
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5TORC1	Torce	520.00	515.00	6.31	46.11	7,450.65	5.85	0.0123	0.0895
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5FIA1	Fiação	520.00	515.00	56.45	412.35	66,625.04	52.33	0.1096	0.8007
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5DOB1	Debinzedora	520.00	515.00	0.00	0.00	0.00	0.00	0.0000	0.0000
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5HEMB1	Contínuo	520.00	515.00	0.00	0.00	0.00	0.00	0.0000	0.0000
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5AB2	Abridora	520.00	515.00	0.00	0.00	0.00	0.00	0.0000	0.0000
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5CARD1	Carda	520.00	515.00	8.30	60.63	9,796.90	7.69	0.0161	0.1177
2018	julho 2, 2018	Customer1	Não	OFI.52400334.1	22241MP311M48030	F5LAM1	Laminadora	520.00	515.00	0.81	5.90	953.61	0.75	0.0016	0.0115

Linhas 1 - 8 de 400

Transportation

Order	Date	OP	Company	City	Company	City	Process	Distance	CO2
OFI.52400354.1	junho 11, 2018	1	Company1	Lenzing	Tearfil	Moreira de Cónegos	Transport from Raw Material	1,877	0
OFI.52400354.1	julho 10, 2018	2	Tearfil	Moreira de Cónegos	Company2	Aquilent	Transport to Dyeing	930	1,400
OFI.52400354.1	julho 14, 2018	3	Company2	Aquilent	Tearfil	Moreira de Cónegos	Transport from Dyeing	930	1,400
OFI.52400354.1	julho 20, 2018	4	Tearfil	Moreira de Cónegos	Company3	Barcelona	Transport to Delivery	1,111	1,700

3,383.5
Subcontracting - Total Quantity (kg)

83.35
Watter (m3)

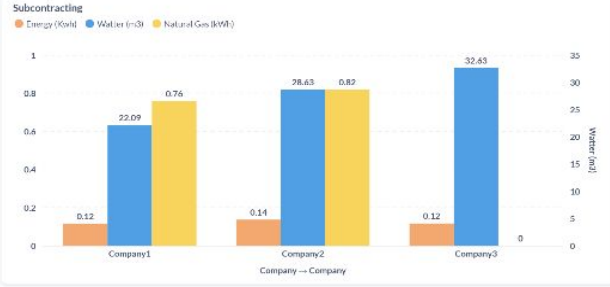
0.37
Power (kWh)

1.57
Natural Gas (kWh)

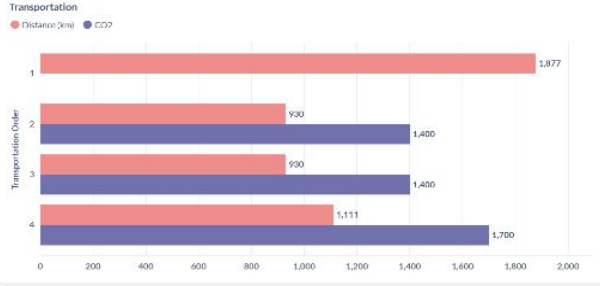
Subcontracting

Date	Company	Task	Quantity (kg)	Power (kWh)	CO2e	Gas (kWh)	Watter (m3)
julho 6, 2018	Company2	Dyeing	1,363.5	0.14	16.35	0.82	28.63
julho 8, 2018	Company3	Other	1,000	0.12	14.35	0	32.63
julho 30, 2018	Company1	Drawing	1,000	0.11	14.35	0.66	22.09
agosto 27, 2018	Company1	Dyeing	20	0.009	1	0.1	0

Subcontracting

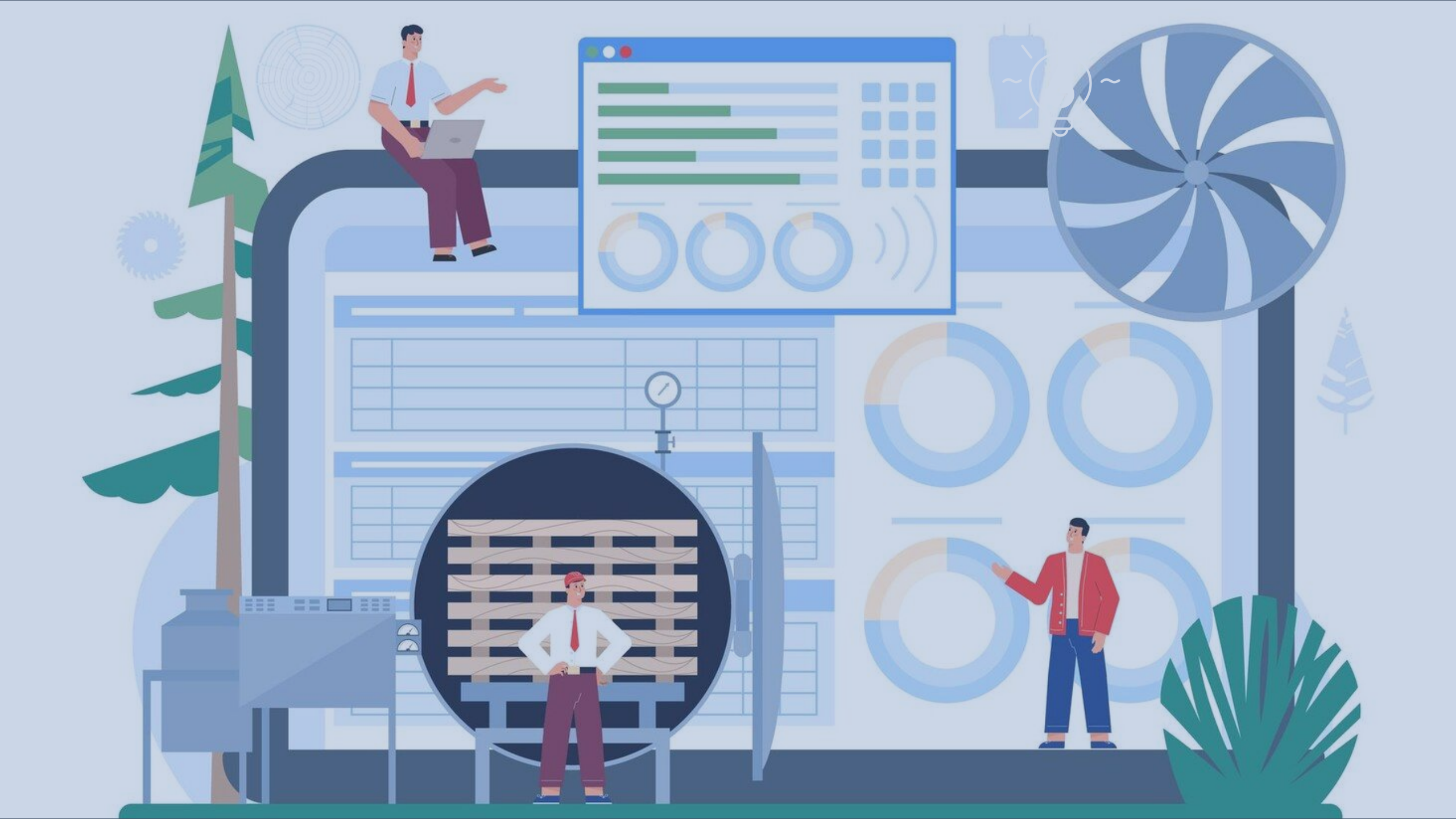


Transportation



CREATING A SMART AND SUSTAINABLE SOCIETY DEPENDS ON US.

CHANGING THE WORLD IS IN OUR HANDS!



SMART INDUSTRY

All-in-one Solution

- ✓ To **simplify** the **process** and **support** the **digital transition**, IOTECH has developed an **all-in-one, modular** and **scalable** solution designed to accelerate the process and adapt to the specific needs of each industry.
- ✓ This **solution** is structured around four core modules:
  1. **Sensing and Monitoring** – for real-time data acquisition and system supervision with sensors installation..
  2. **Data Science and Artificial Intelligence** – to generate insights, predictions, dashboards and reports.
  3. **Digital Product Passport and Life Cycle Assessment (LCA)** – ensuring traceability, sustainability, and regulatory compliance.
  4. **Operational Control Center** – focus on factory floor digitalisation and intelligent machine control and automation.
- ✓ The solution **simplifies and optimize processes**, reduces **paper** usage, and **frees** up time for operators and decision-makers to focus on their **core tasks**.

✓ The system enables **real-time monitoring** of a wide range of parameters, including:

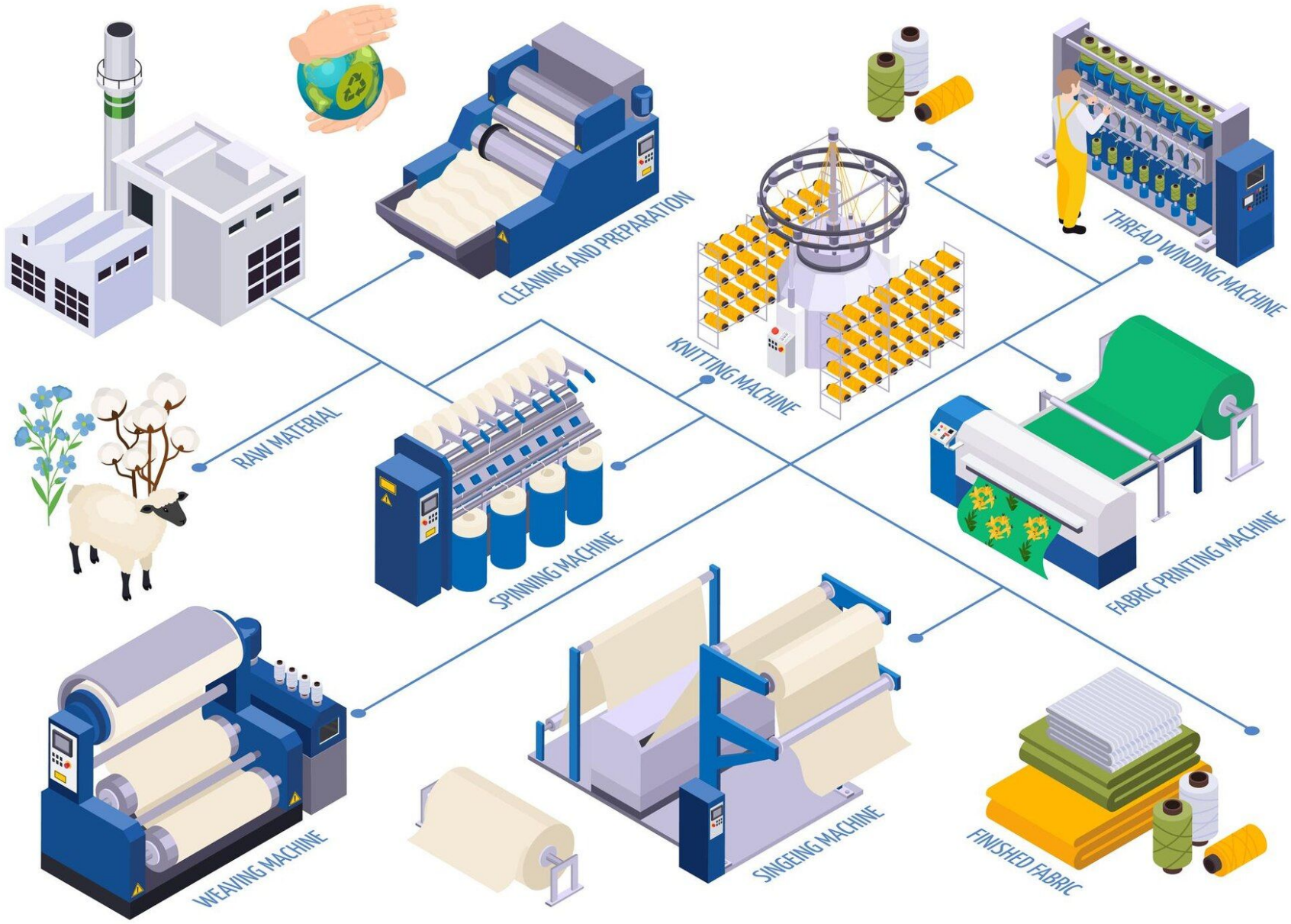
- **Asset consumption**: energy, water, gas, compressed air, vacuum, and more.
- **Environment, Process** and **machine parameters**: rotations, meters, humidity, temperature, pH, turbidity, among others.

✓ It also supports/includes:

- **Full connection** with existing systems / solutions (e.g. CRM, ERM, MES, others)
- **Business Intelligence** through dashboards, KPI-driven reports, and insights
- Registration and control of Digital **Product Passport** data
- **Creation of LCA (Life Cycle Assessment)** indicators
- **Machine control**, allowing start/stop operations via tablet—only after a service order has been properly assigned.
- **Real-time alerts** notify users of overconsumption, air/gas leaks, out-of-range values, and other thresholds defined by each company.

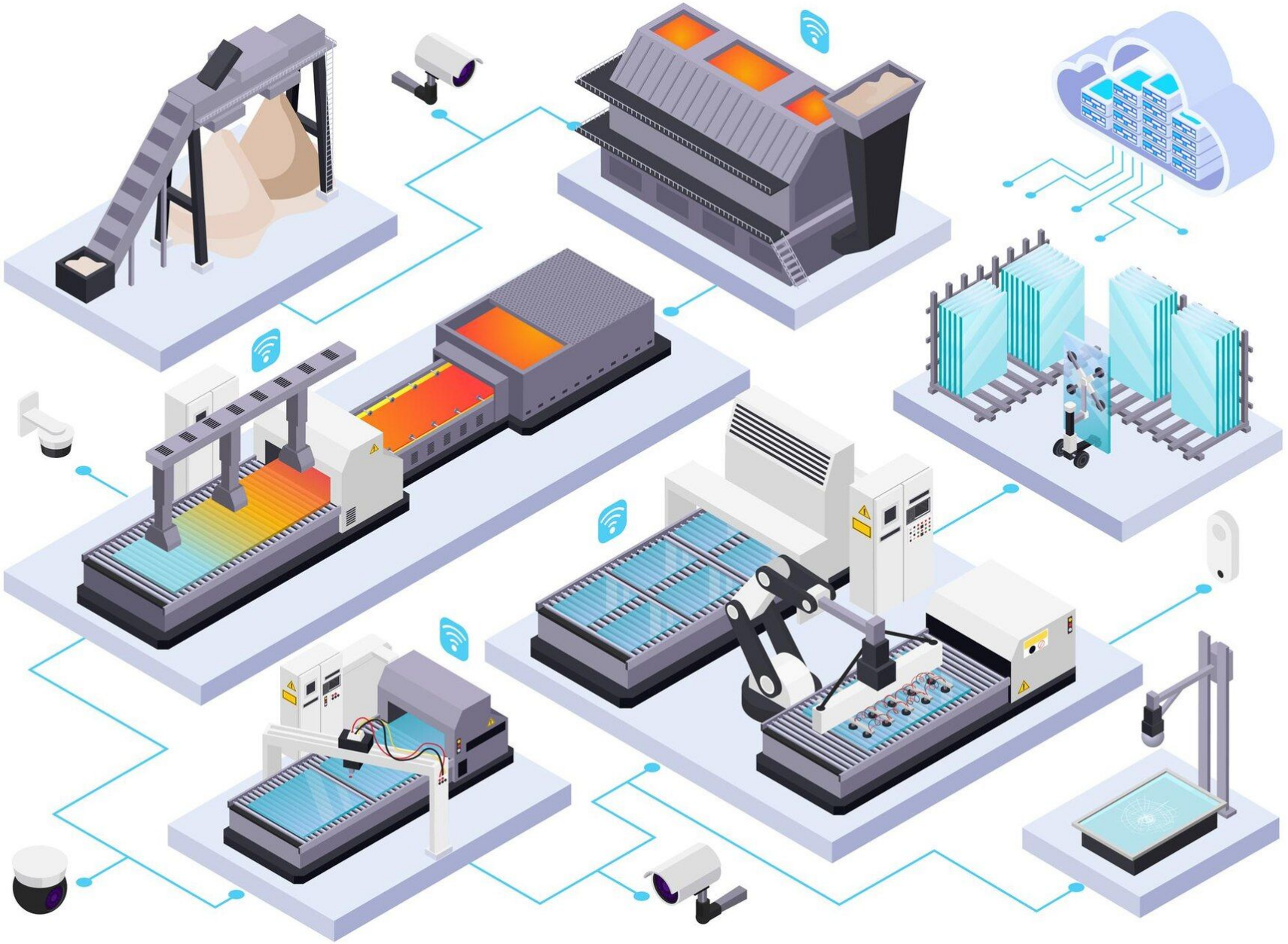
SMART INDUSTRY

All-in-one Solution



SMART INDUSTRY

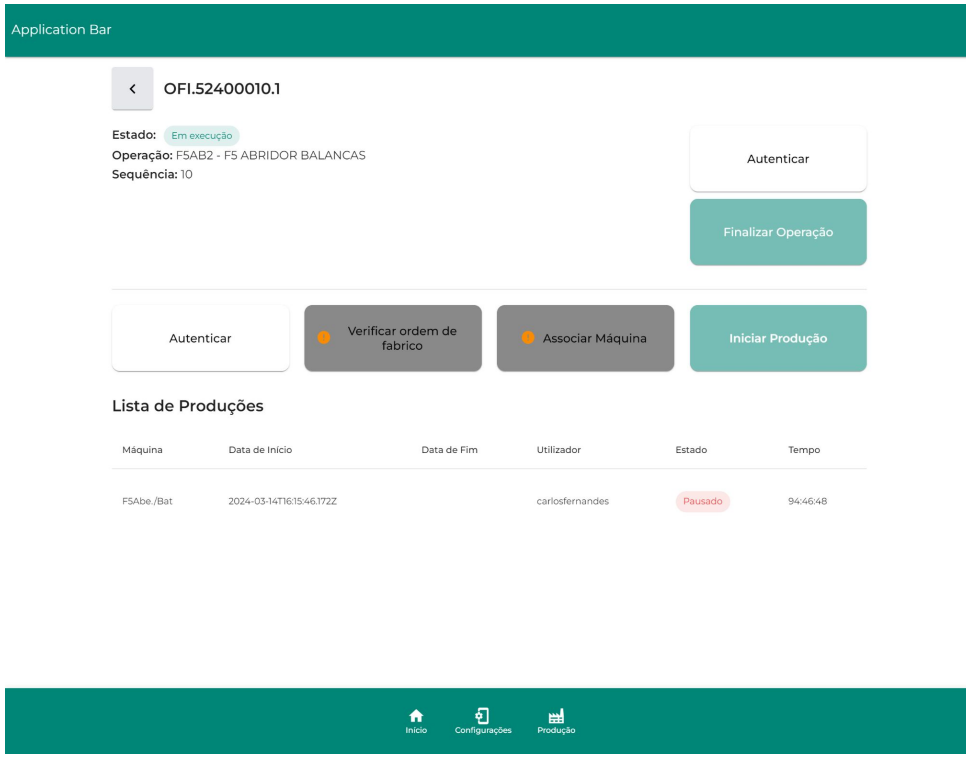
All-in-one Solution

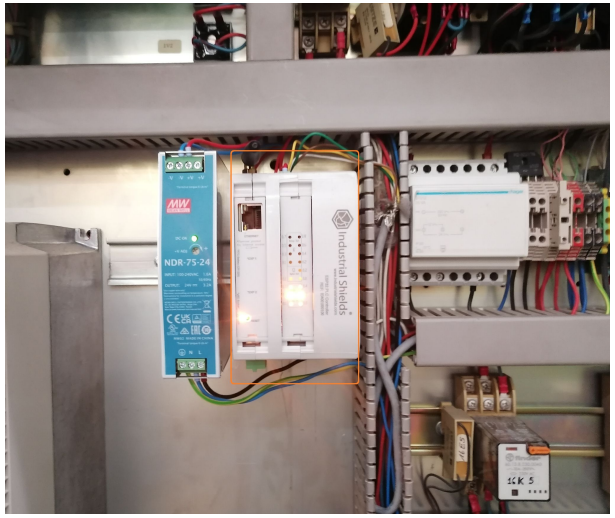


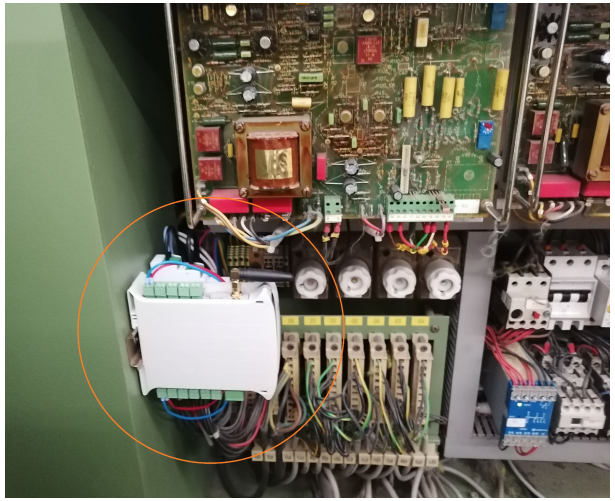
ZERO EMISSION
ZERO CO2
CO2
CO2
IOTech

SMART INDUSTRY - All-in-one Solution

IOTech®

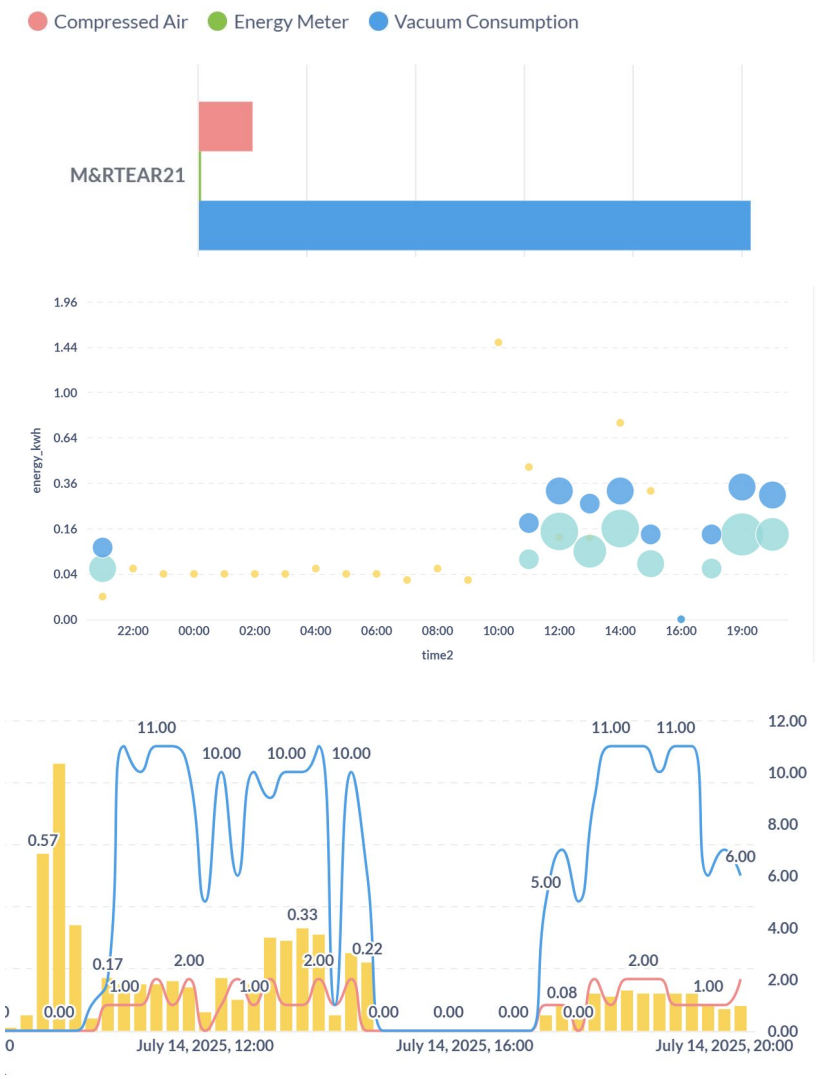






SMART INDUSTRY - All-in-one Solution

IOTech



SMART INDUSTRY - All-in-one Solution

IOTech

N/A	N/A	N/A	N/A
Consumo instant. energia kWh	Consumo instant. ar comprimido m^3	Vácuo instantâneo mbar	Máquinas ativas un

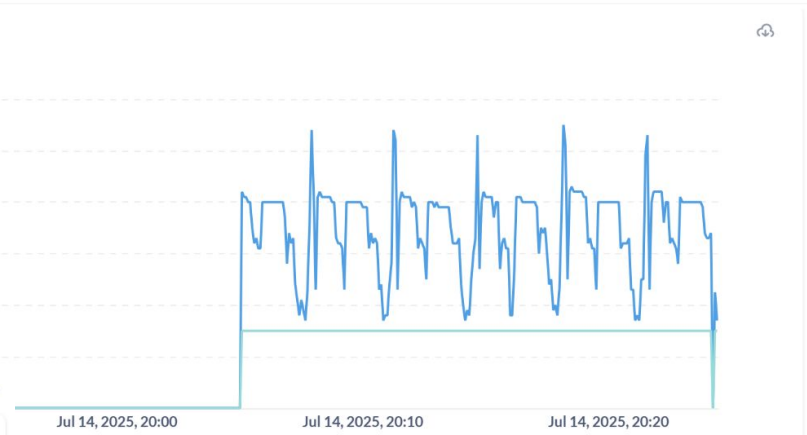
Detalhes dos ativos

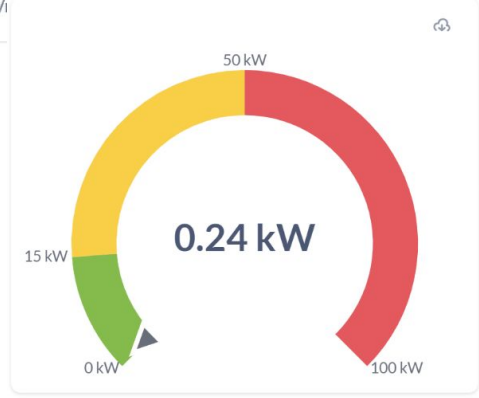
M&RFORM1

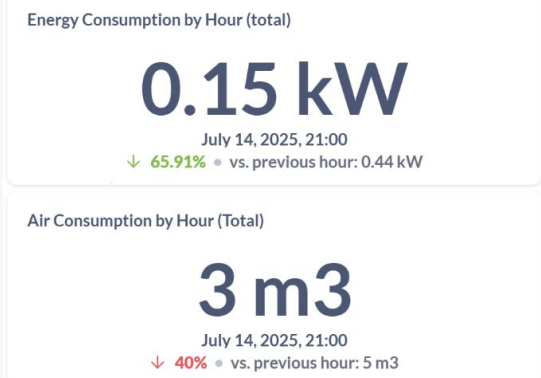
Máquina Enformar

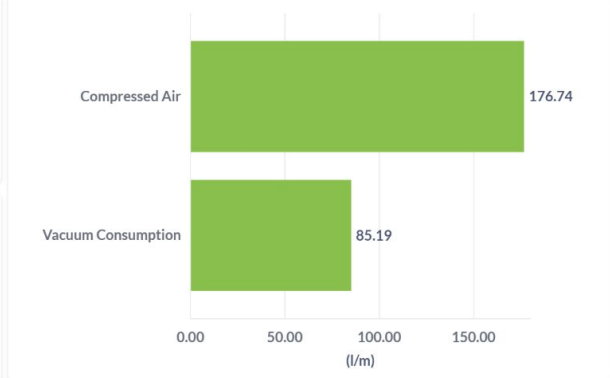
M&RTEAR21

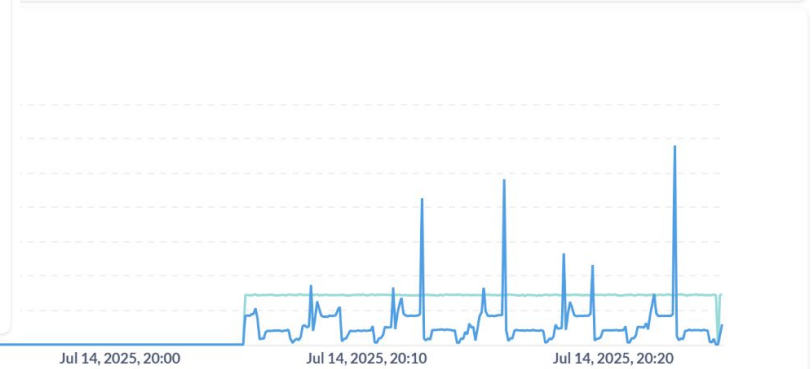
Máquina Tricotar











SMART INDUSTRY - All-in-one Solution

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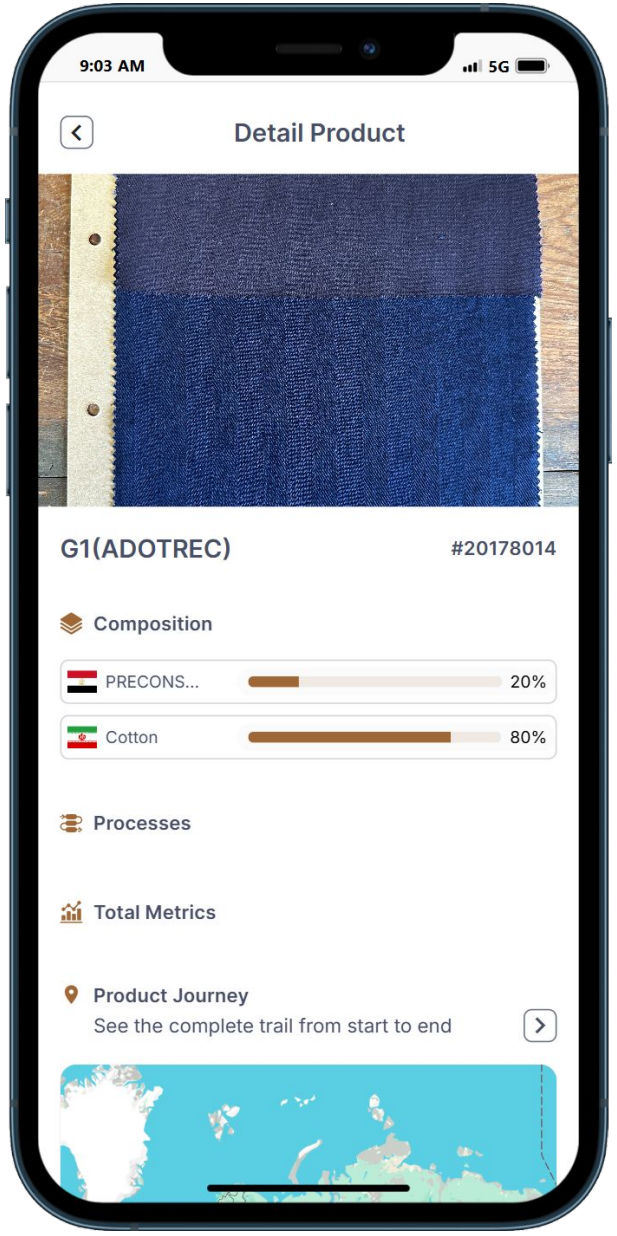

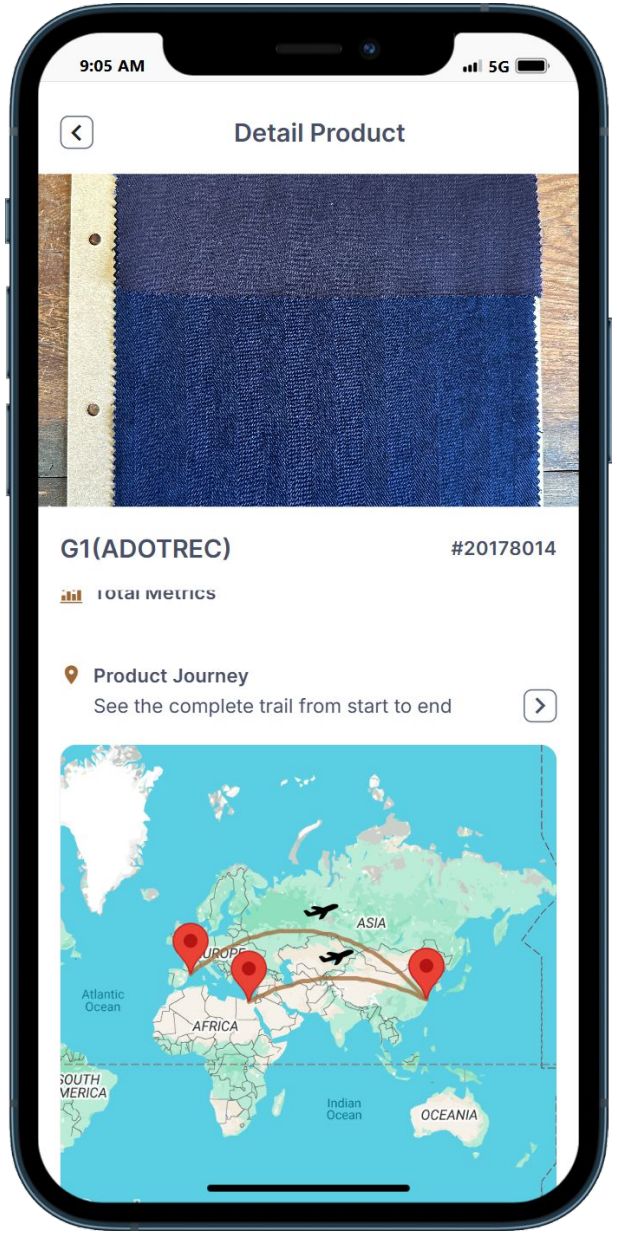

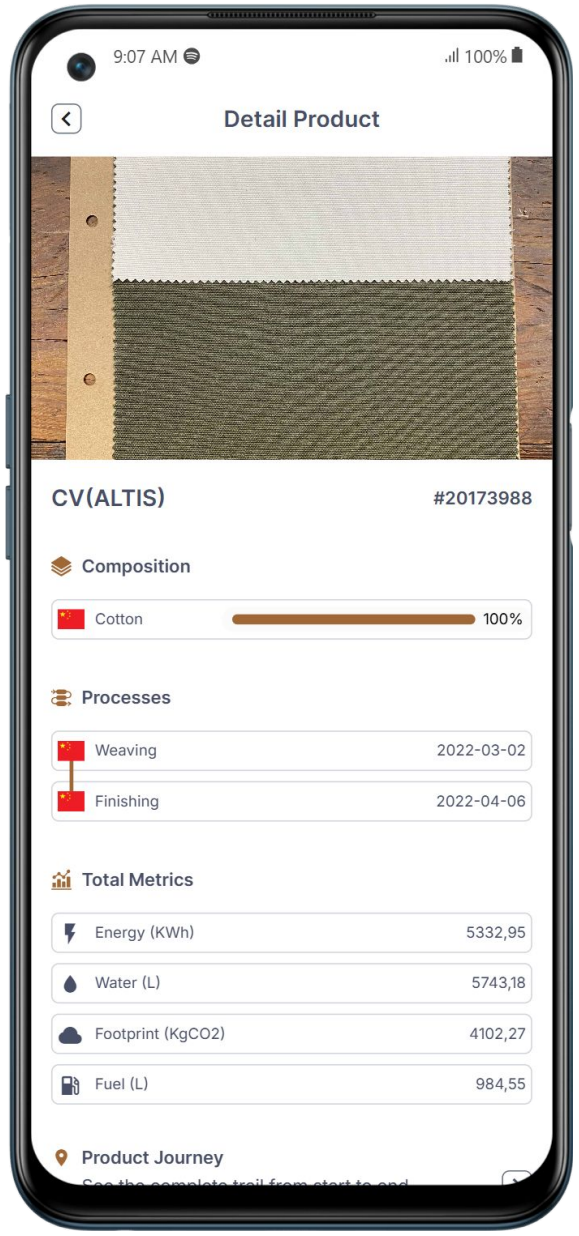

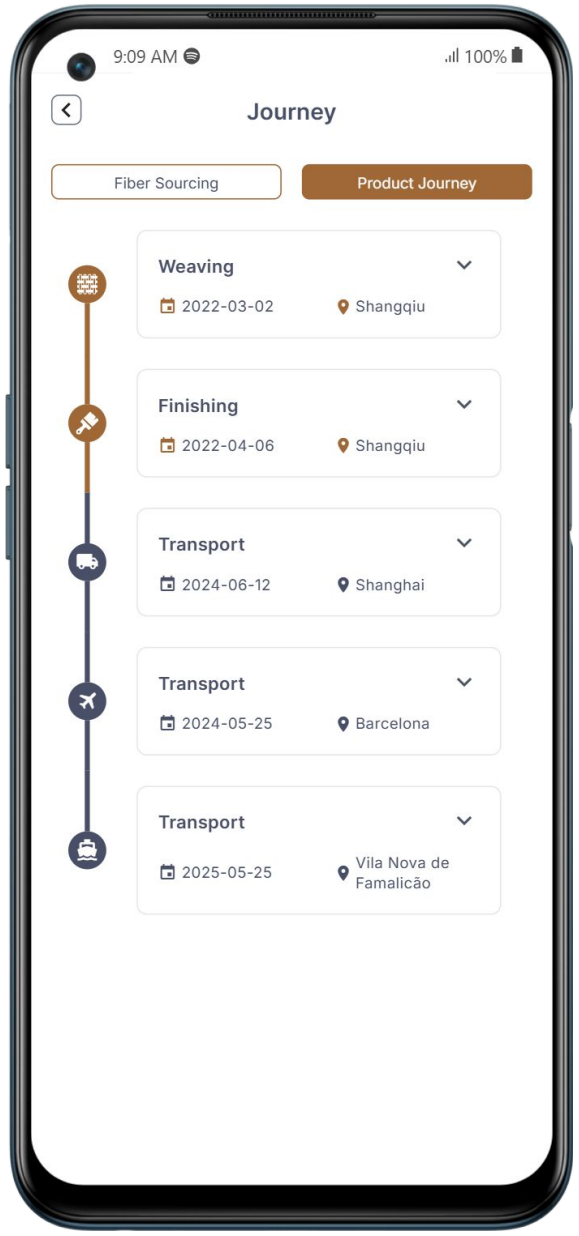

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SHIFT2 DIGITAL GREEN

WORKSHOP

COMO ADAPTAR O MODELO DE NEGÓCIO PARA A TRANSIÇÃO DIGITAL E SUSTENTABILIDADE?

Promovido por: ISQ, TECMINHO Universidade do Minho Interface, CTCV, universidade de aveiro

Apoio: FAMALICÃO MADE IN

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