IoT for Manufacturing Repurposing of advanced textile solutions: a case study

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MISSION
Applied research and technology transfer to **fill the gap** between research and industries
Manufacturing Repurposing: Case Study

One of the world’s leading producers of a wide range of chemical intermediates, polyamide polymers, engineering plastics, synthetic fibers and nonwovens. **Headquartered in Bergamo** (Lombardy, IT), which bore the largest brunt of the initial COVID-19 impact in Italy.

Its **business areas** includes:
- Specialty chemical
- High performance polymers
- **Advanced textile solutions**
Shortage of critical items during COVID-19

Face masks imports to the 27 EU Member States from the rest of the world

The costs incurred by Italy to import masks from China from February to August 2020 correspond to 2.66 billion euros.

Need for reducing dependence on non-European countries

Business Repurposing during COVID-19

- EXPERIENCE: high performance polymers and advanced textile
  - Significant fall in demand due to COVID-19
  NEED to access new markets
  - OPPORTUNITY: Meltblown nonwoven fabric filtering material for PPEs was produced in minimum quantities in Europe

DRIVEN FACTORS

Business proximity to growing markets
(high performance polymers and advanced textile solutions)

Market sustainability both in the short (PPEs) and in the long term
(meltblown filtering applications extend beyond the medical field)

Resources availability (financial resources, physical assets, workforce,...)

Supply chain (identification of suitable and interested partners)

Investment: 10 million euros for a certified meltblown plant to produce filtering tissue for PPEs
> Reduce dependence on imports from non-European countries

Establish a local supply chain to produce PPEs in partnership with third parties. The decentralized structure allows them to be flexible in the management of variable demand volumes.

Early identification of future exploitation for these investments. PPEs production is only sustainable in the short term, until competition from abroad returns.
Business Repurposing during COVID-19: **ISSUES**

1. Identification of process parameters for a specific application
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1. Identification of process parameters for a specific application
2. Dynamic and volatile market

[Graph showing sales data for different categories such as Surgical, Ffp2, Reusable, ND from March 2020 to February 2021 with sales figures in million euros]

Business Repurposing during COVID-19: ISSUES

1. Identification of process parameters for a specific application
2. Dynamic and volatile market
3. PPEs market is not sustainable in the long term
LESSONS LEARNED: Where to act?

- Improve process control and flexibility to face high demand fluctuations
- Manage waste and minimize consumption of virgin raw material
- Design products to maximize their durability, increase performance and promote effective recycling

OBJECTIVES: What to do?

- Collect data and leverage AI and Data Analytics to model processes, enabling quality and process optimization and faster and more reliable Repurposing
- Recycling and recovery of post-industrial scraps and rejects
  - full traceability of purchased materials
  - full process traceability of virgin and post-industrial recycled material
IoT for Repurposing

Parameters Selection

Data Historicization

Data Analysis

Model Development

Validation
The polypropylene scraps are collected, sorted and regranulated to create new raw material. The nonwovens with recycled content were certified as circular products in 2020, according to the International Sustainability and Carbon Certification (ISCC) system.

Through recovery and recycling, production waste is converted into polymer and then into spunbond nonwoven, eliminating the need for valuable new non-renewable raw materials.

**Traceability**
Every production step is managed by process management software collecting, for each lot of materials, detailed information on raw material, production line and processes, together with data on packaging and shipping.
Monitoring, Scheduling, Configuration, Data acquisition, Supervision and Control

TO-BE: Processing, BI
Context Information Mgmt

Data Lifecycle Mgmt
Interoperability with Enterprise Systems

TO-BE: AI prediction & reasoning

Data Lifecycle Mgmt
Interoperability with Enterprise Systems

Data Spaces for Manufacturing

DS INDUSTRIAL DATA PLATFORM
(Trusted Secure Networks)

DS DATA SHARING SPACES
(Asset & Site Corporate Value-Chain levels)

DS BUSINESS MODELS / GOVERNANCE
(Data/Services Trading Marketplaces)

TO-BE: AI prediction & reasoning

Applications Hub
Transactions Manager
(DLT)

Security Services
(IAM, IIC)

Connectors / Secure Gateways

Data Models / Ontologies

Data Sharing API

Open Data Repositories

Data Marketplace

Business Transaction Manager

IoT Reference Architecture

IOT Data Platform in the CLOUD

Data Storage
TO-BE: Data Lifecycle Mgmt

Data Integration
Interoperability with Enterprise Systems

Data Intelligence
TO-BE: AI prediction & reasoning

IOT Data Platform at the EDGE (local cloud)

Data Acquisition
Process Data are acquired and accessible

Data Brokering
Context Information Mgmt

Data Processing
TO-BE: Processing, BI

Field Level Data Spaces, Data Buses B2B Exchanges

IoT Open HW Systems
Configuration, Data acquisition

Automation Systems
Monitoring, Scheduling

Human Systems
Supervision and Control

IOT Data Platform PHYSICAL WORLD

Industry 5.0 INTELLIGENT APPLICATIONS AND PILOTS

Human AI Collaboration

LCA and LCC

Waste Reduction

Low Emissions

Circular Economy

Sustainability
Where we are and where to go

- **AS-IS:**
  - No Data Control
  - Data Silos
  - Data Bridges: Ad-hoc Data Bridges between Enterprise Applications for specific purposes
  - Data Interoperability: Standard Data Models
  - Data Valorisation

- **TO-BE:**
  - Data Bridges: AI-driven support tools
  - Data Interoperability: Industrial Platform for Data Processing and Sharing
  - Data Valorisation: Multi-stakeholder Digital Passports

- **Next TO-BE:**
  - Multi-stakeholder Digital Passports
Thank you!

Find more:
https://www.eur3ka.eu/
https://www.intellimech.it/en/

iotweek.org