Advanced manufacturing solutions tightly aligned with business needs

The AVANGARD project addresses the integration of three novel processing units into an existing microfactory test bed conceived to produce urban electric vehicles.

Figure 1: The i-car at IFEVS premises (left) and the i-bike being tested (right).

The operation of the AVANGARD pilot is being demonstrated through manufacturing i-bikes, i-cars and innovative battery packs. The proposed innovations target urban mobility, where we are entering an era of rapid transformation and disruption, which are also challenging traditional paradigms on manufacturing and business models characterised by an unprecedented speed, scale and scope of technological change.

E-vehicles

AVANGARD focuses on e-vehicle production, such as interactive electric cars and interactive electric bicycles. To this end, sustainability was addressed through the products and the microfactory setup.

Specific tests are used to address certification from the aspect of the product, i.e. with respect to the crash tests and mechanical behaviour.

Manufacturing in Europe and the microfactory concept

The microfactory is based on the concept of minimum upfront investment. To this end, it is expected to be in line with European policies of sustainability, Green Deal, human inclusion, frugality, innovation/ growth and certified production. Customisation and frugality are achieved through the so-called 'pull' architecture, meeting the local community's needs.

Figure 2: Tests run on i-car by CIDAUT.

Figure 3: The pick-up version of the i-car.

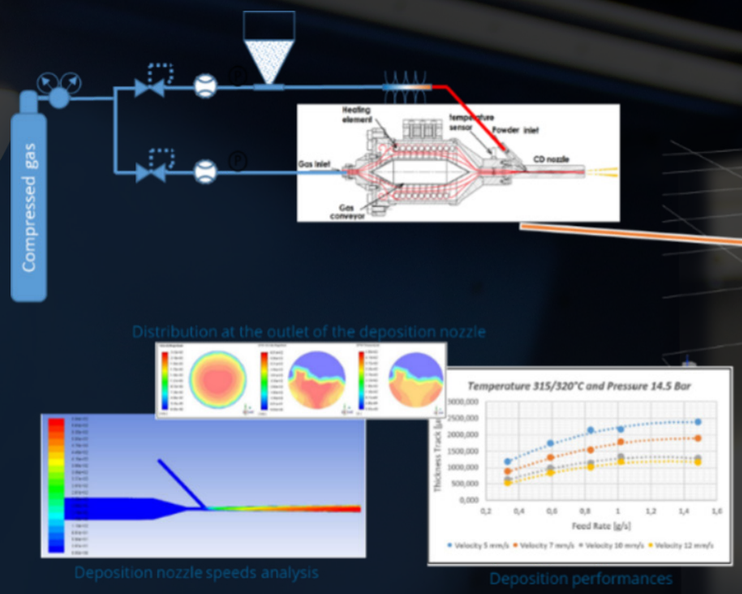

Figure 4: SUPSI introducing cold powder spray.

Manufacturing processes

Special attention is given to manufacturing processes. AVANGARD tested new robotised processes and regarded more 'exotic' solutions with technical capabilities and generalised LCA profit in mind.

In addition, new materials were implemented to address customisation as well as safety. They were integrated into the manufacturing procedure, offering flexibility through 3D printing. MASSIVIT created Dimengel 20-FR (DIM 20-FR), the world's first flame-retardant, photo polymeric gel for 3D printing. The polymer complies with the highest standard for flame-retardant materials, the UL94-V0, which contains a dedicated section (blue card) for additive manufacturing. Also, the following are valid:

- compliant with 1907/2006/EEC regulation 2006 ("REACH")
- compliant with Regulation (EC) No 1272/2008 ("CLP")
- compliant with the US Toxic Substances Control Act (TSCA) regulations; does not contain any chemicals listed in California Prop.65
- compliant with the European Standard EN ISO 5817.

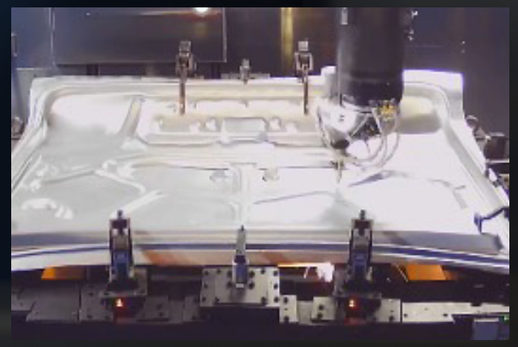

Figure 5: Cutting (left) and welding (right) by PRIMA introduced in the microfactory.

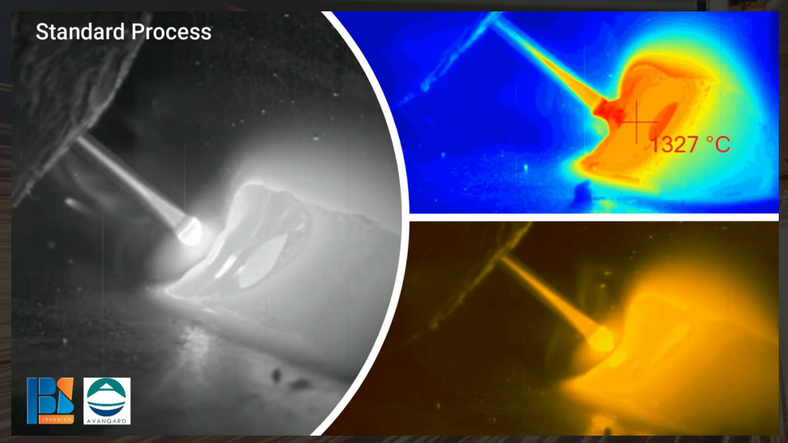

Figure 6: Certifying welding through monitoring (bottom) by BWI.

The digital infrastructure of microfactory

The microfactory needs to be in line with the ongoing digital transformation of industry. To this end, various tools are implicated in the design and operation, starting with the integration of life cycle assessment (LCA). These activities aim to estimate the so-called generalised LCA profit by integrating extra activities such as estimating the LCA cost of digital optimisation. All this information management requires some end-to-end integration, spanning all over the lifecycle, from ordering and design to manufacturing, use phase and end-of-life management.

To facilitate the operation of the microfactory, extra tools were implemented to enhance the certifiability of the various procedures.

Figure 10: Welding digital twin by LMS (top) and Blockchain API by IDFC (bottom).

Figure 7: LCA activities by SPHERA.

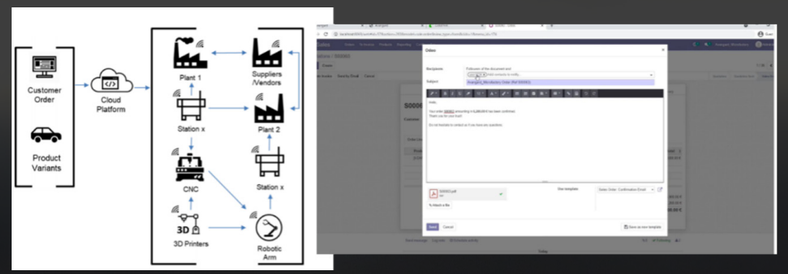

Figure 8: End-to-end integration and software tools by VAASA.

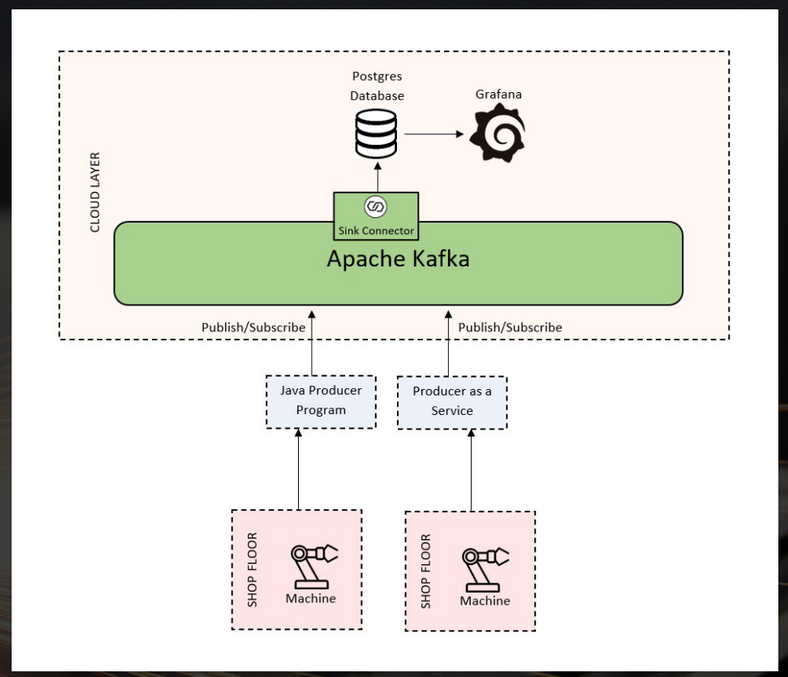

Figure 9: Sample cloud architecture for MES by UNINOVA.

CPS and IoT

Modern context-aware manufacturing could not work without communications. To this end, secure procedures were considered, like firmware updates over the air.

Collaborative manufacturing

Collaborative manufacturing is also a key towards frugality. So, the right combination of partners was used to create a manufacturing network appropriate for the AVANGARD microfactory. Hereafter, two different examples of collaborative manufacturing can be seen: doors manufacturing, maintaining the concept of the microfactory; and circular use of components, extending the profit towards other parts of the lifecycle, like end-of-life management.

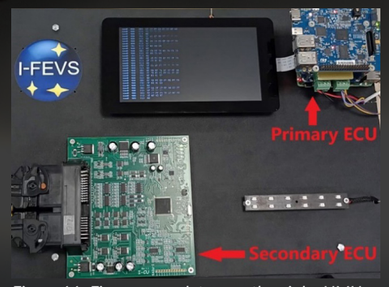

Figure 11: Firmware update over the air by HMU & STM.

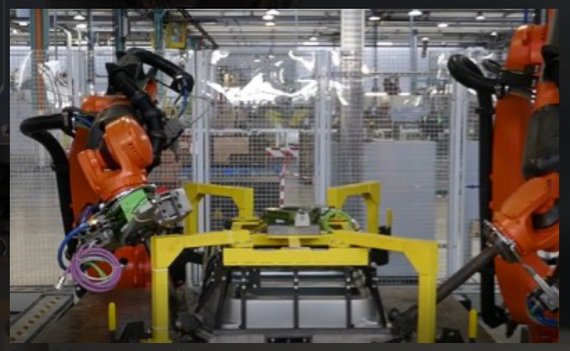

Figure 12: Doors manufacturing by MA.

Figure 13: Circular economy cell by Gizelis Robotics.

Link to major objectives

AVANGARD methodology seems to address various objectives of the Factories of the Future:

- Sustainability and Green Deal
- Non-financial reporting
- Certification
- Industry 4.0 and 5.0.

Stay tuned for extra results

PROJECT NAME

Advanced manufacturing solutions tightly aligned with business needs (AVANGARD).

PROJECT SUMMARY

The AVANGARD project aims at the integration of three novel process units into an existing microfactory test bed conceived to produce urban electric vehicles by utilising 3D-printed parts. The project will prepare the environment for novel forms of collaborative distributed manufacturing amongst different EU regions.

PROJECT PARTNERS

PRIMA Industrie, Italy; IFEVS, Italy; MA Srl, Italy; UNINOVA, Portugal; INTROSYS SA, Portugal; LMS, Greece; HMU, Greece; GIZELIS, Greece; IDFC, Greece; RODSTEIN, Finland; VAASA, Finland; UNITO, Italy; IPM, Italy; MORPHICA, Italy; STGNB 2 SAS, France; ST ROUSSET, France; CIDAUT, Spain; POLEVS, Poland; SPHERA, Germany; BWI, Belgium; SUPSI, Switzerland; MASSIVIT, Israel.

PROJECT LEAD PROFILE

PRIMA INDUSTRIE SpA is a worldwide leader in industrial laser systems and sheet metal working machines. Today the company has about 1700 employees with headquarters in Italy, where the new technological centre of the group is situated. Prima also has facilities around the world, such as in Finland, the USA and China.

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