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IoTwins

Distributed Digital Twins for industrial SMEs: a big-data platform

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RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT № 857191

The project.

IoTwins

PROJECT ID CARD

Type of action

Innovation action

Project reference

857191

Start/End

Sep. 2019 - Aug. 2022

Total costs

20,029,818.75 €

EU contribution

16,422,552.01 €

Call identifier

H2020-ICT-2018-2020

Topic

ICT-11-2018-2019

HPC and Big Data enabled large-scale test-beds and applications

Coordinator

Bonfiglioli SpA

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IOTWINS AT A GLANCE

20	16	23	1	12	3
M€ total value	M€ EU Funding	Partners	Platform	Testbeds	Application areas

- A European project to lower barriers for the uptake of Industry 4.0 technologies to optimize processes and **increase productivity, safety and environmental impact**.
- A technological platform allowing a **simple and low-cost access to big data analytics functionality**, **AI services and edge cloud infrastructure** for the delivery of digital twins
- 12 large scale testbeds, organized in three areas: **manufacturing, facility management and replicability/scale up** of such solutions.
- The identification of innovative business models to exploit the IoTwins PaaS infrastructure

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Partnership.

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PARTNERSHIP

10
Universities, Research Institutes, Associations

9
Manufacturing and electronics companies

4
Service Companies

Setting the context

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The context

- In recent years SMEs had to manage a variety of difficult issues and tackle complex challenges, like process automation, fault management, reliability assurance.
- Digital Twins are one of the most promising technology in the industrial and service sector. Common advantages are processes optimization, productivity increase, safety, resiliency, and a better environmental impact.
- However, currently:
  - there is no method nor framework to fully automate the development and deployment of digital twins to any context.
  - There is a gap of knowledge and expertise between artificial intelligence/data analytics specialists and SMEs.

- **High investments and specific competencies are needed to fully take advantage of these solutions.**

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The IoTwins objectives

- **IoTwins is working to lower the barriers for SMEs**. Designing technological platform that includes:
  - A simple and low-cost access to big data analytics;
  - Artificial Intelligence services to deliver digital twins in manufacturing and facility management sectors.
  - A reference architecture for the development and deployment of distributed and edge-enabled digital twins
- The 12 testbeds will collect large amounts of data to generate and refine the associated digital twins, including optimized models of resources, systems and processes involved
- **IoTwins digital twins are models that represent a system like an infrastructure or a machine.** These models include the system description and its dynamics, the prediction of its evolution and operations optimization, management and maintenance. They are used:
  - To Detect and diagnose anomalies
  - To Determine the optimal set of intervention
  - To enforce production processes quality management
  - To provide predictions for strategic planning.
- **All the IoTwins testbeds share the same methodology**, grounded on the concept of distributed IoT-/edge-/cloud-enabled hybrid twins, to replicate complex systems, with the ambition of predicting their dynamics and temporal evolution.

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Platform & Testbeds.

Hybrid, Distributed and Cloud Twins.

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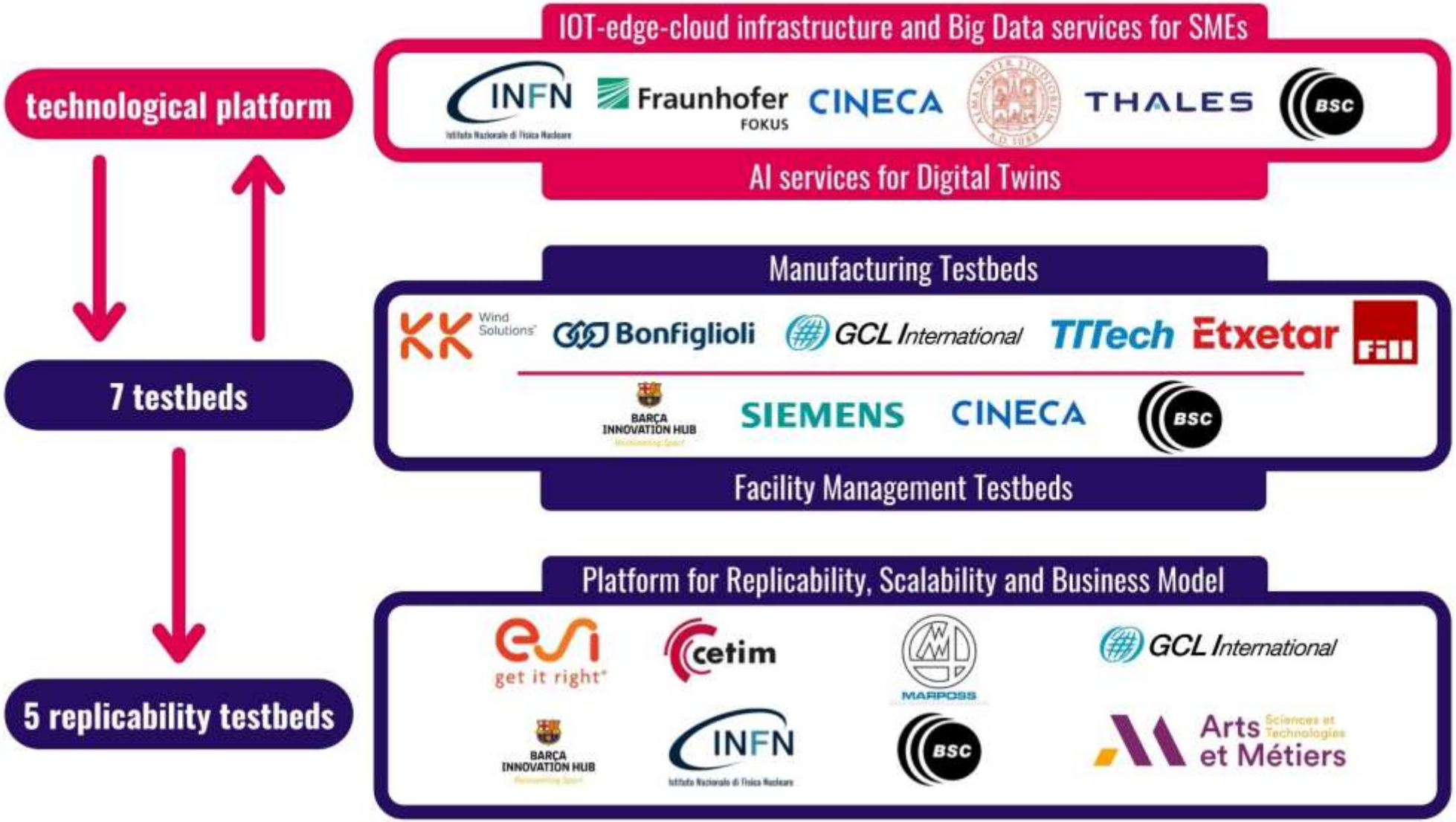
A TECHNOLOGICAL PLATFORM TO FEED 12 TESTBEDS



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Testbeds.

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12 LARGE SCALE TESTBEDS

manufacturing

1. Wind turbine predictive maintenance | Bonfiglioli, KK Wind Solutions
2. Machine tool spindle predictive behaviour | FILL
3. Predictive maintenance for a crankshaft manufacturing system | ETXE-TAR
4. Predictive maintenance and production optimization for closure manufacturing | GCL International

facility management

5. CAMP NOU – Sport facility management and maintenance | Futbol Club Barcelona
6. EXAMON – Holistic supercomputer facility management | CINECA
7. Smart Grid facility management for power quality monitoring | SIEMENS

replicability

8. Patterns for smart manufacturing for SMEs | Centre Technique des Industries Mécaniques
9. Standardization/homogenization of manufacturing performance | GCL International
10. EXAMON replication to other datacentres facilities | INFN, Barcelona Supercomputing Center
11. CAMP NOU replicability towards smaller scale sport facilities | Futbol Club Barcelona
12. Innovative business models for IoTwins PaaS in manifacturing | Marposs

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manufacturing

Testbed #1

Wind Turbine

predictive maintenance

THE ISSUE

A failure on the WTG can cause a production loss form 2 up to 4.000 € /day and repair cost from 60.000 up to 200.000€

Wind turbines are already using operating data to optimize performances but 2 main issues are still present.

- Some critical components have to be monitored in directly with some approximation.
- Acquisition frequency is generally low. So impulsive situations cannot be detected and can be quite dangerous for the WTG reliability and performances.

INVOLVED PARTNERS

TESTBED #1 WIND TURBINE PREDICTIVE MAINTENANCE

manufacturing

THE IOTWINS APPROACH

In IoTwins we are creating a **digital twin of a wind farm** by aggregating simulation and machine learning models of single turbines for predictive maintenance.

Data are used to detect the health status of the turbine to predict failures , to plan wind farm maintenance operations for reducing unexpected breakdowns and downtime.

The testbed will produce a smarter wind turbine by

- **integrating sensors, edge nodes and software components** providing efficient data transmission solutions and control system;
- **simulating the best orientation of blades** to increase energy production and reduce mechanical stresses;
- **developing predictive maintenance algorithms** for each component of the turbine and for the whole farm, based on the information gathered and on the scenarios simulated at the cloud side.

Expected: 20-50% MAINTENANCE COSTS SAVINGS

INVOLVED PARTNERS

Bonfiglioli Forever Forward | KK Wind Solutions | CINECA | INFN Istituto Nazionale di Fisica Nucleare | esi get it right | Arts et Métiers

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Testbed #5

Camp Nou

sport facility management and maintenance

TESTBED #5 CAMP NOU SPORT FACILITY MANAGEMENT AND MAINTENANCE

facility management

THE ISSUE

Camp Nou is the biggest stadium in Europe with almost 100.000 seats and people moving in an out the stadium

The main challenges are

- To maximize mobility and the safety inside and outside the stadium during events
- Manage at best possible evacuation or emergency situations.

Current crowd management systems are not capable of seizing large parallel computational power and their usability for rapid question answering is limited

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BARÇA INNOVATION HUB

Barcelona Supercomputing Center

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TESTBED #5 CAMP NOU SPORT FACILITY MANAGEMENT AND MAINTENANCE

facility management

THE IOTWINS APPROACH

With IoTwins project, we are creating a simulation scenario to analyse anonymized aggregated data and to apply ML technologies that will reproduce the public behaviour.

This testbed analyze how crowds move both historically and in real-time using a the IoTwins platform to collect, transmit and process data in real-time.

The simulation will be used to see what would be the result of the different responses that can be given in specific situations or incidents that are occurring in real time.

- To reduce the spectator's average time to cover the door-to-seat distance.
- To reduce the time for any potential evacuation plan, performing real time adaptations based on the occupation and distribution of the spectators by stadium sectors.
- To personalize the experience and the offering of services to the expected visitors' profiles, both on match and non-match days

INVOLVED PARTNERS

BARÇA INNOVATION HUB

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Thank you.

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