

# Convocatoria de ayudas de Proyectos de Investigación Fundamental no orientada

## TECHNICAL ANNEX FOR TYPE A or B PROJECTS

### 1. SUMMARY OF THE PROPOSAL

**PROJECT TITLE:** Expanding the Horizons of Manufacturing: Solving the Integration Paradox (EHMAN)

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#### SUMMARY

This proposal aims at the **enterprise-wide modelling and optimization (EWMO)** by the development and application of **integrated** modelling, simulation and optimization methodologies, and computer-aided tools for **reliable and sustainable improvement opportunities** within the **entire manufacturing network** (raw materials, production plants, distribution, retailers and customers) and **its individual components**. Such integrated approach, also incorporates information coming from the local **basic control and supervisory modules into the scheduling/planning formulation**, making it is possible to **dynamically react to incidents** occurring in the network components at the appropriate level of decision-making.

The use of an **integrated solution** will allow enhanced **coordination and cooperation between network components** by avoiding competition among them eventually leading to "local optima" and inefficiency associated to inconsistent isolated decisions at different levels. Such integrated solution approach will provide **new structural alternatives, more efficient management policies, more economical design options**, which can work in practice requiring fewer resources, emitting less waste and providing **better responsiveness in dynamic market requirements and operational variations**, thus leading to **reduced cost, waste, energy consumption and environmental impact** and also to **increased benefits**.

This will be achieved through the following R&D+i tasks:

- **Development of advanced mathematical models & methodologies** for integrated approach of:
  - **The network design problem** (e.g. location of plant, warehouses, and distribution centres, capacity and technology selection, etc).
  - **The supply chain planning problem** including distribution planning, inventory control and product demand forecasting.
  - **Integration of production, financial and environmental aspects, risk and uncertainty.**The models will be developed in a **multiobjective** view of achieving the necessary trade-off between often contradictory benefits in terms of economic, environmental, customer satisfaction and increased response to dynamic market changes.
- **Development of detailed production scheduling at plant level** for batch, continuous and discrete manufacturing for **on-line scheduling** that can be implemented in practice under real-time variations and uncertainty.
- **Integrating the tracking system of the network dynamics** within the holistic decision-making model by enclosing a model predictive control framework thus facilitating equipment capacity handling similarly at strategic and operational levels, and enabling adequate response to incidents **for enhanced production sustainability**.
- **Development of suitable frameworks and algorithms** for solving these problems in an efficient and integrated manner (disjunctive programming, Lagrange decomposition).
- **Development of software prototypes** for the implementation of the above methodologies and algorithms, illustrating their applicability in several **real-life industrial case studies** involving typical manufacturing/distribution networks belonging to relevant sectors in Europe