



Brief description of the project

❖ **Company name:** COMET

❖ **Title:**

Workplace redesign to improve safety in accordance with the principles of Industry 4.0 - Integration of smart, economical and ergonomic devices

❖ **Description of the scientific and educational objective:**

The use of load lifting / handling equipment is widespread in the manufacturing and process industry, but makes workplaces dangerous given the high potential for injuries and accidents. Today all companies are evolving in order to make their production processes more modern and to ensure maximum and flexible production, stimulating and safer work environments. For these reasons there is the need to adapt structures, to find innovative solutions to increase safety, to reduce environmental impacts and costs, to automate and monitor processes to make companies aligned with the Industry 4.0 principle envisaged by the PNRR. As regards the lifting / handling of loads, previous studies have highlighted the need for the equipment to be operated safely and be easy to maintain, considerably reducing the associated human errors.

This proposal aims at the redesign of the operator's workplace, assigned to the use of load handling devices, with the aim of preventing accidents, illnesses and deaths through the integration of an innovative safety device. The quantification of the impacts of the redesign of workplaces, following the introduction of the new safety device, follows an approach based on the use of key indicators for (i) the assessment of the safety and performance of load handling systems, (ii) the assessment of social and economic impacts.

The investigated device is an anti-collision system (Visual Guidance System, VGS), whose integration modifies the operator's tasks and the workplace. The operator will be able to perform his work with greater precision, thanks to a better view of the environment in which he operates, and therefore to increase the productivity of the company. The first version of the VGS prototype was developed within the SPRINCE (Smart Process Industry Cranes) project supported by INAIL. The device uses stereoscopic vision to acquire images of the workplace, create depth maps through which it calculates the load-obstacle and warning distances in the event of approaching a collision. The device in the current version needs further implementation to be adapted to any equipment and work environment. Further improvements relate to the software, which should be able to overcome the problems associated with handling the speed of the load and variations in the workplace. An integration system of the VGS with the management software will be implemented to facilitate an efficient dialogue that ensures the optimization of the integrated maintenance of the vehicle fleet, monitoring interventions and deadlines.

❖ **Company Supervisor:** Miduri Maurizio

❖ **Methods of training and research activities:**

The company, in addition to the academic path that doctoral students will follow in the three-year period, will support specific training in the following topics:

- Production process and logistics associated with production

- Regulations (Legislative Decree 81/08, Machinery Directive, technical regulations)

The research activity is summarized in the following steps:

A1 - Design of the integration of the VGS in the work environment

The design will be supported by prototype usage tests carried out in the company. These tests aim to identify the limitations of the currently available version of the prototype. The objectives are: (i) to assess the impacts associated with the use of VGS in complex industrial contexts, (ii) to verify compliance with the principles of Industry 4.0 and to propose adjustments, (iii) to quantify the resulting social and environmental benefits, i.e. the reduction of injuries due to collisions, the maximization of productivity and the awareness of safety and the reduction of costs for accidents (injuries and damage to property), and (iv) implementation of a system for integrating the VGS with the management software.

A2 - Evaluation of the results of each test and derivation of risk indicators.

The activity carried out aims at the derivation of technical, organizational and human factors (risk indicators) through: (i) Development of data collection questionnaires and (ii) Statistical analysis of data and development of risk-based early warning indicators.

A3 - Evaluation of the effects on safety and formulation of proposals for the improvement of the VGS

The activity involving an implementation of the VGS with respect to the industrial context of experimentation. A risk assessment of the implemented device will then be performed in order to quantify the impact on safety in the company.

A4 - Technical-economic analysis

The cost-benefit approach will be used to analyse the connections between techno-organizational factors, human factors and safety indicators, safety and costs, associated with the redesign of the workplace.

❖ **Effects and expected results with particular emphasis on promoting the economic development and the production system:**

The innovation of the project is guided by the various development areas and has the following effects: (a) reduction of the decrease in productivity due to accidents attributable to limited visibility of the workplace and to man-machine interaction, (b) reduction economic losses due to the cost of accidents, repair costs, disruption of material handling and increased workload on other equipment; (c) reduction of occupational diseases due to operator fatigue and stress due to the limitation of the visibility of the workplace and the problems of communication with other workers; (4) management of the emerging risks deriving from the increased use of systems with human-machine interface (software).

❖ **Period in the company**

The proposing company (COMET Srl) will host the PhD student beneficiary of the scholarship financed on the resources of the Ministerial Decree 352/2022 for no. 12 months during the PhD program.

❖ **Period abroad:**

Period abroad for no. 6 months at the following institution:
 aculty of Mechanical Engineering, University of Belgrade 16 Kraljice Marije Street, Belgrade

We also declare that this program complies with the principle "not to cause significant damage" (DHS) pursuant to art. 17 of regulation (EU) 2020/852 in coherence with the technical guidelines prepared by the European Commission (Communication of the European Commission 2021 / C58 / 01) and guarantees compliance with the horizontal principles of the PNRR (contribution to the climate and digital target so-called tagging, the principle of gender equality and the obligation to protect and enhance young people).