

**PUBLIC SELECTION BASED ON QUALIFICATIONS AND INTERVIEW FOR THE AWARDING OF NO. 6 EARLY SYAGE GRANTS FOR CONDUCTING RESEARCH PURSUANT TO ART. 22 OF LAW NO. 240/2010 AT THE DEPARTMENTS OF UNIVERSITY OF BERGAMO
PICA CODE 20AR022**

announced with decree of the Chancellor Rep. no. 479/2020 of 02.10.2020 and posted on the official registry of the University on 09.10.2020

RESEARCH PROJECT - CODE N. 1

“Workload-reduction machine vision-based technologies for manufacturing”

Research structure: Department of Management, information and production engineering

Duration of the grant: 12 months

Scientific Area: 09 – Industrial and information Engineering

Academic recruitment field: 09/G1 – Systems and control Engineering

Academic discipline: ING-INF/04 - Systems and control Engineering

Scientific Director: Prof. Fabio PREVIDI

The WATCHMAN project aims to develop a hub of skills and experimentation on Computer Vision, through the development of Research and Development Goals developed in two application cases. The main goal is the creation of a new element of manufacturing processes (process innovation) with a high impact on product quality. It is the creation of a methodology with a modular approach for the design of highly reconfigurable Machine Vision systems, thanks to the introduction of the latest technological innovations in artificial intelligence, vision systems, collaborative robotics and data management. The purpose of the intervention is the creation of an extremely modular and easily reconfigurable system prototype, capable of solving heterogeneous artificial vision problems in manufacturing and beyond. In particular, modularity will allow the creation of interconnected but independent systems, and therefore usable together or alone on the basis of the needs of the end user. The reconfigurability will make the system easily adaptable to the solution of artificial vision problems in very different productive realities, covering the whole of the Lombard manufacturing sectors.

The research activity will mainly be focused on two workpackages and on the final demonstrator prototypes (WP7 and WP8).

DATA MANAGEMENT module

This WP aims to perform research activities in the field of data management related to the project, specifically, architectures and technological solutions for data management using Cloud or Edge computing technologies. In addition, a study will be performed using ontologies to make the modularity and reconfigurability of the system more efficient.

The ultimate goal is the creation, at M18, of a prototype of the data management module that can be used in the project use cases and scalable to other industrial applications. The system will consist of SW and communication interfaces.

COLLABORATIVE ROBOTICS AND ERGONOMICS module

This WP has the purpose of carrying out research in collaborative robotics and ergonomics. Specifically, collaborative robotics processes will be identified and developed for the movement of items in a context of surface defect identification. In addition, solutions for the improvement of ergonomics will be studied and developed.

The ultimate goal is the creation, at M18, of a prototype of a robotic system that can be used in project use cases and scalable to other industrial applications. The system will consist of HW and SW and communication interfaces.

RESEARCH PROJECT – CODE N. 2

“Analysis of supply chain network configurations in multinational-multiproduct firms”

Research structure: Department of Management, information and production engineering

Duration of the grant: 12 months

Scientific Area: 09 – Industrial and information Engineering

Academic recruitment field: 09/B3 – Business and management engineering

Academic discipline: ING-IND/35 – Business and management engineering

Scientific Director: Prof. Matteo Giacomo Maria KALCHSCHMIDT

The proposed research project is part of an ambitious goal of advancement of knowledge within the framework of Operations & Supply Chain Management.

In particular, the proposed research focuses on the mapping and management of the production and supply chain of international multi-plant companies, with a view to strategic management of global production networks.

The research project aims to focus on international or global companies, focusing on aspects of configuration and coordination of the same, going specifically to deal with global production networks (International Manufacturing Networks - IMNs), that is, the set of production plants distributed globally that they represent the company's core asset.

The research project is initially divided into two different analysis perspectives. The first, more operational, focuses on the role of the plant, on the management of intra-plant dynamics and on the role that it plays especially in situations of co-location of productions of different nature (think of multiple product groups or multiple business units operating on the same site).

The second strategic perspective focuses on the management of the production network in its entirety, on the coordination dynamics between the various production poles of a company and on the variables that determine its managerial and organizational complexity.

Within these two macro-perspectives there is then space for a third intermediate perspective, that of the subnetwork, that is, of the factories of a company that work for the same group of products and through similar production processes. Current theories on international production networks do not explain in detail how organizations design international production networks for different products or product groups involving different groups of factories. This third perspective, therefore, rarely analyzed by the IMN literature, serves as a foundation for explaining the relationship between operational management of the plant and strategic management of the network, especially in contexts of great complexity.

The development of the project will therefore be articulated through the collection of data through case studies aimed at analyzing:

- the role of factories in global companies in a multi-production context;
- global production strategies in terms of flexibility, focus and network coordination;
- global production networks through the perspective of subnetworks.

The expected results, in addition to the description of how the production aspects of global companies are organized and how they are evolving in a context of strong uncertainty, want to generate knowledge for a more accurate management of the production strategy.

The expected results adapt to the contexts of already structured companies with global plants, but also to those companies in expansion, which must have an international structure in the years to come.

The project has been developed in close contact with the industrial world and aims to support companies from a strategic and operational point of view. The ultimate goal is the creation of a management model and specific frameworks that can help companies formulate multiple network scenarios, to adapt to today's reality and to face tomorrow's uncertainties. In terms of advancement in theoretical knowledge, however, this project would fill a gap within the literature on the manufacturing strategy, especially lacking in reference to international strategic management in multi-production contexts.

RESEARCH PROJECT – CODE N. 3

“Statistical modelling of COVID-19 and air quality relationships”

Research structure: Department of Management, information and production engineering

Duration of the grant: 12 months

Scientific Area: 13 – Economics and Statistics

Academic recruitment field: 13/D1 – Statistics

Academic discipline: SECS-S/02 – Statistics for experimental and technological research

Scientific Director: Prof. Alessandro FASSO'

Newspapers, media and even Environmental agencies around Europe reported that COVID-19 lockdown has implied an extended environmental clean-up. Considering air quality, we focus on the Lombardy Region, Italy, which is at the same time the most populous region and the most affected area by COVID-19 disease in Italy. Moreover, it is one of the most polluted areas in the EU.

In Italy, the lockdown was characterised by the closure of all non-essential activities and enterprises and by the minimization of individual mobility [2]. It has implied a generalised reduction of car traffic, see for example [3,4].

Now the question is: how to measure the variation of airborne pollutants such as Nitrogen dioxide (NO₂) and particulate matters (PM₁₀) related to car traffic?

In particular, the following sub-questions arise:

-Which is the reduction due to lockdown?

-How fast reacted the troposphere to the lockdown and to the restart after the end of the lockdown?

-The levels after pandemic will be the same as the pre-pandemic levels?

This issue is especially important because Lombardy in general, and Milan in particular, faced various traffic policies in recent years with heterogeneous effects on the air quality [1,5].

To answer these questions, we will use data from January 2015, provided by the regional environmental protection agency (ARPA Lombardia) for 74 monitoring stations, and reclassified as traffic, background and rural.

To cover all these factors, we will use some statistical spatiotemporal models able to assess the combined impact of meteorology, seasonality, trend and lockdown on the NO₂ and PM₁₀ concentrations in each monitoring station and in the region as a whole.

RESEARCH PROJECT – CODE N. 4

“Ergonomics and collaborative robotics in industrial vision systems”

Research structure: Department of Management, information and production engineering

Duration of the grant: 12 months

Scientific Area: 09 – Industrial and information Engineering

Academic recruitment field: 09/A3 – Industrial design, machine construction and metallurgy

Academic discipline: ING-IND/15 – Design methods for industrial engineering

Scientific Director: Prof. Caterina RIZZI

The WATCHMAN project aims to develop a hub of skills and experimentation on Computer Vision, through the development of Research and Development Goals developed in two application cases. The main goal is the creation of a new element of manufacturing processes (process innovation) with a high impact on product quality. It is the creation of a methodology with a modular approach for the design of highly reconfigurable Machine Vision systems, thanks to the introduction of the latest technological innovations in artificial intelligence, vision systems, collaborative robotics and data management. The purpose of the intervention is the creation of an extremely modular and easily reconfigurable system prototype, capable of solving heterogeneous artificial vision problems in manufacturing and beyond. In particular, modularity will allow the creation of interconnected but independent systems, and therefore usable together or alone on the basis of the needs of the end user. The reconfigurability will make the system easily adaptable to the solution of artificial vision problems in very different productive realities, covering the whole of the Lombard manufacturing sectors.

The research activity will mainly be focused on one workpackage: COLLABORATIVE ROBOTICS-ERGONOMICS module

The goal is to allow robots and human operators to work together with mutual benefit. The robot moves the image acquisition system by sharing the space with the operator who is in turn involved in training the robot which provides information on the operator's posture to maximize the ergonomics of the workstation.

RESEARCH PROJECT - CODE N. 5

“Computer technologies for the protection of digital data markets”

Research structure: Department of Management, information and production engineering

Duration of the grant: 36 months

Scientific Area: 09 – Industrial and information Engineering

Academic recruitment field: 09/H1 – Information processing systems

Academic discipline: ING-INF/05 – Information processing systems

Scientific Director: Prof. Stefano PARABOSCHI

The objective of the project is to operate in the scenario of digital data markets. A line of research concerns the development of techniques for managing high-level security policies that specify the data owner's preferences with respect to how data can be transmitted and manipulated in a market for access to digital data. The second line of research looks at the application of security requirements in technologies for handling large amounts of data. For instance, Cloud infrastructures and technologies based on evolutions of the map-reduce paradigm are considered.

RESEARCH PROJECT - CODE N. 6

“Real-time on-site forensic trace qualification (RISEN)”

Research structure: Department of Law

Duration of the grant: 12 months

Scientific Area: 06 - Medicine

Academic recruitment field: 06/M2 - Forensic and occupational medicine

Academic discipline: MED/43 - Forensic medicine

Scientific Director: Prof. Francesco Saverio ROMOLO

The aim of the RISEN project is the development of an innovative approach for the activities on a crime scene, including disaster sites and terrorist attacks. A set of real-time contactless sensors will be developed for the optimization of the trace detection, visualisation, identification and interpretation on-site, with a consequent reduction of the time and resources in the laboratory.

<https://www.risen-h2020.eu/>

STEP 1

The researcher will focus on the state of the art of technical capabilities for the investigation of trace evidence in selected forensic scenarios. The tangible tasks of this step 1 are to review state-of-the-art of: 1) Techniques used in forensic investigation (analytical, photography, 3D, etc.); 2) Quality assurance tools and techniques; 3) Analytical markers; 4) Operational procedures including time for analysis, manpower needed, missed and misinterpreted traces; 5) Review standards in forensic analysis and data sharing among LEAs. The development of point 5 will provide an overview and an assessment of existing formal and informal standards on National, European, and International level (CEN, ISO etc.) as well as regulatory framework that has to be considered.

STEP 2

Selected traces will be studied to evaluate their analysis and forensic interpretation in laboratories for the transfer of the knowledge from forensic laboratories to the crime scene. In more details the study will provide the following tasks: 1) Forensic operational procedures for both conventional and state-of-the-art laboratory approaches will be collected and summarised; 2) Relevant information about validation, time for analysis and price of the equipment will be collected; 3) A list of validation procedures from forensic laboratories will be also prepared.