IMT SCHOOL FOR ADVANCED STUDIES LUCCA

PHD IN "MANAGEMENT OF DIGITAL TRANSFORMATION"

RESEARCH PROJECTS

Project title: Precision medicine

Company: ROCHE

Project description

Regarding the research project, the PhD students will focus on the topic of implementing personalized medicine (PM) solutions in the clinical setting.

In terms of training, PhD students will participate in specialized advanced courses offered by the PhD program of the IMT School for Advanced Studies Lucca on topics such as enabling technologies for Industry 4.0, health economic models to assess the cost-benefit ratio of innovative health interventions, the management of innovative health technologies, and digital transition processes and their impact on improving health services.

If necessary, this training activity can be enriched by additional external courses or by seasonal schools on specific topics aimed at developing research work. In addition to courses of a scientific and technical nature, the student will develop soft skills through seminars offered by the IMT School for Advanced Studies Lucca on the fundamentals of academic entrepreneurship, intellectual property management, communication techniques for the dissemination and valorization of research, and critical thinking. The skills acquired aim at developing the research project and training a researcher for his future job placement both in the academic field and in technical-scientific and managerial positions in public and private companies.

Regarding the research project, the PhD student will focus on the implementation of personalized medicine in healthcare and clinical settings, with a particular emphasis on the health economic implications of personalized medicine.

As the potential benefits of genomics and PM began to unfold, the concept of Predictive, Preventive and Personalized Medicine (PPPM or 3P Medicine) represents a new era in 21st century medicine: Precision medicine interventions are demonstrating their health benefits to people's and patients' lives while becoming more affordable to be reimbursed by health systems. Nevertheless, the introduction of precision medicine in the clinical setting requires innovative organizational solutions and the development of appropriate HTA and health economic modelling approaches.

This PhD position aims to develop an interdisciplinary approach to accurate economic and social evaluation of precision medicine interventions (i.e., drugs, diagnostics including companion diagnostics).

For precision medicine to flourish as an emerging industry and for health systems to modernize, public and private investments must be thoughtfully and strategically planned, while public policy must create an enabling environment. The following three points are essential first steps to keep Italy and the EU as a whole at the forefront of healthcare:

- Quantitative and qualitative analysis is needed to determine what policies need to be implemented at the regional and national levels, what data infrastructure needs to be developed and implemented, and what personnel need to be properly trained to bring PM to bear and ensure that data can be shared securely and anonymously both nationally and internationally. Looking to England and Australia as models for implementing national genomics strategies may help.
- Health economics approaches to evaluating precision medicine and architectural innovation in health care. New solutions based on health analytics and real-world evidence will be developed.
- An interdisciplinary approach must be implemented to evaluate the ethical, social, regulatory, and sustainability requirements of personalized medicine.

Research outputs include publications on health economic models for precision medicine, appropriate reimbursement systems based on cost-benefit analysis, and new organizational and analytical solutions for precision medicine.

This scholarship includes a mandatory internship at ROCHE (from a minimum of 6 months to a maximum of 18 months, depending on the research plan), and a visiting period in a research center abroad (from a minimum of 6 months to a maximum of 12 months).

Project title: Territorial-based management of patients with cancer

Company: Toscana Life Sciences

Project description

From a training point of view, the Ph.D. student will attend specialized advanced courses provided by the Ph.D. program of the IMT School for Advanced Studies Lucca on topics concerning enabling technologies for healthcare 4.0, the management of innovative and digital technologies for health as well as digital transition processes and their effect on the improvement of healthcare services.

Where necessary, this training activity can be enriched by additional external courses or by seasonal schools on specialistic topics aimed at developing the research thesis. In addition to the courses of a scientific-technological nature, the student will develop soft skills through seminars offered by the IMT School for Advanced Studies Lucca on the foundations of academic entrepreneurship, the management of intellectual property, communication techniques for dissemination and valorization of research, and critical thinking. The skills acquired will be aimed at developing the research project and training a researcher for his future job placement both in academia and in technical-scientific and managerial roles in public and private companies.

Regarding the research project, the Ph.D. student will concentrate their activities on the transformation of healthcare governance for better managing cancer patients in all phases: primary prevention, treatment, follow-up, and secondary prevention. This research program will tackle the main challenges of health and care in Europe, which is being radically transformed along four main drivers:

- Improve the health outcomes towards more predictive, preventive, personalized, and participative health;
- Combination of traditional therapies, immunologic, nutrigenomics, and genomics with digital therapies that can be delivered in settings other than Hospitals;
- Capacity to gather and process huge datasets to better plan healthcare interventions;
- The disruption of new technologies such as Artificial Intelligence, the Internet of Medical Things, augmented reality, and process automatization for better management of cancer patients;

There are 3.6 million cancer patients in Italy, with 1000 new diagnoses every day. These patients are mainly treated in traditional healthcare facilities. The management of cancer patients accounts for 20 Billion €/year to the public healthcare system. To date, as the uptake of digital solutions for health services remains slow and varies significantly across Member States and regions, further action is crucial to accelerate the meaningful use of digital solutions in public health and healthcare to improve the management of cancer patients.

With regard to the research project, the Ph.D. student will focus on the study of:

1. Interoperable GDPR-compliant and cross-regional healthcare models able to fully exploit health data using innovative digital approaches (AI, big data analytics, machine learning, etc.);

2. Data standardization/interoperability models for collection and use of data for public health purposes; Standards for data quality for research purposes (i.e., HTA, PoC);

3. Accessibility, cyber security, privacy & data protection standards;

4. Governance and procurement models for implementing territorial-based management of cancer patients.

Project title: Knowledge Network Analysis

Company: ENI S.p.A.

Project description

Knowledge Network Analyses (KNAs) are activities for collecting, analyzing, and interpreting data related to collaborative networks between people.

At Eni, KNAs have been conducted for about 10 years to study how these networks evolve over time due to organizational changes and the evolution of the company's business units.

The research activity of the PhD student, which takes place within the Doctoral Program in Management of Digital Transformation, consists of:

- developing effective surveys and data collection strategies on inter-organizational collaboration networks;
- analyzing and interpreting the knowledge network data to identify key findings to support innovation;
- examining the temporal evolution of the network by comparing the results of similar KNAs repeated over time;
- proposing new techniques and solutions to measure and incentivize collaboration in specific areas.

The above-mentioned research activity is developed within the framework of the project "Economic and Digital Resilience" (RED), thanks to which the IMT School has been selected among the Departments of Excellence 2023-2027 and has received funding of more than 5 million euros from the Italian Ministry of University and Research.

The RED project aims at analyzing the available evidence on economic and digital resilience in an interdisciplinary way in order to develop innovative digital solutions for the new way of working after the pandemic. At the heart of the project is the creation of a virtual lab, called Open Lab, which will allow online, field and remote experiments to be carried out and, in parallel, will make a crucial contribution to doctoral training based on the learning-by-doing model.

This scholarship includes a mandatory internship at Eni (from a minimum of 6 months to a maximum of 18 months, depending on the research plan), and a visiting period in a research center abroad (from a minimum of 6 months to a maximum of 12 months).

Project title: Development of new technologies for the hydrogen supply chain: simulation methods aimed at the industrialization of devices for the production, storage and use of hydrogen

Company: Ne.m.e.sys S.R.L.

Project description

From a training point of view, the PhD student will attend specialized advanced courses provided by the PhD programme of the IMT School for Advanced Studies Lucca on topics concerning enabling technologies for Industry 4.0, the management of digital transition processes and their effect on ecological transition and environmental impact. Where necessary, this training activity can be enriched by additional external courses or by seasonal schools on specialistic topics aimed at developing the research thesis. In addition to the courses of a scientific-technological nature, the student will develop soft skills through seminars offered by the IMT School for Advanced Studies Lucca on the foundations of academic entrepreneurship, on the management of intellectual property, on communication techniques for dissemination and valorization of research and on critical thinking. The skills acquired will be aimed at developing the research project and training a researcher for his future job placement both in academia and in technical-scientific and managerial roles in public and private companies.

With regard to the research project, the PhD student will focus their activities on the mechanics of materials for the hydrogen supply chain, in cooperation with the company Ne.m.e.sys srl, a research company specialized in development of technologies for the hydrogen supply chain, 30% owned by Nuovo Pignone Holding spa of the international Baker Hughes group. Baker Hughes with Ne.m.e.sys is committed to fostering the energy transition and guaranteeing continuity for society's energy needs, targeting the world goals by 2050.

Manufacturing technologies are developing innovative fuel cells to produce low-cost hydrogen. For example, the United States Office of Energy Efficiency & Renewable Energy has set the goal of 2 $/kg by 2025 and 1 $/kg by 2030, through a path to net zero carbon emissions. In Italy, the cost of producing hydrogen at industrial sites is around 6 Euro/kg and the price of hydrogen in a pumping station is around 13 Euro/kg. New materials and technologies used for fuel cell membranes are expected to have a positive impact on reducing manufacturing costs. Likewise, their use in combination with intermittent sources can lead to more efficient distribution networks, significantly reducing delivery costs.

This PhD position aims to develop an interdisciplinary approach for an accurate assessment of the operational characteristics of hydrogen fuel cell technologies and storage systems, integrating materials research when considering realistic usage operations and accurate assessment of the life cycle (LCA). Research on computational mechanics will be exploited to develop models for the evaluation of the durability of components (membranes, porous materials, etc.) used in standard and innovative fuel cells, towards a more accurate evaluation of their duration and costs. Knowledge of electrical networks and intermittent renewable sources (eg wind and photovoltaic) will be used to evaluate the operational performance in the reduction of disturbances on the energy distribution network. The result of the technical information will be integrated with a refined LCA approach, in order to support informed decisions of policies and decision makers on key topics ranging from the operation to the end of life of fuel cells.

The research product will concern publications on the proposed methods for the mechanical characterization of materials and devices for the production of hydrogen. These results can be achieved both with traditional methods of an experimental nature, and through innovative methods of numerical simulation conducted with virtual testing techniques. The latter represent one of the main enabling technologies for Industry 4.0 aimed at reducing the time associated with laboratory experimentation and the development of new products and materials.

This scholarship includes a mandatory internship at Ne.m.e.sys (from a minimum of 6 months to a maximum of 18 months, depending on the research plan), and a visiting period in a research center abroad (from a minimum of 6 months to a maximum of 12 months).