



IMT SCHOOL PHD PROGRAM IN "MANAGEMENT OF DIGITAL TRANSFORMATION",

**CALL FOR APPLICATIONS 2024/2025
EXECUTIVE SUMMARY**

PHD PROGRAM DESCRIPTION

The IMT School for Advanced Studies Lucca has launched the call for applications for the PhD Programs in "Management of Digital Transformation" (2024/2025 academic year):

<p>Course Description</p>	<p>The digital transition implies profound and highly complex technological, organizational, managerial, and economic changes in all sectors of society, with an important impact on green revolution and environmental sustainability. The ability to govern such changes is essential to take advantage of the opportunities made available by digital innovation by dominating the potential associated risks. The entrepreneurial system, in particular the small and medium-sized enterprises that constitute the beating heart of the Italian economic fabric, may not be ready to grasp the challenges posed by the digital transition as they do not have distinctive multi- and interdisciplinary skills capable of combining set strategic directions with the innovations deriving from the application of digital technologies. Digital transformation also necessarily addresses the psychological and cultural elements of change. Therefore, a correct socio-cultural, behavioral, and psychological approach is necessary to foster change.</p> <p>The objective of the PhD course in "Management of Digital Transformation" is to train a new executive class to respond to the management needs of digital transition processes, drawing inspiration from and responding to the needs outlined in the PNRR to bring businesses and institutions together with universities and research.</p> <p>The MDT doctoral program pursues this goal by combining a "horizontal" approach to academic activities with a "vertical" approach to research. The PhD Program offers a cross-disciplinary educational offer of a multidisciplinary nature dedicated to digital transition issues addressed from a cultural, economic, social, engineering, IT, legal, managerial, neuroscientific, and psychological perspective. Research activities envision a specific in-depth study on a highly-qualified scientific project aligned with the student's curricular profile and motivations.</p> <p>In this context, a distinguishing feature of the PhD Program is the presence of companies and institutions: in fact, a preponderant share of scholarships is expected to be co-financed by - and each scholarship linked to - a research project developed jointly by an academic advisor, to ensure scientific quality, and by a company/institution representative, to ensure the impact, even in the long term, of the research object.</p>
<p>Output Profiles</p>	<p>With the advent of enabling technologies for Enterprise 4.0, the skills and abilities sought will change. To date, companies and public institutions are encountering increasing difficulties in identifying, both at the level of graduates and graduates, the skills necessary for the digital transition. Universities cannot adequately train people and guarantee an effective and rapid placement into the job market around these</p>



	<p>innovative issues. Thus, this PhD Program aims to provide highly sought-after digital skills for the new tasks of the future, that is, that extensive set of technological skills that make it possible to identify, evaluate, use, share, and create content thanks to information technology. The PhD Program will also provide in-depth transversal skills both in research and innovation on enabling technologies for Industry 4.0, with particular regard on their exploitation for the green revolution and the environmental sustainability, and for corporate lean and personnel management to be in line with the features of intelligent work, i.e., work that integrates manual interventions with solid technical skills of analysis, diagnosis, and scientific reasoning, and the application of complex knowledge.</p> <p>Career opportunities comprise the academic field in different scientific disciplinary sectors, including engineering, information technology, and economics, as well as technical-scientific and managerial roles in public and private companies and institutions. The partnership with leading companies and institutions in their respective sectors to develop research projects of high industrial and applied interest will provide an additional advantage to students in terms of employment opportunities.</p>
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The IMT School adopts equal opportunity principles in its selection procedures and rejects any type of discrimination based on sex, gender identity, nationality, ethnicity, religious belief, sexual orientation, state of health, and any other status or quality that is not strictly relevant to the call outlined in this document.

Program official duration: 3 years.

Programs start on November 4th, 2023.

PhD Program Coordinator: Prof. Marco Paggi

Program official language: English.

Scholarships: 5 (distributed among research projects as follows)

Project Title	Companies
Digital twin technologies for materials and manufacturing processes of the footwear industry	Tacchificio Villa Cortese S.r.l.
From niche to scale: Strategic and operational dynamics in high-tech manufacturing firms	Sigma Ingegneria S.r.l.
Numerical methods for fluid dynamic simulations in glass furnaces	Stara Glass S.p.A.
Advanced big data analytics based on machine learning for the ceramics and glass industry	Colorobbia Holding S.p.A.



From donation to drug: Strategic, operational, efficiency and implementation dynamics in bio-pharmaceutical industries with high-impact on the availability of drugs for rare diseases

Kedrion Biopharma S.p.A.

The number of positions may be increased in the event that additional funding is made available after the publication of the Call.

Scholarship gross amount: 16,243.00 Euros/year (see the "Scholarships" paragraph).

Additional benefits:

- All PhD students admitted to the PhD Program are exempt from paying tuition fees, although they are still responsible for paying the yearly Regional Education Tax (currently 140.00 Euros/year);
- All PhD students are offered free meals (lunch and dinner) at the on-campus canteen;
- All PhD students are provided with free accommodation in shared double rooms within the campus residential facilities.

REQUIREMENTS

Applications are open to candidates who meet the following requirements:

1. **Degree:**

- "Laurea Magistrale" or "Specialistica" (according to DM no. 509, of November 3, 1999), or a four- or five-year degree (according to the previous rules of the Italian higher education system) obtained in Italy;
- Foreign degrees that give access to the PhD in the Country where it has been awarded.

For the selection procedure, candidates are required to upload the documents indicated in Table 2 - Attachments to the application.

Applicants who obtain their degree by no later than **October 31st, 2024**, can also apply. These candidates will be admitted to the selection procedure "with reserve" and must provide their degree certificate by the date of enrollment, or they will be excluded from the program.

2. **Knowledge of the English language:** Applicants are required to indicate their level of English.

APPLICATION

The **application form** must be **mandatorily** filled out in **English** through the School's online procedure **by August 30th, 2024, at 1:00 pm (CEST)**.

Applicants must upload the **documents** in **PDF**. The **maximum size is 30MB** for each attachment.

The Selection Committee will accept **attachments** in **Italian or English only** (unless otherwise specified in the table below).



Table 1: Information		
Personal information	compulsory	In this section, applicants must enter their personal data (name, address, contact details, etc.).
English Language Level	compulsory	Applicants must indicate their level of English.
Additional information/Interview	compulsory	Applicants have to indicate the modality for the interview (IMT School campus, videoconference, or similar, or by telephone at an Italian embassy/consulate).
Additional information/Disability	optional	Applicants should indicate if they need assistance to participate in the selection procedure.
Additional information/How did you first find out about IMT?	compulsory	Applicants are required to indicate how they found out about the IMT School.
Education	compulsory	Applicants are required to indicate their university degrees (whose duration must be equivalent to at least 4 years of university studies), the average exam mark, and final grade (if any) for each degree obtained.
Additional qualifications	optional	In this section, applicants may list any other qualifications considered relevant in relation to their application.
Publications	optional	Applicants can list their own published articles, books, or any material that may be considered relevant for the PhD and research activity.

Table 2: Attachments		
1	Copy of National Identity Card or Passport	<p>compulsory</p> <p>Applicants have to upload a copy of a valid identity document:</p> <ul style="list-style-type: none"> • <u>For Italian and EU citizens</u>: Valid National Identity card or Passport • <u>Non-EU applicants</u>: National Identity card or Passport (the latter is highly recommended). <p><u>The copy has to be signed by the candidate, indicating the date and place of the signature.</u> In particular, the document has to contain the applicant's photograph, personal data, and document</p>



			<p>number, place and date of issue. If any of the above information is missing, the document will not be accepted.</p> <p>If the document is not in English or Italian, a translation into English or Italian should also be uploaded (an official/legal translation is <u>not</u> required).</p> <p>In the event that the copy of the document is unreadable, the Selection Committee may request a new submission.</p>
2	Curriculum vitae et studiorum/Resume	compulsory	<p>Applicants must upload their curriculum vitae et studiorum/resume in Italian or English (the latter is highly recommended), indicating their university degrees, work and research experience, and publications (if any).</p>
3	Education	compulsory	<p>Candidates are required to upload one of the following documents in Italian or English:</p> <ul style="list-style-type: none"> • for degrees obtained in Italy and/or in France, Ireland, Belgium, Denmark (Bruxelles Convention of May 25, 1987), and Germany (Italian-German Convention, ratified by the Law no. 176 of 1973): a self-declaration stating the possession of a degree, conferral date, issuing University, and final grade; • for degrees obtained in all other EU and non-EU countries: an official certificate indicating the possession of a degree, conferral date, issuing University, and final grade.
4	Academic transcript/Diploma supplement	compulsory	<p>For each degree, the applicant has to attach one of the documents listed below in Italian or English (English is highly recommended):</p> <ul style="list-style-type: none"> • Academic transcript: an official document detailing the course, classes attended or subjects studied and results, completion date, graduation date; <p><u>or alternatively,</u></p> <ul style="list-style-type: none"> • Diploma Supplement: document produced by the University accompanying the diploma, providing a standardized description of the nature, level, context, content, and status of the studies completed by the applicant (https://ec.europa.eu/education/diploma-supplement_en).
5	Research Project	compulsory	<p>Candidates are required to express their preference for up to three (3) research projects as referred to in Article 1 of this call for applications.</p> <p>The preference expressed by candidates will not be binding when assigning the projects (see "Final Ranking").</p>
6	Research Statement	compulsory	<p>To best evaluate each candidate's aptitude for the PhD Program, all candidates must upload a document (maximum 10,000 characters, spaces included) mandatorily in English, describing:</p>



			<ul style="list-style-type: none"> - the candidate’s competencies and experiences within the scientific or academic field relevant to the project(s) chosen and how they would use them to address the project(s); - the candidate’s motivation for pursuing study at the IMT School, with particular reference to the project(s) chosen; - future projects.
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If the application lacks a piece of information or an attachment referred to as "compulsory", applicants can be conditionally admitted to the selection procedure. Their application will be considered valid only if they produce the required documents by the day scheduled for the interview.

The correct completion of the online application procedure is **confirmed by an automatic email** sent to the email address indicated by each applicant while registering for the procedure; the message only confirms the receipt of the application. The School will not verify the validity and completeness of applications before the call closes.

After the submission, no changes are allowed to the entered data.

Candidates are also required to fill out a **separate section of the application form** dedicated to referees:

References	compulsory	<p>Applicants are required to provide the names and contact information of two referees.</p> <p>The referees who are invited to submit a reference letter in English through the IMT School’s online application system, - by September 3rd, 2024, at 1:00 pm (CEST), will receive an automatic notification from the School’s application system.</p> <p>Applicants will receive an automatic notification when a letter is submitted, but they may not access any reference provided.</p>
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SELECTION COMMITTEES

The Selection Committee is nominated by decree by the Rector of the IMT School in accordance with the School regulations and comprises experts from relevant fields.

EVALUATION CRITERIA AND SELECTION PROCEDURE

Evaluation criteria

The Selection Committees will evaluate candidates’

- academic background, knowledge, skills, and scientific potential;
- general aptitude for research and potential to collaborate in the specific research activities of the selected Track in the application form;
- interdisciplinarity, knowledge, and skills with reference to the multidisciplinary of the IMT School PhD Programs;
- pertinence to a track different than the one selected in the application form.

Assessment of qualifications

The first phase of the selection procedure is the assessment of qualifications. This assessment is carried out in relation to the specifics of the PhD Programs and specifically to determine who is admitted to the interview.

In the assessment of qualifications phase, the evaluation of the candidates is carried out by the Committees defined in the previous paragraph "Selection Committees" and based on the candidates' application form, uploaded documents, and reference letters provided by referees.

Based on the assessment of qualifications, the Selection Committees will draw up a shortlist of candidates admitted to the interview in alphabetical order.

The shortlist of applicants admitted to the interview will be published on the School's website and Online Notice Board ("*Albo Online*").

This is the only official communication of the preliminary results to all applicants.

Interview

Candidates admitted to the **interview** – that will take place on **September 25th, 2023** – must confirm their participation by email to phdapplications@imtlucca.it within two (2) days of the publication of the shortlist, confirming their preference to have the interview conducted in one of the methods indicated in the "Application" paragraph of this call.

During the comprehensive interview, the Selection Committees will assess the candidates' knowledge and skills with reference to the specific characteristics of the PhD Program.

The Selection Committees will assess all interviews by assigning a score (up to 100 points): applicants scoring at least 70 out of 100 will be eligible for the Program and, therefore, listed in the final ranking.

Final rankings

At the end of the interviews, the Selection Committee will draft the final ranking of the eligible candidates for each research project according to the scores obtained in the interview. The preference expressed by candidates in the application form is not binding: the Committee can thus assign candidates to the ranking of projects deemed most corresponding to their profile.

In the event that additional subject-restricted positions become available after the opening of the present call for applications, the Selection Committee reserve to assign eligible candidates to the relevant rankings.

If multiple candidates get the same score, preference will be given to the youngest candidate.

In the event of the withdrawal or exclusion of a candidate, they shall be replaced by the next suitable candidate according to the ranking.

All rankings will be published on the School's website and Online Notice Board ("*Albo Online*").

ENROLLMENT

Once admitted to the PhD Program, candidates wishing to enroll must submit the complete enrollment form to the IMT School **no later than five (5) days from the publication of the results** on the School's Online Notice Board ("*Albo Online*") and website, using one of the following methods:

- in person or by post to:



SCHOOL
FOR ADVANCED
STUDIES
LUCCA

IMT School for Advanced Studies Lucca
PhD and Higher Education Office
Piazza S. Ponziano, 6
55100 Lucca – Italy

- by certified email to imtlucca@postecert.it

Failure to submit the enrollment request by the deadline and through the above-mentioned methods will result in an automatic withdrawal of the candidate from the Program.

The enrollment request is valid only if all the requested documents have been enclosed.

If any of the documents submitted during the application procedure do not correspond to those submitted during enrollment due to an intentional false declaration, the applicant will automatically lose their right to enroll in the program.

Enrollment is effective on the first day of official classes. Unauthorized absences may nullify the enrollment procedure.

SCHOLARSHIPS

The scholarship amount is 16,243.00 Euros/year and shall be disbursed in monthly installments.

For any research or training activities at universities or research centers abroad, the scholarship amount is increased by 50% for the first nine (12) months.

Scholarships are subject to the payment of social security contributions (INPS) managed separately under Article 2, paragraph 26 of Law no. 335 of August 8, 1995, as amended, with two-thirds paid by the Administration and one-third by the scholarship recipient.

Admitted candidates who have already benefited from a PhD scholarship in Italy cannot be assigned another one.

The scholarship has a maximum duration of three (3) years and is subject to annual confirmation: according to articles 15 and 16 of the IMT School PhD Regulations, students must complete all the activities provided for each academic year.

If a student withdraws or is excluded within 45 days from the beginning of the Program, they are not entitled to the scholarship. The scholarship will be awarded to the next eligible candidate according to the final ranking. For this reason, the first scholarship payment will be made only after the successful completion of the first 45 days of the program.

If a student registers after 45 days from the beginning of the Program, he/she is entitled to the scholarship starting from the actual date of enrollment.

FACILITIES

Residential facilities: accommodation

All PhD students who are granted a scholarship have free accommodation in shared double rooms with private bathrooms, priority being given to on-campus residential facilities, or are assigned a housing grant for the entire official duration of the Program (3 years), except for periods spent off campus for study and/or research.

The School can revoke the right to accommodation if it is rarely or not used.

Residential facilities: canteen

All PhD students are offered free meals (lunch and dinner) at the School canteen located on campus for the entire official duration of the Program (3 years). Lunch and dinner are served each day, Monday through Sunday, for the entire academic year, except for the closing periods.

Other facilities

All PhD students have access to library facilities and can benefit from the IT support services for all technical requests related to study and research until the thesis defense.

The School subscribes to an insurance policy for all PhD students. It provides coverage against accidents and injuries incurred by students in Lucca or abroad while performing academic activities. The IMT School also provides students with health insurance policies for research trips outside Europe (students are automatically covered in European countries).

All international PhD students are offered the possibility to take an Italian language and culture course.

TREATMENT OF PERSONAL DATA

The IMT School will use the personal data provided by applicants solely for selection procedures and institutional aims in accordance with the provisions of the current European and Italian legislation (EU Regulation 2016/679 and Italian D. Lgs. 196/03 - *Italian Privacy Code*, as modified by the D. Lgs. 101/2018) and the relevant School Regulations.

Applicants are granted all the rights established by art. 15, sections 2, 3, and 4 of Chapter III, and art. 77 of the EU Regulation 2016/679.

For further information regarding the call and the selection procedure, please contact the PhD and Higher Education Office by email at phdapplications@imtlucca.it or by phone at +39 0583 4326530.

Further information regarding the PhD Programs and the IMT School is available at www.imtlucca.it.

FINAL PROVISIONS

Relevant laws and the IMT School PhD Regulations shall be applied to any issue or item not covered by the present call for applications.

**PHD IN "MANAGEMENT OF DIGITAL TRANSFORMATION"
RESEARCH PROJECTS**

Digital twin technologies for materials and manufacturing processes of the footwear industry

The research project addresses some of the open questions related to the digital transformation of the fashion industry regarding the integration of simulation tools with the traditional production processes of materials, and in particular those related to production of high-quality footwear. The growing trend towards the introduction of new eco-sustainable materials and methods of joining different material constituents requires experts in experimental techniques who are also able to perform advanced numerical simulations for product optimization and higher levels of quality control.

To this end, this project is looking for a PhD student graduated primarily from areas such engineering or materials science interested in acquiring skills of simulation tools for mechanics of materials, materials science and manufacturing processes at research level, and to apply these methods to complex problems in the shoemaking sector, exploiting the collaboration with Tacchificio Villa Cortese (Villa Cortese, Milan) as a leader of this industrial field.

The PhD student will attend during the first semester a minimum of 150 hours of core and specialized courses delivered by the Faculty of the PhD programme of the IMT School for Advanced Studies Lucca on topics concerning enabling technologies for Industry 4.0, innovation, and fundamentals of sustainability. Specific training will focus on numerical methods for virtual testing of materials and for the development of digital twin models of production processes, with special attention to those used in the fashion industry and specifically for footwear. The student will also learn how to integrate computer aided design (CAD) data with computer aided engineering (CAE) simulation tools for product performance assessment and optimization. In relation to production processes, the student will face both traditional methods, such as injection molding, and modern techniques for customized production and prototyping, such as 3D printing technologies. Training on simulation methods will be complemented by acquiring experimental skills on standard and advanced material testing for the footwear materials, with also attention to new eco-sustainable solutions. For the experimental activities, the student will exploit the facilities of the MUSAM Lab on Multi-scale Analysis of Materials at the IMT School for Advanced Studies Lucca (tensile/compressive/cyclic tests in ambient temperature or inside a thermostatic chamber; digital imaging techniques; confocal profilometry for defect inspection) and of the research laboratory of Tacchificio Villa Cortese (mechanical tests, impact tests, climatic conditioning of materials) during the industrial internship (minimum 6 months, maximum 18 months). A research period abroad of 6 months duration is also expected, in a public or private research center to acquire additional competences requested for the research project.

From niche to Scale: Strategic and operational dynamics in high-tech manufacturing firms

The process of scaling up high-technology manufacturing firms is characterised by a complex interplay of strategic opportunities and operational challenges. Scaling up is not merely a matter of increasing output; it involves a comprehensive transformation of organisational structure, processes, and culture. As production scales, firms must navigate capital investment, market positioning, technology integration, supply chain expansion, project management, and regulatory compliance. Each of these elements presents challenges and requires careful strategic planning and execution.

Moreover, the rapid pace of technological change in high-tech industries adds a layer of complexity to the scaling process. Firms are required to continually innovate and adapt their product offerings to remain competitive, all while managing larger-scale operations. This necessitates a dynamic approach to management that effectively balances the need for operational efficiency with the imperative for creative and strategic flexibility. Consequently, the study of markets and product positioning within the framework of scaling high-tech manufacturing firms is crucial for aligning strategic objectives with the firm's need for growth. As firms transition from niche markets to broader production scales, they should re-evaluate their market positioning to ensure that their products meet the evolving demands of a larger customer base. Effective market positioning involves identifying and capitalising on unique value propositions that distinguish a firm's offerings from competitors, fostering market penetration.

As a result, the proposed research aims to delve into these multifaceted challenges by focusing on the managerial strategies that can either facilitate or hinder the scaling-up process. This study seeks to uncover the critical pathways and potential pitfalls encountered during scale-up in the high-tech manufacturing sector by examining how managers navigate these strategic opportunities and operational challenges. In doing so, the research will contribute to a deeper understanding of the dynamics involved in scaling up within high-tech industries. It will explore the interdependencies between technology management, operational scalability, and strategic growth initiatives. It will provide actionable insights to help managers make informed decisions that propel their firms towards successful scale-up.

Thus, the primary objectives of this project can be summarised as follows:

1. Investigate the key factors that influence the scaling up of high-technology manufacturing firms.
2. Analyse the impact of managerial decisions on the scale-up process in high-technology manufacturing environments.
3. Identify the major operational challenges managers face during the scale-up process and the strategies employed to address these challenges.
4. Examine how external factors such as regulatory, technological, and economic conditions affect the scale-up strategies of high-technology manufacturing firms.

This research, part of the RED Project, Department of Excellence for 2023-2027, explores economic and digital resilience post-pandemic, offering crucial insights into digital transformations affecting productivity, competitiveness, and sustainability.

Keywords: high-tech; scaling-up; manufacturing firms; innovation management; strategic management.

Profiles: students with a background in Economics, Management, Engineering Management.

Numerical methods for fluid dynamic simulations in glass furnaces

From a training point of view, the PhD student will attend specialized advanced courses provided by the PhD program 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 specific tools for this 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.

Regarding the research project, the PhD student will concentrate his/her activities on the development of virtual prototyping methods for the calculation of the performance of glass furnaces. STARA GLASS S.p.A. (SG), is in fact a company involved in the design and building of container glass production plants. SG has a strong commitment for the development of new technological solutions and computational design tools which are significantly contributing to the design processes modernization in this industrial field. As such, the company is currently partner in three different EU funded innovation project which cover the three main points of decarbonization: energetic efficiency improvement, use of low-carbon fuels, CO₂ capture.

Their continuous operation at high temperatures puts glass furnaces in the "Hard to Abate" industrial sector characterized by activities which can hardly be completely electrified. The furnace is composed by a basin containing the molten glass on top of which is located a combustion chamber. The fuel typically used is natural gas, although efforts are being made to also include growing percentages of carbon-free hydrogen. The comburant is typically air, which is pre-heated by the hot waste gases so as to maximize energy efficiency. Given the high combustion temperatures (around 1550°C), NO_x formation is a sensible problem. As such, technologies for the emissions of such gases are in place, and improvements are constantly under study.

The selected candidate will then work within the IMT School and in close collaboration with SG R&D department to develop computational methodologies for the simulation and analysis of the most important fluid dynamic phenomena taking place in glass melting furnaces.

The main themes that will be developed during the PhD work will be the study and development of computational methodologies for the simulation of the natural gas and/or hydrogen combustion with air or oxygen as comburant; the study and development of computational methodologies for the analysis of glass convective motions in the melting basin; study and development of computational methodologies for the LowNO_x NO_x emissions reduction systems patented by SG;

Making use of the computational mechanics and optimization expertise available at MUSAM -Multi-scale Analysis of Materials Laboratory of IMT School, great importance will be also given to the development of a series of suitable performance parameters which can summarize the results of the simulation campaigns and guide the design engineers work. In addition, suitable optimization algorithms will be developed and implemented. Such algorithms will couple fluid dynamic simulations of the different phenomena occurring in the furnace, and help identifying optimal design solutions.

The PhD work will also benefit from the industrial internship (minimum 6 months, maximum 18 months) at the R&D offices of SG. A research period abroad of 6 months duration is also expected, in a public or private research center to acquire additional competences requested for the research project.

Advanced big data analytics based on machine learning for the ceramics and glass industry

The need of improving the eco-sustainability of the ceramics and glass industry to increase its competitiveness imposes the analysis of production processes from a holistic viewpoint, with the aim of raising the quality albeit reducing the environmental impact (energy consumptions, material waste, pollutant emissions, etc.).

Within this framework, the research project aims at developing and implementing new methods based on machine learning and artificial intelligence techniques that can act on a large variety of data series stemming from different sources (temperature and pressure sensors, measurements related to quality control, energy consumption and other environmental data, along with data from simulations where available) to extract strategic information and hidden knowledge essential for process optimization.

To this end, this project is looking for a PhD student graduated primarily from areas such informatics, engineering, physics, materials science or applied mathematics, interested in acquiring interdisciplinary competences on the enabling digital technologies for Industry 4.0 and in particular on machine learning, artificial intelligence, optimization and digital twin models, exploiting the collaboration with Colorobbia Holding S.p.A. as a leader of the industrial field of production and distribution of raw materials and semi-finished products for the ceramics and glass industry.

The PhD student will attend during the first semester a minimum of 150 hours of core and specialized courses delivered by the Faculty of the PhD programme in Management of Digital Transformation at the IMT School for Advanced Studies Lucca on topics related to enabling technologies for Industry 4.0, innovation, and fundamentals of sustainability. Specialistic training will focus on Python programming, database management, machine learning, digital twin models, optimization and model predictive control. Thanks to the collaboration with Colorobbia Holding S.p.A., an industrial internship of at least 6 months and a maximum of 18 months will take place at Industrie Bitossi Spa. (Vinci, Florence, Italy) to co-design, apply and test the new algorithms to data stemming from ceramics production. A research period abroad of 6 months in the R&D department of Colorobbia España S.A. (Vilafamés, Castellón, Spain) is also planned:

- to assess the possibility to extend the applicability of the proposed data analytics to data stemming from the production of inks, frits, compounds and other ceramic products;
- to optimize the chemical composition of raw materials and semi-finished products in order to enhance product lifecycle, improve quality and increase environmental sustainability.

From donation to drug: Strategic, operational, efficiency and implementation dynamics in bio-pharmaceutical industries with high-impact on the availability of drugs for rare diseases

The demographic crisis, ongoing health emergencies (with potential risk of shortage), and the complexity of the plasma-derived drug production sector, combined with the consequences of the recent pandemic, necessitate in-depth research aimed at developing and analyzing improvement and efficiency strategies in plasma collection and plasma-derived drug production. This is a complex challenge because this need can only be fulfilled through donation and the emotional and active involvement of individuals, driven by personal feelings or stimulated by appropriate associations. The human factor, therefore, plays a decisive role in developing new communication strategies that aim to achieve massive involvement of new donors.

This research project aims to provide scientifically sound practical solutions. The area of study encompasses various socio-economic, cultural, and cognitive aspects of donation that interact in complex ways and necessitate a thorough understanding of both the demand and supply sides to enhance the effectiveness and efficiency of the transfusion system, with donors at one end and recipients at the other.

Efficiency in collection centers is crucial to facilitate donor access and utilization, ensuring the possibility of increasing collection and the subsequent availability of plasma-derived drugs to as many patients as possible. Exploring the use of artificial intelligence in support of this sector is now an indispensable and necessary opportunity. The question to be answered is how the logic of this specific tool can be applied and what benefits it can bring to organizational and management aspects of the entire process or specific areas within it.

This requires a dynamic approach to management that effectively reconciles the need for operational efficiency with the imperative of design and strategic flexibility. This research aims to delve into the challenge of quickly responding to the growing demand for drugs, focusing on the managerial strategies that can facilitate or hinder the availability of plasma-derived medicines. Additionally, this study aims to identify critical paths and potential challenges encountered in identifying patient needs, donor needs, difficulties related to plasma collection, and recruitment and retention of new donors.

In the high-tech bio-pharmaceutical sector, these aspects are identified through a detailed examination of the paths that managers take to seize strategic opportunities and overcome operational challenges inevitably tied to the "human" factor. In this sense, the research will contribute to a deeper understanding of the dynamics involved in optimizing plasma collection within collection units in Europe and the USA, by comparing models. It will explore the interdependencies between technology management, operational efficiency, and strategic communication initiatives. It will provide valuable insights to help managers make informed decisions that drive their companies towards increased plasma collection and subsequent availability of medications, aiming to ensure access to treatment for as many patients as possible.

The collaboration with Kedrion Biopharma SpA will enable the integration of advanced industrial expertise into the project, ensuring that the proposed solutions are practical and immediately applicable in real-world contexts. The integration of advanced digital technologies allows for the optimization of blood and plasma collection and distribution processes, enhancing transparency, traceability, and secure data management. These improvements are expected to make the transfusion system more responsive and adaptable, better equipped to promptly meet the needs of donors and recipients.

The main objectives of this project can be summarized as follows:

- Investigate key factors influencing the recruitment of new donors and generational turnover.
- Analyze the impact of managerial decisions on the optimization process of collection, including the use of artificial intelligence.
- Identify the main operational challenges that managers face during the communication process and the strategies employed to address them.

- Examine how external factors such as regulatory, technological, and economic conditions influence the organization and optimization strategies of high-tech bio-pharmaceutical companies.

Keywords: artificial intelligence, optimization of collection center processes, bio-pharmaceutical industry, generational change management, business strategy, strategic communication, and human relationships, transfusional system, donors' behavior.

Profiles: Students with a background in Economics, Management, Industrial Engineering, Ergonomics and Psychology.