



**POLITECNICO**  
MILANO 1863

**Ph.D. School of the Politecnico di Milano**  
**Regulation of the Ph.D. Programme in:**  
**Management Engineering**

**39<sup>th</sup> Cycle**

## **1. General Information**

Ph.D. School - Politecnico di Milano

Ph.D. Programme: MANAGEMENT ENGINEERING

Start of the Programme: September 2023

Location of the Ph.D. Programme: Milan Bovisa

Promoter Department: Department of Management, Economics and Industrial Engineering (DIG).

Scientific Disciplinary Sectors:

- ING-IND/17 - INDUSTRIAL MECHANICAL PLANTS
- ING-IND/35 - BUSINESS AND MANAGEMENT ENGINEERING

Ph.D. School website: <http://www.polimi.it/phd>

Ph.D. Programme website: <https://www.som.polimi.it/en/course/phd/>

Areas: 09 - Industrial and Information Engineering

## 2. General Presentation

The Ph.D. Programme in Management Engineering (DRIG – Dottorato di Ricerca in Ingegneria Gestionale) offers candidates advanced training and preparation to conduct research at the intersection of management, economics and industrial engineering fields. It aims to develop professionals who are able to carry out, in these fields, high-profile research in universities and international research institutions, manufacturing and service companies, regulatory authorities and other public bodies. The Programme allows the candidate to develop a sound methodological background and multidisciplinary knowledge by attending courses designed to provide a multiplicity of visions, theories and approaches, a broad cultural panorama, and the ability to study problems in an innovative manner, combining various analytical perspectives.

The commitment of the Department of Management, Economics and Industrial Engineering (DIG – Dipartimento di Ingegneria Gestionale) to research and to cooperate with other academic institutions, and major industrial and service companies, creates an ideal environment for candidates to acquire leading-edge knowledge and cultivate their own research interests in a broad range of research subjects.

The Ph.D. course is run by a Coordinator and a Faculty Board, with the support of a dedicated staff. The Coordinator chairs the Faculty Board, coordinates the preparation of the annual Educational Programme and organises the general educational activities of the Ph.D. courses.

The Faculty Board is responsible for the Educational Programme, assessments approval, and administrative activities related to the Ph.D. course (see for further details the Ph.D. Regulation of Politecnico di Milano and Italian decrees - [regulations - Dottorati di Ricerca \(polimi.it\)](#))

### 2.1 Research topics

Research topics within the Ph.D. Programme are aligned with the *Research Areas and Lines* of the Department; the main areas Management, Applied Economics and Industrial Engineering are briefly described below in terms of the issues addressed, disciplinary research fields and methodologies used.

More focused, problem-driven and interdisciplinary *Research Lines* are identified as priorities in the research agenda of the Department ([the updated list is reported on the DIG website](#)). The Ph.D. Programme echoes these priorities, and a specific number of associated scholarships may be made available each year.

#### 2.1.1 Management

The *Management Research Area* focuses on the study of management and innovation at companies, financial institutions and public administrations from a strategic and organisational point of view. Particular emphasis is placed on the study of the complex links and reciprocal influences between strategy, management and the use of technology, through analysis of business processes both internal and external to the company. At the same time, research in this area is strongly oriented towards understanding the change management processes required when introducing strategic, organisational or technological innovations. The final goal of the research is to develop both innovative theoretical models and practical tools and methodologies to be applied and tested in real

cases. These topics are studied across industries and regions, often comparing best practices or emerging models in various countries. Research in this area is based on the integrated use of various methodologies, including case studies, action research, surveys, simulation and quantitative modelling.

The research in this area is organised in the following fields:

- **Sustainability Management:** organisation, human resources and laws pertaining to sustainability; performance measurement for sustainability; Corporate Social Responsibility; Sustainable Mobility; green marketing.
- **Complex Decision Making:** analysis and design of complex and uncertain systems; risk and performance management in control systems at large companies; social software in managing complex systems.
- **Strategic Management of Technology and Innovation:** strategic planning of technology-based projects; organisation for innovation; open innovation paradigm; management of product and service innovation; design driven innovation; innovation project management; open marketing.
- **Public Management:** new managerial methods, organisational forms and legal rules for Public Administration (in particular in the sectors of Educational Institutions and Research Centres, Healthcare, Justice); public policies for innovation and technology transfer; impact of e-government applications in the public administration.
- **Supply Chain and Purchasing Management:** purchasing strategy and organisation; customer-supplier relationships and network management; global supply chain management; sustainable supply chain.
- **ICT Driven Business Innovation:** strategic management of ICT; ICT governance and organisation; new digital business and entrepreneurship; ICT value measurement; digital and social marketing and CRM; knowledge and competence management; Marketing & New media.
- **Energy Management:** strategy, organisation and legislation in renewable energy businesses; strategy and organisation in the energy efficiency business; energy management, sustainability and mobility; the management and business implications of distributed power generation systems.
- **Strategy and Organisational Innovation in Operations:** strategies and organisational paradigms in manufacturing companies and networks; organisational practices and manufacturing strategies; the role of operational strategy in the overall company strategy.
- **Corporate finance and financial markets and institutions:** asset allocation: drivers and efficiency; public-private initiatives for new technology-based firms; regional financial institutions; public infrastructure financing; Enterprise Risk Management; micro-finance initiatives.

### 2.1.2 Applied Economics

Researchers in the area of *Applied Economics* use economic theory and models to study issues arising in the industrial, international, financial, innovation and entrepreneurship domains.

Investigations into these areas are conducted at multiple levels of analysis, including firms, industries, countries, individuals, public administrations and non-profit organisations.

- Researchers in this area take an approach to this subject in which: special attention is paid to the economic foundations of public policy decisions, company decisions and managerial processes.
- Theories and formal models are empirically based and are tested using multiple methodologies and research designs. Quantitative methods are used for the purposes of testing theories. Rigorous qualitative research is practiced in a theory building effort.
- The regulatory implications of the design and assessment of company strategies and public policies are considered.

The area encompasses the following research fields:

- **Internationalization of economic activities:** multinational enterprises; economic rationale for company internationalization processes (e.g. location choice, entry mode, governance) and their impact on company performance, industries and countries; international trade, international fragmentation of production and off-shoring of business services.
- **International competitiveness of national and local systems:** international competitiveness and exchange rates; mergers of MNEs and competitiveness of local systems (e.g. industrial districts).
- **Technical change and innovation:** economic rationale for company innovation processes and impacts on company performance; collaborative development of technological knowledge, open innovation and communities of users and developers; innovation policies.
- **Entrepreneurship and entrepreneurial finance:** theoretical and empirical research on the determinants of new company creation and development; start-up financing processes; public support measures.
- **Regulated industries:** regulation of electricity sectors; economics and policy of energy innovation; restructuring local government and public utilities; economics and policy of broadband networks.
- **Monetary policy:** monetary policy and macroeconomic stability; central banking; financial frictions and financial instability; global imbalances; financial intermediation and markets.
- **Econometrics:** time series analysis (non-stationary time series, co-integration, long memory, vector autoregressive models), financial econometrics (GARCH models, analysis of ultra-high frequency data), applied macro-econometrics (econometric analysis of monetary policy).
- **Pattern recognition and optimization:** predictive models in finance, economics and bio-life sciences; social media analytics and text mining; optimization models and algorithms; supply chain optimization; business intelligence.

### 2.1.3 Industrial Engineering

The *Industrial Engineering* Research Area examines the strategies, methodologies and techniques for planning, design, modelling, construction, operation, maintenance, processing and disposal of industrial plants, infrastructure and production systems of goods and services. Particular attention

is paid to the aspects of innovation, competitiveness, value analysis, effectiveness, efficiency and sustainability through a systemic view of the corresponding technological, organisational, managerial and economic factors at the factory and company levels. The goal of the research is to develop new or improved solutions to apply in the design and/or management of production and service systems. Theoretical models, methodologies and ICT tools are developed, applied and tested in the laboratory or in real world applications. A close relationship with companies in the industrial and service sectors supports this research activity, which is conducted in collaboration with scientific and industrial partners both nationally and internationally. Various tools, including case studies, mathematical modelling, simulation techniques and laboratory activities are used to conduct this research.

The Research Area is divided into the following fields:

- **Analysis and design of systems for the production of goods and services**, including feasibility studies, operational availability analysis, environmental impact assessment, economic valuation and investment risks.
- **Project management**, including conceptual and strategic project configuration, time and cost management, project risk management and project procurement, particularly focusing on the unique challenges encountered with large and mega projects in the energy, oil & gas and infrastructure sectors.
- **Study of industrial processes**, including manufacturing technology, energy systems and general plant services, based on criteria of innovation, environmental sustainability and technical-economic optimization.
- **Technical Ergonomics and System Safety Engineering**, including Human Reliability Analysis, organisational and human factors analysis, vulnerability and interdependency analysis for critical infrastructure.
- **Operations management for production and services**, including lean management, quality management, safety and ergonomics in the workplace, energy and the environment, compliance management, risk management and customer service.
- **Life cycle management of products and production systems**, including management of processes and systems for product/process development, lean product development, integration with supply chain design, lifecycle cost/assessment techniques and end of life analysis.
- **Maintenance management of production systems and infrastructure**, including facility management and global service.
- **Design and management of logistics systems / supply chains of goods and services**, including traceability, purchasing, distribution networks, post-sales service and reverse logistics.
- **Modelling processes and production / logistics systems**, including service delivery processes and logistics / transportation networks.
- **ICT for manufacturing, operations and supply chain management**, including management and control logic, production / logistics information systems and Internet of Things applications.

## 3. Objectives

### 3.1 Full Time Ph.D. Programme

The Full-Time Ph.D. educational Programme is a three-year Programme comprising 180 credits, of which 125 for the development of the Ph.D. Thesis and 55 for training (see section 6 for further details). The Programme has three basic components.

*Basic research training:* this component includes (a) methodological courses related to key aspects of theoretical and applied research in Management, Economics and Industrial Engineering; (b) thematic courses exploring research issues in specific fields. All courses offered by DRIG are in English and many of them are taught by internationally renowned scholars.

*Specific Research training:* this second area can be arranged to suit the research interests of the candidates; on the one hand, it allows the candidates to strengthen their knowledge on specific topics of interest; on the other, it supports the candidates to establish themselves in the scientific community, by participating in conferences and presenting their scientific work in academic or professional contexts.

*Development of the Ph.D. Thesis:* this is the primary requisite of the Ph.D. Programme; it allows candidates to develop leading-edge research competencies and to produce an original scientific work on a topic that contributes to scientific debate and is of interest in the business world.

The Ph.D. Programme includes a compulsory period of study abroad of at least six months. This period abroad is intended to foster the development of the candidates' international network of relationships, to facilitate their subsequent career path, and opens up further opportunities for high quality research and training (e.g. through Ph.D. courses, schools and workshops offered by the host institutions). A series of scientific cooperation agreements with renowned international academic institutions have allowed Ph.D. candidates to spend extended periods abroad. Some examples include: CRIC (Centre for Research in Innovation and Competition) – University of Manchester, Harvard Business School, ETH Zurich, London Business School, MIT (Massachusetts Institute of Technology), SPRU – University of Sussex, University of Reading, Columbia, UCLA. In addition, Double Degree agreements are in place at the Ph.D. level:

- Double Degree Programme with the Pontificia Universidad Católica de Valparaíso – Chile, Escuela de Ingeniería Industrial, Doctorado en Ingeniería Industrial (started in 2013);
- Double Degree Programme with the Copenhagen Business School – CBS, Denmark, Ph.D. School in Economics and Management (started in 2018);
- Double Degree Programme with the University of Reading, Henley Business School – United Kingdom (started in 2019);
- Double Degree Programme with the National Research University Higher School of Economics in Moscow – Russia (started in 2020);
- Double Degree Programme with TuDelft – The Netherlands (started in 2020);
- Double Degree Programme with Universidad Politécnica de Madrid – UPM, Spain (started in 2021);
- Double Degree Programme with Ghent University – Belgium (started in 2021);
- Double Degree Programme with SKEMA Business School – France (started in 2021);

- Double Degree Programme with UNIANDRES – Colombia (started in 2021);
- Double Degree Programme with Qatar University – Qatar (started in 2022);
- Double Degree Programme with Tampere University – Finland (started in 2022);
- Double Degree Programme with LUT University Lappeenranta-Lahti University of Technology – Finland (started in 2023).

Close ties with the industry and other economic players are a cornerstone of DRIG. This collaboration consists of participation in the candidate's research (sometimes comprising a formal period of internship) and involvement in the Advisory Committee of qualified representatives from companies and public institutions in order to:

- fine tune the DRIG training project by aligning it with the demand for researchers created by external bodies on an ongoing basis;
- identify the research issues that are deemed to be important by the scientific community and other stakeholders in order to provide useful insights into the development of Doctoral Theses.

### **3.2 Executive Ph.D. Programme**

The Executive Ph.D. educational Programme is a four-year, part-time, Programme comprising 180 credits, of which 125 for the development of the Ph.D. Thesis and 55 for training.

The Programme aims to train professionals to be able to carry out high-quality research in the fields of management, economics and industrial engineering at universities, other research institutions, manufacturing and service companies, regulatory authorities and other public bodies. Target candidates are company employees holding a Master of Science degree in Italy or abroad and have a desire to develop strong applied research capabilities in the fields of economics, management and industrial engineering. Previous work experience is required.

The Programme allows participants to work in a stimulating international context that will help them to develop methodological skills and specialised expertise in research and innovation, while their companies benefit from the application of the rigour of academic research to an innovative project that has a practical application and brings concrete benefits to the company.

The Programme is specifically designed to complement and be compatible with each participant's professional life. It is a part-time Programme, during which participants receive an education geared towards applied research and innovation and develop a Ph.D. Thesis on a topic that is relevant to their company, supervised by a member of the doctoral faculty.

The Executive Ph.D. Programme admission process, curriculum, qualification criteria and Ph.D. Thesis characteristics are equivalent to the full-time Programme, although the part-time nature and the professional orientation enable higher level of flexibility and customization in structuring the study plan.

## **4. Professional opportunities and job market**

The Ph.D. Programme aims to train professionals who are able to carry out high-quality research in the fields of Management, Economics and Industrial Engineering at universities or other research institutions. Ph.D. graduates from DRIG are also well equipped with distinctive skills and advanced

knowledge to pursue a professional career in manufacturing and service companies, regulatory authorities and other public bodies.

In this framework, the following opportunities are open to those completing the Ph.D. Programme:

- Post doc, research fellows and young lecturers in Italian and foreign universities;
- researchers and scholars of management, economics or industrial engineering in the research departments of public and private organisations;
- highly qualified personnel in research and training institutions, with the role of providing a link between universities and the business world, or in technology transfer centres in Italy and abroad;
- professionals in leading management and strategic consulting firms able to provide deep and advanced insight in areas of activity relating to the company itself;
- high level professional roles in national (ministries, regulatory authorities, local public institutions) and international (EIB, IMF, World Bank, European Commission, European Central Bank) public institutions;
- managerial roles in multinational companies with a strong focus on innovation;
- entrepreneurs in contexts characterised by a high level of innovation.

Support actions for placement are provided with the purpose of sharing experiences, services and information through a number of initiatives fitting the different types of career opportunities. Amongst the actions, the “Placement Programme for Ph.D. candidates” is the Programme offered by the Career Service, in cooperation with the Ph.D. School of Politecnico di Milano. This Programme is offered to all candidates to support them entering the job market. Other initiatives are directly supported by the Ph.D. Programme in Management Engineering, to share experiences with invited speakers, to gather information on job fairs and funding initiatives, to build opportunities for networking and visibility, etc. Particular emphasis is given to career development in the Management Engineering area.

## **5. Enrolments**

### **5.1 Admission Requirements**

Italian and foreign citizens can apply. They are requested to have graduated in accordance with the pre-existing laws D.M. 3.11.1999 n. 509, or to have a Master of Science degree in accordance with D.M. 3.11.1999 n. 509, or a Master of Science in accordance with D.M. 22.10.2004 n. 270, or similar academic title obtained abroad, equivalent for duration and content to the Italian title, with an overall duration of university studies of at least five years.

The certified knowledge of the English language is a requirement for admission. Please refer to the Ph.D. School website for details.

The admission to the Programmes will be established according to the evaluation of the candidates' curricula, motivation letters, and an illustrative report about the development of a possible Ph.D.



research, which candidates will send contextually with their application to the admission announcement.

Foreign candidates will be asked to demonstrate knowledge of the Italian language, equal to at least A1 level of the Common European Framework of Reference for the knowledge of languages. This requirement will be needed in order to register for the final exam. Italian native speakers and all those who can demonstrate knowledge of the Italian language to the required level will be exempt.

Further details on the admission requirements are included in the Ph.D. Regulation of Politecnico di Milano and Italian decrees (Link to those documents: [regulations - Dottorati di Ricerca \(polimi.it\)](#))

## **5.2 Admission deadline and number of places available (Full-time)**

The number of positions for full-time candidates is indicated in the Call for admission to the 39<sup>th</sup> Ph.D. cycle Programme:

<https://www.dottorato.polimi.it/en/prospective-phd-candidates>

Scholarships both on general and on specific themes are available, in accordance with what is specified in the call for admission.

# **6. Contents**

## **6.1 Requirements for the Ph.D. title achievement**

For full time candidates, the achievement of the Ph.D. title in Management Engineering requires a study and research activity of at least three years equivalent of full-time study, research and development of Ph.D. Thesis.

For part-time candidates (Executive), the achievement of the Ph.D. title in Management Engineering requires a study and research activity of at least four years equivalent of part-time study, research and development of Ph.D. Thesis.

For both paths (full-time and part-time), candidates must earn a minimum of 25 course credits (see section 6.3 below for details), and to continuously conduct studies and research.

At the beginning of the course, the Faculty Board assigns a tutor to each Ph.D. candidate to assist him/her in the overall training Programme. The tutor shall be a professor belonging to the Faculty Board. The tutors assist the candidates in the choice of courses to be included in the study plan, which is eventually submitted for approval to the Coordinator of the Ph.D. Programme (see also section 6.4 below).

The Faculty Board may assign extra course credits to one or more candidates, in case they need to complete their preparation within specific topics, relevant for their research projects.

## **6.2 Research development**

The main aim of all Politecnico di Milano Ph.D. Programmes is the development in the candidates of a research-oriented mind-set, with expertise and skills in a specific research topic. To this end, candidates develop a problem-solving capability in complex contexts, including the capacity of

performing deep problem analysis, identifying original solutions, and evaluating their applicability in practical contexts.

These skills provide the Ph.D. candidates with major opportunities of development in their research both in the academic field, and in public and private organisations.

Ph.D. candidates are requested to develop an original research contribution. The Ph.D. Thesis must thus contribute to increase the knowledge in the candidate's research field. Besides, it has to be coherent with the research topics developed in the Department where the Ph.D. Programme is carried out.

The original research results are collected in the Ph.D. Thesis, where the candidate's contribution is put in perspective with respect to the research state of the art in the specific research field.

The Ph.D. research is developed under the guidance of a supervisor, who supports the candidate in the setting-out and in the everyday activities related to the Thesis development. The supervisor is not necessarily a member of the Faculty Board and may also belong to another institution. The supervisor can be supported by one or more co-supervisors.

Further activities intended to develop the candidate's personal skills and research expertise are encouraged during the Ph.D. path.

Candidates must acquire the capability to present and discuss their work in their research community. Consequently, both the participation to international conferences and the publication of the research results in peer-reviewed journals are encouraged.

The Ph.D. Programme encourages and supports the candidates' research interactions with other groups in their research field, preferably abroad. The Ph.D. Programme includes a compulsory period of study abroad of at least six months in total (equivalent to one semester); through them, the candidates may acquire further skills to develop their research work and Thesis.

The duration of the full-time Programme is normally three years. The duration of the Executive Ph.D. Programme is normally four years.

### **6.3 Objectives and general framework of the teaching activities**

The Ph.D. Programmes and the Ph.D. School activate teaching forms of different kind and credit value, including courses, seminars, project workshops, laboratories. Teaching activities both cover the basic research issues (problems, theories, methods), which represent the founding element of the Ph.D. Programme and clearly identify its cultural position, and deepening in a specialist way some research issues connected with the problems developed in the theses. Classes are all held in English. Certain teaching activities enable the candidate to acquire ECTS credits (Structured teaching activities); other activities, typically specialised activities for which it is difficult to assess and quantify learning, fall within the scope of scientific activities that will be taken into account by the Academic Board in the overall assessment, but whose value is not quantified in terms of ECTS.

As mentioned in section 3.1, the general framework for the Ph.D. Programme in Management Engineering is divided into three types of activities:

- **Basic research training** (composed by Politecnico di Milano course, which include both the Ph.D. School course and the DRIG specific courses);
- **Specific research training;**
- **Development of the Ph.D. Thesis.**

Basic research training and specific research training consist of a mix of training activities. Table 1 report details of their articulation for candidates.

Training activities	Details	Number of ECTS credits (min-max)
Ph.D. School Courses	<a href="https://www.dottorato.polimi.it/en/phd-school/phd-level-courses">https://www.dottorato.polimi.it/en/phd-school/phd-level-courses</a>	10
DRIG Courses characterising this Ph.D. Programme	(a) Methodological courses (listed in table 2); (b) Thematic courses	15-25
Other activities	DIG seminars, other pertinent courses, Doctoral schools, and Workshops indicated by the tutor or supervisor; Presentations at scientific international conferences; Presentations at practitioner-oriented events; Residential courses; courses from other universities	20-30

Table 1 – COURSE TYPOLOGY (MINIMUM AND MAXIMUM IS RELATED TO THE TYPE OF PH.D. PATH AND SCHOLARSHIP)

**Basic research training** is achieved by attending Ph.D. School courses of Politecnico di Milano (minimum 10 ECTS) and courses characterising the Ph.D. in management engineering (DRIG Ph.D. courses).

The Ph.D. School of Politecnico di Milano proposes a set of courses aiming to train Ph.D. candidates in soft and transferable skills. The skills and abilities provided by these courses are expected to help candidates across different areas of their careers in order to respond to the rapidly evolving needs of the global economy and society at large.

At least 10 credits must be earned from these Ph.D. School of Politecnico di Milano courses.

The remaining credits of the **basic research training** must be earned from the courses characterising The Ph.D. Programme in Management Engineering provided by DRIG (DRIG Ph.D. Courses). They include:

- Methodological courses (listed in table 2)
- Thematic courses, which are linked to specific and changing academic topics. The list of these courses is updated and communicated annually to quickly bring new challenges to the candidates.

For full time candidates to proceed to the second year, the candidate must have obtained at least **10** credits from courses, and to proceed to the third year at least **20** credits are required.

For part-time candidates to proceed to the second year, the candidate must have obtained at least **5** credits from courses, and to proceed to the third year at least **10** credits are required. To proceed to the fourth year, at least **20** credits are required.

For admission to the final examination, the candidate must earn at least **25** credits from Politecnico di Milano courses (at least 10 credits from Ph.D. School Courses and at least 15 credits from DRIG Ph.D. courses).

Name of the Course	Academic Year	Language	Credits
Academic Publishing	2023-24	English	5
Advanced skills for academic professionals	2023-24	English	5
Advanced topics in Econometrics	2023-24	English	5
Case study and action research	2023-24	English	5
Experimental and behavioral methods	2023-24	English	5
Literature review in Social Sciences and Engineering	2023-24	English	5
Modelling and Data Analysis of Complex Systems	2023-24	English	5
Project Management (in Action)	2023-24	English	5
Survey research methodologies	2023-24	English	5

Table 2 –METHODOLOGICAL COURSES PROVIDED BY THE PH.D. PROGRAMME IN MANAGEMENT ENGINEERING (DRIG)

**Specific research training** is tailored and agreed with the tutor; it includes DIG department seminars, other pertinent courses, Doctoral schools, and Workshops; Presentations at scientific international conferences; Presentations at practitioner-oriented events; courses from other universities mainly acquired by attending Residential Schools and Courses, Workshops or International Scientific Conferences.

For Industrial full-time candidates (i.e. candidates with a scholarship financed by an institution) and Executive candidates, an ‘embedded case report’ is required, which is a presentation of a report of the Ph.D. research for the institution that sponsors the Ph.D. candidate.

**Overall**, the credits awarded for **Basic and Specific research training** must sum up at least **55 ECTS**.

**The development of the Ph.D. Thesis** is an ongoing activity throughout the Programme, which includes a compulsory period of study abroad for a total duration of not less than 6 months.

At the end of each year, the candidate submits his/her research project to the Faculty Board for approval and admission to the following year.

Flexibility to the requirements illustrated is assessed by the Faculty Board or the Coordinator for double degree Programme and part-time candidates.

If the supervisor and the tutor find it useful or essential that the candidate attends preparatory courses (chosen among the activated courses at the Politecnico di Milano) the Faculty Board of the Ph.D. Programme may assign some extra-credits to be acquired to complete the training path. The credits acquired in this way will be considered as additional, in relation to the mandatory credits to be acquired with the Ph.D. courses.

Attendance at Specialist Courses, Laboratories, Workshops, Schools and Seminar Cycles is strongly encouraged and can be a way for the candidate to earn credits (specific training).

In particular, Management Engineering Ph.D. Programme candidates are strongly encouraged to attend one of the following Schools:

- AiIG Management Engineering School (<https://www.ingegneriagestionale.it/scuole/scuola-estiva-aiig/>);
- "Francesco Turco" Summer School in Industrial Engineering (<https://www.summerschool-aidi.it/section.php?id=18>).

Specific courses and laboratories might be offered exclusively to Executive Ph.D. candidates.

#### **6.4 Presentation of the study plan**

Ph.D. candidates must submit a study plan, which may be revised periodically (approximately every three months), in order to adequate them to possible changes in the course list, or to needs motivated by the development of their Ph.D. career. The study plans must be approved by the Ph.D. Programme Coordinator, according to the modalities established by the Faculty Board of the Ph.D. Programme itself.

#### **6.5 Yearly evaluations**

Candidates present their work to the Faculty Board at least once a year. In particular, the candidates must pass an annual evaluation in order to be admitted to the following Ph.D. year. The last year evaluation establishes the candidate's admission to the final Ph.D. defence.

As a result of each annual evaluation, the candidates who pass the exam receive an evaluation (A/B/C/D) and may proceed with the enrolment at the following year. Candidates who do not pass the exam are qualified either as "Repeating candidate" (Er) or "not able to carry on with the Ph.D. (Ei)". In the former case (Er), the candidates are allowed to repeat the Ph.D. year at most once. The Ph.D. scholarships – if any – are suspended during the repetition year. In the latter case (Ei) the candidates are excluded from the Ph.D. Programme and lose their scholarships – if any.

In case the Faculty Board holds appropriate to assign directly an exclusion evaluation (Ei) without a previous repetition year, the request must be properly motivated, and validated by the Ph.D. School. After the final year, candidates who have achieved sufficient results but need more time to draw up their theses, may obtain a prorogation of up to 12 months.

#### **6.6 Ph.D. Thesis preparation**

The main objective of the Ph.D. career is the development of an original research contribute. The Ph.D. Thesis is expected to contribute to the advance of the knowledge in the candidate's research field. The Ph.D. study and research work is carried out, full time, during the three years of the Ph.D. course. Stages or study periods in (Italian or International) companies or external Institutions may complete the candidate's preparation.

The resulting theses need to be coherent with the research issues developed in the Department where the Ph.D. Programme is developed.

The candidate must present an original Thesis, discuss its contribution to the state of the art in the research field in the research community.

The Ph.D. research is developed following the lead of a supervisor, who supports the candidate in the setting out and in the everyday activities regarding the Thesis development.

At the conclusion of the Ph.D. studies, the Faculty Board evaluates the candidates. Candidates who receive a positive evaluation submit their theses to two external reviewers for refereeing. If the

evaluation provided by the reviewers is positive (or after the revisions required by the external reviewers), the candidates defend their Thesis in a final exam, in front of a Committee composed of three members (at least two of which must be external experts).

## 7. Laboratories

### OBSERVATORIES

The Observatories are on-going practice-oriented research projects, that focus on hot topics selected in collaboration with partner organisations in the business and policy-making communities. The full list of Observatories includes:

- Digital Innovation Observatories ([www.osservatori.net](http://www.osservatori.net));
- Energy & Strategy Observatories (<http://www.energystrategy.it>);
- Entrepreneurship & Finance Observatory (<http://www.osservatoriocrowdfunding.it>).

### LABORATORIES:

At the Department the following Labs are active, some of them in collaboration with other Departments of Politecnico di Milano:

- PHEEL Lab (<http://pheel.polimi.it>) is a laboratory which summarises the analysis of the biological and physiological signals of individual and expert evaluation in order to study the behaviour of individuals in response to specific stimuli (products/services/experiences, interfaces, advertisements, editorial contents, non-advertising messages, social interaction, etc.);
- IoT Lab (<https://www.iotlab.polimi.it>) is dedicated to applied and basic research on topics related to the Internet of Things (IoT). It focuses on the research and design of “open” and “flexible” hardware and software platforms for the implementation of IoT complex systems in support of different vertical application scenarios. The most important of these is Energy Management in Smart Homes/Buildings, with strong connections to the Smart Grid and Smart City themes.
- Urbanscope Lab (<http://urbanscope.polimi.it>). The objective of the Lab is to help renewing the link between know-how and action in the decision-making processes, public and private, which concern and produce the cities and the urban, as complex spatial, social, economic and institutional processes.
- Asset Management Lab is a research laboratory for the development of methods, tools and approaches for the lifecycle management of industrial assets, with a specific concern on maintenance management.
- Industry4.0 Lab – Laboratorio Marco Garetti (<https://www.industry40lab.org/home>) is made by a fully automated assembly and manufacturing line. The high flexibility of the system and the modularity of the configuration allows to test and replicate virtually any variety of manufacturing and assembly system for discrete manufacturing.

## 8. Departmental Secretary for the Ph.D. Programme

The secretary welcomes Ph.D. candidates and it is the point of contact for Department courses, general enquiries on the Ph.D. Programme, Ph.D. courses, study plan, mobility.

Contact details: [phd-ges@polimi.it](mailto:phd-ges@polimi.it).

## 9. Internationalisation and inter-sectoriality

Carrying out study and research activities at external laboratories is strongly recommended. Politecnico di Milano supports joint Ph.D. paths with International Institutions, as well as Joint and Double Ph.D. Programmes. Further information is available on the Ph.D. School website and on the Ph.D. Programme website.

Some agreements with international institutions are currently active for the Ph.D. Programme in Management Engineering, as summarised in the table below.

University	Country	Type of Agreement	Credits transfer
PONTIFICIA UNIVERSIDAD CATOLICA DE VALPARAISO (PUCV)	Chile	Double Degree	YES
CBS – COPENAGHEN BUSINESS SCHOOL	Denmark	Double Degree	YES
UNIVERSITY OF READING	United Kingdom	Double Degree	YES
TUDELFT UNIVERSITY OF TECHNOLOGY	The Netherlands	Double Degree	YES
UNIVERSIDAD POLITÉCNICA DE MADRID – UPM	Spain	Double Degree	YES
QUATAR UNIVERSITY	Qatar	Double Degree	YES
TAMPERE UNIVERSITY	Finland	Double Degree	YES
NATIONAL RESEARCH UNIVERSITY HIGHER SCHOOL OF ECONOMICS	Russia	Double Degree	YES
GHENT UNIVERSITY	Belgium	Double Degree	YES
SKEMA BUSINESS SCHOOL	France	Double Degree	YES
UNIANDES	Colombia	Double Degree	YES
LUT UNIVERSITY LAPPEENRANTA-LAHTI UNIVERSITY OF TECHNOLOGY	Finland	Double Degree	YES

Table 3 - LIST OF ACTIVE INTERNATIONAL AGREEMENTS

Interaction with and exposure to non-academic sectors provides significant benefits to doctoral candidates as well as to research and innovation intensive employment sectors. Direct exposure to the challenges and opportunities in non-academic sectors of the economy and society at large is fostered by networking, connectivity, inter-sectoral mobility and wide access to knowledge. In

particular, the Ph.D. Programme in Management Engineering collaborates with the following Research Agencies and/or Industrial partners.

Name	Public/ Private	Type of Collaboration	Country
ERNST & YOUNG	PRIVATE	Ph.D. Research project and scholarship	Italy
HERMANN GIESSING UNTERNEHMENSBERATUNG	PRIVATE	Ph.D. Research project and scholarship	Germany
BLUETHINK S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
TIDONA GIURIDICA SRL	PRIVATE	Ph.D. Research project and scholarship	Italy
EASYJET AIRLINE COMPANY	PRIVATE	Ph.D. Research project and scholarship	Italy
SIMONELLI GROUP SPA	PRIVATE	Ph.D. Research project and scholarship	Italy
APPLIED SRL	PRIVATE	Ph.D. Research project and scholarship	Italy
4 CROWD S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
COSTA CROCERE	PRIVATE	Ph.D. Research project and scholarship	Italy
DIGITAL 360 S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
FINOS TEXTILES DOMINICANA S.R.L.	PRIVATE	Ph.D. Research project and scholarship	Dominican Republic
HILTI CORPORATION	PRIVATE	Ph.D. Research project and scholarship	Liechtenstein
MARKET ME CONSULTING	PRIVATE	Ph.D. Research project and scholarship	Kanada
ROCHE	PRIVATE	Ph.D. Research project and scholarship	Italy
THALES ALENIA	PRIVATE	Ph.D. Research project and scholarship	France
WIDE GROUP S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
BRIVIO & VIGANO' S.R.L.	PRIVATE	Ph.D. Research project and scholarship	Italy
NUOVO PIGNONE TECNOLOGIE S.R.L.	PRIVATE	Ph.D. Research project and scholarship	Italy
NTT DATA ITALIA S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
STELLANTIS S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
TECHNIMONT S.P.A.	PRIVATE	Ph.D. Research project and scholarship	Italy
A2A S.P.A.	PUBLIC	Ph.D. Research project and scholarship	Italy
INAIL	PUBLIC	Ph.D. Research project and scholarship	Italy
INPS	PUBLIC	Ph.D. Research project and scholarship	Italy
REGIONE LOMBARDIA	PUBLIC	Ph.D. Research project and scholarship	Italy

Table 4 - LIST OF COLLABORATIONS WITH AGENCIES AND COMPANIES AT Ph.D. LEVEL



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## Attachment A1 – Ph.D. Programme Coordinator

Short CV of Programme Coordinator

**Michela Arnaboldi** is full professor at Politecnico di Milano, Department of Management, Economics and Industrial Engineering, where she is also Director of the Ph.D. in Management Engineering.

In 1999 she got a Master Degree in Management and Production Engineering. In January 2003 she obtained the Ph.D. in Management and Production Engineering. Since 1999 she has been working at the Department of Management, Economics and Industrial Engineering of Politecnico di Milano, and she has been member of the core faculty of the School of Management at Politecnico di Milano (MIP), where in 2009 she becomes teaching coordinator for the area Accounting, Control and Performance Management.

Since 2001 she has been collaborating with the School of Management at the University of Edinburgh. In 2008 she has been visiting professor at the Centre for Analysis of Risk and Regulation (CARR) at the London School of Economics. Since 2010 she is collaborating with TuDelft University

Her research activity is mainly focused on two areas: (1) Managing performances in the Public Sector and Cultural Heritage institutions; (2) the evolution of Performance Management Systems in the digital age.

She is author of more than 200 scientific publications and she has been involved, as scientific coordinator or principal investigator, in several national and European projects.

She is Associate Editor of Qualitative Research in Accounting & Management.

She is Member of: the editorial board of Financial Accountability and Management; the scientific committee of the Institute of Public Sector Accounting Research of the University of Edinburgh; the academic board of the International EIASM Conference in the Public Sector, where she is in charge of the young scholar Programme.

## Attachment A2 – Ph.D. Faculty Board - Collegio dei Docenti

1	ARENA MARIKA
2	ARNABOLDI MICHELA (Coordinator)
3	CAGLIANO RAFFAELLA
4	CANIATO FEDERICO
5	CIGOLINI ROBERTO
6	COLOMBO MASSIMO GAETANO
7	FELICE GIULIA
8	FRANZONI CHIARA
9	FRATTINI FEDERICO
10	GHEZZI ANTONIO
11	GRILLI LUCA
12	LAMBERTI LUCIO
13	LETTIERI EMANUELE
14	MACCHI MARCO (deputy Coordinator)
15	MELACINI MARCO
16	MICHELI GUIDO
17	PERO MARGHETITA
18	PISCITELLO LUCIA
19	PIVA EVILA
20	PORTIOLI STAUDACHER ALBERTO
21	ROSSI CRISTINA (Deputy Coordinator)
22	TAPPIA ELENA
23	TERZI SERGIO
24	TRUCCO PAOLO