

ANNEX A

DESCRIPTION AND OBJECTIVES

The increasingly pervasive use of IT and knowledge technologies is altering the rules of post-modern competition, causing a complex transformation of society, businesses, universities, industries, and competitive environments.

The sharp increase in disruptive technological changes introduced by start-ups and innovative small and medium-sized enterprises (whose ambidexterity has completely changed the rules of R&D processes), is pushing all economic, social and institutional actors to develop dynamic capabilities, in order to support the processes of exploration and application of new knowledge, solutions, and technologies. On top of that, there's the need to respond effectively to increasingly complex and diversified social needs. In particular, the growing demands of stakeholders are raising the awareness that a competitive model based solely on maximising production capacity and reducing costs can only generate a temporary advantage. As underlined in the Fair and Sustainable Wellbeing Framework (Bes) promoted by ISTAT, and mentioned in the economic and financial Documents following the approval of Law 163/2016, research and innovation do determine, although indirectly, the overall well-being, as they do underpin social and economic progress. Recalling the United Nations Framework Convention on Climate Change (UNFCCC), the sustainable management of R&D processes and, in particular, technology transfer, can be the main driver of change, giving rise to a new managerial and social paradigm defined in literature as "Sustainable Innovation".

Considering this premise, the PhD course's aim is to examine in depth the main theme represented by the binomial innovation-sustainability, intended as multidimensional expression of interconnected phenomena, thus intrinsically open to multidisciplinary approaches. To this end, the course intends to foster an innovative, international, and interdisciplinary approach, of basic and applied training and research, on the subject of the management of sustainable innovation and the optimisation of technology and knowledge transfer processes between universities, companies, institutions and non-profit organisations.

Professors and researchers belonging to different SDS (Scientific Disciplinary Sectors), together with diversified and integrated cognitive and methodological tools, guarantee the multidisciplinary nature of the course, thus ensuring an adequate approach to a topic that can be addressed from multiple points of view, as pinpointed in the different lines of research that the PhD proposes.

The identified research areas concern aspects of management, corporate finance, statistics, private law, business economics, sociology, political philosophy, computer engineering and management, as well as bio-medical elements relating to the quality of life and the psycho-physical well-being of people.

In particular, five main lines of research are identified:

1. Line of research no. 1 | *Innovation Management in Knowledge ecosystems*
2. Line of research no. 2 | *Sustainable innovation impact assessment*
3. Line of research no. 3 | *Research and Development, Technology transfer and Foresight*
4. Line of research no. 4 | *Collaborative platforms for Sustainability Innovation*
5. Line of research no. 5 | *Sustainable Innovation Governance and Local Economic Development.*

LINES OF RESEARCH

Line of research no. 1 | *Innovation Management in Knowledge ecosystems*

In recent years, the topic of sustainable innovation has drawn the interest of various research fields at international level, gathering matters belonging to different ERC (European Research Council) macro-sectors.

These studies highlight how the reconciliation of economic, social, and environmental aspects in innovation activities is a contributing factor not just to the creation and retention of long-term competitive advantages, when it comes to organisations, but also to the quality of life and well-being of citizens and communities.

In this framework, the PhD intends to foster research projects oriented towards investigating the following topics and areas: the sustainable management of the innovation cycle; the induction and management of innovation processes within enterprises starting from the evolutionary dynamics of knowledge; the effectiveness of new innovation management models oriented to shared value and environmental and social sustainability; the cognitive nature of innovation processes and the perception of enterprises as dynamic knowledge systems (knowledge-based theory); innovation management, both at a strategic and operational level; innovation financing

(formal venture capital, business angel investors, project financing, crowdfunding); the effectiveness of models for analysing the innovation needs of organisations; the impact of knowledge management systems (KMS) on innovation; the creation of Knowledge Innovation Communities (KICs); the development of conceptual frameworks and the validation of strategic market-oriented business design methodologies and tools; user-centred and data-driven innovation of products and services; the employment of new technologies for social needs assessment; the development of new technologies for the promotion of social inclusion, well-being, quality of life, active ageing and the prevention of psycho-physical risks in the workplace.

ERC fields:

- SH1 Individuals, institutions and markets: economics, finance and management;
- PE8 Products and process engineering: product design, process design and control, construction methods, civil engineering, energy systems, material engineering;
- PE6 Computer science and informatics: informatics and information systems, computer science, scientific computing, intelligent systems;
- LS7 Diagnostic tools, therapies, and public health: Aetiology, diagnosis and treatment of disease, public health, epidemiology, pharmacology, clinical medicine, regenerative medicine, medical ethics

Line of research no. 2 | Sustainable innovation impact assessment

Swift and unrelenting technological developments, fostered by Information and Communication Technologies (ICT) and the advent of Smart Manufacturing, are causing disruptive social and economic changes. The employment of innovative digital technologies and Internet of Things solutions, both based on automation, data exchange and interconnection in support of industrial processes, allows to boost cooperation and intertwinement of resources along the entire value chain; it pledges to increase productivity and GDP growth and to improve people's well-being and health. At the same time, digital technologies may entail negative externalities that could include increasing economic and wage disparities, worsening working conditions related to labor intensity, energy consumption, and environmental pollution.

In this context, the new concept of Industry 5.0 promoted by the European Commission, aims at drawing attention on the topic of 'sustainable innovation', and it does so by acknowledging that the social role of industry goes beyond employment and skills development, encompassing care and respect for the planet as well as the well-being of the workers standing at the core of the production process.

Considering these premises, the 'Sustainable Innovation' model urges companies to take into account sustainability (environmental, social and financial) when it comes to their R&D processes, from ideas generation to products and services commercialisation. In particular, the issue of assessing and measuring the impact of Key Enabling Technologies on people's well-being and lives is becoming increasingly important for both companies and policy makers.

In view of the growing interest from people, media, and some institutions, and considering the rate and speed at which information are spreading at global level, certification methods are also attracting the attention of researchers, managers and policy makers. A product/ service certified as ethical, sustainable, and innovative, which is produced by a sustainable supply chain becomes potentially more attractive on the market. A certification of sustainability and innovativeness could provide a differentiated chain supply able to influence the behaviour of consumers and users. Such certification could be used to influence the lower levels of the supply chain, thus improving the overall performance of the chain. At the same time, the development of policies and evaluation tools for Green Public Procurement (GPP) is also being studied and discussed.

In line with this framework, this line of research encourages projects oriented towards assessing and estimating the impact of the 'sustainable innovation'. In particular, abiding to the strategic guidelines of the 2030 Agenda for Sustainable Development, it endorses basic and applied research projects aimed at investigating the impact of technological innovation on the 17 Sustainable Development Goals (SDGs), and the 169 targets that substantiate them.

In this context, original research projects with the following cognitive purposes are promoted: the study of the main theoretical-conceptual frameworks developed by the scientific literature for performance measurement; the development and validation of new econometric models able to measure and evaluate the main drivers and impacts of sustainable innovation; the study of new methodologies to assess the circularity of products/processes/services; new technologies for the certification of sustainable innovation (e.g. Blockchain); the development and testing of sustainable and data-driven management approaches (e.g. Big Data Analytics); the

study of new models and standards for financial accounting and non-accounting reporting.

Further research topics include investigation of the following areas: the assessment of the negative externalities of digital technologies on human health; the study of multidimensional models for the development of wearable technological applications aimed at assessing the impact of physical and motor activity on the performance and mental and physical wellbeing of workers; the impact of information technologies and communication networks on health management, prevention of major cardiovascular diseases, promotion of health-oriented lifestyles and active ageing.

ERC fields:

- SH1 Social Sciences and Humanities. Individuals, institutions and markets: economics, finance and management
- SH3 Environment and society: environmental studies, demography, social geography, urban and regional studies
- LS8 Evolutionary, population and environmental biology: evolution, ecology, animal behaviour, population biology, biodiversity, biogeography, marine biology, eco-toxicology, prokaryotic biology
- PE6 Computer science and informatics: informatics and information systems, computer science, scientific computing, intelligent systems.

Line of research no. 3 | Research and Development, Technology transfer and Foresight

In a knowledge-based economy, technological skills and capacity for innovation play a strategic role.

In order to manage R&D processes, developing a synergistic and relational vision is essential in order to be able to face the major global challenges that have radically transformed the face of our society. At the same time, it is essential to endorse R&D of sustainable, value-creating solutions.

In this framework, this line of research aims at promoting projects oriented towards investigating the drivers and barriers that the implementation of a regenerative economic system faces and towards validating new circular, inclusive R&D models based on the expectations and needs of both users and stakeholders.

In line with the principles of the OECD Frascati Manual, the research will focus on the management of basic and applied research processes, and on experimental development, from scientific research to markets.

Research projects will be promoted in the following areas as well: the role of R&D in promoting growth, competitiveness, employment, inclusion, welfare and health; R&D methods and phases; managerial, financial, cognitive, organisational, cultural and legal drivers of technology and knowledge transfer processes; discoveries, translations and commercial developments of new therapies and solutions to promote human health and well-being; R&D of new diagnostic and therapeutic methodologies; the role of key legal enablers to accelerate the processes of knowledge and technology transfer among and within organizations.

Furthermore, this line of research endorses research projects aimed at studying the key elements and managerial implications of Technology Foresight models, with particular reference to converging technologies enabling the bio-economy, the circular economy and the transition to better resource use patterns.

ERC fields:

- SH1 Social Sciences and Humanities. Individuals, institutions and markets: economics, finance and management
- SH2 Institutions, values, beliefs and behaviour: sociology, social anthropology, political science, law, communication, social studies of science and technology
- PE6 Computer science and informatics: informatics and information systems, computer science, scientific computing, intelligent systems
- PE8 Products and process engineering: product design, process design and control, construction methods, civil engineering, energy systems, material engineering

Line of research no. 4 | Collaborative platforms for Sustainability Innovation

In the 2000s, with the advent of the sixth generation of innovation, the future of management literature is marked by the valuable contribution of Chesbrough (2003). Chesbrough introduced the topic of “Open Innovation”, thus anticipating a clear shift from a closed system that prevents contamination with the outside world, to total openness towards the surrounding environment without defining its boundaries or limits. Digital technologies are further transforming innovation processes (from research to the development and commercialisation phases).

In this context, digital and collaborative platforms increasingly represent an alternative for companies, when it comes to adopting sustainable leanings, defining the role of users and consumers in a distributed innovation process.

These platforms provide a disintermediation function with respect to Open Innovation, promoting and facilitating forms of collaborative innovation, supporting R&D projects and intensifying the interactions between the actors in order to explore new solutions. Through collaborative platforms, users can interact, buy products and services, access additional services or participate in co-creation processes, contributing to the wider phenomenon of the so-called ‘collaborative economy’. At the same time, companies can use these tools to facilitate processes of technology transfer, capital raising (crowdfunding), resource optimisation (crowdsourcing), networking and intellectual property rights management.

These types of digital platforms, in particular, are making the process of stakeholder engagement more accessible and sustainable for small and medium-sized enterprises as well, redesigning traditional industrial landscapes towards an eco-systemic perspective.

This line of research will promote original research projects related to the impact of digital transformation on innovation management and the most appropriate tools to promote sustainable, inclusive, resilient and resource-optimised innovation ecosystems.

In particular, research projects in the following areas will be promoted: the impact of open innovation platforms on online technology transfer; the role of open source innovation platforms; digital crowd-engagement platforms to enable user participation and contribution to the achievement of the UN Sustainable Development Goals; open innovation participatory ecosystems; digital open innovation, crowdsourcing, and sustainable business growth; value co-creation with customers and suppliers; collaborative mechanisms associated with technology and knowledge acquisition; the importance of strategic alliances for knowledge and technology transfer; the creation of Collaborative Business Models; advantages and disadvantages of collaborative platforms compared to traditional trade in goods and services; agile Digital Open Innovation tools to accelerate digital transformation of processes and products in health and wellness; the impact of digital open platforms on business model innovation and the creation of more flexible and customisable products and services that generate value.

ERC fields:

- SH1 Social Sciences and Humanities. Individuals, institutions and markets: economics, finance and management
- SH3 Environment and society: environmental studies, demography, social geography, urban and regional studies
- PE6 Computer science and informatics: informatics and information systems, computer science, scientific computing, intelligent systems

Line of research no. 5 | Sustainable Innovation Governance and Local Economic Development

During the 20th century, the possibilities offered by the world economy have created far better living conditions and widespread opportunities for prosperity than in previous centuries. Average life expectancy has risen significantly also due to the permanent elimination of once deadly diseases. Technological research and the development of new equipment and machinery have improved the relationship between actual work and physical effort involved. In addition, means of transportation previously unknown or inaccessible to most people have made business connections and human interactions more efficient; together with the widespread availability of computers, mobile phones and the internet, they have led to wider circulation of information and new perspectives in work and everyday life. In spite of the advantages, however, many signs point out the side effects and risks of the established economic system, caused by the modern economic activities and new production means themselves. The economic value chain and the social value chain do not always agree; the debate on the impact of public policies on sustainable innovation as a driver of business growth and territorial development is based on this contradiction.

This line of research aims to promote original research projects in the following areas: local policies and strategies for sustainable development in line with the 2030 United Nations Agenda; public responsibility and smart procurement; participatory processes methods; educational

models, design and delivery of training activities, for adults and group management; open government: actors, models, tools; innovation for growth in smart territorial systems; design of services for a smart community: design thinking and sustainability; smart business models, smart ecosystems, public-private partnerships for the development of innovative services for territories; constraints and opportunities of territorial data management, geographical information, information flows: technologies and tools; Knowledge Management, Open Data, Big Data and Smart Data Platforms at the city-user service; assessment of the impact of public policies for sustainable innovation and industrial companies' performance; social impact finance; the effectiveness of national and international policies on improving companies' performance and the development of new governance models oriented towards "shared value"; the management of social relations with stakeholders and the maximisation of the social and cultural impact of innovation.

ERC fields:

- SH1 Social Sciences and Humanities. Individuals, institutions and markets: economics, finance and management
- SH2 Institutions, values, beliefs and behaviour: sociology, social anthropology, political science, law, communication, social studies of science and technology;
- SH3 Environment and society: environmental studies, demography, social geography, urban and regional studies.
- LS7 Diagnostic tools, therapies and public health: aetiology, diagnosis and treatment of disease, public health, epidemiology, pharmacology, clinical medicine, regenerative medicine, medical ethics

EXPECTED OCCUPATIONAL AND PROFESSIONAL OPPORTUNITIES

The doctorate aims at providing an adequate preparation to carry out professional activities in basic and applied research, also at university level, and highly qualified professional activities in companies and public or private national and international structures/institutions/centers, which deal with aspects related to the management of innovation, sustainability, technology transfer in the fields of economics and statistics, political and social sciences, legal sciences and industrial and information engineering.

Due to its interdisciplinary nature, the doctorate allows the acquisition of transversal scientific knowledge and skills and solid specialist skills; it also allows specific in-depth studies through the possibility of research experience abroad supported by the presence of foreign lecturers in the college.

The training translates into an adequate scientific production.