



SUMMARY OF RESEARCH ACTIVITIES

UNICAM, availing itself of a tradition acquired throughout more than six hundred years of its history, pursues the objective of spreading, among increasingly diversified users, the high quality of its research and training activities that find opportunities for development even in applied research opportunities that arise, such as territorial instances. In this sense, as part of its mission, UNICAM shows its willingness to present itself as a polycentric university system, capable of promoting, with its very presence, the historical and environmental qualities of the surrounding area, an important factor in connection with the production situation expressed by the economic system of the region of Marche, characterised by a widespread distribution model.

The particularity of UNICAM is the ability to give rise to interdisciplinary connections, starting from the three coexisting fundamental levels of knowledge it comprises (humanistic, scientific-technological and design-related), providing the civil society, and the labour and production market, with the increasingly advanced tools for controlling the complexity factors that characterise the new globalised world. The strategic objective of UNICAM, as reiterated also in the strategic planning document, is the improvement of the quality of research and higher education, in order to confirm and strengthen its role in the European Research Area (ERA) and in the European Higher Education Area (EHEA), and to contribute to the economic and social development of the Country and of the Territory of reference (third mission). To this end, in agreement with the University Schools (institutions of higher education and research), specific lines of research have been identified, based on objective strengths, verified over the years through the indicators commonly used by the international scientific community for the evaluation of research, and also by the national project of evaluation of the research quality, conducted by ANVUR [Italian National Agency for the Evaluation of the University and Research Systems]. The lines of research are developed within the Schools according to the following scheme, which shows the transversal nature of subjects with respect to the knowledge featured in the University.

Specific lines of research of the University	Architecture and Design	Biosciences and Veterinary	Law	Pharmaceutical and Health Products Sciences	Science and Technology
A. Complex systems, models, methods and applications	✓				✓
B. Quantum phenomena and applications					✓
C. Energy, eco-friendly materials and processes	✓				✓
D. Biomolecules and genes, structures and activities		✓			
E. Food resources		✓		✓	
F. Environment and landscape	✓	✓			✓
G. Synthesis, development and management of pharmaceuticals and health products				✓	✓
H. Animal health and welfare		✓			
I. Food quality and safety		✓		✓	✓
J. Person, market and institutions			✓		✓
K. Citizenship, rights and legality			✓	✓	✓
L. Project, settlement and object quality	✓				
M. Conservation and restoration of architectural, artistic and cultural heritage	✓				



Activities coordinated by the University Schools

University Schools are the basic divisions within the University, responsible for the implementation and coordination of research and educational activities, for transfer of skills and knowledge, and services. They have scientific, teaching and managerial autonomy.

University of Camerino is divided into 5 University Schools:

SCHOOL
ARCHITECTURE AND DESIGN
BIOSCIENCES AND VETERINARY MEDICINE
LAW
PHARMACEUTICAL AND HEALTH PRODUCTS SCIENCES
SCIENCE AND TECHNOLOGY

As regards the internal composition of the **personnel involved in the research activities**, details are given as of 31 December 2018, divided by "University Schools":

Table – Units and Personnel involved in the research - year 2018 and the previous three-year period (situation as of 31 December 2018)

UNIVERSITY SCHOOLS	Lecturers	Research Fellows	PhD Students
	2018	2018	2018
Architecture and Design	36	4	25
Biosciences and Veterinary Medicine	74	16	13
Law	34	0	18
Pharmaceutical and Health Products Sciences	52	6	31
Science and Technology	86	12	60
	Total	38	147

The following paragraphs briefly describe the research fields covered within the five University Schools.

School of Architecture and Design

Lecturers / Researchers, PhD students, Research Fellows, Undergraduate Students and Technical Staff of the School are constantly engaged in the development of scientific and cultural activities aimed at design, realisation and transformation of natural and man-made environment of cities, territories, landscapes, and their characteristic objects.

The School of Architecture and Design operates mainly in three research areas:

1. theories and systems for architecture and built environment;
2. transmission of the architectural and cultural heritage of city and territory;
3. design of industrial product and communication.

Each area brings together competences related to the scientific disciplinary areas that characterise Civil Engineering and Architecture. The lines of research, both basic and applied, related to each of the three areas are linked with some major thematic areas, coherent both with the lines of research characterising the University's 2013-2015 Three-Year Plan, and inspired by the principles of the European Research Area (ERA), and with the strategic objectives of Horizon 2020.



School of Biosciences and Veterinary Medicine

The School is divided into two units, uniform in terms of teaching and science, aimed at promoting, coordinating and organising educational, administrative, assistance and research activities, called “Departments”: Department of Biosciences and Biotechnology (situated in Camerino) and Department of Veterinary Medicine (situated in Matelica).

The scientific structure of the School provides for an interdisciplinary coordination, and various research groups have developed their activity in the following areas:

1. Nutrition and food resources.
2. Environment and territory management
3. Animal health and welfare
4. Food quality and safety
5. Microbial biotechnology and Biotechnology for human health
6. Ecology and evolution

Law School

There are three distinctive lines of research within which the Law School researchers have developed their activities, as specified below:

1. Person, institutions and protection of rights
2. Rights of the citizen and efficiency of public services
3. Fundamental rights and social changes in the global society

The first two areas specifically address issues that, in recent years, have become increasingly pressing, such as the need for a strong recovery of efficiency of fundamental public services in our country (justice, healthcare, education), in the awareness that only an efficient public service is able to provide effective and adequate protection of the rights of the citizen and to justify the resources, nowadays increasingly scarce, that the State must however allocate and implement. The third topic took into consideration the issue of fundamental rights, with particular attention to the following profiles: historical roots, theoretical status, constitutional rank, evolution and risks in relation to economic and social transformations, internal, transnational and international dimensions of their protection.

School of Pharmaceutical and Health Products Sciences

The School of Pharmaceutical and Health Products Sciences develops projects consistent with the lines of research of Horizon 2020, which in turn which, in turn, are referred to in the establishment of the distinctive lines of research of the University. On this basis, in the scientific laboratories of the School, projects are active that are divided into three main areas of research and scientific development.

1. Design, synthesis and development of potential drugs, diagnostics and products for body care and human health
2. Food quality and safety and study of natural substances for maintaining human health and wellbeing
3. Bioethics and Forensic Medicine

School of Science and Technology

The School of Science and Technology has developed its activity within the five organisational sections it comprises. Each of these sections features one scientific area: Chemistry, Physics, Geology, Computer Science and Mathematics.



In line with the scientific nature of the School, the development of advanced research is one of the priority objectives. Various lines of research refer to the issues consistent with the lines of research of Horizon 2020 and with the distinctive lines of research indicated in the University's three-year plan.

Division of CHEMISTRY

The research activities of the CHEMISTRY division focused on three main topics.

(i) Synthesis and characterisation of nanostructured materials that find application in energy production and accumulation, and in environmental quality control. (ii) Synthetic and analytical methods for environmental sustainability. The studies concern the development of new analytical techniques and the modification of pre-existing methods of synthesis and analysis, in order to reduce the environmental impact of industrial chemical processes. (iii) Design and synthesis of new chemical entities for health through a combination of small molecules. The study is aimed at defining potential therapeutic targets and meets the key objectives “Societal Challenges” and “Industrial Leadership” of the Horizon 2020 Program. This topic involves researchers from the fields of organic, inorganic and physical chemistry.

Division of PHYSICS

The research activities of this division concern Experimental Physics and Physics of Matter. In these areas, substantial research groups are active on various issues.

(i) (i) Many-body and superconducting systems, with particular attention to the theories of superfluid systems with applications to superconducting materials, ultracold gases and neutron stars. (ii) Optics and Quantum Information with emphasis on the theoretical and experimental study of optical, nanomechanical and atomic systems for processing and communicating information encoded in quantum states. (iii) Synthesis and advanced characterisation of materials for the experimental study of condensed matter with synthesis and characterisation of functional materials for applications in the field of sustainable energy.

Division of GEOLOGY

Research activities are of multidisciplinary nature, in accordance with the following two thematic areas.

(i) (i) Natural resources, materials and applications. Research activities can be further divided into the following specific topics: a) characterisation of natural geo-fluid reservoirs; b) study of low- and medium-enthalpy geothermal resources; c) materials: crystallochemical, geochemical and structural studies of materials; d) cultural heritage: geological-geomorphological and climatological analysis of archaeological sites, archaeometric studies of ceramic, stone and binder materials; delineation of natural hazards; collaboration in the training of experts in the management of archaeological heritage. (ii) Environmental risks and prevention. The research activities can be divided into the following specific topics: a) Evaluation of the hazards linked to natural phenomena and the related risks; b) reduction of environmental risks.

Division of COMPUTER SCIENCE

Research activities of the Computer Science division mainly concern the topic of “Modelling, analysis and formal verification of distributed systems”. The active projects deal with the following:

(1) Modelling and analysis of business processes. Main research objectives: (a) defining a flexible, sustainable and legitimate software ecosystem for the dynamic integration of services; (b) use of cloud infrastructures for the interoperability and integration of the public and corporate sector, enhancing existing data and services for a smart government.

(2) Formal methods and languages for complex systems. Main research objectives: (a) defining data-driven methods and languages for the recognition of emerging phenomena; (b) defining language abstractions for domain applications; (c) use of the algebraic and computational topology for the definition of a form language.

(3) Analysis and verification of distributed systems. Main research objectives: (a) defining a methodology for the development and verification of pervasive distributed systems, in particular sensor networks; (b) creation of analytical tools and languages for the development of control policies; (c) defining testing techniques for



service-oriented systems; (d) development of network protocols with possible application of security techniques.

Division of MATHEMATICS

Research activities of this division concern:

(i) Mathematical methods for the study of information and form. The main objectives of this line of research are the following: (a) application of the theory of dynamical systems to morphogenesis, study of morphogenetic fields; (b) topology and knot theory, applications to design and to computational aesthetics; (c) applications of Differential Geometry to the analysis of geometric and physical structures with high degree of symmetry; (d) study of the rings of integers in number fields, classification of their modules, connection with computability; (e) methods of model theory for modules over rings; (f) study of differential equations and functions of several complex variables with applications in geometry.

(ii) Mathematical methods for industrial and economic applications. The main objectives of this line of research are the following: (a) analysis and control of linear and nonlinear dynamical systems even in fault conditions, of robotic systems, of power systems and of energy conversion; (b) study of impact problems through modelling, numerical simulations and analysis of experimental results; (c) optimisation, classification and regression problems in logistics, finance, electricity market, and biology; (d) image analysis and reconstruction using numerical techniques; (e) numerical evidence of blow-up for the Navier-Stokes equation; (f) resolution of differential equations in finance using numerical methods; (g) analysis of dynamical systems concerning gravitational collapse and cosmological solutions, study Riemannian and relativistic geodesics in the presence of singularities.