TRAINING SEMINAR 1:
The Civic Universities in the global social challenges

FINAL VERSION

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"MED-QUAD"

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TRAINING SEMINAR_I

(SECOND DRAFT)

Introduction

In the last 40 years the world has become increasingly complex and the challenges more interconnected, requiring collective responses and solutions at individual, national, regional and global level.

As observed by Ban Ki-moon already in 2012, the old economic model is breaking down, growth has stalled, jobs are lagging and gaps between rich and poor are growing.
Global societal challenges, as health and demographic change, food security, secure and clean water, green and efficient energy sources, climate change, and inclusive and secure communities, have both a local and a global dimension and finding sustainable solutions requires the active participation of everyone. The compulsory transition towards the green economy is based on a collective worldwide new perception and practice of production and consumption. This means that global trends must be reflected in local realities, and local activities must be harmonized with the global interconnected picture that affects the planet.
In this process of a comprehensive globalization of almost all facets of the human activities, the university, since its first foundation in Takshashila (600 BC), has been always a global key institution for social development, but the recent events have strongly emphasized its strategic positioning to enhance the competitiveness of nations and regions.
Now more than ever, higher education is tied to the economic, social and environmental fabric of the modern world and committed to take an active responsibility in addressing the challenges of the world's pressing issues. Every HEI is both placed in locally specific cultural, political and organizational contexts and simultaneously affected by global forces. Thus, the pressure for global engagement from diverse groups of stakeholders (policymakers, students, parents, academics, social and environmental groups, intergovernmental, regional and national bodies) needs to be balanced with the local realities and aspirations understood within a global ambience.
In the context of an increasingly knowledge-based society and economy, universities have become critical to the social, economic, cultural and technological development and key actors for meeting the global challenges facing humanity described in the 17 Sustainable Development Goals of the UN Agenda 2030. The role of HEIs in developing the critical thinking needed in young people and researchers to find solutions to the problems facing our world, must be approached in ways that cross both institutional and disciplinary boundaries as well as regional and international specifications.
Through their main missions (training, scientific research, knowledge transfer and social commitment), HE Institutions and systems are exploring the concepts of impact and engagement, of social innovation and responsible research, providing their own interpretation of what is being asked to them and adopting their ways to respond to the changed local and global environment.
Context is important, since engagement with the world outside implies the awareness of the different meaning of concepts that are both locally relevant and globally responsive.
MED-QUAD project, by involving six University/City couples in six different countries of the Mediterranean basin, intends to provide an example of how to manage the dual responsibilities of HEIs at local and global level and how to deal with both at the same time.
Based on the profound links of each university with its territory and on the ancestral cultural, historical and economic ties of the countries along the Mediterranean shores, the project will experiment the QH approach to sustainable development by building and testing a *glocal* model of "Civic University" and living lab able to promote global citizenship, education and Responsible Research and Innovation.

CHAPTER I – The Universities and the places

1.1 – Historical (and geographical) Survey

Even though the university, as a formal institution, is generally considered originated in the Medieval Christian setting, the need to establish a place where knowledge could be transmitted, and new knowledge could be created, started long before.

1.1.A – The BC era

Ancient India

Excavations in *Takshashila* (about 50 km west of Rawalpindi, now in Pakistan), in 1913, revealed the ancient seats of the world's first University.

The school was established in 700 BC and consisted of several monasteries without dormitories or lecture halls where the religious instruction was most likely still provided on an individualistic basis.
More than 10.500 students from all over the world studied there. They came from Babylonia, Greece, Arabia and China and generally entered Takshashila at the age of sixteen. Entrance exam was very difficult, only 3 out of every 10 students passed the admission test. They were supposed to pay for their expenses. However, if a student was unable to pay then he could work for his teacher.
The school offered over sixty different courses in various field such as science, mathematics, medicine, politics, warfare, astrology, astronomy, music, religion, and philosophy.
Panini, the famous Sanskrit grammarian, Chanakya, https://en.wikipedia.org/wiki/Ancient_higherlearning_institutions - cite_note-32 the Maurya Emperor Chandragupta and the Ayurvedic healer Charaka studied at Takshashila.
The famous treatise in ancient Sanskrit *Arthashastra*[1] by Chanakya (or Kautilya, also identified as Vishnugupta, or even more authors), is said to have been composed there.
Takshashila`s prosperity resulted from its position at the junction of three great trade routes.

Ancient Greece

The *Platonic Academy* (sometimes referred to as the University of Athens), was founded ca. 387 BC in Athens by the philosopher Plato.
Intellectuals with a variety of interests came to meet with Plato, who gave public lectures, as well as to conduct their own research and participate in discussions on the public grounds of the *Academy* (a site named after the Attic hero Academus and sacred to Athena) and in the garden of the property Plato owned nearby. By the mid-370s BC, the Academy attracted Xenocrates from Chalcedon and in 367 Aristotle from relatively far-off Stagira.
Around 335 BC, Aristotle founded the *Peripatetic School*, the students of which met at the Lyceum Gymnasium in Athens. [1] [2]
The reputation of the Greek institutions was such that at least four central modern educational terms derive from them: the *academy*, the *gymnasium* (originally for physical exercises, then became a place for intellectual exercises), the *lyceum* (the name of a gymnasium dedicated to Apollo Lyceus) and the *museum* (place dedicated to the Muses, the Greek mythological divinities patron of the arts and human thinking) [3].

[1] The ***Arthashastra*** is an ancient Indian Sanskrit treatise on statecraft, economic policy and military strategy. Composed, expanded and redacted between the 2nd century BC and 3rd century AD the *Arthashastra* was influential until the 12th century, when it disappeared. It was rediscovered in 1905 by R. Shamasastry, who published it in 1909 and its English translation in 1915.
The title translates as "**the science of wealth**" but the book includes the nature of government, law, civil and criminal court systems, ethics, economics, markets and trade, diplomacy, theories on war, nature of peace, and the duties and obligations of a king. The text incorporates Hindu philosophy, ancient economic and cultural details on agriculture, mineralogy, mining and metals, animal husbandry, medicine, forests and wildlife. It also explores issues of social welfare, the collective ethics that hold a society together, advising the king that in times and in areas devastated by famine, epidemic and such acts of nature, or by war, he should initiate public projects such as creating irrigation waterways and building forts around major strategic holdings and towns and exempt taxes on those affected.

Both institutions lasted until 86 BC, when they were destroyed during Sulla's siege and sacking of Athens.

Ancient Egypt

In 2000 BC ancient Egyptians, for higher learning, established the *Per-Ankh*, the "*House of Life*". They were learning centers attached to the temples where, under the leadership of god Djehuti (Thoth), knowledge was considered organic and sacred. The hieroglyph for *Per-Ankh*[1] [(1)] is an open square (house) over the *ankh (crux ansata),* the *"key of life"* symbol. In these *houses of life* in Kemetic temples (Kemet, the Black Land, is the ancient name of the country) scribes learned to preserve and disseminate knowledge through

[1] the open square over the *ankh (crux ansata),* the *"key of life"* symbol spells out its meaning as "House of Life."

the sacred craft of *hieroglyphics* ("holy writing") created by Djehuti. Run by Priests/Servants of creator god Amun-Re, the *Per-Ankh* was where Djehuti's writings were housed and sacred knowledge (his vast understanding of the universe) would initiate seekers into higher levels of consciousness. Djehuti, the Lord of Sacred Writings, who represented the Magician archetype of divine masculinity, was associated to the Goddess Seshat, who, among many attributes, held the prestigious title of *Foremost of the Per-Ankh* and was regarded throughout ancient Egypt as Goddess of Wisdom, Writing, Mathematics, Astronomy, Astrology, as well as Goddess of Architects and Builders.

Later, In the 3rd century BC, amid the Ptolemaic dynasty, the *Serapeum* (temple sacred to the GreekEgyptian god Serapis), the *Mouseion (*the larger research institution dedicated to the nine Muses), and the *Great Library* constituted the University of Alexandria that made the city the capital of higher learning. The Great Library, an important part of the research institution, was proposed to Ptolemy I Soter, by *Demetrius of Phalerum*, an exiled Athenian statesman living in Alexandria. With the support of the Ptolemaic kings' well-funded policies for procuring texts, the library quickly acquired many papyrus scrolls. It is unknown precisely how many such scrolls were housed at any given time, but estimates range from 40.000 to 400.000.
Even though it was known that it was in Alexandria, only in May 2004 archeologists found the site of the *University of Alexandria*, the intellectual and cultural hub of the world where *Archimedes* crafted a water pump of a type still used today, *Euclid* organized and developed the rules of geometry, *Hypsicles* divided the zodiac into 360 equal arcs, *Eratosthenes* calculated the diameter of Earth within a few hundred kilometers of accuracy, *Zenodotus of Ephesus* and *Aristarchus of Samothrace* standardized the texts of the Homeric poems, *Callimachus* wrote the Pinakes, considered the first library catalogue, *Apollonius of Rhodes*, composed the *Argonautica*, *Aristophanes of Byzantium* invented the system of Greek diacritics and was the first to divide poetic texts into lines. Other scholars are believed to have produced there the *Septuagint*, the ancient Greek translation of the Old Testament.

1.1.B – *The AD first millennium*

Between the 3rd and 9th century, within a deeply changed geo-political framework, higher institutions were established in many cities of the world.

EUROPE

The collapse of the Roman Empire in the 4th century created a period of anarchy and economic crisis across Europe. The intellectual climate changed drastically, and large numbers of books and papers were lost or destroyed.
Greek and Roman learning was preserved in Eastern Europe in the Byzantine Empire, and over time Islamic scholars absorbed and spread the ancient texts throughout the Middle East.
In Western Europe the few surviving texts were dispersed in monastery libraries. Furthermore, the early medieval monks were more interested in theological and philosophical texts than pagan mathematics or science, so few copies were made of such works. Latin was the language of the monks and the surviving texts were rewritten in abbreviated medieval style of Latin, often based on poor translations from Greek. Over time the curriculum of medieval learning became based on large compendiums of simplified Greek knowledge compiled by encyclopedists such as Boethius (480-524).

Over the centuries many surviving ancient texts decayed or were destroyed in wars and other disasters.

Greece

During the 4th century AD, the Platonist philosopher *Plutarch of Athens* started a school which identified itself with Plato's Academy. That school lasted until 529, when it was closed following an edict from the Emperor Justinian prohibiting pagans from teaching.

The Academy was also emulated during the Renaissance by the *Florentine Platonic Academy*, whose members saw themselves as following Plato's tradition.

ASIA

India

During the 800 years that *Takshashila* was operational, it attained great fame. The University consisted of:
– 300 lecture halls with stones benches for sitting
– laboratories
– Observatory called the Ambudharaavlehi for astronomical research
– Massive Library called Dharma Gunj or Mountain of Knowledge, consisting of 3 buildings: Ratna Sagar, Ratnodavi and Ratnayanjak.

Takshashila's prosperity resulted from its position at the junction of three great trade routes. In the second half of the 5th century, it was severely damaged by Hephthalite invasions and during the 7th century it was gradually abandoned by its inhabitants.

Nalanda was established in the 5th century AD in Bihar (India), and operated from 427 to 1197. It was devoted to Buddhist studies, but it also trained students in fine arts, medicine, mathematics, astronomy, politics and the art of war.
The center had eight separate compounds, ten temples, meditation halls, classrooms, lakes and parks. It had a nine-story library with 9 million books where monks meticulously copied books and documents so that individual scholars could have their own collections. It is mentioned to be the world's very first residential university, and among the greatest centers of learning in the ancient world. It had dormitories for students, housing 10.000 students in the school's heyday and providing accommodation for 2.000 professors. Nalanda attracted pupils and scholars from Sri Lanka, Korea, Japan, China, Tibet, Indonesia, Persia and Turkey, who left accounts of the center.

Vikramashila was established by King Dharmapala (783 to 820) in response to a supposed decline in the quality of Nalanda. Tibetan sources (especially by Tāranātha, the Tibetan monk historian of the 16th –17th centuries) report Vikramashila and Nalanda as the two most important centres of learning in India during the Pala Empire. Atisha, the renowned "pandita", is sometimes listed as a notable abbot. Subjects like philosophy, grammar, metaphysics, Indian logic etc. were taught there, but the most important branch of learning was tantrism. It was destroyed by Muhammad bin Bakhtiyar Khilji around 1200.

University of Mithila was famous for Nyaya Sutra (an ancient Indian Sanskrit foundational text of Hindu philosophy composed by Akṣapāda Gautama) and logical Sciences. It was gradually started from the philosophical conferences held by Janaka, the king of Mithila at his court. These philosophical conferences led to the formation of a seat of learning and this seat of learning converted into the university of Mithila.

Further centres include *Telhara* in Bihar (probably older than Nalanda), *Odantapuri*, in Bihar (circa 550 - 1040), *Somapura Mahavihara*, in Bangladesh (from the Gupta period to the Turkic Muslim conquest), *Sharada Peeth*, in Pakistan, *Jagaddala Mahavihara*, in Bengal (from the Pala period to the Turkic Muslim conquest), *Nagarjunakonda*, in Andhra Pradesh, *Valabhi*, in Gujarat (from the Maitrak period to the Arab raids), *Varanasi* in Uttar Pradesh (eighth century to modern times), *Kanchipuram*, in Tamil Nadu, *Manyakheta*, in Karnataka, *Mahavihara, Abhayagiri Vihāra*, and *Jetavanaramaya*, in Sri Lanka.

China

The ancient imperial academy known as *Taixue* was established by the Han Dynasty. It was intermittently inherited by succeeding Chinese dynasties up until the Qing dynasty, in some of which the name was changed to *Guozixue* or *Guozijian*. *Peking University* (Imperial University of Peking) and *Nanjing University* are regarded as the replacement of Taixue. By 725 AD, *Shuyuan* or Academies of Classical Learning were private learning institutions established during the medieval Chinese Tang dynasty.
The *Yuelu Academy* (later become *Hunan University*) founded in 976 AD, which is one of the four ancient

famous *Shuyuan* (Academies) during the Song dynasty.

Japan

Daigakuryo was founded in 671 and *Ashikaga Gakko* was founded in the 9th century and restored in 1432.

Korea

Taehak was founded in 372 and *Gukhak* was established in 682. *Seowons* (the most common educational institutions of Korea during the mid- to late Joseon Dynasty) were private institutions established during the Joseon dynasty which combined functions of a Confucian shrine and a preparatory school.
The *Seonggyungwan* was founded by in 1398 to offer prayers and memorials to Confucius and his disciples, and to promote the study of the Confucian canon. It was the successor to *Gukjagam* from the Goryeo Dynasty (992). It was reopened as *Sungkyunkwan University*, a private Western-style university, in 1946.

Ancient Persia

The *Academy of Gondishapur* was established in the 3rd century AD under the rule of Sassanid kings and continued its scholarly activities up to four centuries after Islam came to Iran. It was an important medical centre of the 6th and 7th centuries and a prominent example of higher education model in pre-Islam Iran. When the Platonic Academy in Athens was closed in 529, some of its pagan scholars went to Gundishahpur, although they returned within a year to Byzantium.

AFRICA Egypt

In Cairo, *Al-Azhar*, established in 970 AD, served as an organization of higher learning. Morocco

In Fez, Fatima al-Fihri, an Arab woman heir of a rich family, established a mosque in 859, which eventually became the organization of higher learning, the *University of al-Qarawiyyin.* Tunisia

The *Ez-Zitouna University*, which was established in 732, served as an organization of higher learning.

Ethiopia

In the 4th century, amid the reign of Emperor Ella Amida, the Axumite imperial church served as an organization of higher learning.

Mali

In the 12th century AD, the *University of Sankore*, which began as the Mosque of Sankore, served as an organization of higher learning in Timbuktu. The *Mosque of Sankore*, the *Mosque of Sidi Yahya*, and the *Mosque of Djinguereber* constitute what is referred to as the University of Timbuktu.

1.1.C - *The 11th and 12th century*

In the 11th century the Crusades, while destructive and religious-driven wars, produced some positive outcomes for European society by creating new contacts with the East so helping to recover lost ancient knowledge. Western scholars came to realize that Islamic intellectuals had a storehouse of ancient learning wider than their own. The Arabic scholars had added new material to the classics, also by absorbing the intellectual traditions of nearby cultures such as Hindus and Babylonians. Many European scholars traveled to Spain, the southern half of which was an Islamic state, to learn Arabic and other so-called oriental languages.

After the collapse of the Roman Empire, the survival of the few ancient texts was entrusted to the monks of Western monasteries, who copied mainly theological and philosophical texts, neglecting fields as mathematics or science, so few copies were made of such works. However, such monasteries became centers for copying the new texts recovered from the East and the focal points of medieval learning, giving rise to the *monastic schools* (*scholae monasticae*), in which monks and nuns taught classes. At the same time bishops began to establish schools associated with their cathedrals to provide the church with an

educated clergy. These *cathedral schools*, together with the *monastic schools,* especially those in capital cities or at pivotal trade routes, began to grow with the slow rise of trade and economic stability.

Learning became essential to advancing in the ecclesiastical hierarchy, and demand quickly exceeded the capacity of cathedral schools, each of which was essentially run by one teacher. Furthermore, while originally intended for religious study, various reforms made these schools accept secular students, and, as student numbers climbed, they gradually evolved into universities.

Pope Gregory VII was critical in promoting the concept of modern university as his 1079 Papal Bull ordered the regulated establishment of cathedral schools that transformed themselves into the first European universities.

Syed Farid Alatas [4], noting some parallels between the Colleges and Madrasahs, inferred that the first universities in Europe were influenced by the Madrasahs in Islamic Spain and the Emirate of Sicily, but (George Makdisi, Toby Huff and Norman Daniel [5] [6] [7]) there is no evidence for an actual transmission from the Islamic world to Christian Europe also due to the differences in the structure, methodologies, procedures, curricula and legal status of the "Islamic college" (madrasah) versus the European university.

The first Western European institutions generally considered universities were established by the Kingdoms in Italy (the Kingdoms of Naples, of Sicily and of Italy then part of the Holy Roman Empire), in England, in France, in Spain, and in Portugal between the 11th and 15th centuries for the study of the Arts and the higher disciplines of Theology, Law, and Medicine.

Among the earliest universities of this type were the University of Bologna (1088), University of Paris (1150), University of Oxford (1167), University of Modena (1175), University of Palencia (1208), University of Cambridge (1209), University of Salamanca (1218), University of Montpellier (1220), University of Padua (1222), University of Toulouse (1229), University of Orleans (1235), University of Siena (1240), University of Valladolid (1241) University of Northampton (1261), University of Coimbra (1288), University of Pisa (1343), Charles University in Prague (1348), Jagiellonian University (1364), University of Vienna (1365), Heidelberg University (1386) and the University of St Andrews (1413) begun as private corporations of teachers and their pupils.

1.1.D - *From the 13th to the 15th century*

The medieval university, evolved from the older Christian cathedral schools and monastic schools, was a corporation of students and masters, organized for the purposes of higher education, but it is difficult to define the exact date when they became true universities, though the lists of *studia generalia* (i.e., open to students coming from everywhere) for higher education in Europe held by the Vatican provide reliable information.

The word *universitas* originally applied only to the scholastic guilds—that is, the corporation of students and masters—within the *studium (*at least one of the highest faculties of Law, Theology or Medicine*)*, and it was always modified, as *universitas magistrorum, universitas scholarium*, or *universitas magistrorum et scholarium*. Eventually, probably in the late 14th century, the term began to appear by itself to mean a selfregulating community of teachers and scholars recognized and sanctioned by civil or ecclesiastical authority.
There is some debate among scholars about which particular place can be called the first university. The medical school at Salerno (Italy), is often cited as the first university, or at least one of the first universities. Salerno was well known as a health resort from the 9th century, and a meeting place of Greek, Latin, Arabic, and Jewish learning, being a port situated on important trade routes. It became a *universitas* sometime in the 12th century, and obtained formal recognition in 1231, but remained solely a medical school and did not influence the style and organization of later universities.

The development of the medieval university coincided with the widespread reintroduction of Aristotle from Byzantine and Arab scholars, so that the European university put Aristotelian and other natural science texts at the center of its curriculum.

Although it has been assumed that the universities went into decline during the **Renaissance** due to the scholastic and Aristotelian emphasis of its curriculum being less popular than the cultural studies of Renaissance humanism, Toby Huff [6] has noted the continued importance of the European universities, with their focus on Aristotle and other scientific and philosophical texts into the early modern period, arguing that they played a crucial role in the Scientific Revolution of the 16th and 17th centuries: *"Copernicus, Galileo, Tycho Brahe, Kepler, and Newton were all extraordinary products of the apparently Procrustean and allegedly Scholastic universities of Europe… Sociological and historical accounts of the role of the university as an institutional locus for science and as an incubator of scientific thought and arguments have been vastly understated"* [6].

Initially medieval universities did not have physical facilities such as the campus of a modern university. Classes were taught wherever space was available, such as churches and homes. A university was not a physical space, but a collection of individuals banded together as a *universitas*. Soon, however, universities began to rent, buy or construct buildings specifically for the purposes of teaching.

Universities were generally structured along three types, depending on who paid the teachers. The first type was in Bologna, where students hired and paid for the teachers. The second type was in Paris, where teachers were paid by the church. Oxford and Cambridge were predominantly supported by the crown and the state, which helped them survive the Dissolution of the Monasteries in 1538 and the subsequent removal of all principal Catholic institutions in England.

These structural differences created other characteristics. At the Bologna university the students ran everything, often putting teachers under great pressure and disadvantage. In Paris, teachers ran the school; thus, Paris became the first spot for teachers from all over Europe. In Paris the main subject matter was theology, so control of the qualifications awarded was in the hands of the Chancellor of the diocese, as an external authority. In Bologna, where students chose more secular studies, the main subject was law.

Universities often competed to secure the best and most popular teachers, leading to the marketisation of teaching. Universities published their list of scholars to entice students to study at their institution. Teachers and scholars used to move around, and popular teachers brought students with them (students of Peter Abelard followed him to Melun, Corbeil, and Paris) [8]

Medieval learning was based on the **seven liberal arts:** arithmetic, geometry, astronomy, music theory, grammar, logic, and rhetoric. The **quadrivium** (four) comprised the mathematically based ones (arithmetic, music, geometry, and astronomy), but these were much less popular than the linguistic **trivium** (three) of grammar, rhetoric, and logic, which led to further study in theology, philosophy, medicine, and law. The mathematically based **quadrivium** was taught after the linguistic **trivium** and awarded the degree of Master of Arts.
University studies took six years for a Master of Arts degree while a Bachelor of Arts degree was awarded after completing the third or fourth year. Studies for this were organized by the faculty of arts, where the seven liberal arts were taught. All instruction was given in Latin and students were expected to converse in that language. The curriculum included the three Aristotelian philosophies: physics, metaphysics and moral philosophy. Once a Master of Arts degree had been conferred, the student could leave the university or pursue further studies in one of the higher faculties, law, medicine, or theology, the last one being the most prestigious.

As students had the legal status of clerics, Canon Law prohibited women from being admitted into universities. Students were provided with the legal protection of the clergy. No one was allowed to

physically harm them; they could only be tried for crimes in an ecclesiastical court and were thus immune from any corporal punishment. This gave students free rein in urban environments to break secular laws with impunity, which led to many abuses: theft, rape, and murder. Consequently, uneasy tensions with secular authorities, initiated the demarcation between *town and gown*.
Masters and students would sometimes "strike" by leaving a city and not returning for years. This happened at the University of Paris strike of 1229 after a riot left several students dead.

Most universities in Europe were recognized by the Holy See as a *Studium Generale*, testified by a papal bull. Members of these institutions were encouraged to disseminate their knowledge across Europe, often lecturing at different *Studia Generalia*. Indeed, one of the privileges conferred by the papal bull, was the *Ius ubique docendi*, the right to teach everywhere.

For several years the structure remained more or less the same till the eighteen century when the political, social and economic changes generated a radical reform of the higher education. The original system of only four faculties (arts, theology, medicine and law), was divided and new faculties and subjects were created. The natural sciences, for instance, had evolved from the natural scientific quadrivium of the liberal arts as well as from medicine. The humanities developed from the trivium, whereas the social sciences grew out of the law faculty.

This Western-style organizational form gradually spread from the medieval Latin west across the globe, eventually replacing all other higher-learning institutions and becoming the prominent model for higher education everywhere, including the colonies.

1.1.E - *From 16th to 19th century*

The **Scientific Revolution** was a series of events that marked the emergence of modern science during the early modern period, when developments in mathematics, physics, astronomy, biology (including human anatomy) and chemistry transformed the view of society about nature.
The Scientific Revolution took place in Europe towards the end of the Renaissance period and continued through the late 18th century, influencing the intellectual social movement known as the **Enlightenment**. While its dates are debated, the publication in 1543 of Nicolaus Copernicus' *De revolutionibus orbium coelestium* (On the Revolutions of the Heavenly Spheres) is often cited as marking the beginning of the Scientific Revolution.
Without entering the debate among scholars on the (no) role of universities in the Scientific Revolution, scientists as Galileo, Kepler, Newton and others were teachers in the universities where they had studied, and even though their research was not officially supported by the academia, most relied on some kind of other patronage, such as the Church (Copernicus) or wealthy families who liked supporting intelligent people (Galileo, Kepler, many others). In all cases, the higher education system was influenced by the new approach to research.
In France the foundation of specialized colleges (that evolved into the Grandes Écoles) became prototypes of Polytechnics, in Germany the foundation of the University of Berlin, as a result of the reform launched by the scholar W. von Humboldt, fostering the interconnection of free research and teaching, became one of the prototypes of modern research universities.

In the 19th century the **Industrial Revolution** and the rapid development of technology and its use in factory production asked for increased number of qualified civil servants and engineers, expert of the technical sectors of construction and military. The *École Polytechnique* in Paris and the *Technische Hochschule* in Karlsruhe were the pioneer technical universities. In the United Kingdom some institutions evolved to meet the needs of a rapidly evolving industrial society, becoming the predecessors of the so-called *redbrick universities*.

This transformation process included not only support for key industrial sectors such as mechanical or chemical engineering, but also hospitals, contributing to a healthy workforce which later became the foundation for university medical schools.
The number and quality of schools for higher technical education therefore increased and several Polytechnic schools raised in Europe. [9]

1.1.F – *The 20th century*

Between the late nineteenth century and the first two decades of the twentieth century, German research universities played a hegemonic role in Europe. The strong government support to universities and other scientific institutions resulted in higher professorial salaries and better equipped laboratories than was possible at universities that relied on endowments. [10]
In the industrial society, the technological innovation was often based on the strict collaboration between industry and government [11]. Universities were not directly involved in the process. However, the wellknown vacuum tube firm Raytheon founded in 1920 in Cambridge (Massachusetts) by Vannevar Bush, Professor of Electrical Engineering at the M.I.T, increasingly interwined university research in both industry and government. [12]
During the World War II direct links between university, industry and government in USA were established leading to an attitude change among scientists who previously were opposed to government funding of universities. After the war, linear models of innovation were adopted, largely relying on government funding for research boosting innovation, technical solutions and new ideas. However, till the sixties, little research had been turned into innovation so that a different approach to university-based innovation and an enhanced role of government in USA and other countries was required.
The subsequent development of flourishing high-tech regions around M.I.T. (Route 128) and Stanford University (Silicon Valley) inspired the triple-helix model of university-industry-government relations that [13] [14] [15] identified not only as the key factor for American higher education and research hegemony in the twentieth century, but, more generally, as the basis of productive technological innovation in the knowledge society.
Until the early 1980s, scientific creativity was considered a personal attribute of scholars, without considering the interaction of a stimulating environment with talented individuals as fundamental enabler of the creative process. Spatial differences in research practices, financial resources and socio-cultural environment had little consideration. Science was assumed to be placeless. [16] [17] [18]
From 1980 onwards, studies on creativity highlighted that talent, wealth of ideas, endurance and other personal traits are not the only factors influencing a person's scholarly pursuits. The talented students and creative scientists do not work isolated from the social, cultural e economic context where their research is evaluated by the surrounding academic community.
The importance of places, settings, environments and spatial relations for research and scientific careers is underlined by the Geography of Science, that tries to explain why a specific field first developed at that university and not in another, or some universities produced and attracted outstanding scholars whereas others not, and to identify the barriers. [19] [20] [21] [22] [23] [24] [25]
Another environmental factor influencing the performance of scholars and talented students can be seen in the institutional organization, affecting the psychological climate to which creative persons are particularly sensitive and responsive. [26] [27] [28]
Since the 1980s Human Geography has developed new concepts of space and place leading to a better interface with Social and Behavioral Sciences.
A place can be defined as a "*setting having a symbolic and emotional meaning: providing identity and communicating a complex history of events, cultural memories and emotional attachments*" [29]. A place of work means social status or position in a hierarchy and university towns inherit the reputation earned by generations of individual scholars and their achievements. Thus, Universities and research institutions are not simply locations, but social spaces on which scholars' career expectations are projected, and where the *knowledge environment* has a significant impact on research process.

The university's knowledge environment, indeed, is the result of systemic interdependencies and causal interactions of personal, financial, material and nonmaterial resources relevant to the generation, diffusion and application of scientific knowledge at a specific place or environment, with a high direct impact on the regional economies [30].
By generating a number of start-up and spin-off companies in knowledge-intensive industries in Silicon Valley and along Route 128, the leading American research universities made Silicon Valley a model for regional clusters of high-tech innovation around the world, but the global transfer of such business culture proved to be difficult because strictly connected to the historical and geographical specificity in which this innovation emerged.
Even though [31] the contribution to the emergence of successful high-tech regions in Asia provided by the engineers from India, China and Taiwan, who founded their own companies in their home countries, after the education in U.S. Universities and work experience in Silicon Valley, had proved the possibility of a successful transfer of Silicon Valley's methodology, the question raised about the value of spatial proximity in the high-tech innovation and the reproducibility of such models of IT and Biotech clusters in other sectors. Indeed, close university-business interactions were important for creating the clusters in the 1970s, but their role decreased with the shift from product-based to a producer-service based system with technical consultancies.

1.1.G – *The 21st century*

Between the end of the 20th and the beginning of the 21st century, disruptive technologies as Artificial Intelligence, Cloud Computing, IoT, Big Data, robotics, have favored the advent of what is identified as the fourth industrial revolution (Industry 4.0).
It represents a new stage in the organization and control of the industrial value chain, enabling more direct models of personalized production, servicing, as well as customer/consumer interaction, through a technological fusion of the boundaries between the physical, biological, and digital worlds within intelligent cyber-physical systems.
As in the previous three industrial revolutions, all activities of human life, including education, are strongly affected. At any stage of this evolution, Universities had to revise their teaching and research methods and to adopt new development and organizational models.
The first industrial revolution (Industry 1.0), characterized by the mechanization of the industry with limited production based on the use of oil and steam engines as a source of energy, and the second industrial revolution (Industry 2.0), based on the organization of work and the use of electricity to promote mass production, gave rise to the establishment of Polytechnics and consequent university-industry relationships.
The third industrial revolution (Industry 3.0), based on the integration of electronic components and information technology in the industry for the automation of production tasks, reinforced the links with the companies also through the establishment of industrial clusters/parks with the support of the governments for the knowledge transfer and exploitation (Triple Helix model). Industry 4.0 is a direct consequence of Industry 3.0 by means the development of intelligent industrial systems and the permanent integration of advanced technologies. It also encourages a shift from mass production or service provision to customized products and services based on individual customer requirements, introducing the social component in the innovation approach (Quadruple Helix model).
It is evident that the industrial revolutions were the result of social and scientific changes that, in turn, required new ways of knowledge production and transmission.
Nowadays, in an ever more connected world, in the context of the ongoing globalization of the economy and society, scientific production must address the needs not only of the global markets but also of the local communities.
This means that the transition from Mode 1 to Mode 2 that accompanied the achievements of Industry 3.0, must be further enhanced. In **Mode 1**
Problems of knowledge are set and solved in a context governed by academic interests of a specific community, are based on the disciplines, on homogeneity, have hierarchical structure, and tend to

preserve its form. Quality control is performed by peer review judgements In

Mode 2

Knowledge is produced and carried out in a context of application in a Cross/trans-disciplinary[a] environment, within Heterogeneity[b] . It is Heterarchical[c] and transient as well as socially accountable and reflexive.

Summarised, the difference between the two modes is that Mode 1 represents the traditional production of knowledge, steered by the discipline and the professors within the organisational frame of the research institute, while Mode 2 is practical and project-oriented, and produces knowledge for application within a flexible project organisation and management. The further transition is very well described by [32] in the synoptic table below.

Changing universities' societal engagement roles in transition from an entrepreneurial university to Sustainable Entrepreneurial University

Models Roles	Entrepreneurial University	Sustainable Entrepreneurial University
Knowledge flow	University as a knowledge producer for technology transfer. Knowledge producer, as one direction move of the knowledge from the academy to the industry, is mainly reflected in the concepts of academic capitalism [33]. Mode 2 knowledge production [34] and the third mission of universities [35]	University as anchor organization for knowledge exchange. Knowledge exchange, as bi-directional of knowledge flow, has been described by Geuna and Muscio [36] as: University-industry interaction does not involve only transferring knowledge from the former to the latter; it also helps academics to develop interesting research questions, conduct better research and provide improved understanding of research applications in industry. The bi-directional nature of knowledge exchange is fundamental to value co-creation, which is a key characteristic of both innovation ecosystems [37] [38] and Mode 3 knowledge production [39]. Model 3 knowledge production extends Mode 1 and Mode 2 knowledge production, and it is defined as "the nexus or hub of the emerging twenty-first century Innovation Ecosystem, where people, culture, and technology ... meet and interact to catalyze creativity, trigger invention, and accelerate innovation across scientific and technological disciplines, public, and private sectors... and in a top- down, policy-driven as well as bottom-up, entrepreneurship empowered fashion' [39]

[a] Cross/trans-disciplinary: (1) The knowledge production is started from practical problems, not from theoretical or discipline-based problems. (2) The production takes place in a 'project organisation,' not in a fixed and permanent structure, like a department or institute. When the production is finished the organisation may be closed down. (3) The knowledge production implies problem solving, including both empirical and theoretical components, and therefore contributions to the store of knowledge, although not discipline knowledge. (4) The dissemination of the results – the new knowledge – is made directly to those who have been involved in the project/production process.

Mode 2 of knowledge production is dynamic, a problem-solving capacity on the move. [b]

Heterogeneity: an increased number of places where knowledge can be produced.

[c] Heterarchical: alliances and connections when establishing project organisations for Mode 2 production have in principle no limits, not least in terms of electronic/communication technology. Simultaneously there is a continuous differentiation at different places and within different activities – to increasingly sharper specialities.

Interactions with innovation actors	Universities' reciprocal collaborations with industries and governments are best illustrated in the triple helix model [40]	Universities for building trust among collaborators in innovation ecosystems. The actors in innovation systems are more diverse and citizens are becoming increasingly important stakeholders [39] Trust is considered a key factor to successful knowledge exchange and co-innovation. This can be explained by both social exchange theory and social network theory. From the former perspective, Muthusamy and White (2005) [41] argue that since there is no way to assure an equivalent return for a favor, social exchange requires trusting others to discharge their obligations' (418). From the latter perspective, trust is crucial for realizing the value of weak ties, which mostly contribute to the creation and diffusion of innovation [42]
University and society relations	Universities for meeting the societal needs, for example, concerning economic growth and innovation, is a main characteristic of an entrepreneurial university [43]	Universities for shaping a better future society [44], which means that 'universities seek to achieve their developmental role through the transformation of society and production of new knowledge' [45] can be captured from the perspective of universities as institutional entrepreneurs [46]. Institutional entrepreneurs are those organizational or individual actors who not only initiate diverse changes in the institutional environment but also actively participate in the implementation of such changes [47]. When universities, as well as members within them, become institutional entrepreneurs, they are able to change the institutional environment favoring innovation ecosystems development [46]. The process of fostering institutional changes can be understood as social entrepreneurship [48], which is "an innovative approach to achieve social mission" [49].

In the context of the ongoing globalization of the economy and society – a process in which higher education is an active player - questions arise about the contribution that universities can make to the public good, not least in the places where they are located.
More specifically, [50] not only what is a particular university "good *at*" in terms of the quality of its research and teaching (as reflected in national and international league tables), but also what is it "good *for*" in terms of its active contribution to the wider society globally and locally.
The *local dimension* is particularly relevant when universities are directly or indirectly funded from the public purse and where local and national governments are accountable to their electorates. Politicians and citizens could ask the local university for an evidence of the contribution it has effectively and actively provided to the development of the territory.
Indeed, even though universities are in many ways connected and active at a global level, they are **still locally fixed and embedded within their regions**, on which they have significant impacts, connecting the global and the local.

1.2 - Universities' third mission and the engagement between the university and the society

Focus:

- Universities' pivotal role in providing a highly qualified workforce and a world-class science and engineering base
- Universities' need to be stimulators and facilitators of knowledge transfer to, and working with, business and society
- Universities as powerful drivers of innovation and change in the economy, but identifying the role which best suits their strengths
- The two main purposes of the Third Mission activities: Institutional capacity building (to establish "interface" arrangements and develop skills for knowledge transfer and translation between universities and industry and communities in priority areas), specific projects and initiatives (to support activities that address a specific need and opportunity and have an identifiable and measurable outcome) - Creativity and knowledge environment: the financial and material endowment, the high-level basic research and the applied research
- The business model of the entrepreneurial university, the triple helix model and the limits.

1.2.A – The entrepreneurial university

The past half century has also been one of challenging debate about the role of the university in society and for societal development. Suffice it to recall the dispute about nineteenth-century models such as the European Humboldtian university and the traditional American engaged university as opposed to more contemporary models such as the entrepreneurial (or triple-helix) university.
With globalization, this dispute spread throughout the world and exceptional pressures on university systems came from the shift to the **entrepreneurial model** in the United States and the launch of the **Bologna process in Europe**.
A World Bank study [51] posited a true "academic revolution" in the societal repositioning of the university. Closely connected to this dispute has been the addition of a **third mission**, outreach, to complement the two traditional university missions, education and research. The outreach mission positions regional engagement by the university as a management task of the university staff.
Knowledge creation, knowledge transfer, and spillovers have become the major challenge for the university's role in society and a core issue in economic geography and regional policy.

1.2B - The engaged university

Teaching and research per se do not make the university available for engagement in regional development. Both missions brought about rather disordered, invisible, and ineffective forms of engagement. This assessment also holds for what can be seen as the high road of university engagement in regional development, namely, the creation of research-based firms (university spin-offs) by university staff and graduates.
This third mission goes beyond teaching (first mission) and research (second mission) to include practical entrepreneurial skills. These additional and less theoretical skills should prepare the graduates for starting their own spinoffs in a labor market in which formal employment is scarce. To fulfill this task, universities need highly qualified staff members with knowledge about modern techniques and practices. This new comprehension of the way that teaching, learning and research could be developed, within a mature view of the concept of engagement, must integrate changes in internal organization, structures, dynamics, incentives and recognition systems that allow academia to advance new ways of developing its core academic mission.

1.3 - Universities' third mission and knowledge-based economic and socio-cultural development

Focus:

- Our global society is facing a tremendous crisis of values today and so, due to this crisis, many unsatisfactory occurrences have arisen.
- Values bring quality and meaning to life and give a person their identity and character. Values may be regarded as *"certain behaviour or ways of life regarded as more desirable than others"*

- There is a great need to equip the present education being imparted to children with values for life in order to make them good human beings.

Now the main questions are: what is the remedy for that? How can education cope with it?

Engagement with society necessarily entails struggles for change and transformation altering the current dynamics, structures and power relations. The challenge for HEIs is how to support *community-university engagement* to ensure a positive internal response for faculty and students.

New approaches to knowledge mobilization and transfer are needed between institutions and their communities at local and global levels.

Greater coordination is desirable between governments, civil society, educative institutions and the private sector in order to achieve this transformation.

Furthermore, these alliances and partnerships have to be forged with the constellation of social actors, for teaching and research activities and also linked with technological and social innovation.

This represents a new range of relations at diverse levels, involving diverse actors and for diverse types of intervention, to better answer current challenges in the creation and dissemination of knowledge. To incentive and support such initiatives, HEIs should establish specific structures and mechanisms under new rules. As has been done in the recent past to foster enterprise engagement, the challenge now is to design interfaces that are multifaceted in their composition, scope and functions.

As well described in [52], the higher education models by solving broader social and economic challenges and problems of our contemporary global society should provide answers to:

- What are the socioeconomic-environmental interfaces of the present-day higher education system?
- Are they capable of offering solutions to the micro-level problems and challenges faced by humanity at large?
- How can society examine the relevance of higher education and knowledge capacity-building and its dissemination or the development of economically underprivileged communities?
- What are the prospects of knowledge capacity-building through higher education under a holistic stakeholder' framework?
- How can we evaluate the nature and scale of the global implication and impact of the higher education system?
- What policy guidelines and action plans should be developed for large scale acquisition and dissemination of higher education and research outputs?

Our global society is facing a tremendous crisis of values today and so many unsatisfactory occurrences have arisen due to this crisis. There is a great need to equip the present education being imparted to children with values for life in order to make them good human beings. Values bring quality and meaning to life and give a person their identity and character. Values may be regarded as *"certain behaviour or ways of life regarded as more desirable than others".*

The 21st century is seeing a rapid acceleration of the infusion of **new technologies** into production processes, everyday life and quality of life projects. At the same time, there is growing global and local complexity in the fabric of societies, so the systems of social organization and cohesion are under the severe threat of break-down.

There is a need, therefore, to review the nature of the curricula and whether they connect with what is likely to be the world of work in 2035 [53]. There is also the potential emergence of new professional careers, some linked with the technological developments and others related to new conceptual frameworks for the diffusion of human-technology interfaces in society.

Arguably, an efficient knowledge economy is based on innovation systems with a high degree of openness and diversity, not only with regard to knowledge in the strict sense of the word, but also with respect to tolerance towards the cultural, religious and ethnic characteristics of the carriers (e.g. entrepreneurs and researchers) of that knowledge.

Thus, the global dimension of globally distributed knowledge networks has increased dramatic all in importance over the last decade. This means that it is more vital than ever for national and regional

policymakers to understand how the international context interacts with region- and sector-specific conditions in affecting innovativeness, competitiveness and economic growth.

The **triple helix approach** represents one strategy of improving the connectivity in a regional innovation system (RIS). The triple helix perspective has attracted much attention among policymakers as well as among researchers in the area of innovation research [11]. It underscores the increased interaction and interdependence between universities, industry and government in modern, knowledge-based economies by acclaiming the transformation to the entrepreneurial university.
Based on the innovation system view that innovation stimulates economic growth, the approach is "*motivated by an assumed need to bring innovation processes closer to a context of application*" [54]. The triple helix approach can be viewed as the operationalization of a regional innovation system as an explicit regional innovation policy strategy. The triple helix approach maintains that, in a rapidly emerging knowledge economy, places with entrepreneurial universities would increasingly see growing demand for knowledge transfer to industry and, through government, to society. The paradigmatic example of this phenomenon is the Massachusetts Institute of Technology (MIT). MIT is, to say the least, a successful case, and one that has served as a model for similar attempts to create entrepreneurial universities internationally, the latest example focusing on discussions to establish a European virtual MIT funded by the EU. However, not surprisingly, research has found that a model design based on MIT worked less efficiently in different contexts with more average universities, different university policies and forms of funding (e.g. in continental Europe).
Three important contextual differences must be kept in mind.
Firstly, MIT and most other leading American universities are private and receive generous funding, making them attractive to the best staff and students internationally.
Secondly, these leading American universities have been exposed to institutional competition for funding staff and students for a number of years, and, consequently, have learned and adapted their policies and organizations to this situation, something that European universities are only starting to experience in recent years as a result of globalization.
Thirdly, in the USA, massive public funding has been invested in research-intensive areas related to the military sector (e.g. IT) and the public health sector (e.g. biotech).

1.4 – International Universities *Focus*:

- Students and teachers' mobility, cooperation, networks
- The Bologna process and the borderless education
- The European Universities Initiative and the European Education Area

Universities are sites of cultural encounter and exchange through diverse international linkages among their students, researchers, and academics.
They have been key knowledge hubs in recent globalization processes "*shaped by an increasingly integrated world economy, new information and communications technology (ICT), the emergence of an international knowledge network, the role of the English language, and other forces beyond the control of academic institutions*".

The internationalization of higher education—defined by Knight (2003) [55] as "*the process of integrating an international, intercultural or global dimension into the purpose, functions, and delivery of postsecondary education*" has ranked highly on policy agendas of governments and universities in order "*to respond to the many demands placed upon them by globalization and as a way for higher education to prepare individuals for engagement in a globalized world*".
After an initial focus on mobility of students, researchers, and academics and curriculum development, internationalization strategies have proliferated since the 1990s. They include interinstitutional

partnerships, such as joint and mobile degree programs, and the creation of international branch campuses till the recent EUI.
Whereas transnational education programs contribute to epistemological globalization in some ways, [56] have shown that these programs can produce highly ambiguous results for the immobile international students because they lack authentic experiences and language skills acquired in the country that exports its degree programs.
Storme, Faulconbridge, Beaverstock, Derudder, and Witlox (2016) [57] have shown that virtual mobility cannot substitute for physical mobility of researchers and academics, for face-to-face contacts remain important for the exchange of tacit knowledge and the creation of social network ties.
This highlights again the importance and the role of the places where universities are located. Allan Cochrane explores the relationship between universities as place-based institutions and wider globalization processes. His central argument is that even though universities are in many ways connected and active at a global level, they are still locally fixed and embedded within their regions, on which they have significant impacts. He considers the changing conceptualizations of the geographies of higher education and explores the concept of globally integrated, but regionalized, universities that are "*placed as development nodes and transmission belts and as active partners in communities*".
Cochrane examines universities for their institutional and discursive practices, presenting four case studies on different relations between universities and their regions, which are all linked to geographical reimaginations of the universities in their specific places and wider networks. He stresses that the strategic place-based operations and business practices of universities (as employers) have significant local impacts, including local partnerships, property development, and unplanned or unintended consequences, such as changing demographics or a change in the reputation of the city or area.
Jane Kenway examines the geography of the contemporary university with regard to international student mobility and associated university practices. She proposes an understanding of universities as being not only territorially rooted, national, and subnational institutions but also places of regional and transnational routes. She argues that universities have become unbound and examines how "*roots and routes*" of students and universities conflict and intersect.

1.5 – Conclusions and Remarks

1. There is no fundamental contradiction between promoting competitiveness and solving societal challenges.
2. Responsible, sustainable and healthy economic growth is a precondition for dealing with global challenges.
3. Universities play a key role in producing the outcomes of competitiveness and solving societal challenges through research and the supply of human capital.
4. To generate social benefits from universities, organizational and institutional innovation are required.
5. The third mission started to be implemented in 1997.
6. It introduced the innovation system/triple helix approach as an organizational model or its innovation policy.
7. The regional engagement paved the way for a transition from a Mode 1 to a Mode 2 method of university research.
8. The pressure of recent crisis on social fairness and the acceleration of environmental ills, require a further step towards a Mode 3 method supporting the model of Sustainable Entrepreneurial University.

CHAPTER II – Universities as social innovators

2.1 – The University of the XXI century

Focus:

- The fundamental mission of universities to pave the way for the era of the people, promoting justice, gender equality, sustainability and democracy
- Investment in lifelong higher education, accessible to all citizens, an irreplaceable element for social progress, the generation of wealth, the strengthening of cultural identities, social cohesion,
- Transforming higher education functions to lead society in generating global knowledge to address global challenges and promote critical thinking and active citizenship which would contribute to sustainable development, peace, wellbeing and the realization of human rights (UN Agenda 2030).

Policies at European and world-wide level increasingly emphasizes the role of higher education in local development due to the shift in regional policy from reducing regional disparities towards indigenous local development – skills, innovation and entrepreneurship.
The Europe 2021-2027 Strategy reinforces the role that higher education and innovation play in smart, sustainable and inclusive growth. Smart Specialization Strategies (S3) now intended as Sustainable Smart Specialization Strategies (S4), are based on local partnerships between higher education institutions, public sector, industry and society as a prerequisite for receiving European Structural and Investment Funding (ESIF).
Perhaps never before in recent history has the role of higher education been so intricately tied to the economic, social and environmental fabric of the modern world.
The demands from all stakeholders for quality, robust and diverse systems of higher education to take an active responsibility in addressing the challenges of the world's pressing issues, are putting increasing expectations on HEIs to drive local and national socio-economic development and address global challenges. This pressure for global engagement comes from a diverse group of stakeholders: policymakers, students, parents, academics, social and environmental groups, to lobbyists, inter-governmental, regional and national bodies.
The globalization and internationalization of the university creates an unrivalled invitation for learners, scholars and researchers to pool their collective creativity, knowledge and experiences for change. The growing number of networks of higher education institution and collaborative research projects has proven to be the cornerstone for accelerating the move from fact finding to solution building.
At the same time, the United Nations, World Bank, European Commission and other groups and governments are calling for universities to play a greater role in resolving global challenges such as poverty, food scarcity, climate change, energy and water security. Universities' action is needed to achieve the UN Sustainable Development Goals, which relate to challenges in poverty and inequity, hunger and food security, energy and climate change, health and education and peace and justice (UN Agenda 2030).
Horizon Europe programme targets not only excellence in research but also research on societal challenges such as climate change, food security, clean energy, integrated transport and cyber security. Many higher education institutions have made efforts to respond to these demands and expectations and have developed policies, activities and services that address the needs of local industry and communities, as well as global challenges.
Their responses take different forms depending on the university's mission and operational environment, but typically encompass human capital and skills development, research and development (R&D) cooperation, entrepreneurship and knowledge transfer, and sometimes also broader civic engagement.
These actions may take the shape of fixed-term transactional services in addressing clearly articulated external demands or longer-term transformational activities which may focus on sustainable development needs or building a new knowledge-based industry (European Commission 2011).

	Transactional services	**Transformational activities**

Type of need/demand **Stated need or demand**	Stated need or demand in the local community either in the HEI's or international partner's location	Latent or unstated needs or 'grand' challenges facing the world
Type of approach	Output-driven approach	Outcome-driven approach
Type of objectives	Clear objectives	Less explicit objectives
Link to time	Usually time-bound	Less clear timeline

Becoming a locally and globally engaged university can be very challenging, particularly if the aim is to achieve economic, social and environmental sustainability.
Higher education institutions are often slow to change due to institutional and other barriers and constraints which may be out of their control.
Institutions may also need to prioritize other pursuits which are vital for their survival or because of funding systems and increasingly competitive environments.
If HEIs want to make meaningful progress on the Sustainable Development Goals (SDGs), traditional solutions, research projects and isolated community projects will not be enough.
HEIs need to contribute to the development of innovative and financially sustainable solutions that help build economic, social and environmental wellbeing and deliver the changes that the global community needs.
To address the challenges of globalization and localization and to work towards the Sustainable Development Goals (SDGs), there is a need to coordinate existing and new collaborative projects and to build long-term partnerships, not only with communities, but also with social enterprise which can help lift these communities.
The engagement can take many forms, including student placements, support for students and faculty-led social enterprises, accredited courses, incubation spaces, support services and research expertise for social enterprises and inviting social entrepreneurs to serve as student mentors (British Council 2016).
Strategic collaboration between a HEI and its partners implies balancing or shifting from the ad hoc one-onone collaborations between individuals to collaborations between organizations in the public sector, NGOs or business and industry.
Strategic collaboration also implies a move away from short-term relationships to long-term partnerships based on interdisciplinary action, commitment as well as shared responsibility and benefits.
Following Puukka [58] **10 steps** to build a globally and locally engaged higher education institution for a sustainable future:

Steps	**Tasks**
1. Institutional commitment	Make an institutional commitment to local and global development. Develop an overall vision as a globally and locally engaged institution
2. needs assessment	Conduct a needs assessment, i.e. foresight exercise of technological, scientific and societal, cultural, environmental needs and development trajectories with partners.
3. Institutional capacity assessment	Assess the institutional capacity, strengths and weaknesses in terms of the potential to address local and global sustainable development needs.
4. Institutional activity audit	Map the HEI's engagement activities and local and global linkages.
5. Gap analysis	Perform a gap analysis based on the previous steps (2-4).
6. Target setting and role definition	Determine involvement, select priorities for strategy and define objectives. Determine target of opportunity in which HEI involvement will bring added value.
7. Organization development	Develop an organization or the new roles.

8. Policy development;	Define a coherent policy mix, roadmap and action plan
9. Policy implementation	Implement new policies and the new engagement role. Align resources with the goals.
10. Evaluation and improvement	Develop monitoring and evaluation mechanisms

Local and global engagement can enhance and improve the HEIs' missions, providing new resources, stimulating more attractive and relevant study programmes or research activities, but also increase the risks of dilution of scientific capacity, distraction from the pursuit of excellence and other objectives, as well as serious ethical issues linked to industry collaboration.
For many universities, research priorities are determined by funding availability, especially in the areas of engineering, science and medicine. In some cases, as institutions committed to promote peace and mutual understanding, can see their research used to develop weapons which are then sold to governments and armed groups across the world by arms companies.
Developing an institutional commitment to sustainable local and global engagement requires a redefinition of the institutional plans and policies that should take into account the diverse views of university staff, students, alumni, government, community and industry.

2.2 – Why Cities and their Universities need each other *Focus:*

- Increased Cities' responsibilities
- Investment in new research and students' involvement
- Increased creativity and financial availability

As described by J. Goddard [59] universities are "anchor institutions" that are not only '*in*' the city but also '*of*' the city where they are established.
Cities are increasingly taking on more responsibility for the local economy, for the health and education of their citizens, and for the physical and human environment. City governments find it difficult to address the multi-faceted challenges and engage citizens in a meaningful way, for several reasons including reduced resources.
Universities are being expected to undertake original research, to teach ever more demanding students, and to engage with business and the community and address societal challenges in their locality. This means that city engagement is not just a new and onerous responsibility for universities but can be a chance to explore new research avenues, interact with local stakeholders and stimulate creativeness. The university of the future will need to regard its local setting as inherent to its operations, with financial, business and cultural exchanges, in the knowledge that this new activity benefits both sides and is recognised as a core activity for cities and universities alike.
Cities need their universities to engage more closely.
Cities need to do more for their citizens.
The public are interested in the future of their places; they are concerned about the delivery or loss of public services, the cost of housing, the reliability of transport, the availability of jobs, the range of shops and entertainment venues, and the extent of green spaces and clean air.
But the opportunities for citizens to engage with public bodies on their terms on a broad range of issues affecting the future of cities are limited.
Universities, located in many cases at the heart of the cities, are in an obvious place to assist in this challenge in this new world of **higher expectations and fewer resources**.
Many city leaders are interested in social innovation and in new ways of delivering services. They are also taking a strong interest in activities that may bring with them a physical or intellectual competitive advantage.

The EU states: "*a smart specialization strategy needs to be built on a sound analysis of regional assets and technology…smart specialisation needs to be based on a strong partnership between businesses, public entities and knowledge institutions*."
Universities are vital partners in deciding on and implementing smart specialisation. There is also increasing enthusiasm for the idea of "*smart cities*" and "*digital public services*".

On the other side [60] **Universities are under pressure from**:

- More demanding students.
- More demanding graduate employers.
- The need for bigger and more synoptic research ambition in response to major societal challenges.
- A shifting research funding landscape towards more directed programmes.
- The need to be seen to have public value.

Universities of all kinds can benefit from civic engagement. The public universities have an undeniable responsibility to the communities of which they are part, and any university which occupies a large amount of prime city center property risks being regarded as little more than a passive real estate developer. **A growing number of institutions want to ensure that their resources are used in ways that match the needs of society at large, globally and locally. This priority is highly consistent with the European community's embrace of Responsible Research and Innovation (RRI) as a principle underlying its Horizon Programme.**
However, it is not possible to turn an institution into an engaged civic university overnight. The best approach is to start with individuals who already have an interest in issues that also concern the surrounding city or region, not to restructure the university from the top down.
This means that the civic university is not only characterised by what it does, but also how it does things. A focus should be "how" to ensure that activities are not just determined by individuals or small groups, but in an enabling environment that encourages and promotes active institutional citizenship.
A civic university can therefore be identified by its:

1. *sense of purpose* – It strives to ensure that its cumulative impact on society as a whole is greater than the sum of the parts of individual activities;
2. *Active engagement with the wider world*, the nation in which it operates and the local community in which it is located, through dialogue and collaborations with individuals, institutions and groups locally, nationally and globally;
3. *Holistic approach* which sees engagement as an institution-wide activity and not one confined to specific individuals or teams;
4. *Sense of place*. While the university may operate on a national and international scale, it recognises the extent to which its location helps to form its unique identity as an institution;
5. *Willingness to investing* its objectives to have an impact beyond the academy, including releasing financial resources to support certain projects or activities, or to "unlock" external sources of funding;
6. *Transparency and accountability* to its stakeholders and the wider public with clear benchmarks and performance indicators which help it to express its civic mission in practical ways, not only to measure it but also to encourage others to assess the value of its actions;
7. *Innovative methodologies* used to build and sustain engagement activities locally and with the world at large.

Universities are almost all non-profit bodies whose autonomy is assured by statute but are increasingly being expected to be active contributors to city development. With society increasingly facing complex challenges (as for instance ageing and climate change) which have both local and global dimensions, the role of universities in addressing these problems is fundamental in finding and testing new methodologies and tools.

2.3 – The Civic University and the Quadruple Helix model

Focus:
- Innovation vs Social Innovation
- the transition from Mode 1 to Mode 2 and Mode 3

In promoting dialogue between universities and policy makers responsible for territorial development the notion of the university as an "anchor" institution provided by Goddard [59] is relevant:
"Large locally-embedded institutions typically non-governmental public sector, cultural or other civic institutions that are of significant importance to the economy and the wider community life of the cities in which they are based. They generate positive externalities and relationships that can support or 'anchor' wider economic activity in the locality. Anchor institutions do not have a democratic mandate and their primary missions do not involve regeneration or local economic development. Nonetheless their scale, local rootedness and community links are such that they can play a key role in local development and economic growth representing the 'stick capital' around which economic growth strategies can be built" Anchor institutions might be characterized as not just in the place but of the place.
The Work Foundation (2010) defines anchor institutions as: "*Large locally embedded institutions, typically non-governmental public sector, cultural or other civic institutions that are of significant importance to the economy and the wider community life of the cities in which they are based……"*
Being anchored in a particular location does raise questions for the university about the requirement for academic practice to be of relevance to the place in which academics live and work as citizens. In terms of the contribution of universities to business innovation, the way innovation takes place is changing, moving from a linear model to a co-production model which highlights the important role of users, service, open and social innovation.
This implies the building up of a contextual *Social Innovation*
The influential European Commission's Board of European Policy Advisors (BEPA) have defined **social innovation** as*:*
"Innovations that are social in both their ends and their means. Specifically, we define social innovations as new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations.
They are innovations that are not only good for society but also enhance society's capacity to act. The process of social interactions between individuals undertaken to reach certain outcomes is participative, involves a number of actors and stakeholders who have a vested interest in solving a social problem".
This can be seen into three perspectives:

1. A social demand perspective in terms of the needs of vulnerable groups traditionally not met by the market and where there is a strong role for social entrepreneurs
2. A societal challenge perspective through which societal problems are addressed through new coalitions and where the boundaries between the economic and social blur
3. A systematic change perspective where social innovation is reshaping society itself

Social innovation implies extending the dominant model for university external collaboration from the so called "triple helix" of university, business and government to a "quadruple helix" which embraces civil society.
More specifically two recent reports for the European Commission: *"The Quadruple Helix, with its emphasis on broad cooperation in innovation, represents a shift towards systemic, open and user-centric innovation policy. An era of linear, top-down, expert driven development, production and services is giving way to different forms and levels of coproduction with consumers, customers and citizens."* [61]
According to Arnkill et.al. [61] the quadruple helix model can have four variants depending on whether the focus is on citizens, firms, the public service sector or simply the better commercialisation of university research by testing products and services with users

1. A triple helix model with users added on
2. A firm centred 'living lab' model

3. A public sector centred 'living lab' model
4. A citizen centred model

Although the role of digital technologies is central to the quadruple helix, this does not necessarily mean that geography no longer matters. Indeed, the city as a living lab for testing new ways of organising the delivery of services in a sustainable and inclusive way (for example to an ageing population), is influencing public policy all over Europe.

2.4 – Open Innovation 2.0 vs Embedded Innovation 3.0 *Focus*:

- Open Innovation 2.0 vs Embedded Innovation 3.0
- Fourth Industrial Revolution Industry 4.0

In the last years a new mode of innovation is emerging that blurs the lines between universities, industry, governments and communities. It exploits disruptive technologies — such as cloud computing, the Internet of Things and big data — to solve societal challenges sustainably and profitably, and more quickly and ably than before. It is called Open Innovation 2.0 (OI2) [62]

According to the European Commission Open Innovation can be defined as

"A new paradigm based on a Quadruple Helix Model where government, industry, academia and civil participants work together to co-create the future and drive structural changes far beyond the scope of what any one organization or person could do alone. This model encompasses also user-oriented innovation models to take full advantage of ideas' cross-fertilisation leading to experimentation and prototyping in real world setting."

Innovations drive economic growth and improve quality of life while reducing environmental impact and resource use.

Issues as traffic congestion, energy consumption reduction, early health interventions, …. can find targeted solutions through innovations tested in "living labs".

Yet many institutions and companies remain unaware of this radical shift. They often confuse invention *(=creation of technology or metho*d) and innovation *(=the use of that technology or method to create value).*

Awareness of Open Innovation 2.0 needs to be raised across industry and society. The European Union's *Open Innovation Strategy and Policy Group* (OISPG) is a global leader in spreading its knowledge. It has published 1O reports on different aspects of this innovation paradigm with the goal to make OI2 a discipline practiced by many rather than an art mastered by few.

At the core of OI2 is the idea of a compelling shared vision which different stakeholders commit to and collaborate to create a reality and shared value. In the framework of a quadruple helix innovation deployment, the possibility exists to drive real structural change and add value: Innovation is no more something that is done *for* or *to* a user, but the users/citizens co-participate in the process, as well as profit from its outcome.

In today's complex world, experiments simply cannot be conducted in isolation. Collaborative research will accelerate the innovative process and improve the quality of its outcomes. Instead of being seen as a research object for innovation addressed to the citizen/user, they become an integral part of the innovation process.

Innovation can be defined as the "adoption of something new which creates value for the individual or organization that adopts it" ([63], [64]) so it is the user or citizen who is often at the fulcrum of where value is produced by an innovation.

The term open innovation — where ideas pass between different organizations to create value — was coined by organizational theorist Henry Chesbrough in 2003 [65] Open innovation 2.0 is neither easy nor is it a panacea.

Innovation itself is changing very fast and other Innovation paradigms are emerging arising from the interaction of three mega trends, increasing digitization, increasing power of IT, mass collaboration and sustainability. These three mega trends create the conditions and resources which enable a new kind of innovation mentality and methodology where deep integrated collaboration and exponential technologies

result in co-created innovations which are rapidly adopted and the new products, solutions and services deliver both financial and societal wealth.
The adoption of OI2 does not mean that other types of innovation will cease. OI2 can create a different order of innovation where new processes and environment can better create and manage significant structural changes and deliver remarkable outcomes for both the innovation creators and adopters, leading both economic and societal wealth. The kind of outcomes which are delivered can be characterized by Ramaswami's 3Ws, "Wealth, Welfare and Wellbeing' [66]

How innovation modes have evolved

Closed innovation	Open innovation	Open innovation 2.0
Dependency	Independency	Interdependency
Subcontracting	Cross-licensing	Cross-fertilization
Solo	Bilateral	Ecosystem
Linear	Linear, leaking	Nonlinear mash-up
Linear subcontracts	Bilateral	Triple or quadruple helix
Planning	Validation, pilots	Experimentation
Control	Management	Orchestration
Win–lose game	Win–win game	Win more–win more
Box thinking	Out of the box	No boxes!
Single entity	Single discipline	Interdisciplinary
Value chain	Value network	Value constellation

OI2 is based on 12 principles described **i**n [62] Martin Curley Twelve principles for open innovation 2.0, where the principles for applying the innovation 2.0 are detailed and several tips provided.

Keys to collaborative innovation

1. **Purpose.** Efforts and intellects aligned through commitment rather than compliance deliver an impact greater than the sum of their parts. A great example is former US President John F. Kennedy's vision of putting a man on the Moon. Articulating a shared value that can be created is important. A win–win scenario is more sustainable than a win–lose outcome.
2. **Partner**. The 'quadruple helix' of government, industry, academia and citizens joining forces aligns goals, amplifies resources, attenuates risk and accelerates progress. A collaboration between Intel, University College London, Imperial College London and Innovate UK's Future Cities Catapult is working in the Intel Collaborative Research Institute to improve people's wellbeing in cities, for example to enable reduction of air pollution.
3. **Platform**. An environment for collaboration is a basic requirement. Platforms should be integrated and modular, allowing a plug-and-play approach. They must be open to ensure low barriers to use, catalysing the evolution of a community. Challenges in security, standards, trust and privacy need to be addressed. For example, the Open Connectivity Foundation is securing interoperability for the Internet of Things.
4. **Possibilities**. Returns may not come from a product but from the business model that enabled it, a better process or a new user experience. Strategic tools are available, such as industrial designer Larry Keeley's breakdown of innovations into ten types in four categories: finance, process, offerings and delivery6.
5. **Plan.** Adoption and scale should be the focus of innovation efforts, not product creation. Around 20% of value is created when an innovation is established; more than 80% comes when it is widely adopted. Focus on the 'four Us': utility (value to the user); usability; user experience; and ubiquity (designing in network effects).
6. **Pyramid**. Enable users to drive innovation. They inspired two-thirds of innovations in semiconductors and printed circuit boards, for example. Lego Ideas encourages children and others to submit product proposals — submitters must get 10,000 supporters for their idea to be reviewed. Successful inventors get 1% of royalties.

7. **Problem**. Most innovations come from a stated need. Ethnographic research with users, customers or the environment can identify problems and support brainstorming of solutions. Create a road map to ensure the shortest path to a solution.
8. **Prototype**. Solutions need to be tested and improved through rapid experimentation with users and citizens. Prototyping shows how applicable a solution is, reduces the risks of failures and can reveal pain points. 'Hackathons', where developers come together to rapidly try things, are increasingly common.
9. **Pilot**. Projects need to be implemented in the real world on small scales first. The Intel Collaborative Research Institute runs research projects in London's parks, neighbourhoods and schools. Barcelona's Laboratori — which involves the quadruple helix — is pioneering open 'living lab' methods in the city to boost culture, knowledge, creativity and innovation.
10. **Product**. Prototypes need to be converted into viable commercial products or services through scaling up and new infrastructure globally. Cloud computing allows even small start-ups to scale with volume, velocity and resilience.
11. **Product service systems**. Organizations need to move from just delivering products to also delivering related services that improve sustainability as well as profitability. Rolls-Royce sells 'power by the hour' — hours of flight time rather than jet engines — enabled by advanced telemetry. The ultimate goal of open innovation 2.0 is a circular or performance economy9, focused on services and reuse rather than consumption and waste.
12. **Process**. Innovation is a team sport. Organizations, ecosystems and communities should measure, manage and improve their innovation processes to deliver results that are predictable, probable and profitable. Agile methods supported by automation shorten the time from idea to implementation.

Today, the concept is evolving fast. Driven by the ever-increasing number of connected people and devices, it has never been so easy to exchange information and ideas.

Another conceptual approach for a next-generation innovation paradigm in the Digital Economy is proposed and called "*Embedded Innovation*" (Innovation 3.0).

The approach is based on the observation that, in order to survive, SMEs – especially those operating in an increasing dynamic and digitalized environment, with knowledge being the most indispensable and important resource for innovation - need to establish trusted relations to aligned communities, networks and stakeholders [67]

The notion of "embeddedness" is introduced to mark the increasing challenge of substantially integrating firms into their surrounding communities so as to assure the absorption of their exploitable knowledge.

In this context, Innovation 3.0 goes beyond Open Innovation (Innovation 2.0).

Innovation 3.0 is expected to evolve as the third way for SMEs to synergetically combine closed and open innovation. Trust is supposed to be the enabling parameter in balancing necessary multiple relationships with communities.

Open Innovation to date is mainly discussed in large-scale companies which display numerous examples of successful strategies of knowledge absorption from external sources, as well as inside-out technology transfer and knowledge exploitation

In contrast, the Innovation 3.0 paradigm relates to experiences from in-depth case studies on Open Innovation in SMEs of the Digital Economy

These SMEs are, by nature, more open to collaborate in innovation processes, because knowledge is widely distributed, and knowledge cycles are extremely dynamic.

We define "*Embedded Innovation*" (Innovation 3.0) as the fundamental ability of a firm to synchronize organizational structures, processes and culture with open collaborative learning processes in surrounding communities, networks and stakeholder groups so as to ensure the integration of different external and internal knowledge, i.e. competences or technological capabilities, and to exploit this knowledge to commercial ends.

With this definition of "*Embedded Innovation*" (Innovation 3.0), we extend the common definition of Open Innovation by introducing the notion of integrating the organization into communities to ensure knowledge absorption instead of just managing inside-out and outside-in processes. The decisive difference between Innovation 3.0 and the Open Innovation paradigm is the new modeling of learning processes. This differentiates *Embedded Innovation* from its predecessors with respect to the transition from single-agent to multi-agent based innovation processes:

- Knowledge generation and knowledge flows in the Digital Economy are widely distributed throughout the entire innovation system.
- Corporate innovation and long-term competitiveness depend on the ability to integrate these knowledge flows into an organization.
- Knowledge generation usually takes place in different communities throughout the innovation system. Supported by new interactive Web 2.0 based tools, knowledge, behavioral attitudes, skills, values and/or preferences are articulated and shaped continuously as a result of human interaction, whether in a working or leisure context.
- We call this 'Community based learning', as the social interaction delivers a mutual progress in knowledge accumulation within the social community [67]

"*Social innovations are innovations that are social in both their ends and their means…new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations.*
The process of social interactions between individuals undertaken to reach certain outcomes is participative, involves a number of actors and stakeholders who have a vested interest in solving a social problem, and empowers the beneficiaries. It is in itself an outcome as it produces social capital" [68]

2.5 – The Civic University and the Responsible Research and Innovation (RRI) *Focus*:

- Part of the growing expectation of universities is that they will contribute to the major challenges facing society. Such an approach characterises the European Union's Horizon programmes designed to contribute to the "*smart sustainable and inclusive growth*".
- Many of the themes within the programme such as health, demographic change and well-being; smart, green and integrated transport; and inclusive, innovative and secure societies have an explicit or implicit territorial dimension.
- Horizon 2020 and Horizon Europe also have a cross cutting theme of 'Science With and For Society' which recognises that "*betting on technology acceptance by way of good marketing is no longer a valid option … Early and continuous iterative engagement with society in research and innovation is key to innovation adequacy and acceptability"*

With these points in mind the Commission has endorsed the concept of **Responsible Research and Innovation*:***
"RRI is a process where all societal actors (researchers, citizens, policy makers, business) work together during the whole R&I process in order to align R&I outcomes to the values, needs and expectations of European society… There is a need for a new narrative drawing on a broad-based innovation strategy encompassing both technological and non-technological innovation at all levels of European society, and with a stronger focus on the citizen and responsible and sustainable business - a quadruple helix and placebased approach to science, research and innovation." (Science With and For Society- SWAFS, Work Programme 2014)

These principles have been embodied in the *Rome Declaration adopted by the European Council in December 2014* which calls upon public and private research and innovation performing organisations to implement institutional change that foster RRI by:

- Reviewing their own procedures and practices in order to identify possible RRI barriers and opportunities at organisation level;
- Creating experimental spaces to engage civil society actors in the research process as sources of knowledge and partners in innovation;
- Developing and implementing strategies and guidelines for the acknowledgment and promotion of RRI;

- Adapting curricula and developing training to foster awareness, know-how, expertise and competence of RRI;
- Including RRI criteria in the evaluation and assessment of research staff.

HEIs should provide the framework conditions and policies for the adoption and implementation of RRI practices and the development of RRI projects.
They should contribute to the development of a culture in which the values supporting RRI are an intrinsic part of the research and innovation process, with special emphasis on the next generation of researchers.
The expectation is that RRI will have a structuring effect on research systems and practices.
Ultimately, this is expected to improve the impact and the acceptability of research – as well as the public's trust in science and its actors.
The most important issue behind Responsible Research and Innovation (RRI) is that it implies the involvement of a number of stakeholders in the processes inherent to research and innovation. This goes well beyond the individual contribution of any one of the actors involved, actors including: research and innovation performers, policymakers, civil society organizations, companies and re-searchfunding bodies.
In other words, the involvement of representatives from society as a whole is essential to achieving a number of the aspirations of RRI; that is, to arrive at more sustainable, ethically acceptable and socially desirable outcomes.
Therefore, it is very likely that the most important factor for success is public engagement.
Certainly, RRI will continue to foster local competitiveness, but it will also affect glob-al demand through its contribution to solving global challenges. There is, in this case, no contradiction between local and global goals that are inherent to the mission of HEIs. In addition, the concept of RRI applies regardless of its local or global scope. Applying the principles of RRI will move the focus from the local to the global through a type of bottom-up process.
Several precedents for and definition of responsible research and innovation, as well as the role of research in society, can be found in recent literature and are referred to http://rri-tools.eu/about-rri.eu (but other examples will be studied to find the MED-QUAD approach)

2.6 – Conclusions and Remarks

Different strategies are needed to develop university and social networks in the early 21st century and can be set out as follows:

- The complexity and variability of the social and economic problems of the modern world require multidisciplinary and multi-agent approaches. In this regard, there is a need, on both a local and global scale, for close and continued collaboration between the institutions of the Quadruple Helix: public institutions, universities, companies and the tertiary sector.
- Beyond the efforts and results of individual institutions of higher education, as for instance reflected internationally in various university rankings, it is strategic to encourage inter-university collaboration and the sustenance of an ecosystem of complementary universities in a given territory or country.
- Universities and scientific institutions in general are becoming key pieces in the knowledge society and economy: this includes the creation of knowledge, its transfer and its dissemination, as well as innovation in the broadest sense. That is why there is a need for university, science and innovation policies to be strong and stable over time, with sufficient basic public funding to be competitive on an international scale. - The old adage of *"think globally, act locally"* is still completely relevant for collaboration networks between universities and among the different agents of the Quadruple Helix. Never before has it been so necessary to have a shared "local-global" outlook, and this applies to the university and social arenas too.

CHAPTER III – Quadruple Helix, Living Labs and Responsible Research and Innovation

3.1 – Social Innovation within QH model: The role of universities *Focus:*

- The growing importance of Social Innovation
- New Strategies, Organization and Management of Universities: Social Innovation in Education and Research and Cooperation with stakeholders relevant for Social Innovation

The present global challenges, summarized in the UN Agenda 2020, affect regional innovation systems that need to develop new approaches, new forms of collective actions between public and private stakeholders, as well as new methods to address social challenges through innovation which generates social and public value.

The COVID-19 pandemic has pushed organisations, including universities, to test new ways of stimulating social innovation, that means to build up a regional innovation system, in which the importance of knowledge is not determined exclusively by competitiveness and productivity, but by taking into account the creation of social well-being, the impact on the quality of life and co-creation of knowledge as part of public–private partnerships.

The recently discussed concepts of Society 5.0 and Industry 5.0 [69] [70] highlights the need to re-think existing working methods and approaches toward innovation and to focus them on developing humanoriented solutions and social innovation.

The QH model plays an important role in fostering the shift from technical to social innovations, though civil society participation in the context of regional innovation systems continues to be low, and the regions have experienced difficulties in getting civil society groups involved [71] This is in contrast with the general belief and awareness that citizens have the power to suggest new types of innovation and can become the driving force behind the innovation process, both at the design stage and during the implementation. The fourth helix is fundamental for establishing the innovations needs to improve the quality of life and strengthen social well-being. Furthermore, the QH model is flexible and may be extended or modified taking account of contemporary (and specific) challenges and problems (for instance, the need for a more sustainable development and climate change challenges are reflected in quintuple helix model, that adds the fifth dimension—the environment—and sets the stage for sustainability priorities and considerations so that nature is central and equivalent component of and for knowledge production and innovation). Existing global challenges and rapid technological progress in a world increasingly complicated, have led to growing expectations towards universities and their roles in modern ecosystems.

Responding to sustainability challenges requires not only trans- and multi-disciplinary approaches but also a high level of engagement of social and human capital.

Today, universities are expected to play increasingly challenging roles in order to provide a response to the urgency of many wicked problems that need transdisciplinary approaches and collective actions. It is generally recognised that if universities wish to actively contribute to sustainability they need to go beyond their traditional functions of education, research and community outreach and to integrate social innovation in their core and new missions [72].

A renewed EU Agenda for Higher Education emphasises "*HEIs should be engaged in the development of their cities and regions, whether through contributing to development strategies, cooperation with businesses, the public and voluntary sectors or supporting public dialogue about societal issues. Outreach beyond the academic community in local languages should be incentivised and rewarded, including as part of career development*".

The new HORIZON Europe highlights the importance of cooperation between science and society for solving social problems, thorough the section *Science with and for Society* where research combining scientific excellence with awareness and social responsibility is stimulated and supported.

Social innovation is well conceptualised and developed in literature, but the focus is put on civil society organisations or social entrepreneurs and less attention is given to universities as agents of change. Indeed, "*relatively few studies address issues related to institutional change and incentive structures that influences the ability of universities to engage in social innovation*" [72] and "*although universities have a huge*

potential to contribute their knowledge and other assets to social innovation, a recent inventory of social innovation in Europe highlighted how underdeveloped and one-dimensional these contributions were" [73]. Reasons underneath this gap are object of study and models of engaged universities are proposed in ongoing research.
Universities are certainly "complicated mixtures of different communities with changing power and specific relations with external actors" [74] and "*only few contributions have explored the connection between the social innovation concept and the QH model framework*" [75]

MED-QUAD intends to address this gap and reinforce the concept that, apart from differences between universities, their embeddedness in regional ecosystem of innovation is one of key dimensions that influence their engagement in social innovation.
The research will address the ongoing global debate on the social and sustainable challenges in order to contribute to university policy and practice in implementing social innovation in a collaborative process, in a region, the Mediterranean basin, where no previous studies have been conducted.
The proposed research will be based on the empirical studies on the partner universities and their collaborative networks. The intended result should clarify, or at least hypothesize, the key measures universities should take to stimulate their functions within the QH model and generate social innovation.
Connection between QH model and social innovation is still at the first stage of implementation, so the case study of MED-QUAD universities could provide a useful contribution to the ongoing research and analysis.
Even though limited to the project partners and some other universities in their countries, the empirical research will increase knowledge on the implementation of social innovation at universities of the involved countries and will identify the challenges and problems in terms of building cooperation with the social and business environment (third and fourth helix) as well as with policy makers (at least at municipal level).
Concerning Italy, the recent paper [75] provides a picture of the participation of universities in QH partnerships as an expression of public and community engagement under broad third mission goals, and describes the conflicts and drawbacks that can hinder the alignment of partners' contributions. The study is focused on three Italian projects under the EU Urban innovative actions' (EUI) program, thus very pertinent to the issues concerning the civic university that MED-QUAD intends to build up. The authors design four key phases in QH governance processes: i) identification of a common nexus, ii) building of shared strategies, iii) implementation, and iv) learning feedbacks.
Other suggestions for strategies can be found in Joanna Morawska-Jancelewicz (2021) [76] where the author addresses the contribution of universities to social innovation through an empirical study on Polish public universities experience and policies.
The research that MED-QUAD intends to conduct is focused on the identification of the potential of involved universities to create and implement social innovation addressed both to internal (that is students, scholars and staff) and external (that is business and policy-makers) stakeholders.
The final aim is to analyse how this innovation can be used and embedded in the QH model implemented by the project and to identify the structures and mechanisms needed for a concrete and effective implementation of the role of civic university. This means the identification of the new forms of cooperation with the QH community and new organization of the fundamental missions of education and research, as well as of internal organization and management driven by a renewed sense of social responsibility.

3.2 – Analysis of MED-QUAD universities' potential concerning Social Innovation organization and implementation: Proposed methodology for research *Focus:*

- Aim of MED-QUAD project
- Expected results

Analysing the potential of any organization, means to understand how the resources, the experiences, the abilities and attitudes can be used for the identified specific aim.

In the case of universities and their role in QH development model, they include infrastructure, funding sources, management, human capital, local, national and international links, research and educational projects.
A QH innovation system on a given territory strengthens the capacities of all entities and allows the acquisition of collective skills enabling innovation processes.
Universities have a central role in creating a fertile environment where the civil society organisations can play an active role in the innovation process, but they need to take the correct measures in terms of organization and management of their activities and create proper structures and mechanisms.
Aim of the empirical research is the identification of the key features of a socially engaged university that contributes to social innovation in the Mediterranean region.
The partnership is aware that there are numerous definitions of social innovation, and the debate is ongoing due to the complexity of variables to be assessed to measure the effects of social innovations results. The aim of MED-QUAD is to learn by doing in very specific contexts and possibly to identify and design a model useful for other institutions in the region.
Concerning Education, Research and Third Mission, the partner universities
- have introduced new courses and updated the traditional ones according to the needs of the labour market;
- have managed and are managing several international projects concerning the establishment of new curricula in cooperation with institutions of other countries according to the EU policies and strategies for the EHEA;
- are developing research projects in cooperation with EU and non-EU institutions;
- have organized or are organizing Technological Transfer Offices;
- are adopting new regulations and restructuring the institutional management; - are engaged with local stakeholders and policy makers.

The proposed research will try to have a clear picture of the level of reciprocal trust for a real commitment of the 4 QH components in this renovation process.
The methodology will follow the suggestions coming from ongoing projects as described below. The results of the analysis will be object of a report and annexed to this teaching material.

3.3 – QH collaboration, Living Labs and RRI: lessons learnt from previous projects *Focus:*

- Ensuring interaction of the QH actors
- Living Labs as places for Responsible Research and Innovation and New Services design and implementation.

The QH Model for initiating an innovation process depends on various characteristics/variables, as for instance, the aims, the context and the “owner” of the expected innovative outcomes.
The main challenge is to involve in the process the citizens/end-users, in a way that they are not considered passive recipients, but active participants since the starting phase.
As well proved in the last years, the lack of involvement of citizens might lead to:
- Products and services not used
- Lack of transparency and mutual understanding of innovators and end-users • Frustration
- Technical innovation instead of social innovation.

The representatives of the four actors, academia, public authorities, industry and citizens, may vary amongst the MED-QUAD regions, since the new services and innovation products are delivered and used by different organization. Furthermore, in different phases, different approaches and methods may be utilized to involve the four actors, but the underneath strategy is unique and shared.
For each activity it is fundamental to involve the identified QH actors from the beginning of the innovation process.

Among the existing different approaches to the Quadruple Helix Model for innovation, MED-QUAD selected the Living Labs as places for co-creation of theoretical and practical tools for studying and intervening in real-life problems and needs and co-design of new Services.

The MED-QUAD experimentation will take into due account the reports, conclusions, recommendations and guides of some projects focused on the concrete application/identification of a QH model for innovation that best fits to the specific project aims.
In particular we considered
- http://riconfigure.eu/ [77]
- https://rri-tools.eu/ [78]

From RICONFIGURE project:
The overall aim of the project was to obtain a better understanding of what happens when the four main sectors of society (industry, academia, policy and civil society) collaborate during research and development (R&D) projects within a QH model of innovation: its inner workings and its relationships with the outside world of governance structures at regional, national and European level.
The project was methodologically anchored in two points:
- to intervene in the reality under study as opposed to merely observing this reality from afar: This approach is opposed to classic qualitative and quantitative research where observers seek the position of neutrality from which they interact as little as possible with the reality under study.
- to adopt social labs (SL) as instruments for studying and intervening in real-life innovation projects. In this project, a social lab is the platform through which RiConfigure researchers interact with the selected reallife cases of QH Collaborations (QHCs).
- to use the philosophy of *Responsible Research and Innovation* (RRI) where stakeholder inclusion is associated with innovation products and a better understanding of the risks and benefits associated with these products.

The produced five Social Labs were designed in order to answer the following three questions. The first one concerns the real-life practice of QHC; the second one concerns the relationship between QHCs and the principles put forward in RRI literature, and the third one concerning the relationship between QHCs and the governance (political) context in which these QHCs are active.
1. How do partners interact within a QHC and what contributes to the success of such interaction?
2. To what extent do the parties engage in practices, and develop competences, that are in line with the model of RRI?
3. What is the relationship between public governance frameworks on the creation and success of QHCs?

The first one concerns the real-life practice of QHC; the second one concerns the relationship between QHCs and the principles put forward in RRI literature, and the third one concerns the relationship between QHCs and the governance (political) context in which these QHCs are active.
Results
The main lesson is that the theory of QHC is quite different from the practice of QHC. Once applied in practice, the theoretical idea of four helixes collaborating together in research and innovation stumbles upon a myriad of real-life barriers such as funding, role distribution, incentives, power structures and path dependency. These barriers can sometimes be overcome. Yet, in order to do so, the in-between step of reflecting upon these barriers and their origin is crucial.
In this context, the project has identified a series of opportunities and 'enhancers' that can be further exploited to get the best out of such a collaboration. Specifically, when it comes to civil society, participation of citizens can help experts realize that they do not necessarily speak the same language and learn to use an appropriate language.
Regarding the RRI competences for QHC, it can be stated that in general stakeholders are much more flexible and adaptive than the theoretical four-fold categorization would suggest. In fact, when it comes to systemic innovations that are unavoidably impactful for society as a whole, it is almost a 'job requirement'

that one be skilled in navigating the RRI competences distinguished in the RRI literature, e.g., systems thinking, moral competence, learning skills (Ploum, Blok, Lans, & Omta, 2018).
Regarding the relationship between governance frameworks and QHCs (see section 4) it can be noticed that this relationship is not yet a very strong one. Policy is not, at this moment, written with the specific aim of fostering quadruple helix collaborations nor is it in any clear way the driving force behind existing QHCs. When QHC are formed, they spring into existence not because of some compelling policy framework but rather because of a mutually recognized benefit of the presence of stakeholders from all sectors. As emerged from the analysis of real-life QHCs cases, the interaction among the four components is not a clear-cut coalition of equal partners. Sometimes one or more "helixes" are scarcely present or even missing. This is particularly true for the civil society component that can be substantiated in a very diverse way and about whose role there are diverging positions among the representatives of the other "helixes".
Important observations

- Although the project successfully implemented five different QHCs, they acknowledge that the resulting understanding is fragmentary and quite case-specific. The gathered knowledge is 'tied down' to the details of the cases under investigation, even though there are features useful for the creation and management of successful QHCs regardless of case details. One of them is the relationships of power that are formed within a QHC.
- Although the partners involved in QHCs are well aware that they *must co-innovate*, the process of coinnovation has been mainly known through case-based empirical data. The process of co-innovation, also referred to as "value co-creation" and "open innovation", is generally associated with QHCs, but the word *functions more like a buzzword than a determinant of clear methodologies or principles of collaboration*. The case studies have provided an empirically rich picture of how stakeholders see co-innovation, on which a more theory-driven modelling of the process can be rooted.

<u>From RRI project:</u>
Science and Technology have changed the world and continue to be a driving force for humanity's progress, but in some cases, innovation has led to controversial or unintended consequences. Global warming has been driven by human activities and there are several examples of innovations that originally served a valuable purpose but had later negative consequences. Society today is facing some colossal issues — such as food security, antibiotic resistance and energy supply — so it is important that science continues to progress, but in the right way, that means to conduct research that not only answers questions and solves problems, but is also in line with the ethical values and needs of society. It is important to involve wider society through open and transparent processes and ensure their voices are considered.
This is where Responsible Research and Innovation (RRI) comes into play.
RRI Tools developed the following definition: *Responsible Research and Innovation is a dynamic, iterative process in which all stakeholders in research and innovation become mutually responsive and share responsibility for both the process and its outcomes.* This means the focus is not only on achieving socially desired outcomes, but also on how the research and innovation (R&I) that leads to them is conducted. RRI can thus be broken down into four key elements: outcomes, process dimensions, policy agendas and stakeholders.

- RRI contributes to create more engaged public, responsible actors and responsible institutions. - RRI has clear benefits for research and innovation, making science and technology more ethical, sustainable and socially beneficial.
- RRI contributes to generate better solutions to societal challenges, such as the seven grand challenges articulated by the European Commission:
- Health, demographic change and wellbeing;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;

- Climate action, environment, resource efficiency and raw materials; - Inclusive, innovative and reflective societies; - Secure societies.

To achieve these outcomes, the research and innovation process should be:
DIVERSE AND INCLUSIVE: To produce outcomes that align with the values and expectations of society, all the groups involved in and affected by research and innovation need to work together.
OPEN AND TRANSPARENT: RRI is also about achieving a more knowledge-based society. This means making the process of research and in-novation more transparent and open to all actors, providing them with meaningful information during all stages of the process.
ANTICIPATIVE AND REFLECTIVE: Responsible actors consider not just the immediate impacts of their work but look ahead and reflect on the kind of future they are trying to build.
ESPONSIVE AND ADAPTIVE TO CHANGE: Finally, research and innovation must respond to the views expressed by the public and other stakeholders and, if necessary, methods or goals should be changed. In the section "**How To Apply RRI**" the project provides practical advice, manuals and guidelines to help put RRI into practice. Specific guide is given to

- Policy makers
- Civil Society Organizations
- Education Community and Research
- Industry and Business

in the sections **"How To"** (http://www.rri-tools.eu/-/toolbox_user_tools) where suggestions concern

- How to incorporate RRI in policy/funding institutions
- How to incorporate RRI in higher education institutions
- How to set up a participatory research agenda
- How to incorporate the RRI principles in a funding call
- How to design a RRI-oriented project proposal
- How to co-create community-based participatory research - How to embed RRI in citizen science.

3.4 – The MED-QUAD approach

Focus:

- how to involve the helixes
- LLs: from theory to practice

MED-QUAD main aim is to reinforce the role of universities in their socio-economic-cultural environment and provide an efficient model of Civic University able to provide the right answers to the everchanging and challenging local and global requirements for a real social innovation.
This aim will be achieved

- by using theoretical and practical/empirical studies, analysis and approaches for the identification of a QH model that fits the involved region
- by establishing two concrete cross border Living Labs around two real life problems/needs as start points for a durable cooperation in other fields
- by promoting the principles of RRI and paving the way for further development.

The above will be implemented through several joint actions focused on:

- Understanding Power Relations in the established QHs
- Identifying the Co-Innovation Process suitable for the MED-QUAD study cases.

Several tools will be used:

- Brainstorming: relaxed and informal approach which encourages actors to be creative and spontaneous ideas are gathered with the aim to solve a problem or get new ideas.

- Focus groups: a small group of people whose reactions on a new product are studied and/or tested in guided or open discussions in order to determine the reactions that can be expected from a larger population.
- Customer Journeys: a method that describes the "journey" of a user and his interaction with services. It provides a visual overview of the specific incidents that take place, the authorities and people the user is in contact with and the user's experiences. This allows to see which parts of the service need to be improved and to identify hidden or new users.
- Hackathon： participants develop a whole new service or product in a span of 12/24 hours. They work in different teams, prepare short descriptions of the results in order to be evaluated by a jury.
- Workshop: A Workshop provides a common understanding of a problem, identifies the challenges and brings new perspectives.

The core place of all the activities are the Living Labs that deal with user-centred open innovation ecosystem, and operate in the city context, integrating concurrent research and innovation processes within a citizen-public-private partnership, in a cross border perspective.
User-centred research methods such as action research, crowd sourcing, empathic design, participatory design and other usability methods, already exist but fail to sufficiently empower users for co-creating into open development environments through the whole product/service life cycle.
A living lab is not a test bed but constitutes an experiential environment, which could be compared to the concept of experimental learning, where users are immersed in a creative social space for designing and experiencing their own future.
The living lab process, which integrates both user-centered research and open innovation, is based on a mature multidisciplinary team working together in the following four main activities:

- Co-creation: bring together technology push and application pull (i.e. crowd sourcing, crowd casting) into a diversity of views, constraints and knowledge sharing that sustains the ideation of new scenarios, concepts and related artifacts.
- Exploration: engage all stakeholders, especially user communities, at the earlier stage of the cocreation process for discovering emerging scenarios, usages and behaviors through live scenarios in real or virtual environments (e.g. virtual reality, augmented reality, mixed reality).
- Experimentation: implement the proper level of technological artifacts to experience live scenarios with a large number of users while collecting data which will be analyzed in their context during the evaluation activity.
- Evaluation: assess new ideas and innovative concepts as well as related technological artefacts in real life situations through various dimensions such as socio-ergonomic, socio-cognitive and socioeconomic aspects; make observations on the potentiality of a viral adoption of new concepts and related technological artifacts through a confrontation with users' value models.

MED-QUAD Living Labs will be a collaboration of Public-Private-Civic Partnerships in which, in a cross-border perspective:

Enterprises, academia, policymakers, users/customers/citizens:	Stakeholders	⟸ **WHO**
Collaborative products development from ideation to market deployment:	Co-create	⟸ **HOW**
New products, services, businesses and technologies:	Innovation	⟸ **WHAT**
In regions, urban and cross-border environment:	In real life and virtual networks	⟸ **WHERE**
In all roles and phases of innovation production:	In multi-contextual spheres	⟸ **WHEN**

3.5 – Conclusions and Remarks

The literature presents several examples of methods, tools and strategies for promoting social innovation. Case studies prove that so far definitions and methodologies, when switching from theory to practice, assume specific means around the concrete experimentation under observation, with limited capacity to be extended to other situations.

It is also clear that there is not a unique recipe for a social innovation supporting sustainable development. “Geography”, as underlined in this paper, has a fundamental importance also in the application of the principles of RRI and in the implementation of a durable functioning Living Lab.
The ambition of MED-QUAD is to provide and test a model for the MED region and add some more information and data in a complex and not completely explored field. The results and outcomes will be added to this document.

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