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Article

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The Role of the University for Promoting Sustainability through Third Mission and Quintuple Helix Model: The Case Study of the Tor Vergata University of Rome

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Abstract: The research aims to analyze the role of universities to promote sustainable strategies inside and outside their academic communities. In particular, the focus is on projects promoted by the Academia that respond to the big problem regarding waste. After an analysis of the literature on the evolution of the Helix Model and the Third Mission of University, the research focuses on the analysis of the causes of the open call “Mission Sustainability” promoted by the Tor Vergata University of Rome, aiming to promote sustainable action in the territory, in a specific project involving the installation of incentivizing compactors in the Campus for PET collection. The research methodology applied to the case study, mainly qualitative, is based on the document analysis of university report and strategy planning, the call and the specific project promoted by professors and researchers titled “GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context”. This case is relevant for both academic and practical aspects because it is a research application in a specific context leading to the following main results: sensitization and awareness of students, employees and the whole academic community on the problem of waste from PET plastic; involvement of stakeholders in public engagement activities for collecting waste; studying the practical application of possible benefits from the installation of compactors and increasing the sense of belonging towards the University, green and common space care.

Keywords: Sustainability; Third Mission; university; circular economy; Quintuple helix.

Introduction

Sustainable development is a major global objective to overcome the economic, environmental and societal crises in many countries. In the last 30 years, the concept of sustainable development has taken shape thanks to a greater awareness of the need for sustainable development. Various public Institutions at international and national levels (e.g. International Organization, National Public Administration, Municipality, and University) played a key role. One of the main instruments to develop a smart, sustainable and integrated growth (European Commission, 2010) is through the circular economy (European Commission, 2014; Pardo & Schweitzer, 2018) and education (European Commission, 2008; Hamid, Ijab, Sulaiman, Anwar, & Norman, 2017). Furthermore, it is important to promote a sustainable behavior (Goal of the Sustainable Development Goals) specifically on sensitive issues such as social and environmental responsibility, so that all citizens can acquire and develop skills needed to promote the goals of the Agenda 2030 (United Nations, 2015).

In recent years, issues related to the environment and sustainability have significantly increased their thickness, due to the growing belief that our planet has limited borders and uncontrolled use of its resources could lead to catastrophic effects for humanity. One

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of the major issues related to the environmental dimension concerns the production of waste, which has grown exponentially over the last decade due to the high industrialization and increase in population worldwide. Italy, for example, has been sentenced, by the European Court of Justice, to pay 40 million euros for the failure to comply with the EU legislation on waste and landfill, to which there will be added further penalties for each semester passed from the sentence up to the final regularization of illegal landfills in the area. When waste is not previously differentiated, it generates emissions with a high CH₄ and CO₂ content, two greenhouse gases carrying irreversible pollution; to avoid this, the landfills must be equipped with efficient gas collection systems, to avoid their dispersion in the atmosphere. The basic problem is that in a system with obvious gaps, illegal dumps or disposal systems controlled by “crime-organization” are proliferating, generating further environmental damage related to pollution of the soil, groundwater and surface water. This vicious circle is the author of a series of negative externalities, such as the pollution of land, damage to the health of individuals mainly due to exposure to the harmful substances produced, damage to the ecosystem in general. It is necessary to review the management methods of the entire sector, trying to give a concrete application to the objectives set by the regulations on waste.

Several plans and programs at the national¹ and European levels have been promoted to increase policies aimed at implementing the 4R principle in terms of waste: reduction (of the same and their danger); reuse; energy recovery; material recovery (Figure 1). Despite the good intentions the results obtained employing these tools are, at least for now, unsatisfactory. The management methods² of the same seem to be disappointing as they still see a too high usage of landfill disposal.

The effect of these inefficiencies on the waste problem generates a series of negative externalities, such as, for example, the high costs associated with the methods of disposal, much more expensive than the methods of recycling and recovery, both of energy and matter. Diseconomies that take away huge public resources, which could, instead, be used to provide better services to citizens, with targeted interventions on sectors of primary importance such as transport, assistance, health, and school. Furthermore, the environmental and social significance of these issues should not be underestimated.



Figure 1. The 4R principle in terms of waste

This research aims to explore the state of the art of the role of University to promote sustainable models and practices of circular economy in University (Kelly, Mason, Leiss, & Ganesh, 2006), through the collaboration at the bottom-up level. More specifically, we

¹ In Italy, concerning waste, the Legislative Decree 5 February 1997 n. 22, the c.d. Ronchi Decree, subsequently repealed by art. 264, c. 1, lett. i) of d. Lgs. N. 152 of 3 April 2006, to implement the implementation of directives 91/156 / EEC on waste, 91/689 / EEC on hazardous waste and 94/62 / EC on packaging and packaging waste.

² Art. 183, paragraph 1, lett. d) Legislative Decree 152/2006 provides the following definition of management: "The collection, transport, recovery and disposal of waste, including the control of these operations, as well as the control of landfills after closure".

explore the existing literature concerning the Triple Helix Model, Quadruple Helix Model, and Quintuple Helix Model as an evolution of the society and respective relationship between the main actors and the “Third Mission” of University; we provide an analysis of the case study of the call “Mission Sustainability” promoted by the Tor Vergata University of Rome, considering its goals, mission and vision, and of the specific project promoted by professors and researchers of the university titled “GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context” that won funding from the call “mission Sustainability”, to promote case study useless to recycle plastic collected in the roman campus. This paper is the result of the research called “GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context” (Ref. Unique Project Code (CUP): E86C18000500005) entirely financed by the Tor Vergata University of Rome through the call for projects of scientific research of the University “Mission: Sustainability”. A draft of this research has been present in the Seventh Edition of the International Academic Conference “STRATEGICA - Upscaling Digital Transformation in Business and Economics” hosted by the Faculty of Management from SNSPA, in partnership with the National Bank of Romania and the Romanian Academic Society of Management (SAMRO), held in Bucharest, Romania, October 10-11, 2019.

A literature review on Third Mission and Quintuple Helix Model as ways to a socio-ecological transition

The important point is to consider waste no longer as a problem, but as a resource (de Vega, Benítez, & Barreto, 2008), including for universities, capable of creating new job opportunities, encouraging the formation of a circular economy, i.e. a type of economy capable of regenerating itself, in which the activities are organized in such a way that the waste produced by some becomes the basic resources of others (Kirchherr, Reike, & Hekkert, 2017; Murray, Skene, & Haynes, 2015). An economy designed to “self-regenerate” - given that the materials of technical origin are designed within a flow that foresees the least loss of quality - and that intentionally “reconstitutes” itself as it aims to rely on renewable energy sources, minimizing and the use of toxic chemicals. The plastics are constituted by macromolecules called “polymers” which in turn consist of chains of smaller molecules, called “monomers”. The different types of plastic differ from each other in their appearance and intended use, but they have some very specific characteristics in common: they are light, washable, economical, easily malleable once heated, reproducible in series and particularly functional for the food storage. The most common plastic materials on the consumer product market (Table 1).

Table 1. Different plastic on the consumer product market

CODE	DESCRIPTION
High-Density Polyethylene (HDPE) Low-Density Polyethylene (LDPE)	used for the production of bags, box, adhesive tapes, bottles, garbage bags, tubes, toys
Polypropylene (PP)	used for the production of furniture items, food containers, detergent bottles, and personal hygiene products, carpets, garden furniture
Polyvinyl Chloride (PVC)	used for the production of egg trays, pipes, and insulating films so that it can also be found between the walls of the house, indoors, in windows or tiles and even as credit cards
Polyethylene Terephthalate (PETE or PET)	used especially for bottles of soft drinks and mineral water, but also for the production of synthetic fibers.

Polystyrene or Styrofoam (PS)	used to produce food trays, cutlery, plates, caps
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In this scenario, the University, as a public actor, plays a crucial role in the territory in which it is threatened with the opportunity to be a promoter of change in wrong public policies and activator of virtuous circles. Universities can answer the challenge of Agenda 2030 (Zhang, Williams, Kemp, & Smith, 2011), approving a new “mission” and “vision” to support the sustainable development in terms of education, research and relationship with the territory, with a view to the third mission. Traditionally, the third mission has been studied and implemented as a means for transferring technology and economically exploiting the results of research activities carried out by universities, for example through the creation of spin-offs and incubators. The changing of socio-economic conditions has recently led to integrating this paradigm, as shown by the diffusion of the conceptual models of the Triple, Quadruple and Quintuple Helices (Etzkowitz & Leydesdorff, 2000) models for national innovation ecosystems, which can be seen as an advanced mode of experimentation of the third mission approach. The Triple Helix innovation model focuses on university-industry-government relations; it underlines the importance of higher education for innovation and is compatible with the knowledge economy (Etzkowitz, 2008; Etzkowitz & Leydesdorff, 1995).

In the Quadruple Helix, the territorial context and the civil society (Fourth Helix) are seen as key drivers in a democratic approach to innovation where government, business, academia, and civil participants work together to co-create the future, Open Society model: from a knowledge economy to knowledge society and democracy (Ranga & Etzkowitz, 2013). The Quintuple Helix Model (figure 2), adding the perspective/helix of the ‘natural environments of society’ supports the formation of a win-win situation between ecology, knowledge, and innovation, creating synergies between economy, society, and democracy (the “socio-ecological transition”, European Commission, 2008). If the University is the principal actor in Quintuple Helix Model, it could be a promoter of circular economy’ actions inside Academia and, in this context, to sensitize other actors (political system, economic system, public administration, and media) to involve a responsible behavior.

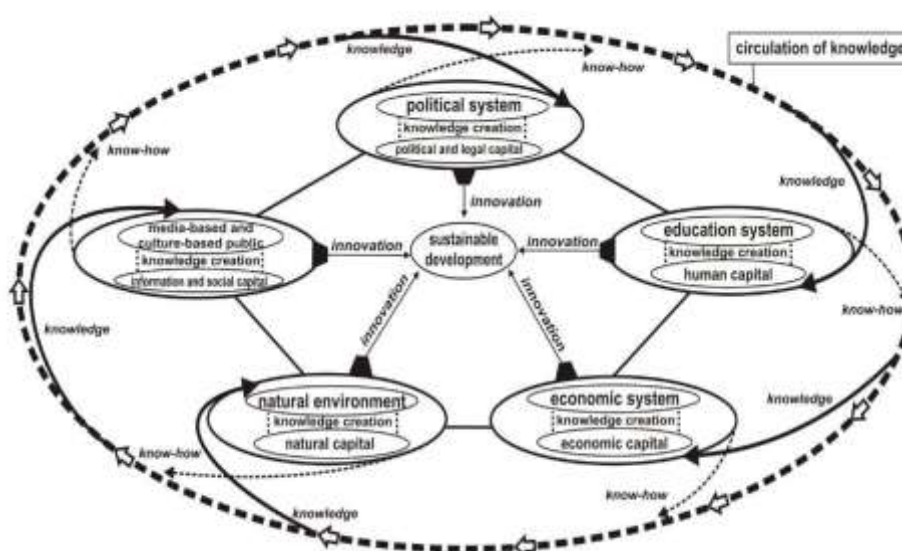


Figure 2. Quintuple Helix Model
(Etzkowitz & Leydesdorff, 2000)

Universities play a crucial role in this time and the connection in a quintuple helix model, they must promote social cohesion and equality: a rethinking of the role of education as a mechanism to promote social mobility and the academic environment as a model of

tolerance of ethnic and cultural diversity. The concept of the university's third mission is part of the transition from the theoretical model of the knowledge society, defined by the "triple helix", in which universities, industry, and government collaborate for socio-economic development (Etzkowitz, 2008), to "Open Society" model (Figure 3), described by the "quadruple helix", in which government, industry, universities and civil society linked together to co-plan a sustainable future (European Commission, 2014). To achieve this, universities are increasingly asked for the main engine of economic development processes (to act as an "entrepreneurial university"), but also to be an active part in other sectors that local communities pay more attention to, such as sustainability social and environmental. In particular, the term "Third Mission" refers to all the activities with which the universities activate processes of direct interaction with civil society, companies, institution and organization (Quintuple Helix Model) to favor the growth of the territory and civil society, offering services and structures, in this way knowledge becomes a tool to obtain productive results (Novelli & Talamo, 2014). In a phase of strong economic and social difficulty, the culture and research represent the moral energy that can help countries mitigate the effects of the crisis. In this context, the Universities, in particular, the Italian universities, recognizes the responsibility to commit to talent development, supporting ideas and multiplying the intellectual energy of the country. Therefore, academic activity development, mainly based on core activities, such as high education, training, and research, should be integrated by the so-called "Third Mission", which is one of the main tools enabling resource allocation. "Third Mission" refers to a set of activities by which the University triggers processes of direct interaction with civil society and businesses, to promote the growth of the territory.

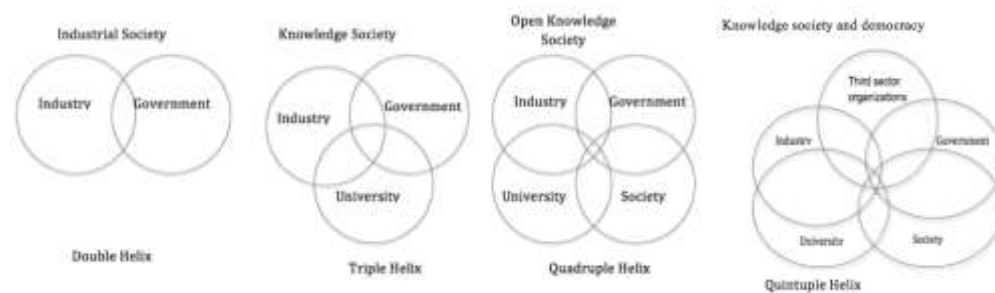


Figure 3. Evolution of Knowledge Society
(Ranga & Etzkowitz, 2013)

The origins of the "Third Mission" of the university, and future development in Europe, were defined by the Rector of the University of California (Kerr, 1963), during a lecture at Harvard University, where he replaced the word "University" with "Multiversity", as a university community able to assess the differences of society and respond to the changing cultural and economic needs of a given period without forgetting the future perspective. The word "Multiversity" was intended to urge the American university to take into consideration the responsibility for "saving society". It is possible to define two macro functions of the third mission:

- The first is represented by the third mission as the economic enhancement of knowledge, in which the third mission aims to promote economic growth, through the transformation of the knowledge developed by research into knowledge useful for productive purposes;
- The second is represented by the cultural and social mission, in which public goods are produced to increase the well-being of society.

In universities, there are skills, professionalism, ideas, projects which, if outsourced, can have enormous value in terms of "reputation", economic, social and improvement of the quality of life. Outsourcing these skills outside university boundaries means to enhance and transfer the work of innovation and production to the territory by creating new economic opportunities, work, and social improvement, to create shared value (Porter & Kramer, 2011). Education is one of the most important sectors: it promotes economic

growth, strengthens productivity, contributes to individual and collective development and reduces social inequality. The university as a bearer of knowledge is at the forefront of this change and became a principal player to promote the goals of Agenda 2030 (United Nations, 2015) and play a crucial role in the virtuous circle defined on collaboration, SDGs 17 "Partnership for Goal", has triggered a virtuous circle defined on collaboration and quintuple helix model' perspective.

Research methodology

After a brief background analysis of the importance of circular economy in the waste sector, the first part introduces the framework of a shift of paradigm in the University and a literature review of the Third Mission of University (Kerr, 1963; Novelli & Talamo, 2014), as well as the evolution of the Helix Model from Double Helix Model to Quintuple Helix Model (Etzkowitz 2008; Etzkowitz & Leydesdorff, 1995, 2000). The analysis has been applied to define plastic waste' characteristics.

The research focus is on the new role of University as a driver for sustainable development through social responsibility in an urban scenario. The research goals are: to develop a conceptual framework on the role of education at the university level in promoting sustainability, according to the Third Mission approach and the role of high Education in Sustainability. The research is enriched by a case study analysis and documental analysis (Bowen, 2009; Labuchagne, 2003). on a project titled "GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context", promoted by the Department of Management and Law, Department of Biology, the Botanic Garden of the Tor Vergata University of Rome and the Government and Civil Society Research Group (GCS) and GREENTOSI student association, played a crucial role to build this project to involve an incentive compactor to improve recycling plastic waste in University. The documental analysis has been on: university report and strategy planning, the call "Mission Sustainability", the project "GREENtosi for UniRecycling purpose between Third Mission and Sustainability.

A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context and its respective phases and objectives achieved. The Case studies analysis (paragraph 3), carried out in a Roman neighborhood called Tor Vergata, and in particular in the Tor Vergata University of Rome, based on an ethnographic approach for the understanding of organizations has changed (Ybema, Yanow, Wels, & Kamsteeg, 2009). This research process has been held in a participatory context and the authors have applied passive participant observation methods since they have participated in a different class, workshop and meeting in presence with the different stakeholders of the academic community. The case study analysis is enriched by a qualitative research methodology as documental analysis for reviewing and evaluating electronic documents (Bowen, 2009) as Sustainability Report of the University 2019 and 2018, the "Call Mission Sustainability", the Strategic Plan of the Tor Vergata University of Rome and the project submitted. During the research, the information has been systematized, summarized and elaborated to present an interpretation on the base of the main theories and models considered. The case study is a specific example of stakeholder engagement, the importance of partnership in Quintuple Helix's perspective, co-design and circular economy with a view of Sustainable Development Goals (United Nations, 2015).

Case Study: Tor Vergata University of Rome

The Tor Vergata University of Rome is a young university in Italy and it implemented sustainability in the university thanks to a “top-down” model mixed a “bottom-up” participation actions promote from the governance but also the community. The mission and vision of the Tor Vergata University of Rome aim to contribute to the education and training of people, scientific research and technological, organizational and social innovation necessary to reach the 17 SDGs (United Nations, 2015), given the third mission. The university has more than 30,000 students and is ranked among the top 100 in the world in 2017 by THE (Times Higher Education) which considers only the best universities founded for less than 50 years. University of Tor Vergata is the only Italian University in the “QS Top 50 Under 50” that is the ranking of the 50 best universities in the world created in the last 50 years. Tor Vergata aims to be an effective promoter of territorial sustainability, and, for this reason, it aims to increase collaboration with the public and private sectors, third sector organizations and investors, nationally and internationally.

Starting in 2014, a “Sustainability Plan” was promoted, including the actions necessary to reduce long-term negative externalities - with particular reference to greenhouse gas emissions - generated by the university's activities. More recently, in February 2016, in collaboration with the *Unipolis Foundation*, the Roman university proposed the creation of the Italian Alliance for Sustainable Development (ASviS) intending to raise awareness of the importance of the issues addressed in the Agenda 2030 (United Nations, 2015). Furthermore, it is one of the promoting universities and active member of the RUS, Sustainable University Network. In 2019, the University established the “Office for Sustainable Development”, directly submitted to the Rector, in full top-down logic. The office is supported by the “Committee for the implementation of the Mission and Vision of the University” composed by representatives from each Department. The Committee has promoted to integrate the sustainability approach in training, research and projects, in collaboration with the “Italian University for Sustainability Network” (RUS) created by CRUI.

The university, in line with the global objective promoted by Agenda 2030 (United Nations, 2015), published since 2017 a “Sustainability Report” with the GRI-4 (Global Reporting Initiative) approach. The Report has a double function: to disseminate and understand the strategies, the objectives, the performances achieved, the improvements that can be made. The “Office for Sustainable Development” and a specific working-group, composed by professors, researchers, Ph.D. students, and the university staff experts in the subject, collaborate every year to analyzed the social, economic and environmental results of the university and translate these in a challenge in the sustainability report.

The Tor Vergata University of Rome and the open Call “Mission Sustainability”

“The future of our environment depends on the intelligence with which we use the present one” this phrase, reported in the Sustainability Plan 2020 of the Tor Vergata University of Rome, summarized one of the main issues facing today's society, that of environmental sustainability. The policies related to the efficiency of consumption and the recovery of materials, as widely confirmed by the numerous provisions in the EU and national sphere, represent today a primary need. The growing concern as a result of the obvious and dangerous climate changes, accompanied by the progressive reduction of available resources. It follows that in this context the University, as a key institution at the base of cultural and ideological change, must take an active role in the management of these problems. It must also represent a reference model, as well as an example for the entire community, through the adoption of prudent internal policies aimed at eliminating - or at least reducing - waste of materials and resources.

In 2016 the Tor Vergata University of Rome promoted the “Mission Sustainability” Call. The university has intended to support research through the funding of competitive research projects for the development of ideas with high scientific content and technology, selected based on scientific excellence and innovative strength, aimed at achieving environmental, economic, social and institutional improvement objectives in the conceptual framework designed by the 2030 Agenda (United Nations, 2015) on sustainable development, both locally and globally, as well as fostering the use and dissemination of research results. The University has allocated a total of € 1,230,000.00 dividing for CUN areas (National University Council), to enhance the role and responsibilities of the Departments, each Department has been assigned a fee of € 15,000.00 (Table 2).

Table 2. Funding of the call “Mission Sustainability” for areas’ CUN

CUN AREA	BUDGET
01: Mathematics	€80.000,00
02: Physics	€120.000,00
03: Chemistry	€110.000,00
05: Biology	€170.000,00
06-07: Medicine - Agriculture and Veterinary	€200.000,00
08: Civil Engineering and Architecture	€80.000,00
09: Industrial Engineering and ICT	€145.000,00
10: Sciences of the philological-literary and historical-artistic anthology	€75.000,00
11: Historical, philosophical, pedagogical and psychological science	€75.000,00
12: Law	€75.000,00
13-14: Economics, Statistics, and Political and Social Sciences	€100.000,00

The winning projects, which had to present in the written project application (in the English language) the reference to at least one of the 17 SDGs, are being implemented as they will have to finish within 18 months from the date of communication of the approval and financing. The evaluation criteria of the projects to which the auditors had to comply are: a) scientific and innovative nature of the project concerning the state of the art (max 50 points); b) clarity, credibility, and feasibility of the objectives and impact of the project, also considering its relevance for the realization of the University mission and vision (max 20 points); c) quality of the PI (Principal Investigator) and the entire research group (max 20 points); d) appropriateness and appropriateness of the costs (max 10 points). A careful analysis underlines not only scientific importance that the projects must have but also the connection with the trend-topic of sustainability in connection with the strategic planning of the University (mission and vision). The Board of Directors of the Tor Vergata University of Rome approved, on 25 June 2016, the ranking of the projects referred to in art. 3 of the Call “Mission: Sustainability” (DR 2817/2016), selected by the respective Departmental Councils with their formal resolution, authorizing the Management III - Division 3 Accounting budget and treasury to the assignment of funding to the Departments of the Scientific Managers for the relative management. To the project titled: “GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context” (the PI is Gloria Fiorani), has been located € 7.500,00 (start in 1° July 2018; deadline 31 December 2019).

The project: “GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context”

The project aims to encourage the recycling of plastic waste, in particular water bottles sold at refreshment points and automatic vending machines located in university buildings, and to raise awareness among stakeholders of the problem of waste disposal and related pollution. The expected result will be to introduce an incentive compactor in the buildings of the University, useful for the collection of plastic waste and their

compression to be resold and then donated or reused in terms of the circular economy. The project also stems from the positive response of the academic community which, from research conducted in 2016, expressed the will to collaborate for sustainable development and the interest in using incentive recyclers (98% of survey participants) to improve the separate collection system in the University, considered inadequate by 90% of the sample (Mititelu, Fiorani, & Litardi, 2017). The indirect expected result is to stimulate the stakeholders to virtuous and proactive behaviors.

The pilot project is a specific interdisciplinary research-intervention that involves the academic community, the shops affiliated with the University, the local administrations and the territory and which provides for the installation of incentive compactors on the Campus for the collection of PET. The research project is composed of 8 phases. In particular:

Phase 1: FormAction (Formation + Action). The main objectives of this phase are soft skills development, sensitization on sustainable development, SDGs deepening, encouragement of students' self-employment and promotion of participate planning (students, academic's community, citizens, public and private –profit and no-profit –administrations) by extra-formative activities of New Economy Labs, operating from 4 years and addressed to all young people of Lazio under 30 (university students or not). Partners: "Next-Nuova Economia per tutti" (association), University, Lazio Region. Every year, several research-action projects rise from Labs to answer Territory/University's needs and challenges: from close and self-referential place to open, dynamic and creative space (Mititelu et al., 2017)

Phase 2: Organizing student collaboration. Creation of green student association (GREENtosi) to promote sustainability values and, possibly, managing both the incentivizing compactor and the relationship between partnership-companies, in cooperation with the academic community.

Phase 3: Literature and best practices analyses. Analyses of national and international best practices of incentives recycle politics (i.e. German Government's Pfand, incentivizing compactors in Norway, Finland and Sweden, virtuous experiences in Italy, discounts on tickets or metro pass linked to PET recycling in China).

Phase 4: Market analysis and stakeholder management. Analyses of the PET market, potential interested people in the project (stakeholder mapping and engagement), incentivizing recyclers' suppliers, possible machine's installation procedures (purchase, rental or partnership with dealers).

Phase 5: Realization. Installation of one or more incentivizing compactors in Athenaeum's strategic points, linked to approved retail outlets (starting from the already existing platform "Agevola.uniroma2.it"), which could grant: discounts and facilitation to citizens provided with incentivizing recycler's receipts, partnership/ patronage institution with public local administrations (Municipio VI, Rome Municipality and Lazio Region) and prediction of rewarding/ incentivizing systems inside or outside the University. For some machines, the use of health insurance cards should be required since it enables traceability of virtuous behaviors so that they could be rewarded by companies with relief on waste tax and also with services, like parking, transports, coupons, etc.

Phase 6: Evaluation of the project's impact. Territorial network activated with the view to Third Mission. Data analysis about the attendance and use of the incentivizing recycler will be carried out. Evaluation of the academic response at the experimentation taking in accounts the types of incentives (monetary/of image/social recognition/extracurricular credits) will be performed by sending a questionnaire to the academic community and making interviews to privilege testimonies, as well as a partner of the initiative. Consider eventual earnings coming from the PET's sale or the use of collected PET for the creation of nameplates, used from the Botanical Garden of the Tor Vergata University of Rome and produced by a 3D-printer. This phase will facilitate the expansion of green student associations.

Phase 7: Sharing results. The results of experimentation will be presented in the national and international meetings and propagated also through scientific and educational publications at the national and international levels. Also, it will be possible for a

workshop at the Tor Vergata University of Rome for presenting the results of the pilot project.

Phase 8: Repeatability of the experience. Considering the results obtained in the first 18 months of experimentation, the project could be replicated in all Faculties of the University, with the possibility of applying a competition system between faculties to achieve Athenaeum's founds on the base of the amount of collected PETs.

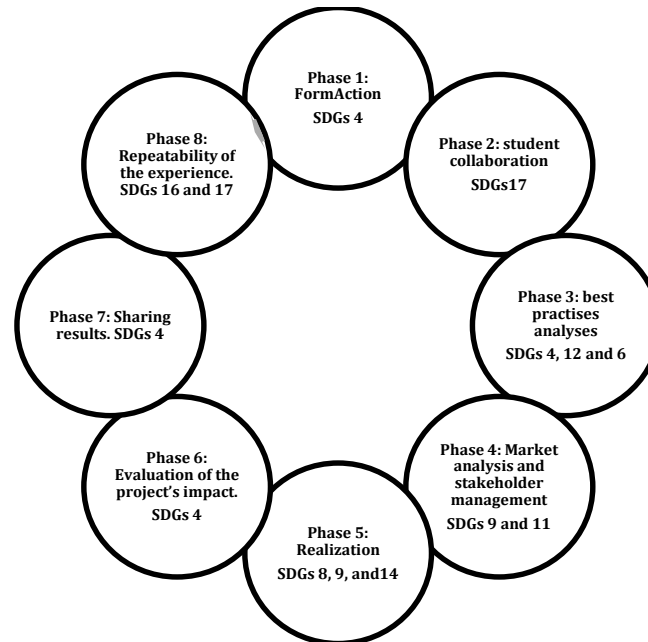


Figure 4. Phases of the project as a virtuous circle connected with SDGs
(Authors' elaboration)

The specifics objectives of the research project are:

1. Sensitize academic community and target territory to the importance of circular economy and recycling materials;
2. Support the creation of a student association/green cooperative startup that opens up on the values of sustainability (as GREENtosi student association created and launched during a Conference "CSR and Social Innovation Conference" on 28 March 2019, Faculty of Economics, Tor Vergata University of Rome);
3. Strengthen the internal relationship between teachers, administrative personal and students;
4. Strengthen the relationship with the territory with a view to Third Mission, valorizing the existence connections (Agevola.it project) and starting new ones as the Outlet called "Le Torri", situated in a social-economic problematic neighborhood near University;
5. Investigate the inclination to recycling on the base of economic incentives (coupon, usable in all the retail outlets) and not-economical ones (reputational and relational image for example);
6. Strengthen the bonding between Departments and the role of COVISION, as the interdepartmental center of research on Sustainability Development, Responsibility, Cost-Reporting, and Social Innovation.
7. Using the collected PET for the production, by a 3D-printer, of nameplates which will be used in the Botanical Gardens of the Tor Vergata University of Rome;
8. Attract resources to reverse into sustainability projects;
9. Create awarding systems in the University on the quantity of collected PET from single Faculties;

10. Becoming a reference model for both administrations and citizens, spreading “the good practice of recycling” at the national and international levels

Results and consideration

The project is in line with the “mission” and “vision” of the University, because it converts sustainability into a Third Mission perspective, in terms of teaching, through the development of experimental extra-training that can make young people aware of the issue of sustainable development, to develop their soft skills and to stimulate youth creativity and self-entrepreneurship to respond to the challenges and needs of the territory. The research project is an intervention-research project and it proposes an innovative solution to minimize the impact of PET plastic on the environment, able to enhance the University's strengths in a transversal perspective (between teachers, researchers, administrative personal, technician, librarians and student' association GREENtosi) and interdisciplinary internal relations as (Department of Management and Law, Department of Biology, research center “COVISION”, Government and Civil Society Research Group). The strengthening of external relations constitutes a strong link with the territory, the company, SME and public administrations, able to carry out a continuous innovation process, seizing the opportunities that come from both the market and the strategic location of the University in the territory. The research project is an example of co-design for the achievement of 17 SDGs and Sustainable Action Plan 2020 of University, which provides promotion of a virtuous circuit of recycling PET, the current weak point of the University.

The main SDGs that the project answer are: 4 (quality education), 8 (decent work and economic growth), 9 (industry, innovation, and infrastructure), 11 (sustainable cities and communities), 12 (responsible consumption and production), 14 (life below water), 16 (peace justice and strong Institution) and 17 (partnership for the goals) e related targets (Table 3).

Table 3. SDGs connected with the project “GREENtosi for UniRecycling purpose between Third Mission and Sustainability. A virtuous experimental partnership with a view to the quintuple helix in the socio-ecological transition context”

SDGs	TARGET	DESCRIPTION
4 (quality education)	4.4	By 2030, substantially increase the number of young people and adults who have the necessary skills, including technical and professional skills, for employment, for decent jobs, and business skills.
	4.7	By 2030, ensure that all students acquire the knowledge and skills necessary to promote sustainable development through, among other things, education for sustainable development and sustainable lifestyles, human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship and the enhancement of cultural diversity and the contribution of culture to sustainable development.
8 (decent work and economic growth)	8.3	Promote development-oriented policies that support productive activities, the creation of decent work, entrepreneurship, creativity and innovation and encourage the formalization and growth of micro, small and medium-sized enterprises, including access to services financial.
	8.4	Progressively improve, until 2030, the efficiency of global resources in consumption and production in an attempt to separate economic growth from environmental degradation, following the ten-year framework of sustainable consumption and production programs, with developed countries taking the initiative.
	8.6	By 2020, substantially reduce the percentage of unemployed young people who do not follow a course of study or who do not attend training courses.

9 (industry, innovation, and infrastructure)	9.b	Support the development of domestic technology, research, and innovation in developing countries, also ensuring a favorable political environment, among other things, for industrial diversification and to give added value to raw materials.
11 (sustainable cities and communities)	11.6	By 2030, reduce the negative per capita environmental impact of cities, particularly concerning air quality and waste management.
12 (responsible consumption and production)	12.4	By 2020, obtain the eco-compatible management of chemicals and all waste throughout their life cycle, following the agreed international frameworks, and significantly reduce their release into the air, water and soil, to minimize their negative effects on human health and the environment.
	12.5	By 2030, to substantially reduce the production of waste through prevention, reduction, recycling, and reuse.
	12.6	Encourage companies, especially large and transnational companies, to adopt sustainable practices and integrate sustainability information into their regular reports.
	12.8	By 2030, ensure that people have relevant information and awareness of sustainable development and lifestyles in harmony with nature all over the world.
14 (life below water)	14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, particularly that from land-based activities, including marine litter and nutrient water pollution.
16 (peace justice and strong Institution)	16.7	Ensure a responsive, inclusive, participatory and representative decision-making process at all levels.
17 (partnership for the goals)	17.17	Encourage and promote effective partnerships between public, private-public and civil society subjects, based on the experience and strategies for accumulating resources of the partnerships.

Source: Fiorani, Gismondi, & Litardi, 2016

The study is original from both an academic and a practical point of view because it is applied research. In fact, in addition to the aspects of literature and documental analysis, the main factor of the case study is the participation of the various stakeholders in the project thanks to the awareness of the topic of waste and importance of the recycling that has increased in recent years by the academic community. The project of inserting incentive-compactors in a public university is a unique case in Italy and Europe, which certainly could be a good practice to replicate in other universities. The role of the University of Tor Vergata as a primary place of production and transmission of knowledge in the territory, is one of the main potential levers to overcome the vicious cycles of the economic crisis and social decay that plagues the areas' of Municipality neighborhoods. A virtuous relationship between science, knowledge, and society contributes to the growth of human capital, as well as productive and civil, and the culture of professionalism, all being necessary for a healthy social and economic development.

During the research analysis, the enthusiasm and social values guiding the professors, researchers and students are conflicting often with the limited economic resources, territorial problems and the lack of appropriate reforms that impede the implementation of rapid change and innovation. The "Third Mission" confirms to be an activity partially able to allocate funds for the development of university activities that produce extra-university projects (e.g. the projects developed into the laboratories). Moreover, the strong presence and activity of the third sector organizations increasingly play a fundamental role in the transition to a sustainable and resilient "Open Knowledge Society".

Conclusion

The European Commission, through the communication "Innovation in a knowledge-based economy", in the European Parliament, establishes the overcoming of the role played by universities, not only in training and research but also in the promotion and diffusion of knowledge and technologies, especially in the local economic context.

In Italy, the concept of the Third Mission came very late due to cultural and regulatory difficulties. The reasons that determined the progressive interest of universities for the third mission can be traced both to the long-term changes in the organization of scientific research and the development of technologies and to the needs of its main stakeholders. The third mission was fully integrated into Italian universities thanks to Legislative Decree no. 1988/27 January 2012, which defines the principles of "Self-Assessment, Periodic Assessment and Accreditation" (AVA) and subsequently Decree no. 47 of 30 January 2013 of the Minister of Education, University and Research (MIUR), which identifies the indicators and parameters of periodic evaluation of research and the third mission. In this way, universities must take on a more direct "entrepreneurial role", providing investments in applied research functional to their economic impact, favoring institutions of excellence capable of producing innovative knowledge, evaluating and measuring the cognitive performance of individual universities.

The Tor Vergata University of Rome integrated the Third Mission since 2014 in line with Quintuple Helix Model collaboration as others public Italian universities considered best practices in promoting sustainability, such as the *Alma Mater Studiorum* University of Bologna (born in 1088), is the oldest Italian state university in the western world.

The *Alma Mater Studiorum* University of Bologna is the first University in Italy for sustainability. In 2019, for the third consecutive year, the University of Bologna is the first university in Italy for attention to environmental sustainability. Even more relevant is the global positioning. In the general classification, the University of Bologna reaches 12th place (on a par with the Dublin City University and the University of Sussex). This is certified by the new edition of the GreenMetric ranking³, the ranking that evaluates the green policies and actions put in place by universities all over the world. *Alma Mater Studiorum* University has created a "Sustainable Multicampus" using management and operating models based on the principles of sustainable development, as a strategy that combines economic development, social inclusion, and environmental sustainability. The University communicates and reports on its sustainability work through the web. The activities promoted by the University and the related SDGs pursued by distinguishing them for the four areas of intervention identified by Alma Mater: Energy, Mobility, Environment, and People. The project brings attention to the needs and habits of the university community, the environment and their mutual relationship through new management models capable of reducing the environmental impact of the University's policies, of helping to improve the well-being of the community that lives university spaces and to encourage an increasingly greener and attentive environmentally friendly community with more active and responsible behavior.

This consideration shows that young and ancient universities are moving to converge towards the objectives of sustainable development, raising awareness of the territory. However, they are located in different social and economic contexts (region, demographic, etc.). In general, both, old University (*Alma Mater Studiorum*) and young University (the Tor Vergata University of Rome), promote sustainability through a top-down model and used the sustainability report as a communication tool for external stakeholder and a strategic plan for internal stakeholders. An interesting aspect is that while universities, in

³ The GreenMetric ranking is designed to involve universities around the world in the common commitment to issues of sustainability and respect for the environment. The ranking is made by evaluating the actions and policies adopted by universities in the green field, with particular attention to climate change, water and energy consumption, waste recycling and transport sustainability.

general, have moved to increase sustainability on their campuses through direct activities started by academic management, in the Tor Vergata University of Rome this has also happened through a bottom-up model. In fact, through a public call promoted by the Rector, the whole academic community (in particular professor, researchers, Ph.D. students) applied to the open call to present ideas for promoting research-actions, in terms of social-environmental sustainability actions, in the territory where the University is located and in the campus too.

In conclusion, it is possible to define the project of call “Mission Sustainability” promoted by the Tor Vergata University of Rome, and in particular the case study of “Greentosi of Unirecycling [...]” as a model of higher education that contributed to social change towards sustainability (Filho, 2000; Scholz, Lang, Wiek, Walter, & Stauffacher, 2006; Scholz, Steiner, & Hansmann, 2004) at a strategic level (long-term strategic vision and mission), tactical level (facilitate cooperation with different stakeholders) and operational level (higher education can implement changes in curricula, research, and universities). In this sense, alongside the traditional missions typical of Italian universities (education and research), relations with institutions, companies, and organizations operating in the territories are becoming activities of primary importance for implementing the logic of change towards local sustainable development. In this scenario, it is possible to review the structure of the University as an evolution of the “Multiversity” (Kerr, 1963) in an articulated model of a “Sustainable University” where at the base we have the two primary functions of the academy (education and research) and four pillars, in addition to those of the third mission, collaboration with a view to the quintuple helix model and public engagement (figure 5).

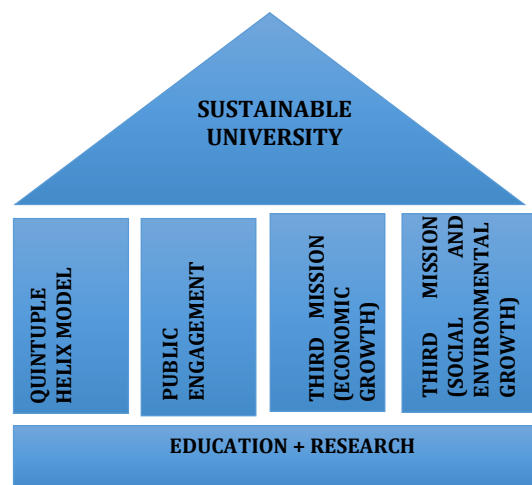


Figure 5. The pillars of Sustainable University
(Authors' elaboration)

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