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The Triple Mission of the Modern University: Component Interplay and Performance Analysis from Italy

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Abstract: We explore the interplay between the three missions of the modern university (teaching, research, and 'third mission': education, scientific productivity, and socio-economic interaction with non-academic environments), with a focus on the Italian public university. We execute a path analysis compliant with the isomorphic 'one-size-fits-all' university management framework, revisited under a stakeholder approach in light of students' needs and expectations. We investigate the impact of the university's knowledge-based missions on student outcome: student satisfaction and early job placement (data from nearly 400,000 respondents per year from 2011–2014) epitomizing both educational effectiveness/attractiveness and competitiveness. Although performances do not appear to all be correlated with each other, there is a positive relationship between research and third mission quality, and finally between the socio-economic mission and student satisfaction. This kind of mission-related evaluation can shape the institutional decisions (government policy and funding) and influence management priorities or behavior by revealing the way the quality of academic productivity and knowledge transfer to communities can create value from the point of view of the core stakeholder (university students). Our findings across missions offer a new perspective, while the innovative structural method helps to reconcile the three institutional goals in one big picture.

Keywords: higher education institutions; university quality; evaluation; job placement; student satisfaction; third mission; stakeholder theory; scholarship; socio-economic interaction

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1. Introduction

1.1. Background

Education is a public service fundamental for the growth of youth and society. Since the advancement of higher knowledge is aimed at human, social, and economic progress with a leading role played by universities, the present article offers an analysis pertaining to the university's missions and relating evaluations. In particular, we analyze the Italian Higher education institutions (HEIs). In such a context, universities have performed for centuries both traditional teaching/learning activities (first mission) and academic research (second mission as technical knowledge production). Only recently a new stimulating mission (so-called 'third mission'—although the expression is rather nebulous and ambiguous [1]—often designated as outreach and engagement to favor territorial development through intentional interactions between universities and non-academic environments) has been explicitly added, reflecting the ever-growing involvement with the economy and society. Monitoring the three missions' achievements is a crucial task of public administration, management, and control inherent to the tertiary education government.

Our starting point: as firms/enterprises aim to create value by ensuring their customers' satisfaction, so would HEIs (under a stakeholder and shared value approach) by satisfying as much as possible their students' needs and expectations (public value-added). This is a major result of the public value creation process [2,3] applied to universities. Hence, our purpose is to explore the role of the university evaluation system as an instru-

ment of quality/effectiveness assessment, with a special investigation regarding scientific knowledge performances and students' outcome.

In particular, the extant literature has not yet specifically examined (gap) the catalyzing function attributable to scientific research and third mission quality toward learning outcomes so as to shape new directions for modern educational development.

1.2. Motivation

Being comprehensive (original term *Universitas* means 'a whole'), each university is supposed to excellently play a triple role. In fact, because of the one-size-fits-all 'view' institutionally adopted (requiring the triple optimization of missions), each university is under isomorphic pressures called to effectively contribute to society through the pursuit of education/learning, research activities, and knowledge transfer, always playing at the highest levels of performance. As known, the primal mission of the university (education) is to activate future human capital creation (by directly providing students with learning skills). In turn, knowledge advances thanks to research that is methodologically rigorous and relevant in terms of content and objects of investigation, and it is expected to be disseminated through effective teaching at various levels, ensuring a constant connection to the real world as well. Both scientific productivity and transfer of knowledge to the territory are supposed to provide students with higher competencies and/or applied skills (e.g., via university-industry labs, technical seminars, apprenticeship networking, etc.), as well as with more job opportunities.

Of course, the first mission can be improved by continuous institutional investments and advances in teaching activities and educational methods (e.g., e-learning or blended courses, virtual presentations, web conferences and classrooms, interactive/participative approaches, focus groups and team projects, competency-based learning, data analytics, digital textbooks, video streaming, career counseling, teacher training—mentoring—hiring, etc.). Nevertheless, educational growth opportunities come from the second and third missions when conducted in a manner fostering the improvement of learning attitudes.

According to the unitary model made of interconnected missions, it is appropriate to test on an empirical basis to what extent high-quality scientific activities and socio-economic interactions are translated into a real outcome for students, i.e., if academic products and knowledge transfer to communities and territories constitute a fruitful context which becomes a 'real impact factor' for university students.

1.3. Purpose

Research Question (RQ): Do universities' higher scientific knowledge-based performances and socio-economic development commitment evenly complement and support the higher education goal impacting students? i.e., do (and to what extent) higher-quality research and knowledge transfer of services to society/territory connected to universities ('third mission') raise the educational effectiveness/attractiveness indicators from the core-users' side (i.e., students')?

We wonder if universities with higher performance for the scientific mission and/or socio-economic mission offer better educational programs and competencies able to form more enthusiastic and brilliant students.

2. Literature Review and Hypothesis Development

2.1. Relevant Studies on University Missions

The universities date from the founding of the University of Bologna and University of Paris (XI–XII century, both connected to the elder tradition of Roman Church schools), whose purposes included scientific investigation, training professionals, improving society, critical thinking instruction, and research. By the XVIII century, universities began publishing academic journals too, while two important models were established, the French (*Grandes Écoles*) and the German model. The former was more severe with discipline and control; the latter developed two ideas of the Enlightenment, the individual and the world

citizen, inside a fascinating environment of academic freedom for teachers/researchers and students directed at enabling their intellectual investigation of the world. In the XIX century, the Humboldtian ideal of higher education emerges (*Bildungsideal*). The core idea was a holistic combination of studies and research, integrating arts and sciences to achieve both comprehensive general learning and specific cultural knowledge. In such a context, professors reproduce their own realizations so that students observe and learn the act of knowledge creation.

This teaching-research unitary model profoundly influenced the European higher education institutions (the British Universities emphasized the importance of research, as well as liberal education in conjunction with utility), and also Japanese and American universities later (although 'market-driven' [4]); in this sense, see also (p. 6, [5]). The first two missions (education and research) are still the highest legacy of such *Bildungsideal* and have remained almost constant throughout history.

This premise on the cultural roots (origins) concerning the definition of the university's scope is important to understand the current set of missions, which is the result of more recent evolution. Now, we examine the recent literature on the modern view of the university (compounded) mission.

2.1.1. The (Modern) Triple Mission Model

Since the 2000s, a new role of universities in society has been recognized with the introduction of the Third Mission (TM), at first integrated implicitly into the research mission due to their compatibility/complementarity and, allegedly, attitude to drive universities toward the same direction [6,7]. Arguments in favor of a (slight) revision of the old double mission statement are grounded in the fact that universities provide a push to modern knowledge-based economies [8–11]; additionally, the new mission pays tribute to the Triple Helix model [12,13] systematizing the key features of university–industry-government interactions into an 'innovation system' format [14,15].

From this modern view, growing interactions are supposed to generate new institutional and social formats for the production, transfer, and application of knowledge [16], where a remarkable part is played by R&D activities (mainly through patent management and academic spin-offs). As a result, a new central concept is the 'Entrepreneurial University' [17,18], which conceives a proactive attitude in putting knowledge to use and creating new knowledge (strategic knowledge creation for society). Indeed, for such an advanced and complex university ("a global phenomenon with an isomorphic developmental path, despite different starting points and modes of expression"—(p. 313, [12]), the involvement in socio-economic development—i.e., the academic 'Third Mission' (leading an invisible revolution)—appeared most salient. This represents a powerful impulse and a great challenge for university professors and scholars in order to obliterate the accusation or the risk of living in the 'ivory tower' [19] prone to the cultivation of intellectual perfectionism. Recently, [20] pointed out an evolutionary process in the mounting of the network of knowledge production promoted by universities. Reflecting on real experiences, the conceptualization is seen as the antecedent to a renewed triple mechanism, involving the relationships between institutional spheres with clear boundaries. Such transition and the subsequent emergence of entrepreneurial universities should be expedited by the intervention of intermediary organizations between institutional spheres promoting knowledge exchange activities (with a broad range of stakeholders, including users in the commercial, public, and voluntary sectors). In this respect, [21] had already introduced the knowledge exchange combining the triple helix and the third mission (Schumpeter-revisited).

It is worth noting that TM has been increasingly considered as a critical dimension of universities' activities, variously implemented by a 'specific mix' (inherited and/or constructed) with a variety of scale and scope; at the same time, its institutionalization has been supported by the public policy agenda across OECD countries for the last twenty years [22–24]. It indicates a gradual changing process that necessarily takes several years (along with both infrastructural and cultural progress [25]) and can finally create new

potential roles for universities; in one sense, it challenges the traditional societal privileges and monopolies long benefited [26].

Hence, a new source of competition between HEIs took place beyond teaching and research, providing new dimensions to rank universities' scope achievement: [27], for example, indicate at least three dimensions in the nonprofit-social-approach, entrepreneur focus, and innovative approximation. Theoretically, [28] highlights the 'tangling' of conceptual frameworks to explain the scope achievement related to the third mission paradigm (with four areas of variance: focus on public versus private good; university–business cooperation and entrepreneurship; relation to theory; stakeholder perspective); resultantly, there remains a lack of clarity about how the modern university engages a set of external stakeholders. Universities interact to convert their knowledge into value, while managers are required to adopt a major proactive and rational TM approach.

New research lines regard, among the others, the university scope of co-creation for sustainability [29,30] alongside the intellectual capital framework [31–33]. It is worth noting that a number of scholars and public administrators focused on the unitary three-missions system conceiving it as a whole, while others focused specifically on the universities' performance issues, as follows. In this regard, we highlight the literature concerning Europe/Italy, omitting the illustration of the peculiarities of the missions of universities located on different continents, which have different cultural roots. This can be seen in the interesting transnational study of universities' mission statements through content analysis on a sample of universities from Europe, North America, Asia, Oceania, Latin America, and Africa conducted by [34]. As known, today, the institutionalization of universities' third mission—alongside teaching and research—is global, representing an evolution from one-way service to interactive engagement [23].

2.1.2. The (European) Institutional Framework: The 'One-Size-Fits-All' University Model

Across Europe, the three missions' model has been explicitly incorporated into the legislative frameworks that regulate universities and this has obviously fueled much of the literature. In such a perspective, European universities have increasingly been playing a key strategic role in strengthening economic competitiveness and development [35]; however, (paradoxically) financial constraints increase uncertainty in management, emphasizing the need for a stronger social and economic impact. Such requirements stimulated a rethinking of universities in Europe because institutions are pressed to listen to and work more closely with external partners (stakeholders) in implementing their function, re-orienting the mission toward knowledge "triangle" attainment (education, scholarship, and innovation).

Furthermore, while pursuing their scopes/missions, universities are widely ranked on the basis of their institutional performances (variously measured). In this regard, with reference to European universities, [36] highlighted how rankings (which can be debatable due to the heterogeneity of purposes and criteria in various contexts and countries) are the subject of another paradox: the more they are criticized by social scientists and experts on methodological grounds [37], the more they receive attention in policymaking and media. There descends the importance of investing in data integration and open data at the European level, facilitating 'managerial efficiencies' related to HEIs administration (strategic planning and control).

Such a new wave reached Italy as well (relatively latecomer [38]. There, [39] offers a well-done discussion on the aforementioned tasks assigned to the national evaluation bodies, their functions within the university system, and the adoption of quantitative parameters and standards in the evaluation and formal accreditation process. More in general, [40] critically described the evaluation turn in the higher education system, exploring how new public management policy ideas and technologies circulating in the globalized education space have been re-contextualized in a re-design of the Italian HE System. On the contrary, [41] illustrated the specific path toward the third mission deepening the activities of university knowledge transfer offices in Italy. Shortly before, [42–45] analyzed the propulsive role of academic spin-offs and collaboration between universities and firms in

Italy (especially the ones in the proximity of top-rated departments), even influencing the location of innovative startups, while [46] reported an interesting investigation of the espoused values embedded within the statutes of 75 Italian universities, wondering whether all institutes conceive the new mission aimed at territorial development in the same way. Such investigation elucidates which organizational orientations emerge by classifying values through qualitative content analysis with four patterns: the need for coherence (balancing public functions and third mission activities); exploitation (focused on patent disclosure); openness (readiness to participate in external change and to satisfy external needs); old school (entrepreneurial activities as a source of funding). This shows a more complex phenomenon for the institutionalization of the university missions with respect to a binary public/private opposition. Of course, the new socio-economic mission is considered particularly important for business schools and, from this perspective, [47]'s inquiry about the future of Higher Education in Management, shedding light on the administration of Italian institutions.

That premised, since the three missions are expected to be performed in an excellent manner at the same time by each university, we consider the theoretical framework known as the 'one-size-fits-all' University Model, as illustrated in [7]. This model (as incorporated into the legislative framework) conceptualizes universities as centers of excellence institutionally articulated in education, research, and TM.

With reference to Spanish HEIs (system similar to the Italian, with about 50 public universities, within the common EHEA), a critical conclusion has been recently elaborated in [7]. The shortcomings of this perspective are pointed out: on the one hand, universities are fictitiously treated as homogeneous institutions with equal capacity to perform and contribute to social engagement; on the other hand, multiple missions may be conflated. It shows that while research and the third missions ride together, teaching is negatively related to both of them. Results suggested the need to converge on single missions to achieve quality and excellence, prospecting that universities should develop a specialist focus [48,49] rather than a multiple. As a consequence, missions could be more clearly revisited as 'university strategies' linked by a complex relationship of compatibility, calling for a better understanding of how different modes of funding and alternative governance models can meet strategic priorities.

From both a literature and factual institutional reality, we realize that to create public value in society and the economy (by educating fresh and skilled human capital appropriately), the university strategies and management should be oriented to satisfy primarily (though not exclusively) their *key stakeholders* (students). As a consequence, to duly complete the picture and discover whether the above-mentioned 'one-size-fits-all' framework works or not, with or without faults, it is relevant to ascertain if and to what extent students appreciate the university's endeavors and new achievements reconnected to the educational offer (undergraduate courses: three-year bachelor's degree program; postgraduate courses: three-year master's degree). In other words, we need a stakeholder approach to the university management framework in light of students' needs and expectations.

2.1.3. University Students' Point of View (Key Stakeholder Approach)

In university Mission Statements (worldwide), the importance of students is always emphasized [34]. From the vital point of view of students [50], the business of university education should consist of acquirements, attainments, expertness (in particular arts and pursuits), proficiency achievement: in brief, knowledge in relation to learning (both theoretical and practical). Eager to attain competencies, they need satisfactory courses and programs successful in investigation, training, molding, and enlarging their mind [51,52] in such a way that during the educational experience they learn to contemplate the truth (knowledge received) through—Newman would say—*the eye of the mind* (i.e., the work of discipline and habit). Nevertheless, in today's economic environment characterized by uncertainty and dramatic competition in the search for job opportunities, the competitive and globalized society demands the increasing availability of a highly qualified workforce with

higher professional skills and attitudes; therefore, the keen, enthusiastic, and sympathetic student will ask for more useful/effective higher-education or fruitful instruction with features of utility concretely 'spendable' (usefulness appreciation and success evaluation). In this regard, the "knowing-in-practice" perspective [53] theorizes knowledge as the ability to purposefully go on with practice and information as a rich resource.

Training of the intellect with a robust and applicable method, intelligent encouragement [54], and motivation [55] will enable students to observe, understand, and learn knowledge and discharge their future duties to society, preparing them for the 'art' of social life [56]. University education, finally, is a major 'Investment' in the future of society. *Per se*, it must be effectual.

Hence, a contextual inquiry around student appreciation is due to test the university missions' effectiveness. Their opinions, especially on the (spread of) quality service culture, are important because they can reveal conflicts and contradictions between the three missions of universities. In this regard, [57] recently outlined the trends in quality management (QM) studies to provide universities with the best evidence on their focus and models for quality improvement. Despite the role of quality growing in importance (as universities strive to compete in an increasingly underfunded market for students and scholarship funds), the current literature appears to be fragmentary and limited in volume and scope. The most common topics in the literature are QM implementation issues, models/techniques/tools and dimensions (people management, process management, information analysis), with results predominantly addressed to understand the stakeholders' requirements and feedback on their performance perceptions. Students, as core stakeholders of the university, are discussed both as 'end customers' and as 'graduates and participants' in the learning process, with valuable views on their own overall experience, as naturally influenced by the learning contexts and technical approaches [58–64].

Students' evaluations regarding their university are essential, as they increasingly become protagonists within the quality assurance processes. Addressing business students' satisfaction and expectations in higher education, [65] identified a dozen factors through an exploratory factor analysis (professional comfortable environment; student assessments and learning experiences; classroom environment; lecture and tutorial facilitating goods; textbook and tuition fees; student support facilities; business procedures; relationship with teaching staff; knowledgeable and responsive faculty; staff helpfulness; feedback; class sizes). Lastly, [66]'s measuring the instruction quality (comparing it across different courses, teachers, departments, and institutions) underlined that student evaluations are widely used to measure teaching quality in higher education. They impact teacher promotion decisions, student course selection, as well as auditing practices for institutional performance fulfillment. What is more, assessing selection bias (mostly deriving from the selection of unobserved characteristics) is possible; nonetheless, adjusting for selection would have a small impact, validating a largely related literature that considers the observable determinants of evaluation scores without correction.

In conclusion, the studies on high education institutions under a stakeholder management approach are growing, where the role, expectations, and valuations related to students are pivotal [3,67–69].

2.2. Hypothesis Statement

Historically, university education has excited much interest, and today, it still elicits vivid discussion at both international and local levels. Our investigation focuses on Italy, the birthplace of the first modern university based on the academic freedom (Bologna University, adopting the *Constitutio Habita*), in order to deepen the relationship between the renewed and innovative strategic functions [70]. Similar the policy of other European governments, over the last two–three decades the higher education strategy has been essentially centered on internationalization openness and mobility encouragement [71], institutional autonomy, new competitive funding mechanisms, and assessment of the quality of teaching and research, corroborated by the supervened third mission. This way, academic learning

has been put alongside innovative public governance (establishing an appreciable quality assurance system) with a stronger attitude regarding the lifelong learning of students and social contract alignment (see [72,73]) so as to make universities more effective, efficient, competitive, and modern [74,75]. Supplementary features (typical of the managerialism model [76])—common in private sector organizations with the inherent strategies, structures, technologies, instruments, and values of the so-called *new public management*)—are the systematic recourse to auditing and benchmarking practices, a new system of accountability, government/processes harmonization, and the empowerment of HEIs leadership. Such conditions have strongly encouraged sustaining a quality improvement in HEIs, and the university system has invested a lot in such quality enhancement.

Beyond academic instruction and scientific research, the new mission has been stated and pursued: the third mission (services to economy/society). Here, especially, external stakeholders [77] are more interested in universities having a stronger scientific reputation, innovation, R&D, mobility, industrial applicability, etc., producing and transferring new services (which are the result of their best-applied research appreciated by market) to the socio-economic environments. Hence, the second mission (scientific production in the academic community) is expected to significantly impact the third (scientific knowledge transfer to territory by socio-economic interactions).

It is important to note that while teaching and research are the duties of professors, TM activities are a good practice but mostly represent a (strategic) choice, able to create a (public) value added for society and, at the same time, higher quality performances (in a great account by the State and agencies). TM needs to be stimulated.

Against this backdrop, we learn that in harmony—due to an orderly functioning of the university organization/system—the three missions should support each other triggering, at last, a profitable chain reaction: excellent teaching is expected to be provided by professors and researchers who produce high-level scientific outputs effectively shared first in the academic communities (publications et similia), and then applied in the non-academic environments (patents, know-how, innovation projects, services, etc.). In fact, on the one hand, the high quality of professors' products, as disseminated in the academic community, is a clear clue of outstanding competence to create reputed knowledge (this would entail more opportunities for students to acquire high-grade and up-to-date knowledge or skills); on the other hand, university closeness to the 'real world' (e.g., industry) is an undoubted signal of utility, attractiveness, and efficacy for the applied research activities when transferred outside (this facilitates the creation of operating networks with external stakeholders, and finally favors the students' educational training embedding knowledge and early job placement). Therefore, both missions (namely, research and socio-economic interactions) should be implemented in consideration and for the sake of student learning (*ex multis* [63]) and, as a result, better the university student's trust level. Moreover, the third mission usually promotes and strengthens outgoing orientation and tutorship, job placement initiatives, labor supply, intermediation services, and curricular and extracurricular internships and apprenticeships.

In brief, scientific research and the third mission can continuously 'complete' and re-orient the practical 'execution' of the university courses and education lectures and projects granting new topics, tools, and future opportunities.

Accordingly, we state the Hypothesis 1 as follows:

Hypothesis 1 (H1): *Higher quality scientific research (knowledge production within academic communities) is related to higher quality of the third mission (knowledge transfer to non-academic communities by socio-economic interactions) and they both significantly support higher student outcome (i.e., higher satisfaction rate for degree programs usefulness/appreciation plus early job placement, both meant as educational effectiveness/attractiveness indicators, and, as a result, competitiveness factors for each university).*

In other words, scientific and third mission achievements and performances are expected to show a *positive correlation with the student experience and career* (both undergraduate and postgraduate education), therefore, with educational effectiveness, attractiveness and competitiveness.

We could term such a supposed virtuous process the *educational triple helix assumption* (limited to missions), which is compliant with the ideal one-fits-all university framework [7] revisited under a core stakeholder-oriented approach [3,67–69] to create public value and human capital (graduate students) in higher education institutions [78,79]. For the simultaneous optimization of each mission, in fact, the goals are expected to be correlated positively with each other. Such a process is only partially compliant with the well-known Triple Helix Model [6,12,13] (based on university–industry–government interactions: in our case, while university is fully involved, the industry is partially involved, as for the job placement structures and the non-academic socio-economic actors interacting with universities—spinoffs, companies, etc.; additionally, the government is partially involved, limited to the government policies driving the quality culture inside the university, with the effect of influencing academic strategy and behavior).

It is worth noting that the H1 statement is a specification of the RQ developed thanks to the literature review. Our hypothesis implies a prediction (in line with the institutional/theoretical framework) that is empirically tested and discussed in the following sections.

3. Methods

This section deals, first, with the specification of the sample (main characteristics and identification of the mission-related indicators), and second, with the statistics and the econometric model we carried out. From the methodological standpoint, compared to previous studies, after the elaboration of the usual univariate and bivariate statistics, i.e., descriptive and correlation analysis, we propose for the first time the unitary PLS/SEM method to accurately show the joint effect of the knowledge-based missions on the educational outcomes for university students.

In brief, our empirical examination investigates whether the institutional missions are an operating system, rather than just a possible nominal set of substantially unrelated processes and tasks assigned (bureaucratically entangled). It implies an original deepening of modern public universities' missions, with a particular focus on the materiality aspect from the students' point of view (also controlling for the size and geographical effect).

3.1. Sample (Italian Public Universities and Official Quality Evaluation Indicators)

Our empirical verification draws from official data on mission performance and outcome concerning public universities provided by reputed public sources (such as Anvur and AlmaLaurea). Tasked to ensure the quality of higher education and research in Italy, Anvur (the Italian National Agency for the Evaluation of University and Research Institutes) systematically evaluates processes, results/outputs of education, and research activities in Italy, lately including technology transfer. First of all, we take into account the 2011–2014 "VQR" (Evaluation of the Quality of Research) concerning the public universities (state-funded), a category that comprises most of the Italian universities, particularly the largest institutions. A four-year evaluation of their scientific productivity and third mission performance resulted by means of *ad hoc* (independent) GEVs work (Evaluation Experts Groups). The next evaluation process, from 2015–2019, only started in 2021 because of the extraordinary delay due to COVID-19.

The overall evaluation involved n. 450 Italian and foreign experts, assisted by 14,000 reviewers, professors, and researchers. The evaluation analyzed over 118,000 studies by some 65,000 professors and researchers. Against this backdrop, we examined all n. 61 (100%) state-funded universities and excluded the remaining 21 institutions (private universities officially recognized by the Ministry of Education, University and Research, HEIs funded by local administrations, and superior graduate schools with postgraduate education) for several reasons (student data not fully available in the period, higher student

tuition fees and other fundings not comparable with public universities, very different efficiency and standing of organisation and network in many cases).

We retain the same indicators selected and adopted for the national quality assessment since such official indicators (described as follows) are perfectly consistent with the international literature and best evaluation practice concerning universities. Indicators (and relating sub-indicators) are expected to be ideally (positively) correlated with each other.

The main indicator of research quality used in the VQR is the productivity-related *IRAS1* (value between 0 and 1) representing the ratio between the sum of the scores obtained by a single university in a scientific area for its (best) publications selected/submitted, and the sum of the scores of all the universities evaluated in the same science area. This indicator depends on both the quality and the number of publications submitted for evaluation by each university. Reported data show that, recently, universities located in the South and the islands of Italy have been narrowing the traditional gap with the universities of the rest of the country. VQR is used as a criterion to distribute among the universities an important share—more than 1 billion euros per year—of the Ordinary Financing Fund (FFO), allocated by MIUR. As a consequence, scientific knowledge productivity is a very significant public matter.

We find four clusters of indicators useful for our structural analysis, consisting of research (sub-)indicators (*IRAS*), third mission indicators (*PI-SPO-CT*), student outcome indicators (*Sat* and *Occ*), and a pair of control variables (which could be significantly associated to geo-size: *DimSM* and *GEOn*). That said, we collected and processed the following data (see Table 1 for details):

Table 1. Mission-related indicators.

	Products % weight (i.e., the incidence of a university production in relation to overall products of university system).
	Quality research production indicators (IRAS):
IRAS1	quality research products of the university structures evaluated (in relation to the overall national assessment made for each scientific area of the HEIs system)
IRAS2	quality of the attractiveness of the human resource (effective hiring policy, even from abroad mobility: publications of newer professors and researchers of each university are specifically considered)
IRAS3	quality of financial attractiveness (indicator regarding revenues from national and international funding—namely PRIN, FIRB, ERC, NIH, etc.—purified from local financing)
IRAS4	growth and innovation performance (indicator concerning the relative number of Ph.D. students, postgraduate students, and research fellows, even from abroad)
	Quality TM (third mission) activity indicators:
PI	invention patents (university management of intellectual property, including plant variety rights)
SPO	academic spin-off organizations
CT	third-party projects
	Student Outcome indicators:
Sat	student satisfaction with reference to degree programs and general services provided by their university (drawn from massive surveys carried out immediately after the achievement of the degree, considering all the programs/courses—first level or second—offered by every institution); it is expressed as a % of individuals declaring a good and an excellent satisfaction (percentage out of the total of students, who have been asked if they were satisfied overall with their degree program and would ideally enroll in the same course again)
OccLT	students' job placement rate (as by 1 year after bachelor's degree)
OccLM	students' job placement rate (as by 1 year after master's degree)
	Control (geo-size) indicators:
DimSM	dummy variable to account for small–medium size (up to 20,000 students)
GEOn	dummy variable to account for institutes with headquarters located in Northern Italy (Aosta Valley, Piedmont, Liguria, Lombardy, Emilia-Romagna, Veneto, Friuli-Venezia Giulia, and Trentino-Alto Adige/Südtirol)

With reference to scientific research quality (IRAS), the first indicator (IRAS 1) is measured considering the sum of the submitted products' evaluation: 1 when the work is given an A or *excellent*, 1.8 for B or *good*, 0.4 for C or *acceptable*, 0.2 for D or *limited*, and 0 for E or *scanty*; valuations made by the 16 GEVs involved through bibliometric analysis and/or peer review. The value reported is in %. The second indicator (IRAS 2) is calculated similarly, referring to the new hires. The third (IRAS 3) adds up the funding (cash income) obtained by participating in competitive bids for national and international research projects (in % of the funding of all the universities evaluated in the same science area). The fourth (IRAS 4) counts the number of Ph.D. students, postgraduate students, research fellows, etc. of each university in comparison with the national number.

The third mission (TM) has been assessed by a special committee comprising 28 independent experts—CETM, who ranked the levels of commitment and participation through four merit classes: A (the university structures TM activity on the basis of a functional strategy that deserves attention as a best practice), B (when university structures TM activity explicitly and coherently), C (if university shows levels and types of TM activities worthy of attention for potential, but not adequately structured), D (the university shows a limited span of third mission activity).

With respect to invention patents (PI), the first indicator is based on the following sub-variables: Inventive capacity (PI_ 1); Proficiency to manage intellectual property (PI_ 2); Economic valuation of the intellectual property portfolio (PI_ 3).

The second indicator (academic spin-off organizations—SPO), instead, is based on: Employment impact (SPO_1); Economic impact (SPO_2); Exit strategies through acquisition or IPO (SPO_3); Demographics of spin-off organizations (SPO_4); Growth dynamics (SPO_5). The external collaboration with university structures is focal.

As for the third indicator (third party projects involvement—CT), we have: Research intensity for third parties (CT_1); Intensity of services and projects for third parties (CT_2); Intensity of teaching on behalf of third parties (CT_3); Intensity of institutional relations (CT_4); Financing by private parties (CT_5).

To corroborate the evaluation of the technology transfer (beyond the invention patents management already included in the model), it is expected to be considered in the near future (still being at the explorative stage) along with the evaluation of the promotion of networks and third mission relationship with the territory (SIT_1), the use and coordination of internal resources or units for such purpose (SIT_2), and the establishment of internal intermediary core facilities (SIT_3), as well as the production of public goods (e.g., museums, archeological sites, public engagement, clinical trials, etc.). Such aspects may better contribute to delineating the role of universities as agents of innovation-based growth, i.e., highlighting more completely the interactions between universities and the rest of society (outside the academic environments). As [80] argued, entrepreneurial ventures may represent a viable and effective mechanism to transform academic knowledge into regional economic growth.

As for the impact on student indicators (learning outcome), the AVA public evaluation (self-assessment, evaluation, and accreditation) of degree programs by means of Evaluation Experts Committees (CEV) resulted as still incomplete at the time of the structural analysis (since it takes a long time for self-evaluations to be very carefully scrutinized and externally audited by a third party, such as ANVUR). As a consequence, we measured the higher education outcomes directly connected to student experience using AlmaLaurea data (and Istat statistics), collected on the basis of massive surveys submitted to new graduate students from each university scrutinized (nearly 400,000 respondent students per year), focusing on the student's satisfaction grade and job placement rate (one year) after the first and second cycle. We refer to a service managed by a consortium of 64 Italian universities with the support of the Italian Ministry of Education, University and Research, which makes students' CVs available online (acting as an intermediary between graduated students, universities, and companies, in order to facilitate the entry of youth into the labor market and to support companies with the personnel search, minimizing the matching times

between demand and offer of qualified work). In one sense, AlmaLaurea seems to realize a kind of 'outsourced third mission' shared activity. In line with [66]'s reflections, student evaluations of this kind can be deemed as useful as appropriate to reveal teaching quality in higher education.

Thus, we examine both the graduated student's profile and early occupational status. We draw both the satisfaction and the effectiveness levels of education by disclosing the graduate student appreciation of courses and global services experienced, on the one hand, and the recognition expressed by the labor market, on the other hand. In addition, a couple of control (dummy) variables account for the possible significant effect of the size and location of the public universities. In brief, we suppose that small–medium-sized universities with headquarters located in Northern Italy can better impact the student satisfaction due to more tailored and innovative services and assistance (organizational efficiency). As for the graduates' job placement rates, we suppose that universities located in Northern Italy (the most developed and productive area of the country, with one of the highest GDPs per capita in Europe and highest tuition fees as well) facilitate graduate students to get more occupational opportunities. More uncertain is the occupational effect of the university size (yet we assume that a bigger size could be more likely and capable to establish a higher number of network relations with other organizations, thus, providing students with additional opportunities). Other possible control variables are omitted, such as the student fee amounts (because of positive association with the location in Northern Italy)—required within the 20% of ordinary funding (national mean €1000; north €1800).

3.2. Statistics

First of all, we process and elaborate the collected data and report the main descriptive statistics in order to describe the sample through the drivers identified.

For each indicator, we show the range, the minimum, the maximum, the mean value, and the standard deviation.

After the univariate statistics, we conduct a bivariate analysis through a correlation (pairwise, one to one) study as well.

Such statistics are preliminary to the inferential analysis subsequently conducted in order to test our research hypothesis (H1).

3.3. SEM/PLS

The econometric method is aimed at testing the impact of knowledge production and socio-economic transfer on students' outcome (given by the learning appreciation feedback and job placement). After the descriptive statistics and pairwise correlations, in fact, we performed a SEM approach (structural equation modeling) to embed our several indicators (observed during the four-year evaluation time span from 20112014) in a unitary picture.

Methodologically, SEM examines cause and effect relationships among variables across multiple fields, often identifying linear causation among latent and observed variables (where latent variables are those represented by multiple observed variables, properly aggregated).

The SEM approach is increasingly adopted in educational studies too, though in several ways and with different purposes. A comparative structural equation modeling coupled with factor analysis to introduce a conceptual model of student satisfaction (from private universities) with higher experience was conducted by [81]; while [82] dealt with the application of structural equation modeling in educational research and practice. Later, [83] carried out a vast methodological review of structural equation modeling in higher education research. Several areas for improvement have been found with the statistical application of SEM in higher education studies providing best-practice guidelines (with data screening, estimation methods, sample size and power, fit indices, validity, and reliability). Recently, [84] analyzed the impact of the relational coordination on the quality of education online with a structural equations model.

Concerning the structural path analysis modeling, the general reflection of (p. 232, [85]) is enlightening: "So long as we want to try to describe complex real-life phenomena as they

occur in their natural settings, it seems that our chief alternatives are the literary essay and the path model".

In short, since the typical OLS is a poorer and 'pooled' system, we delineate and test a set of causal links between our variables formalized 'as a whole' within a system of algebraic equations (SEM) able to give a representation of 'real processes' and interactions involved in tertiary education, prospecting the possible multiplicity of causes on a given variable as well as the relations between different causes and effects. The specific approach in our case is the Partial Least Squares (PLS), also known as Projection to Latent Structures by virtue of its scope of 'general strategy'. SEM/PLS methods imply two stages: (1) an iterative process assesses the values of latent variables; (2) values are included in one or multiple regressions as independent or dependent according to their position inside the path diagram. Therefore, our econometric model is to systematize and highlight the interrelationships within a 'unitary framework' that can simultaneously test the research hypothesis H1, enabling predictions useful for university management and politics. The structural model showed to be consistent with a Principal Component Analysis (with eigenvalue > 1, so as to control for the communalities or common variance, equal to 0.5 at least), which indicated our latent variables properly composed: research quality, third mission quality, and graduate/placement indicators.

Compliant to RQ and research design, the independent variables are the above-mentioned universities' high-quality knowledge productivity and transfer indicators, while the student outcomes (job placement and general satisfaction) represent the dependent variables. Our variables are drawn from the accredited sources ANVUR and AlmaLaurea; in this respect, the structural modeling adopted (PLS) does not require the variables involved to be scaled because the software standardizes them first.

In brief, SEM predicts the existence of latent variables concurrent with the existence of manifest variables. The approach adopted is reflective (i.e., a latent and unitary indicator is reflected simultaneously in its main observable sub-indicators). As known, this kind of Partial Least Squares path modeling is a variance-based structural equation procedure increasingly applied in the social sciences [86,87].

4. Results and Discussion

4.1. Preliminary Analysis: Descriptive Statistics and Correlations

The following tables report, respectively, the descriptive statistics (Table 2) and the correlations (Table 3) concerning the selected mission-related indicators relating to the sample (100% Italian Public Universities).

Table 2. Descriptive statistics.

Items	Range	Minimum	Maximum	Mean	Std. Deviation
Scientific products weight	7.0996	0.0764	7.1760	1.639343	1.3755630
IRAS1	6.5174	0.0847	6.6021	1.639349	1.4119462
IRAS2	8.3571	0.0471	8.4042	1.639346	1.6424888
IRAS3	8.0874	0.1018	8.1892	1.639344	1.5426085
IRAS4	8.2441	0.0826	8.3267	1.639344	1.5465821
PI	0.72	0.00	0.72	0.1319	0.13363
SPO	0.403	0.113	0.516	0.22170	0.084818
CT	0.582	0.001	0.583	0.10647	0.119771
Sat	0.2495	0.5715	0.8210	0.675635	0.0503887
OccLT	0.5455	0.2330	0.7785	0.443566	0.1140089
OccLM	0.378	0.493	0.871	0.68261	0.104109
DimSM	1	0	1	0.56	0.501
GEOn	1	0	1	0.48	0.504

Our elaboration of data.

Table 3. Matrix pairwise correlations.

	Prod Weight	IRAS1	IRAS2	IRAS3	IRAS4	PI	SPO	CT	Sat	OccLT	OccLM	DimSM	GEOn
ProdWeight	1												
IRAS1	0.989 (**)	1											
IRAS2	0.884 (**)	0.917 (**)	1										
IRAS3	0.907 (**)	0.923 (**)	0.862 (**)	1									
IRAS4	0.952 (**)	0.963 (**)	0.890 (**)	0.893 (**)	1								
PI	0.517 (**)	0.553 (**)	0.512 (**)	0.509 (**)	0.582 (**)	1							
SPO	0.444 (**)	0.491 (**)	0.459 (**)	0.423 (**)	0.513 (**)	0.678 (**)	1						
CT	0.688 (**)	0.724 (**)	0.719 (**)	0.635 (**)	0.782 (**)	0.825 (**)	0.689 (**)	1					
Sat	−0.049	0.004	0.067	−0.031	0.031	0.186	0.234 (*)	0.197 (*)	1				
OccLT	0.002	0.050	0.071	−0.050	0.112	0.055	0.136	0.117	0.352 (**)	1			
OccLM	0.126	0.181	0.203	0.087	0.252 (*)	0.278 (*)	0.283 (*)	0.429 (**)	0.386 (**)	0.653 (**)	1		
DimSM	−0.668 (**)	−0.646 (**)	−0.595 (**)	−0.524 (**)	−0.554 (**)	−0.123	−0.164	−0.282 (*)	0.192 (*)	0.059	0.016	1	
GEOn	0.108	0.184	0.216	0.142	0.226	0.352 (**)	0.375 (**)	0.440 (**)	0.134	0.561 (**)	0.661 (**)	0.055	1

Our elaboration of data: ** Pearson Correlation significant at the 0.01 level (2-tailed); * Pearson Correlation significant at the 0.05 level (2-tailed).

As for the academic research and third mission evaluations reported by Anvur, the mean values are closer to the minimum than the maximum. As for the student satisfaction opinions reported by AlmaLaurea, the mean evaluation is quite good (yet not enthusiastic: 0.65–0.70/1.00). As for the occupational condition, only 44% of new graduates were employed one year after the bachelor's degree (3-year first cycle '*Laurea*', 180 ECTS credits), while, more effectively, 68% of new graduates were employed one year after the master's degree (2-year second cycle '*Laurea Magistrale*', 120 ECTS credits). This seems to reveal that (in Italy) the 3 + 2-year model is not very effective in terms of early job placement after the first cycle. As for the control variables, 56% of universities are not big and 48% are located in Northern Italy, showing quite a balanced composition with the distribution of the HEIs analyzed.

The further table exposes the correlation matrix (Table 3).

We conclude that both scientific research quality indicators (IRAS 1, 2, 3, and 4) and third mission indicators (PI, SPO, CT) are, as supposed, correlated with each other (one to one test: especially scientific publications with patents and third-party projects); such performance indicators also show a positive correlation with the products % weight (incidence of a university production in relation to overall products of the university system). The third mission (unlike research or scholarship) appears related to the job placement rate for master's degree students and, more generally, to the student satisfaction rate expressed for education programs. By contrast, student satisfaction appears unrelated to the quality of academic research reported. In this regard, it is worth noting that the first cycle programs (counting a larger student population) usually require a non-research thesis, in some cases a final exam attributing limited credits (whereas the second cycle courses require an experimental work or, in any case, a very articulate thesis with more credits).

4.2. SEM/PLS Results

The present subsection reports the findings coming from the SEM/PLS method performed for the purpose of testing the university (knowledge-based) mission's relevance from the student viewing angle. While the first mission creates value in the form of human capital and high-skilled labor (graduate students), the second and third missions regard the specific knowledge component (academic production and real-world dissemination) of the higher education system. Therefore, we examined the possible existence of a *student*

value-relevance (in the matter of education) attributable to the official evaluations related to the specific knowledge component performances of universities, investigating whether scientific production and transfer increase (or not) student outcome. The following diagram (Figure 1) illustrates the implementation of the structural model with the resulting parameters: factor loadings (lambdas, outer model) and path loadings (betas, inner model).

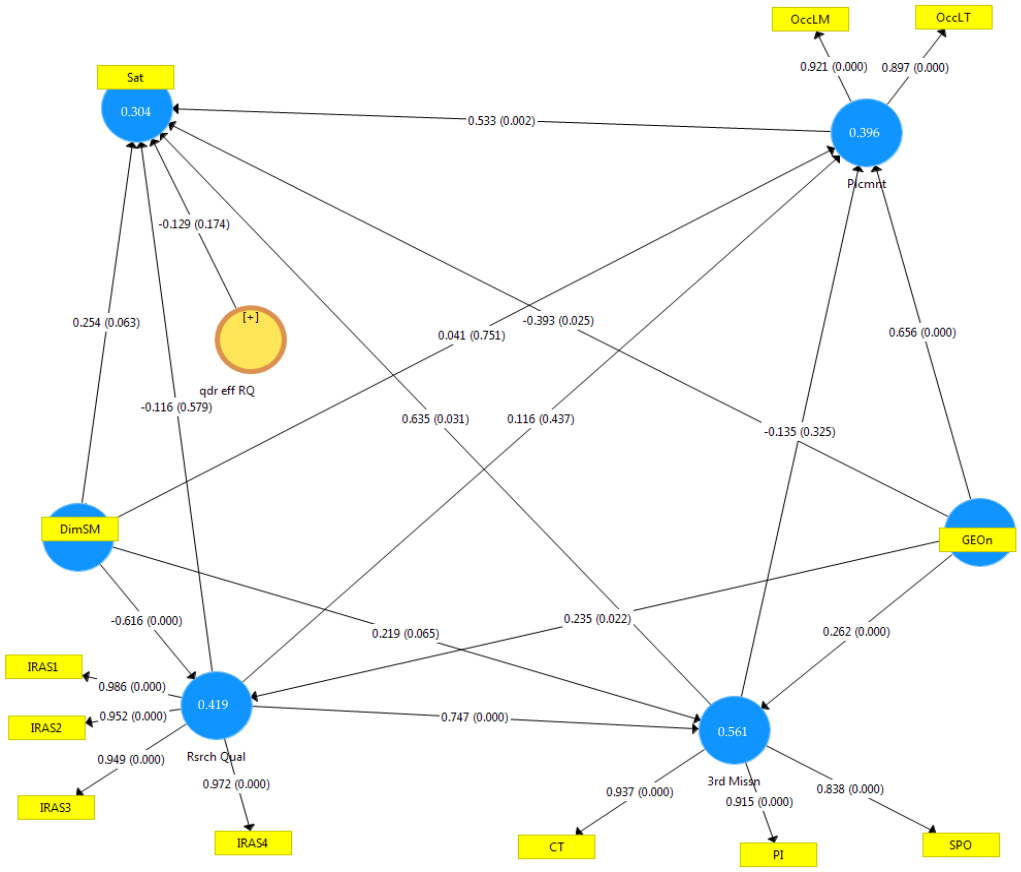

Figure 1. Pls path-diagram: Impact of Research and TM Quality to University Student outcome (Italian public HEIs; 2011–2014). To be read from bottom to top. At the bottom of the graph, there are the two scientific and applied knowledge input aggregate variables (quality of research, as second mission—**left**, and quality of third mission—**right**, each one derived on the basis of underlying sub-indicators); collaterally the two control variables for geo-size (geographic location on the right and university size on the left, both dummy); at the top, the two main output-variables concerning the student outcome (both reflecting the educational effectiveness/attractiveness and, as a result, the university competitiveness): (a) student satisfaction about education programs experienced, on the left side, and (b) early job placement (articulated in bachelor and master degree students), on the right. The inner (structural) model is represented by regression coefficients reported on the arrows which start from input to output variables (or between input/output variables) to express the interplay between the university missions. The outer (measurement) model is shown by loading coefficients reported on arrows between an aggregate (input or output) variable and its manifest underlying factors. In brackets are the *p*-values (significance levels). Inside the circles (latent variables built up on manifest ones) the general fitting (R^2). Our elaboration of official data (Partial Least Squares; bootstrapping).

Inside the "graph", the reflective vectors between the identified latent and manifest variables express the loading coefficients (outer model). The contribution (possible impact) of university scientific research and third mission quality variables on the university student outcome is given by the linear regression vectors (inner model). A quadratic effect test suggested non-linear analysis as not appropriate.

The scientific research quality variable is built on Anvur indicators IRAS 1, IRAS 2, IRAS 3, and IRAS 4 aggregated; the third mission quality variable is built on Anvur indicators PI, SPO, and CT aggregated. Our diagram (Figure 1) reports the regression coefficients between the variables; *t*-statistics were available after reiterative bootstrapping calculation (resampling technique by a self-starting process to attain estimates significance). In particular, the outlined diagram indicates the following main relations (relevant findings):

- a positive path coefficient, equal to +0.747 (significant) *from* research quality *to* third mission quality;
- a positive path coefficient, equal to +0.635 (significant) *from* third mission quality *to* student satisfaction;
- not significant impact (negative) of academic research on student satisfaction;
- not significant impact of both academic research and third mission quality on early job placement;
- universities located in developed regions (Northern Italy) are significantly associated with a higher grade of scientific research and third mission quality, as well as with higher job placement rates (although not with higher satisfaction grade);
- small–medium sized universities significantly denote higher student satisfaction and third mission competency (dynamism), but lower early job placement rates and lower the quality of scientific research (likely due to less stable relationships/networking with the labor market or industry and fewer financial resources to invest in than bigger institutions).

In sum, the university's location and size in our picture appear significant background (environmental) factors in many respects. Moreover, the analyzed time period (2011–2014) comes after the Financial Crisis: the positive geo-effect on early job placement could have been affected or mildened by some worsening of hiring in the labor market (nonetheless, it was not possible to compare data to a period far from crisis).

As for the detailed statistics related to the SEM/PLS, the *p*-values associated with the indicators inside the latent variables were always excellent (0.000), showing a level of significance below 0.01%. No sub-indicators were required to be carved out. The overall reliability of the construct, as regards to the "composed" latent variables, is justified by appropriate values for both CR—Composite Reliability (0.98 Research Quality; 0.93 3rd Mission; 0.91 Placement: each largely greater than 0.59, as exploratory research requires) [88,89] and Alpha Cronbach > 0.70 (see [90]). General results reassured by plausible AVE measures (respectively equal to 0.93, 0.81, and 0.83 > 0.50, so constructs are satisfactory); [91] testing the Convergent Validity of the model or construct communality, with appropriate rho-A values (respectively equal to 0.98, 0.92, and 0.80). Indeed, parameters were never below the critical values.

Moreover, the R-squared (respectively equal to 0.42, 0.56, and 0.40), and the final R-squared for the student outcome (education satisfaction) equal to 0.30 are reported inside the latent performance figures (adequate fit). We conclude that the students prefer degree courses delivered at universities that, based on their official performance, prove to be more effectively connected to the real world (by socio-economic interactions) rather than to the pure academic scientific community.

4.3. Discussion

By searching for the connections across the current tripartite mission of the modern university (teaching, academic research, and third mission), we analyzed the public university evaluation system and the relating impact on student outcome. Our results for Italian HEIs show how and to what extent universities can provide a significant push to the knowledge-based economy and learning society, triggering a positive spiral, where the third mission plays a new pivotal role. As known, in general, universities are expected to generate and push valuable and profitable research useful not only for academia itself but also for industry and society, even embedding scientific knowledge in students' competencies and abilities while the learning process is taking place. This entails higher knowledge cre-

ation for human capital [74], upgrading territorial business environments [92]. Traditional missions (teaching and research) are ultimately seen as part of a broader and more complex nexus of knowledge management activities and (partly) market-oriented consultancy addressed to several economic agents and stakeholders; as such, universities can aspire to become hubs of strategic knowledge for the development of regional innovation systems [7]. It follows that—to create shared public value available for their stakeholders—universities are required to plan and act as strategic actors who drive growth, produce valuable knowledge inputs for innovation, and transfer this knowledge to society [93]. In this context, the modern diversification of the higher education institutions and programs offers—in combination with the traditional scientific contribution to the academic community—more growth opportunity areas and objectives [73], such as students and workers lifelong learning, technology transfer, innovation, and social engagement (interaction with other social actors and target groups). At the same time, the establishment of official performance systems for the evaluation of research and third mission quality appears as an essential condition for investing in innovation and remaining competitive, orienting both single universities and governmental politics on the upgrading and empowerment of higher education. In such a total quality culture picture, it seems necessary and stimulating to deepen the possible effect of scientific performance in the broader sense on student trust and career (primary stakeholders, alongside their own families (backing 'investors')).

We tested, on an empirical basis, whether the level of satisfaction and subsequent employment rates for students rose with higher quality of scientific products and third mission activities (usually reported and illustrated by professors, researchers, and management staff during the courses) signaling utility for their own educational/learning purposes. In other words, our findings are to show the (student-side) value-relevance of the official evaluations concerning the university's scientific knowledge-based achievements and performances.

Preliminarily, we have to recognize that the practical standards and guidelines for quality assurance in the European Higher Education Area (ESG) [94] have mainly addressed teaching/learning and support processes for a long time, neglecting others, such as research (scholarship) and the third mission processes of universities [95]. In fact, while the literature on quality management evolved over time towards an idea of integration, the institutional framework for the implementation of real quality management practices in universities has not become a truly integrated quality management/governance model yet. This represents a first flaw for the theorized *One-size-fits-all* University Model (where each university should be strategically oriented and constantly managed to perform excellent quality in each mission). Indeed, only when the unitary model really works are the three component performances positively correlated, then scientific knowledge-based missions can significantly improve the learning process and provide students with higher competencies.

Our empirical findings, limited to Italy, reveal that the unitary model does not grant the expected convergent results. In a nutshell, we collected and analyzed the quality performance indicators from Anvur (the Italian body at first tasked to ensure the quality monitoring of higher education and research; afterward, third mission has begun to be seriously evaluated), while AlmaLaurea provided updated data and detailed information on student outcomes (student satisfaction and early job placement rates were selected as the most material aspects determining success for university courses). Thus, to answer our research question, after examining the full indicators pertaining to the whole universe of Italian public (state-funded) universities (100%), a comprehensive scrutiny was set to identify for the reported timespan from 2011–2014 a unitary framework with a proper path-analysis, PLS.

The econometric model designed to verify our research hypothesis (where the three missions are supposed to cooperate with each other and be positively correlated under a virtuous process—a sort of educational triple helix blowing toward the same growth direction) gave some interesting findings and it enables predictions useful for university governance and management. Fitting indicators of the study: R-squared (equal to 0.304 for

the outcome main construct), and SRMR (Standardized Root Mean Square Residual, equal to 6–8%) appear adequate [96] for this kind of study (Goodness of Fit). This allows us to take into consideration the results coming out of the model.

Surprisingly, the quality of academic production is not directly correlated with student satisfaction (the counter-intuitive impact resulted in being negative though not statistically significant). Yet, looking at the entire system of relations, we draw the following detailed chain/process. First: the higher the quality of scientific research, the higher the grade of the university's competitive services offered, relationships forged (socio-economic interactions), and applied knowledge transferred to the territory (ending in more valuable invention patent management, academic spin-off organizations, and third-party projects). Second: the higher the third mission quality, the higher the student satisfaction expressed in general for the learning experience held at a university intensely interconnected with the territory. On the other hand, neither the quality of scientific research nor the quality of third mission would raise the early job placement rate for the new graduates. By contrast, the university's geo-economical localization itself (regardless of university size, which seems not significant) is more likely to favor early occupational opportunities.

We learn that fulfilling the tripartite mission by excelling in all its dimensions at the same time is a hard business; moreover, student satisfaction (proxy of education quality valuation associated with student experience) shows to be not uniformly correlated to the quality of both academic research and third missions in Italy. In this regard, the suggested ideal 'One-size-fits-all' University Model set as 'default framework' (compliant with laws) can raise some relevant concerns. For example, universities that in real life excel in teaching may not necessarily excel in research and vice versa (this foreshadows the perspective of a future separation between teaching universities, substantially offering bachelor's degrees, and research universities with master degrees and Ph.D. or post-doc courses, in line with Carnegie classification: i.e., a decline in the comprehensive or 'universal' university, due to being specifically re-oriented toward a stronger specialization of knowledge).

Nevertheless, although the higher scientific productivity of university did not show to have an immediate 'real impact factor' on students (for sometimes traditional academic products may be complicated compared to their personal understanding and appreciation, and, even more importantly, not always professors and researchers publishing in top rating Journals/Reviews—Q1, top H-index, IF, etc.—manage to ensure the same top standing commitment in teaching), a mediating function is carried out by the third mission quality, which instead owns the factual feature to grant greater concreteness, utility, opportunity, temper, and openness (receptiveness) [97]. In fact, we conclude that universities making greater efforts to improve practical utility and achieve social contribution (or decrease tensions with external actors)—unlike the academic/scholarship contribution—are associated with higher educational effectiveness or attractiveness (i.e., higher students' liking and success). It follows that student trust and motivation can raise with the quality of activities aiming at maintaining a continuous relationship between the university and the real world.

Partially different from the quantitative analysis operationalized by [7], which referred to Spanish universities from 2007–2008 (where the second and third missions resulted correlated positively with each other but both negatively to first mission), we find that in Italy, the socio-economic interactions can significantly impact the students' outcome (limited to student satisfaction), whereas quality research would only exert an indirect effect on their feedback. According to our findings, TM plays as *trait d'union* between research quality and overall satisfaction for educational achievements. As such, we can confirm that thanks to patents management, spin-off development, industrial laboratories, entrepreneurial discovery and projects, social events, etc., the third mission shows to be a widening of teaching and research [73], a vehicle for professors, researchers, and scholars to leave their "ivory tower" behind forever [98]; at the same time, an instrument to facilitate student understanding of complexity of the economic, social, and environmental issues involved [1]. Against this backdrop, the development of the traineeship (student project works, internships, etc., even abroad—Erasmus, Leonardo da Vinci, and Tempus)

alongside the so-called public engagement can be a relevant driver for the educational and third mission services corroboration, facilitating a better future work placement of graduates [99,100], then the student overall appreciation by virtue of beneficial relations with industry and society (stimulating student engagement as a result).

We learned that the third mission is likely boosted where applied research is more highly appreciable. This is understandable because society and industry are very attentive to scientific progress developed by universities, and university students will feel uplifted by this source (synergies-based) of new opportunities for their future. This vital connection constitutes an indirect bridge between the second mission and the university's value concretely achievable by the student.

Even the issue of public funding cannot be marginal because public evaluation is a determinant factor to justify public investment decisions at the national (or supranational/European) and local (regional or federation or single university) levels related to mission design. In Italy, the recent reward criteria to share the ordinary fund for the regular financing (FFO) yearly attributed to universities (additional to the base-share teaching-linked determined on both historical basis and efficiency/standard costing of courses) is increasingly linked to the VQR score, for the most part based on the scientific production of universities and marginally (yet growing) to the third mission. Since its proactive function in improving educational achievements, greater financial incentives toward third mission are expected and welcome [101].

From the above findings, we can also draw some first indications in terms of education policy, both at the state administration level and regional (federated) or single university management level oriented to the public value creation (mainly effected by means of creation of new human capital fresh graduated and full of competencies and attitudes treasured by the labor market). The quality evaluations mission-related and their mutual interplay may influence the university's behavior and shape institutional decision-making, signaling managerial implications for improving educational quality and orienting government policy on higher education. At the public management level, each university or federation (local/regional HEI administration) is required to put and empower a more effective high-quality triple-mission-helix in its strategic planning (individual or consolidated). Therefore, our findings could suggest to HEIs to renovate their quality management processes and education quality strategies, redefine actions and responsibilities, redesign departments, *check and balance* learning and research activities with performances, also by means of best teaching incentives, with the scope of stimulating professors and researchers to grant the same abnegation or top standing commitment to teaching and research, involving, before long, valuable third mission initiatives addressed to their territory. At the central administration (superior) level, the state would have the opportunity to rethink the current comprehensive university model until now—denoting an 'in-between' nature (hybrid between the 'pure research' and 'pure teaching' universities)—unshakeable paradigm within the traditional systems. In fact, findings showed some flaws in such a comprehensive model.

Alternatively, wearing more conservative reading lenses, the faults of the unitary model may be interpreted as an imperfect alignment of tripartite mission performances that is only temporary, just needing some correctives. In this light, the Humboldtian and Newmanian legacy [5] would still be a richness to preserve. Accordingly, it is still valuable that more souls—indissolubly linked to each other (teaching to scientific and social functions/services, and vice versa)—keep being interpenetrated in one unique body: the university. Since the human capital educated and formed (university students) cannot be disconnected from the high-grade applied knowledge and territorial services provided, the unitary governance would be of help to comprehensive learning processes. Nonetheless, a variant innovative solution could be prospecting separate careers between teacher–scholar and scholar–teacher in universities [102], as a possible pathway for future policy (currently, in Italy the researcher is a preliminary role before professorship qualification attainment). The organizational consequence for academic professions (remodeling the scholarship and

professoriate with relating priorities): the scholar–teacher could be assigned to research-oriented departments, while the teacher–scholar allocated to tuition-oriented departments of the same university. University researchers would get a light teaching load with roles from junior to senior/top (similarly to assistant/associate/full professors, whose products, by contrast, would not necessarily result in traditional academic publications, yet in more accessible and inclusive data knowledge management, top quality course materials, worksheets, articles open to be reviewed or commented on by readers, open access, etc.). This kind of division of the higher educational top workforce might contribute to optimizing the universities' multiple mission achievement. In this scenario, in line with our structural results, TM would constantly be for each university or faculty the bridge between its excellent scientific research departments (strategically offering Ph.D. teaching and postgraduate education, with scientific research committed as priority) and excellent teaching departments (structures offering innovative tuition, highest technologies, networks, online services, etc.), finally bringing practical culture, knowledge, and applications to the learning economy and society. A milder solution might be, within the current system, the recognition of new awards and financial incentives for innovative and more effective teaching methods, in order to make the first traditional mission more impressive, attractive, prestigious, and successful.

5. Conclusions and Suggestions

We analyzed the interplay between modern university teaching, scientific productivity, and 'third mission'. We carried out a path/performance analysis concerning the Italian public universities compliant with the 'one-size-fits-all' university management framework re-visited under a stakeholder approach in light of student needs and expectations, in order to reveal the 'real' impact of the university's knowledge-based missions on student outcome (student satisfaction and early employment experienced). The aim was to realize if and how such missions can contribute to the effectiveness and competitiveness of university courses (educational offer). Our hypothesis of positive correlation for all the components of the tripartite mission (H1) was partially confirmed. The university performances accounted for did not appear to all be directly correlated with each other. The quality of research did not appear immediately correlated with student satisfaction. By contrast, there is a positive relationship firstly between the research productivity and the third mission quality, and finally between the socio-economic mission and the student satisfaction. We can argue that society and industry appreciate the scientific progress developed by university research and transferred to the territory through applied knowledge or services (thanks to appreciable invention patents, academic spin-off organizations, or third-party projects), while university students, in turn, would find in such synergy new opportunities for their future (given that the learning activity held at a university more intensely interconnected with territory appears integrated and attractive). Nonetheless, different from the university's localization *per se*, the two knowledge-based missions would not raise the early employment rate for new graduates.

This compounded result, which may be interpreted as imperfect alignment of the triple mission implementation, could reflect some faults of the university management framework. Additionally, the mission-related quality evaluation can shape the institutional decisions (government policy and funding) and influence management priorities by revealing the way the quality of academic productivity and knowledge transfer to communities and territories can create value for the core stakeholder (university student). New resources (financial incentives and innovative tools) and human competencies in applied educational activities related to emerging strands in high-quality scientific research would be welcome and fruitful. On the other hand, the third mission seems to increasingly ensure adequate performance as for attractiveness and competitiveness of universities.

In such across-missions perspective, we made a contribution by: (a) putting the focus on the simultaneous interplay of the three missions considered through (official) quality

evaluations; (b) highlighting the incongruity of the unitary model by observing some contradictions between the theoretical hypothesis and the empirical evidence.

There remain some limitations concerning a few relevant aspects, such as the different sources for evaluations/data taken into account (Anvur and AlmaLaurea), as well as the limited extensibility of findings (inappropriate outside the European institutional environment and culture—namely, EHEA and ERA). Future research should validate and enlarge results: it can be suggested to broaden the scrutiny in different contexts/countries and time periods, also examining the third cycle programs. As for Italy, a new analysis is required with a major consideration of public engagement and public goods production (beyond R&D activities and projects) inside TM and, most importantly, after the official completion of the (whole university) total quality education assurance system assessment conducted by Anvur—instruction quality evaluation for the accreditation of all university courses [103,104], along with the accomplishment of the next VQR. Equally important for the future are independent data originating mostly outside of the universities. By contrast, despite this kind of study having a common limitation in the number of cases, it is worth underlining that our work examined the entire population of public universities enabling the structural equation modeling [105]. Private universities have been excluded, such as in similar studies, due to heterogeneity in several aspects of governance, such as efficiency, funding, ratings, reputation, etc. (future research could add and compare private HEIs).

Other future directions can be recognized: the adoption of the quintuple helix model of innovation [106] as a broader framework (with full consideration of university–industry–government relations, plus, both the culture/media-based public and civil society, and socio-ecological interactions for sustainable development); methodological implementation of a mixed-method approach to performance management, e.g., qualitative comparative analysis to control the quantitative findings [107–109]. Eventually, consistent with innovation policy studies that treat key actors (such as universities) as relatively homogeneous, our work considered public universities in an equal manner regardless of the weight and characteristics of the various scientific areas within each university. Future verification could study if and how different disciplines might affect the relationships among the missions of universities, as illustrated above.

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