



A quality evaluation approach to disclosing third mission activities and intellectual capital in Italian universities

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Introduction

Recent literature on Intellectual capital (IC) in the public sector focus the attention on the real ability of IC management methods to create value (Guthrie *et al.*, 2012; Dumay *et al.*, 2015) in public organizations and in their ecosystems (Dumay and Garanina, 2013; Dumay, 2016). In the field of higher education, literature focus on universities and integrating the IC management approach (Jones *et al.* 2009; Elena-Perez *et al.*, 2011) with the validation of IC reporting models (Leitner, 2004; Sanchez *et al.*, 2009; Secundo *et al.*, 2010; Siboni *et al.*, 2013), preferring an ostensive approach (Mouritsen, 2006). However, a small part of universities use appropriately these tools to verify and manage the value created by their activities (Secundo *et al.*, 2016). In European universities, the adoption of performance measurement models to verify results is consolidated (Guthrie and Neumann, 2007; Melo *et al.*, 2010), in full compliance with the principles of autonomy and accountability requested for public universities.

The use of public resources by universities is increasingly monitored (Sánchez and Elena, 2006), and the funding system has forced universities to adopt competitive attitudes and approached them to promote social and economic growth in their regional context (Parker, 2007). The traditional efficiency and effectiveness objectives entrusted to public universities must be re-interpreted based on their ability to create social and economic value, the real goal of public institutions (Dumay and Guthrie, 2012; Dumay, 2014). Consequently, management and performance measurements should be anchored to strategic objectives and measures that not only quantify the outcomes of some processes (Neely *et al.*, 1995) but also allow stakeholders to assess the adequacy of results according to the resources used to achieve them (Cave *et al.*, 1988).

The IC measurement models and IC management approach are anchored to long-term strategic goals and focus on processes as well as resources to highlight value-generation paths. These tools aim to improve the internal management, effectively develop teaching and research strategies (Secundo *et al.*, 2015), strategically allocate resources and communicate adequately with stakeholders (Sánchez and Elena, 2006). Literature on IC suggests to merge the *results-outcome* measurement models with approaches focused on *resources-processes* (Sanchez *et al.*, 2009; Veltri *et al.*, 2014; Siboni *et al.* 2013, Leitner *et al.*, 2014). In this paper we suppose that a possible convergence manner is the quality evaluation system employed by universities to assess the performance of their activities (*accountability*) and provide useful advice for university management (*enhancement*). Quality evaluation activity “focuses and guides the interaction between the external calls for increased accountability and the internal efforts of an organization that is addressing it” (Koslowki, 2006, p. 280). A similar purpose is claimed by the Intellectual Capital of University (ICU) framework (OEU, 2006; Sanchez and Elena, 2006; Secundo *et al.*, 2016), mainly focused on research and teaching activity.

Recent studies (Secundo *et al.*, 2015) suggest to analyse how IC can promote the development of a ‘third mission’ within the university, a new mandate that expands the boundaries within which this institution creates value (Laredo, 2007). The concept of the third mission refers to a varied array of activities aimed at transferring knowledge useful to society and organizations to develop entrepreneurial skills, innovation, social welfare, and solid human capital and promote the development of science and society through various forms of communication and social engagement (Etzkowitz, 2003; Rothaermel *et al.* 2007, Hsu *et al.*, 2015).

Some guidelines provided by international agencies aim to monitoring the third mission within European universities, linking this new mission to the innovation goals (Molas-Gallart *et al.*, 2002). The *European Indicators and Ranking Methodology for University Third Mission Project* (E3M) proposes a comprehensive structure of measures centred mainly on the entrepreneurial capacity of universities, in addition to a scoreboard of descriptive indicators of social engagement activities (E3M, 2012). ICU framework was developed in an embryonic stage of third mission, for this reason the predominantly qualitative nature of the information requested by ICU permits exploration of the phenomenon but does not offer specific insights for the third mission. By contrast, the quality evaluation system aims to analyse the efficiency, effectiveness and value of research policies and the third mission by observing how intangible resources work in the organization, with a focus on both intangible activity and intangible resources.

Some authors (Secundo *et al.*, 2014, 2016) adopt the IC framework to identify appropriate measurements of third mission activities from a *performative* perspective. Secundo *et al.* (2017) propose and test the IC Maturity Model for monitoring and managing the third mission as well as research and teaching activities in an integrated manner. These authors show how a self-assessment tool may contribute to gain better insights about the utilization of IC and may increase the efficiency of the university technology transfer offices. However, the search for additional integrated measurement models tested on the whole university organization remains open. The adoption of an IC framework for this purpose requires a preliminary analysis of the relationship between IC components and the development of third mission activities. Moreover, an appropriate model of performance measurement must consider the effects produced by third mission activities in the university ecosystem (E3M, 2012).

The effectiveness of the third mission initiatives is linked to the regional context in which the university operates, and therefore adequate contextualization of the phenomena is required to avoid errors in extending findings internationally. Some studies observe

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3 the impact of university's performance on the local development: Branwell and Wolfe (2008) demonstrate how the University of
4 Waterloo plays a critical role for the local firms, fostering economic growth with its graduates, spin-offs firms and R&D activities.
5 Barra and Zotti (2016) observe a sample of Italian public universities and show the positive effect of Italian graduates on the regions
6 where the universities operate. Other researches analyse the positive contribution on the regional economic growth played by the
7 licensing and academic spin-offs (Shane, 2004; Guerrero *et al.*, 2015), by the academic patents (Henderson and Jaffe 1998) and by
8 the university incubators (Auricchio *et al.*, 2014). Some studies show that geographical proximity could be a good channel through
9 which efficiently transfer knowledge and technology from the universities to the industry sector (Abramovsky and Simpson, 2011).
10 For these reasons, our analysis refers to the regional area where the university is located, to capture the effect of the third mission
11 activities on the local growth.

12 Based on these considerations and following a reporting perspective, this research aims to answer three research questions:

13 *RQ1: How can quality evaluation measures integrate the disclosure of ICU?*

14 *RQ2: What is the relationship between IC and the development of third mission activities in universities?*

15 *RQ3: What is the impact of third mission activities in the regional area where the university is located?*

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18 Methodologically, this research observes the disclosure of IC components provided by the quality evaluation process adopted in
19 Italy, using data from 2004 to 2014 collected by the National Agency for Evaluation of Universities (ANVUR) and referred to the
20 Italian universities funded by the Ministry of Education, University and Research (MIUR). Finally, we analyse the impact of third
21 mission activities in the region where the university is located, using development ratios provided by the Italian Institute of Statistics.
22 This research provides useful implications for the development of strategies and processes within the university in an "holistic"
23 manner, in order to planning better the third mission activities for the purpose of collective value creation.

24 The paper is structured as follows: Section 2 introduces the theoretical framework employed to explain the convergence between
25 third mission, ICU perspective and quality evaluation approach. Section 3 presents the research methods, describes the quality
26 evaluation system used in Italian universities, and outlines the general connections with IC measurement models. Section 4
27 describes the results of the analysis and presents the contribution of IC to the development of the third mission and the impacts of
28 third mission activities in the university ecosystem. Finally, Section 5 draws conclusions on the possible institutionalization of IC
29 culture through the quality evaluation approach.

30 31 32 **2. Third Mission and Intellectual Capital Culture: a Neo-Institutional Sociology Perspective**

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34 The principles of accountability, autonomy, and third mission development are the pillars of the innovation process through which
35 European universities are rediscovering and enhancing their relationships with stakeholders and addressing challenging business
36 and social goals. European universities have received these principles in a variety of ways, ranging from the academic
37 entrepreneurship in the UK (Wright *et al.*, 2007; Rosli and Rossi, 2016) to incomplete autonomy in Italy (Franzoni, 2007). In Italy the
38 rigid bureaucracy and strong rooting of academics in the culture of their disciplinary groups have generated a structural inertia of the
39 system (Lucianelli, 2006). However, recent public sector reforms and impulses resulting from end markets have introduced policies
40 oriented toward a culture of performance management and promotion of the third mission in Italian universities. These policies aim to
41 overcome past inefficiencies, promote social and economic development, and manage the crisis of legitimacy faced by universities.

42 Some authors (Etzkowitz and Leydesdorff, 1999; Bozeman, 2000; Link *et al.*, 2007) associate the third mission only with
43 technology transfer (TT) and further strengthening of the entrepreneurial university, thus limiting the decision-making and operational
44 spectrum that university strategies and policies should follow. The intent of the third mission is not to favour and develop only
45 business relations but rather to impact the social and economic environment by creating public goods through the results produced
46 by teaching and research (Molas-Gallart *et al.*, 2002; Sanchez and Elena, 2006; Laredo, 2007). The neo-institutional sociology
47 perspective (NIS) is a proper interpretation of this evolution and its goals.

48 NIS theory asserts that organizations seek legitimacy and support, especially financial support, from their context and from the
49 institutions essential for their survival (Stone, 1991; Euske and Euske, 1991; Fogarty, 1996; Parker, 2007). This obligation often
50 leads them to change their structures and processes via isomorphism phenomena that may be coercive, e.g., imposed by the rules
51 and pressures of key institutions (DiMaggio and Powell, 1983; Carmona *et al.* 1998); mimetic, e.g., inspired by the excellence
52 achieved by other organizations (Fogarty, 1996; Cornforth and Edwards, 1999); or normative due to the innovative drive promoted by
53 key persons within the organization. The development of the third mission of universities involves a combination of these three forms
54 of isomorphism resulting primarily from continued interaction promoted by researchers with relevant stakeholders. The aim of this
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3 interaction is to obtain full recognition within the set of rules that emphasize third mission activities, thus leveraging universities to
4 upgrade this dialogue with their own ecosystem (Modell, 2001).

5 According to NIS theory, performance-planning and performance-measurement tools are the means by which universities project
6 a defined image to obtain approval from their stakeholders (Carmona *et al.*, 1998) and reduce internal management ambiguity to
7 stimulate rational and efficient behaviours (Greenwood *et al.*, 2002; Parker, 2007). Moreover, achieving this legitimacy changes the
8 nature of academic activities: teaching courses observe the professional and cultural needs of the region, and research is oriented
9 towards attracting funding and the transferability and practical utility of the results for external partners. In this context, universities
10 discover the importance of developing skills in performance management (Sanchez *et al.*, 2009), improving the decisions about the
11 allocation of resources (Sanchez and Elena, 2006).

12 In contrast to declining financial resources, the intangible resources are more stable and occasionally incremental and they build
13 the competitive differentials of university, improving the social legitimacy of this institution (Leitner and Warden, 2004; Secundo *et al.*,
14 2010). This system of strategic resources is defined as IC of University (ICU), which is conventionally represented by the skills and
15 knowledge of human resources, by the knowledge encoded within the organization and processes, and by the network of relations
16 with external stakeholders (Canibano and Sanchez, 2009; Leitner *et al.*, 2014). The ICU framework considers the three university
17 missions in an integrated manner (OEU, 2005; 2006), anticipating other performance evaluation systems and with the following
18 purposes: to improve transparency in the use of resources; to identify alignment among the university's mission, goals and intangible
19 activities; and to disclose the hidden value generated by knowledge.

20 The disclosure of the ICU remains sporadic and not fully institutionalized, with some exceptions. In Austria, the mandatory
21 adoption of *Wissensbilanz* required by the *Universitätsgesetz* (University Act, 2002, art.13, par.6) is a pioneering example of coercive
22 isomorphism (Leitner, 2004) that engages in this sector a focus on the relational dimension of university processes and encourages
23 a strategy inspired by the creation of value. In Spain and in Italy, however, the voluntary adoption of descriptive reports of ICU or
24 groups of intangibles is closer to configurations of mimetic and normative isomorphism, albeit for dissimilar purposes. The Spanish
25 experience reveals a framework combining disclosure and managerial instances (Sanchez *et al.*, 2009; Elena-Perez *et al.* 2011;
26 Corcoles and Ponce, 2013), whereas the Italian case represents a response to an increased need for transparency (Secundo *et al.*,
27 2010; Siboni *et al.*, 2013; Veltri *et al.*, 2014; Vagnoni and Oppi, 2015). Other on-going and voluntary experiences in ICU disclosure
28 practices are present in some universities in Eastern Europe (Elena-Pérez and Leitner, 2013).

29 Due to this lack of comprehensive evidence, the adequacy of ICU tools to focus the decisions and behaviours of organizations
30 and academics towards excellence in performance and the development of the third mission remains unclear. Some authors take
31 very critical positions on the ICU model (Piber and Pietsch, 2006) and consider it primarily a communication tool for social
32 legitimating purposes (Corcoles *et al.*, 2011) rather than an appropriate tool to stimulate discussion about good governance of
33 resources or the adequacy of goals. Frequently, universities receive the tools of change institutionally while remaining resistant to it
34 due to the absence of adequate reward systems and the existing mismatch between the academic and managerial cultures
35 (Dambrin *et al.*, 2007). Although it is possible for universities to use and upgrade their IC without adopting reporting models (Dumay,
36 2016), non-disclosure of these results does not activate the reward systems and, consequently, the social legitimacy required to
37 support the organization, its activities and partnerships.

38 A relevant stakeholder of state universities in Italy is MIUR, which acts as both the main investor and the outside manager
39 directing the organization and operations of universities via guidelines and standards. The disclosure required by MIUR is
40 necessarily integrated because it should inform on the adequacy of governance, activities, resources used and results achieved over
41 time, in summary, the overall public value created (Moore, 1995). By contrast, the information requested by other external
42 stakeholders is fragmented and can target the scientific results obtained, the quality of teaching, or the social implications of
43 knowledge shared by universities, all partial configurations of the performance-result measurable at a given time. Moore (1995)
44 associates public value with the ability of public stakeholders to produce results judged as desirable and valid by the recipients
45 (social mission), to use resources effectively and efficiently to conduct activities in relation to set goals (organizational skills), and to
46 achieve consensus and support from relevant stakeholders (legitimacy and support). The ICU perspective and the quality evaluation
47 system follow these pillars and address multiple stakeholders simultaneously rather than only users of public services. Moreover, the
48 ICU perspective and quality evaluation system are inspired by a principle of collaboration and co-creation of value rather than simply
49 assessing/measuring performance by observing resources and tasks simultaneously.

50 Definitions in the literature of quality in higher education differ (Harvey and Knight, 1996) and include fitness for purpose, that is,
51 the capacity of a service to meet the expectations of stakeholders or conform to the institutional mission; exceptional standards of
52 academic achievement; and value for money, which assesses quality in terms of return on investment (accountability). The most
53 widely accepted definition is fitness for purpose (Harvey, 1998); according to this concept, universities measure quality in terms of
54 their ability to meet their missions and objectives. In Italy, quality evaluation has been recently revised by two laws (D.Lgs. No.

19/2012; DM No. 47/2013) that integrate the principles of assurance and self-evaluation of research and teaching with those related to the third mission. The outcomes from the new mission are also evaluated by observing previous periods to explore characteristics and further direct the development of university policies. These principles and tools reveal numerous convergences with the criteria for measuring and representing IC components described in the next sections.

3. Research Method

To interpret the relation between IC components and the development of third mission activities, this research uses the disclosure provided by the quality evaluation model for the human capital, the structural capital and the relational capital employed in research, teaching activities and the third mission.

The Italian quality evaluation model (VQR) is selected for the following reasons: the disclosure required by VQR is mandatory and follows identical criteria, thus allowing comparisons between organizations; VQR comprises a mixture of financial indicators, non-financial measures and qualitative data about activities, as required for adequate ICU reporting (Sanchez *et al.*, 2009); VQR produces numerous indicators anchored to IC components; and in contrast to other voluntary reporting models adopted in Italian universities, including the Balanced Scorecard (Del Sordo *et al.*, 2007), the Social Reporting (Sangiorgi and Siboni, 2017) and the Performance Plan (Siboni *et al.*, 2013), the disclosure emerging from the VQR is associated with reward and sanction mechanisms activated by MIUR. Consequently, only the VQR approach triggers competitive attitudes at all levels of the organization (the whole system, departments, scientific area, researchers), incisively guides decisions on research strategies, teaching and relations with the external environment, and therefore facilitates the practical use of information in university management.

In this paper the results of two quality evaluation processes for Italian universities are analysed with a focus on third mission performance: VQR1 for the period 2004-2010 and VQR2 for the period 2011-2014. Primary data are taken from documents provided by ANVUR, the Network for Enhancement of Research (Netval), MIUR and university websites. The statistical analysis employs the VQR indicators summarized in Table II for the IC components and in Table III for the third mission initiatives. To avoid distortions in the sample, we exclude data related to clinical activities, which are available for few universities, and data on E-universities and those with few scientific areas assessed (less than 3). Using the ANVUR database for the public and private universities located in Italy, a sample corresponding to 75% of the population that includes 71 public and private institutions is selected. These institutions were financed by MIUR according to the VQR processes for the total period of 2004-2014. The analysis is completed by observing the impacts produced by the third mission initiatives undertaken during the assessment period on the regional context in which university operates.

3.1. The Quality Evaluation Approach (VQR)

In Italy, the quality evaluation system for teaching, research and third mission activities entrusted to ANVUR is derived from the European Standards for Quality Assurance and is structured at two levels: a periodic self-assessment of teaching, research and the third mission (AVA) and a cyclical evaluation process conducted by external auditors and focused only on research and the third mission (VQR). Both levels provide information useful to IC disclosure and intangible assets management, however, the AVA procedure offers a fragmentary disclosure, because the self-evaluation process assess the university's activities in separate manner and in different periods. Consequently, this paper analyses only the VQR model, which offers an integrated disclosure on resources, strategies and processes related to research and third mission activities assessed together in a longitudinal perspective.

The ICU reporting framework (OEU, 2006) does not elaborate third mission performance in detail due to the explorative stage of this new mandate for universities. The indicators related to the third mission are included in structural capital (e.g., patents) and relational capital (e.g., contracts from third parties, incubators) and are mainly centred on technology transfer and entrepreneurial activity. The framework proposed by E3M (2012) and reviewed by Secundo *et al.* (2016) presents a comprehensive structure of financial and non-financial measures focused mainly on the entrepreneurial capacity of universities, in addition to a detailed scoreboard of descriptive indicators of social engagement activities. The qualitative nature of social and cultural activities enriches the narratives about the relational and structural components of ICU. Following this framework, the VQR approach adopted in Italy aims to analyse the efficiency, effectiveness and value of research policies and the third mission using qualitative and quantitative indicators related to IC components and intangible activities, especially in the second model (VQR2).

VQR2 encompass more indicators related to relational capital, including a better disclosure about the frequency and consistency of strategies, policies, and goals for the third mission. The purpose of VQR2 is to establish real commitment to the development of a long-term strategy oriented towards innovation and social engagement to improve excellence within the university and its ecosystem. The Italian VQR approach does not tie third mission performance to funding policy because the indicators are still experimental, but

the adoption of this model has increased awareness among universities of the importance of third mission activities and the inclusion of specific objectives, targeted policies and resources. By contrast, in the UK, the adoption of a performance-based funding model linked to third mission performance forces universities to focus their strategies on a limited range of income goals related to entrepreneurial activities and neglect the social development goals of the entire ecosystem (Rosli and Rossi, 2016).

[Insert Table I here] **Table I.** Comparative Analysis: ICU Framework, Third Mission Scoreboard, VQR1-2

3.2 The Evaluation System for the Third Mission in Italy

Third mission activities were evaluated for the first time in the VQR1 process, which referred to the years 2004-2010, although this evaluation was exploratory. Data were collected from questionnaires submitted to universities with the aim of understanding the nature and frequency of these initiatives. The results from VQR1 were used to design the Ministerial Guidelines (ANVUR, 2015) for the third mission evaluation employed in VQR2. The indicators used in VQR1 for third mission activities were collected at the *central level*, as the data provided by the individual departments were fragmented and incomplete. The indicators were classified as absolute values that refer to resources and outputs (e.g., number of patents) and as weighted and normalized indicators related to activities (e.g., the value of patent ability - ITMS) and derived from a set of qualitative and quantitative data. The assessed activities are divided into two areas (Table II): *economic valorisation of knowledge* and *sharing of knowledge for social and cultural purposes*.

VQR2 considers the following qualitative and quantitative information at both the *central level* and the *department level* (ANVUR, 2017, p. 7):

- the ability of university to develop clear and realistic goals associated to the third mission, to identify the strengths and weaknesses of the organization, and to associate the goals with appropriate indicators;
- the organizational and human resources used and the processes established for the third mission;
- the results achieved in terms of the university's ability to economically assess research findings, enhance human capital in the area, and contribute to the economic, social and cultural development of the context by distributing public goods.

The indicators are strongly centred on TT (Table II) and partially oriented to the exploration of social, cultural and public activities. This approach provides a common basis for assessing the whole university system by informing on the adequacy of the initiatives undertaken, the capabilities, and the degree of commitment truly dedicated to the development of the third mission, followed by the nature and range of outcomes achieved in the context.

The interpretation of the data on the third mission lends itself to the lowest standardization because the nature of the initiatives undertaken and the effects achieved are strongly related to the territory. The environment in which the university is located not only receives but also strongly influences the activities that the university selects to conduct in favour of society. The efforts of universities in supporting local growth are greater in geographic areas that have a weaker industrial network and low levels of investments in R&D, with results observable only in the long term (E3M, 2012). Consequently, any attempt to rank universities based on the performance achieved in the third mission must be contextualized according to the characteristics of the area within which university acts. Section 4.2 analyses the effects of the third mission in the local context and links these effects to the specific features of each geographic area.

[Insert Table II here] **Table II.** Indicators for the third mission in VQR1 and VQR2

4. Findings and discussions

The descriptive analysis of absolute and weighted third mission indicators shows that all universities present relevant initiatives in a homogeneous manner and that university commitment to the third mission increases over time.

During the VQR1 period (Table III), the major differences, as indicated by high standard deviations, are in the ability to develop other activities with social and cultural purposes (ITMS8; OTM), in networking activities through business incubators (ITMS4), and in the ability to preserve and produce cultural goods for the community (ITMS6-7). Two factors are responsible for these differences: the compositions of the scientific areas in universities, which are divided between generalist and specialized institutions in technical-scientific or strictly social-cultural areas; and low awareness of the nature of public engagement activities.

In the VQR2 period, the major differences are the ability to support entrepreneurship through spin-offs (ASO) and the ability to promote continuing education (FC). The high standard deviation of the value of contracts with third parties, expressed in absolute

terms and in thousands of euros, is due to the concentration of high-value contracts among a few universities, but this activity is present in the entire sample in both periods. In fact, a widespread presence of third-party contracts emerges (Table V) over ten years, together with other social third mission activities (OTM). A few universities do not present descriptive checklists of other third mission initiatives, which instead appear common and very heterogeneous in the rest of the sample for both periods. The internal documents of the assessment show that more than 12,000 initiatives were named OTM during the VQR1 period, mainly anchored in human and social sciences and mostly initiated from 2009 onwards (ANVUR, 2013, p.562). The VQR2 period (Table IV) shows an increased focus on placement activity and other initiatives devoted to improving the university image (ANVUR, 2017, p.30). This shift reveals a widespread commitment to public engagement but is often associated only with marketing goals.

Table V shows that over time, partly as a consequence of institutional rules, the absence of patenting activity (PAT) and entrepreneurship (ASO) decreases. The professor's privilege for patents and other ministerial incentives for spin-offs transform these tools into career and research development processes outside the university. Most spin-off companies have low levels of turnover or, in many cases, no turnover (Netval, 2016; ANVUR, 2017, p. 19), revealing an entrepreneurial weakness that should prompt further reflections on the real contribution of these companies to local economic development.

In both periods, several universities did not participate in networks for the purposes of technology transfer (Table V), even though the presence of universities in these external structures increased in ten years. In the VQR2 period, 70% of Italian universities have an internal technology transfer office (TTO) with a placement unit, revealing a preference towards internal governance of this activity.

[Insert Table III here] - Table III. Descriptive Statistics Period 2004-2010 (VQR1)

[Insert Table IV here] - Table IV. Descriptive Statistics Period 2011-2014 (VQR2)

[Insert Table V here] - Table V. Absence of Third Mission Indicators

4.1 The Role of IC in Promoting the Third Mission

To verify the contribution of IC to the third mission, a regression analysis is performed between the indicators of VQR model related to the IC components (*independent variables*) and the *i* integrated quality measures for the third mission of all *j* scientific areas (*dependent variable*). These quality measures are expressed by indicators properly weighted and normalized by the size of the university, as defined by the number of human resources and scientific products of each organization and scientific area. The general performance achieved by a university in each third mission activity (dependent variable) is triggered by the value of IC, which is represented by a set of measures expressed in absolute terms for each component.

For VQR1, the following quality indicators for the third mission are considered as the dependent variables and are presented in Table III with the code ITMS: attraction of funds from third parties (ITMS1); patent ability (ITMS2); entrepreneurship (ITMS3); networking in business development through incubators (ITMS4) and consortia (ITMS5); protection and diffusion of cultural goods through museums (ITMS6) and archaeological sites (ITMS7); and public engagement through other third mission activities (ITMS8). For VQR2, the following revised measures for quality in the third mission (TM) related to outputs are considered as the dependent variables and illustrated in Table III: total number of patents (No. Pat) and the funds provided by them (FundsPat); number of active spin-offs (ASOAct); total funds received by contracts with third parties (CT_funds); participation in incubators (INC), science and technology parks (STP), and other networks (CON); number of activities delivered by technology transfer offices (TTO); value of activities related to public engagement (PubEng); and number of courses for continuing education programmes (FC).

The independent variables refer to the indicators associated with human capital, structural capital and relational capital summarized in Table II. To avoid multicollinearity, each model developed for the single third mission indicators excludes the absolute value of correlated resources (e.g., absolute number of ASO and the quality indicator of entrepreneurship) but considers the mutual interaction among research, teaching and the third mission (e.g. patent ability and entrepreneurship; incubation activities and ability to attract funds from third parties). The linear regression analysis uses the following models for VQR1 (1) and VQR2 (2), adopting the stepwise selection approach:

$$ITMS_{ij} = \alpha_0 + \beta_1 HC + \beta_2 SC + \beta_3 RC + \varepsilon \quad (1)$$

$$TM_{ij} = \alpha_0 + \beta_1 HC + \beta_2 SC + \beta_3 RC + \varepsilon \quad (2)$$

The variables included in this analysis are summarized in Table VI.

[Insert Table VI here] - Table VI. Dependent and independent variables

Table VII shows that, during 2004-2010 period, the ability of universities to increase the value of their structural capital, specifically increased quality of scientific production (UPG) and productivity of research processes (P), over time has a positive effect on the patenting activity (ITMS2), spin-offs (ITMS3) and on the ability to attract funding from external partnerships (ITMS1). The ITMS1 variable partly reflects the good reputation of the university among external stakeholders and the ability of researchers and departments to build strategic relationships. ITMS1 is also influenced by the reduction of public funding obtained for competitive projects (FIN). This decrease in public funding encourages research on financial resources in the market to support the operative structure. Such partnerships are also stimulated by other structural resources, such as the presence of patents (PAT) and cultural goods (AS), that reflect the technological and cultural nature of the skills shared with external users.

During 2004-2010, the patenting ability (ITMS2) is influenced by funds obtained from contracts with third parties and appears to be greater when there are fewer human resources (HR), proving that smaller organizations are more oriented towards the protection of Intellectual property. The entrepreneurship attitude (ITMS3) also depends on the presence of patents and international partnerships activated by researchers (COAI). This relation shows that a spin-off is primarily a tool to use patents in the market and that the propensity of research towards commercialization reflects the international orientation of the scientific community. Moreover, the dependence of entrepreneurship on excellent research (X) demonstrates a synergy between the two missions, rejecting suggestions that these missions are antagonistic.

The propensity to support TT activities through business incubation services (ITMS4) and other partnerships in research and services with public-private entities (ITMS5) is greater in the most productive universities (P). The decline in public funding for research and the implementation of other social and cultural initiatives of the third mission (OTM) induces a preference for incubators in support of TT, whereas participating in a consortium is influenced by the presence of intense provision of services to third parties and joint research and training projects (CT). Participation in a consortium is also influenced by the quality of scientific production of the organization (R), which in turn contributes to social and cultural engagement (ITMS8). By contrast, there are no significant relationships between the variables of IC and the strictly cultural dimension of the third mission linked to the preservation and dissemination of public cultural goods (ITM6_7).

[Insert Table VII here] Table VII. Regression analysis of ICU measures in VQR1 (2004-2010)

During 2011-2014 (Table VIII), structural capital influences third mission activity in different ways. Patent ability (No.Pat) and the financial returns from patents (FundsPat) are influenced by the following factors: the quality of research (R); the number of spin-offs (ASO); the amount of public funds gathered from competitive research projects (FIN2); and the funds provided by third-party research contracts (CT_Funds).

The ability to create spin-offs that survive over time (ASOAct) is stimulated by the quality of research (R) and the number of patents owned by the university. Compared to the previous period, the link between patents and spin-offs emerges more strongly as a consequence of the increase in business activity, together with the ability of universities to improve the quality of their research. In addition, in this period, presence inside incubators (INC) increases academic entrepreneurship, and the positive effects of patenting activity and good research on contracts with third parties (CT_Funds) are confirmed. However, other significant intangible resources emerge in these relationships, including a positive impact of new human capital (PhDs, research fellows, post-docs) and negative effects of some external intermediaries (CON).

Furthermore, the reduction of public funding obtained on competitive projects (FIN2) stimulates relationships with external partners for research, services and teaching activities. Universities prefer internal management of interactions with outside partners instead of external structures such as consortia and other alliances. The university commitment to incubation activities (INC) is stimulated by good quality of research (R), whereas the orientation to manage TT activities through internal structures (TTO) is influenced by the presence of spin-offs (ASO).

Finally, public engagement (PubEng) and the promotion of continuing education programmes (CL) are influenced by the availability of human capital for these activities (HR_CL). The contribution of the university to lifelong learning is also stimulated by good quality of research (R), relationships with third parties, and the presence of an adequate budget for TTO. Universities that are less productive in publications (P) are more involved in continuing education programmes.

In summary, the evaluation model (VQR1) shows strong contributions of structural capital and partial contributions of some relational assets during the examined period, whereas the subsequent VQR2 model reveals the emergence of the development of both structural and relational assets. For the human capital component, the indicators show only the importance of temporary researchers involved in third mission activity.

[Insert table VIII here] Table VIII. Regression analysis: ICU measures in VQR2 (2011-2014)

4.2. The impact of Third Mission Activities in the Regional Context

The last research question concerns the impacts generated by third mission activities at the local level and requires contextualization of the results according to the characteristics of the areas in which the universities are located. The data used for the w dependent variables are taken from national statistics on the social and economic development of k regional areas (ISTAT, 2015). These variables describe the public value (PV_{wk}) in this way: *wealth produced locally* (GDP); *level of innovation*, as described by the innovations introduced by local private firms (Innov), by European patents registered by local firms (EUpat), by the number of new high-tech enterprises established in the period (Newhi) and their rate of survival (Surv), and by the level of investment in R&D carried out in partnerships (EXR&D); *human capital*, defined by the number of researchers in the enterprises (CUfirm), the participation in lifelong training initiatives (Lifeedu), the employment rate (EMP), and the number of graduates employed in the local firms three years after degree (Empgra); and *attitude to consume public goods* (Pubgo), as indicated by the number of visitors to places of historical, cultural and artistic interest.

The analysis aims to verify the effectiveness of the i third mission activities displayed by j Italian universities ($ITMS_{ij}$; $TM_{i,j}$) and the ability to co-generate public value together with stakeholders in the local context. The impact is estimated by considering for each period the influence of the third mission initiatives on the w development variables of the k regions in which the universities are located (PV_{wk}). The value of these initiatives originates from a logarithmic variable estimated on the data collected from 2004 to 2014, considering that the effects of some initiatives may occur in periods subsequent to their performance. In general, a local firm takes a long time to introduce an innovative product after registering a patent and to achieve patents after using incubator services. For each VQR period, the models take the following formulation:

$$PV_{wk} = \alpha_0 + \beta_1 ITMS_{ij} + \varepsilon \quad (3)$$

$$PV_{wk} = \alpha_0 + \beta_1 TM_{i,j} + \varepsilon \quad (4)$$

Table IX shows positive influences among the regional development indexes and some third mission initiatives. The most influential activity in the VQR1 period (2004-2010) is contractual partnerships with external entities (ITMS1) linked to the assignment of research projects, consultancy, or training activities. These initiatives have positive effects on the level of local wealth, on the ability of enterprises to produce European patents, including product and process innovations, and on the presence of human capital with a high level of knowledge in R&D within local firms. Similar impacts are generated by university spin-offs (ITMS3) and by the use of public cultural heritage related to archaeological sites (ITMS7). The latter variable has a negative influence on the patenting activity of local firms (EUpat) and on CUfirm, possibly because industrial activities are typically absent in primarily touristic destinations to avoid danger to historical sites. The positive connection of sites of historical and artistic interest with local wealth is plausible as these sites generate tourism.

The presence of third-party contracts and university spin-offs also encourages the establishment of new knowledge-intensive and technology-based companies in the area (Newhi) and supports their survival over time (Surv). Although some of these companies are represented by spin-offs, the gap between the number of spin-offs and other start-ups is high. Therefore, it is assumed that the presence of research skills in the area facilitates the establishment of an innovation-oriented business structure. Similarly, the ability of these companies to survive over time benefits from partnerships with universities, often directly related to the common development of research projects.

Both service activities and training for third parties (ITMS1) and TT services provided through consortia (ITMS5) promote employment (EMP) in the area. The same initiatives also promote rapid graduate employability (Empgra) by local businesses. The type of university services that facilitate employment and whether recruited graduates were trained in the universities of the area should also be investigated. Another significant relationship is that between the consumption of public goods by citizens and the

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3 provision of museums and buildings of historical-artistic interest (ITMS6). There is no impact of the patenting activity of the university
4 and incubators, possibly due to their low diffusion.

5 In the VQR2 period (2011-2014), there are less significant influences of the activities of the third mission of the university on the
6 socio-economic growth of the regions (Table IX). These results indicate that the period during which the incidence of third mission
7 initiatives in the territory is observed should be extended. Third-party contracts remain the most relevant activities, especially those
8 related to teaching activity committed by local firms (CT_Fundsteaching). This variable also influences the innovation capability and
9 the presence of human capital employed by local firms for R&D projects. The amount of university patents (Unipatent) and the
10 presence of active university spin-offs (ASOAct) have important impacts on human capital employed in the region. Further
11 investigation must analyse in depth the nature of knowledge sharing by universities with firms. The TT activities shared by the
12 science and technology parks have a positive influence on the survival rate of new high-tech firms present in the territory, whereas
13 internal university offices for TT (TTO) do not contribute to the partnerships related to R&D projects.

14
15 **[Insert Table IX here] Table IX.** Regression analysis: third mission and local context

16 17 **5. Conclusions and implications**

18 This research aims to contribute to the intense scientific and political debate on the role of IC approach in promoting, among
19 universities, the development of third mission activities useful for the growth of local contexts. Integrating the study of Secundo *et al.*
20 (2017), the research findings show that quality evaluation reports provide useful information about the contribution of IC components
21 to third mission performance. In the Italian university system, structural capital is particularly important for the development of third
22 mission activities that create value in the region in which the university operates. Although it is implied that human capital remains
23 the key-performance, the universities' strategies must pay close attention in the development of the structural component of IC,
24 particularly with regard to the quality of scientific production and the ability to codify knowledge through patents. The quality
25 evaluation approach clearly shows the paths to follow to achieve the first goal.

26 The analysis shows that Italian universities support the patenting policy mainly to fuel the development of other third mission
27 initiatives and increase relationships and legitimacy among stakeholders rather than solely for financial revenue. About the impact of
28 third mission activities on the local growth, this study confirms the dominant contribution of the entrepreneurial university but also the
29 important role of humanistic scientific field in the touristic areas, where industrialization is less developed. This finding shows the
30 strong linkage between the higher education institutions and the features of the geographic area where the university is located,
31 confirming that third mission activities must be planned according to the local demands.

32 Recalling the theoretical assumptions of NIS, we can conclude that in Italian universities the mandatory adoption of quality
33 evaluation process is a case of coercive isomorphism, that emphasize the third mission development, stimulating the dialogue
34 between the universities and their ecosystem. The analysis shows that universities have implemented some policies on intangible
35 resources management that are capable of triggering interactions among IC components in a systematic way and the recent
36 guidelines of MIUR for the assessment of university performance confirm this hypothesis. The quality evaluation approach integrates
37 the internal managerial perspective with the reporting instances required to make universities more accountable and, consequently,
38 rewarded. Enhanced communication with external stakeholders thus becomes the challenging goal in the national university system.

39 Universities' managers must give more attention to structural and relational assets, which can effectively enhance the credibility
40 of university and attracting more private financing sources. Future policies should promote the strengthening public-private
41 partnerships and establishing effective TT institutions to further increase the presence of universities in the local context. For this
42 purpose, the university system should develop appropriate organizations and governance styles for managing complex relationships
43 with the local context, international scientific communities, and supranational bodies responsible for social *policies*. In terms of policy
44 implications, to encourage the institutionalization of an IC culture, the disclosure required by recent performance plans (Siboni *et al.*,
45 2013) must be integrated with information provided by the quality evaluation process. The value of this process is the uniformity of
46 information, which eliminates the impediment to comparability of voluntary reports of ICU widely highlighted in international practice.
47 Such comparability also facilitates evaluation by Ministry.

48 Within the Italian university system, the full institutionalization of the third mission requires other processes: greater awareness of
49 the objectives and effects of the third mission, which must stimulate the socio-economic development of the local context and not just
50 promote the university's image; and the adoption of organizational structures capable of integrating the three missions and managing
51 new forms of collaboration, such as pre-commercial procurements, patent-based investment funds, confederations of universities
52 and the development of doctoral courses on a regional basis.

53 Despite these contributions, this research presents some limitations, including the absence of assessments of teaching activity
54 and other information related to human capital. Furthermore, the paper is based on the final results produced by an external auditor;

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3 further investigations should include discussions with university managers and researchers on how the quality evaluation approach
4 enhances decision-making and the management activities. Quality systems require collegial activity and collective discussion of
5 results, future strategies and policies but take considerable time to gather data, documents, institutional approvals and resources.

6 Future research directions can be glimpsed in the extension of observations to public research centres, which have different
7 organizations and operations than universities, to verify how the quality evaluation model enables IC disclosure across various
8 knowledge entities within the same country. Furthermore, the investigation of IC disclosure in universities with a mature IC culture
9 would verify the real usefulness of voluntary reporting compared to mandatory quality reporting. Finally, an analysis of other contexts
10 that adopt performance appraisal approaches of the third mission similar to VQR would be useful to verify different ways of
11 institutionalizing the third mission and IC culture.

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Journal of Intellectual Capital

A QUALITY EVALUATION APPROACH TO DISCLOSING THIRD MISSION ACTIVITIES AND INTELLECTUAL CAPITAL IN ITALIAN UNIVERSITIES

Table I. Comparative Analysis: ICU Framework, Third Mission Scoreboard, VQR1-2

IC components	<i>ICU reporting (OEU, 2006; Sanchez and Elena, 2006)</i>	<i>Third Mission Scoreboard (ETM Project, 2012; Secundo et al., 2016; 2017)</i>	<i>Quality Assessment Exercise- VQR1 (Anvur, 2013)</i>	<i>Quality Assessment Exercise - VQR2 (Anvur, 2017)</i>
HUMAN CAPITAL	Funds for R&D/HRs % Research staff % PhD students Visiting and international students	PhD students on entrepreneurship or with entrepreneurial competences Administrative Staff and Faculty members employed for TTO, external cooperation, entrepreneurial courses, lifelong learning programmes, spin offs... Staff funded by competitively R&D projects, postgraduate students or scholarships funded by private firms	No. researchers Vertical mobility (No. researchers recruited or with career advancement) No. faculty members in international mobility No. PHD students, research fellows.. International co-authorships and their quality	No. researchers No. HR involved in third mission activities, continuing education programmes... No. PHD students, research fellows.. International co-authorships
STRUCTURAL CAPITAL	Financial indicators (Resources for R&D, administrative staff, fund raising, budget for scientific field...) Publications: No., quality / visibility / internationalization degree IPRs: patents, copyrights, licensees, returns from IPR Presence of strategic plans, performance measurement systems, useful information for decision-making processes	Expenditure for databases, scientific journals, IT No. of books, pilot applications, ongoing research projects, software platforms, PCs (per students, staff members, researchers)... % of success in project acquisition IPR, Spin offs Creative commons and social innovation projects Scientific journals with university staff into editorial board Incubators co-owned by the university	Publications and their value: No., scientific value per area, % of excellent publications, quality of publications presented by researchers recruited or promoted in the period Growth rate in quality evaluation respect previous assessment (2001-2003) Funds by competitive projects and total funds for R&D Patents and spin offs Museums and archaeological sites	Publications and their value: No., scientific value per area, % of excellent publications, quality of publications presented by researchers recruited or promoted in the period Growth rate in quality evaluation respect previous assessment (2004-2010) Total competitive funds for R&D Patent activity and value ASOs profile Management ad nature of cultural goods TTO profile
RELATIONAL CAPITAL	No. of spin offs Contracts and R&D projects with external parties (No. nature of the partner, activity, funds..) Technology Transfer Institutions (incubators, S&TP): activities, budget Checklist of other social and cultural activities	Continuing education programmes, total credits for the training courses Third-party funded projects, partnerships No. firms or research institutions involved in R&D, education activities Faculty members in scientific boards and journals Internationalization degree: foreign students, Erasmus, international joint degree programmes, countries with collaborations, visiting staff.. International awards Presentation in scientific conferences Budget for social engagement Events open to community Visits to partner companies and research centres	Funds from contracts with external actors for research, services, consultancy.. Incubators and consortiums Other third mission activities (policy making, public lectures, social events...)	Funds from contracts with external actors for research, services, consultancy, teaching, relations with institutions and with private partners External TT structures: Incubators, science and technology parks, consortiums and other TT networks Other initiatives and relations with social community (public engagement) Relations with external students for continuing education programmes (No. courses)

Table II. Indicators for third mission in VQR1 and VQR2

Third mission activities	VQR 1 (2004-2010)		VQR2 (2011-2014)	
	Measures	Qualitative data	Measures	Qualitative data
<i>A) Entrepreneurial activities and TT</i>				
-Third-party contracts	ITMS1*: quality of external contracts CT: total funds from external actors	Funds divided by activities	CT_Funds: divided by sources (research contracts, services, teaching, public transfer, other private funds)	Research and services relations, institutional relations, private partnerships No. and role of Human resources involved in these activities
-IPRs	ITMS2*: quality of patenting activity PAT: No. of patents	Patents divided per scientific area Revenue from patents % patents sold, licenses..	ResPat: No. research patents UniPat: No. university patents FundsPat: funds from patents (licensees, sales..) TotValuePatent: value of general patenting and funding activity	Profile of patent: name, scientific area, inventor, national or international domain, size of portfolio, nature of applications No. and role of Human resources involved in these activities
-Entrepreneurship	ITMS3*: quality of entrepreneurial activity ASO: No. of spin offs	Spin offs divided per scientific area Turnover	ASO: No. spin offs, ASOAct: No. spin offs active in 2014 <i>Employment impact</i> <i>Economic impact</i> <i>Value creation attitude</i> : No. ASO acquired or listed <i>Demographic data</i> : No. Active/No. Closed ASOs No. of patents co-owned with university No. of other university patents used by ASO, No. of university research projects assigned to ASO, No. of equipment and services provided by universities	ASO Profile: industry, name, researchers and their role, age, scientific area, nature of shareholders, active or inactive, financial data Employees divided by graduated and PHDs No. of Human resources involved in these activities Nature of support received from university and relationships with departments
Business facilitators	ITMS4*: quality of incubation services INC: No. of incubators ITMS5*: quality of networking activity CON: No. of consortiums and alliances for TT	Other qualitative data: services and activities delivered, scientific focus, equity...)	INC: participation in incubators (0,1) STP: participation in science and technology parks (0,1) CON: participation in other TT networks (0,1) TTO: No. of TT activities, TTOs budget	<i>For the external intermediaries</i> : organization rules, budget, nature of the relations with the context, strategy for TT, governance of relations (internal office, contract, association...), staff members, private members.. No. of Faculty and administrative staff employed in these relations <i>For TT offices</i> : staff members, budget, placement office, organization rules, services provided for TT
<i>B) Social and cultural activities</i>				
-Cultural goods	ITMS6*: quality of museum goods M: No. of museums	Cultural goods divided per scientific area, dimension and budget	PubGoods: No. archaeological sites, museums, historical buildings	Location, dimension, destination, budget, maintenance costs, visitors, opening days, revenues by visitors..

	ITMS7*: quality of archaeological and excavation activity			
	AS: No. of archaeological sites			
-Public engagement, social services and lifelong learning	ITMS8*: attitude toward public engagement and other social services OTM: No. of other third mission activities	Nature, period, aim, department	PubEng: value of initiatives and relations with social community (from qualitative data) Clinical services: No. of trials, patients, training courses, No. laboratories and clinical centres CL: No. of courses, No. of faculty members involved in continuous learning courses	Nature, period, aim, department, impact, budget, communication tools (informed peer review evaluation) No. of human resources involved in these activities Credits, scientific area, students, external partners

**weighted by relevance for strategic management and normalized by size (HR and P of structure and scientific area)*
Source: ANVUR, 2013, 2017

Table III. Descriptive Statistics: Period 2004-2010 (VQR1)

	No.	Min	Max	Mean	Std.Dev.
CT	71	,00	917120,02	141485,0446	143278,2929
PAT	71	,00	,97	,0061	,13654
ASO	71	,00	,34	,0254	,04557
INC	71	,00	,03	,0013	,00392
CON	71	,00	,20	,0488	,04865
M	71	,00	,09	,0052	,01376
AS	71	,00	,85	,0569	,12505
OTM	71	,00	5,45	,4280	,92496
ITMS1	71	,00	5,97	1,3821	1,49456
ITMS2	71	,00	6,32	1,1744	1,74844
ITMS3	71	,00	6,68	1,3868	1,68776
ITMS4	71	,00	14,47	1,3890	3,19913
ITMS5	71	,00	8,50	1,3838	1,46410
ITMS6	71	,00	20,13	1,0860	2,99963
ITMS7	71	,00	9,07	1,3890	2,50427
ITMS8	71	,00	44,30	1,3717	5,33992

Table IV. Descriptive statistics period 2011-2014 (VQR2)

	N	Min	Maximum	Mean	Std. Deviation
ResPat	71	,00	,93	,1851	,18903
UniPat	71	,00	1,00	,1081	,16488
FundsPat	71	,00	,58	,0740	,13692
TotPatvalue	71	,00	2,28	,3672	,41139
ASO	71	,00	46,25	11,6761	11,16471
ASOAct	71	,00	38,00	8,6127	8,38268
TotASOValue	71	,00	,91	,1996	,21749
CT_Fundsresearch	71	,00	3409525,58	449613,5108	634765,10024

CT_Fundsservices	71	,00	6836882,76	322147,4125	859107,36267
CT_Fundsteach	71	,00	809338,30	36263,6904	110298,96114
CT_fundsPublic	71	,00	2462274,13	542837,1724	586313,62111
CT_Funds Private	71	,00	2118790,03	355561,7158	428934,90557
INC	71	,00	1,00	,4225	,49748
STP	71	,00	1,00	,5070	,50351
CON	71	,00	1,00	,7465	,43812
TTO	71	,00	1,00	,8592	,35034
CL	71	,00	325,00	41,1761	56,85760
PubEng	71	,00	,76	,4827	,18311
Valid N (listwise)	71				

Table V. Absence of Third Mission Indicators

	VQR1(2004-10)		VQR2(2011-14)	
	Frequency	Percentage	Frequency	Percentage
CT	1	1,4	0	0
PAT	15	20,8	9	12,67
ASO	17	23,6	14	19,71
INC	53	73,6	40	56,33
STP	-	-	35	49,29
CON	9	12,5	18	25,35
PubEng	8	11,11	5	7
M	42	58,33	--	--
AS	26	36,11	--	--
PubGoods	--	--	14	19,7

Table VI. Dependent and independent variables

	VQR1 (2004-2010)			VQR2 (2011-2014)	
	Independent	Dependent		Independent	Dependent
<i>Human capital</i>	HR: No. active researchers	ITMS1	<i>Human capital</i>	HR_TD: No. HR in third mission	CT_funds No. Pat
	MOBV: HR in Vertical mobility	ITMS2		HR_CL: No. HR in continuing education	FundsPat ASOAct
	HR in International mobility	ITMS3		programmes	INC
	HRF: No. PHDs	ITMS4		HRF: No. PHDs, research fellows..	STP
	COAI: No. International co-authors	ITMS5		COAI: No. International co-authors	CON
		ITMS6			TTO
		ITMS7			PubEng
		ITMS8			CL
<i>Structural capital</i>	P:No. Publications	ITMS1	<i>Structural capital</i>	P:No. Publications	CT_funds
	X:% of excellent publications	ITMS2		X:% of excellent publications	No. Pat
	R:quality of publications	ITMS3		R:quality of publications	FundsPat
	UPG: improvement degree in quality during the time	ITMS4		UPG: improvement degree in quality during the time	ASOAct
	FIN: total competitive funds for R&D	ITMS5			INC
		ITMS6			STP
		ITMS7			CON
		ITMS8			TTO
					PubEng
					CL
	PAT: No. patents	ITMS1		UniPat: No.	CT_funds

	ASO: No. spin-offs M, AS: No. museum and archaeological sites	ITMS2 (excluding PAT) ITMS3 (excluding ASO) ITMS4 ITMS5 ITMS6 (excluding M) ITMS7 (excluding AS) ITMS8		university patents ASO: No. spin-offs No. TTO PubGood: presence of cultural goods (1,0) FIN2: total competitive funds for R&D	No.Pat (excluding UniPat) FundsPat (excluding UniPat) ASOAct (excluding ASO) INC STP CON TTO PubEng CL
<i>Relational capital</i>	INC: No. incubators and consortiums OTM: No. of other third mission activity	ITMS1 ITMS2 ITMS3 ITMS4 (excluding INC) ITMS5 (excluding INC) ITMS6 ITMS7 ITMS8 (excluding OTM)	<i>Relational capital</i>	Single CT_Funds: research, consultancy, services, from public, teaching for private institutions TTOs budget INC, CON, STP: No. incubators, consortiums, science and technology parks PubEng: other activities in Public engagement	CT_funds (excluding single CT funds) No.Pat FundsPat ASOAct INC (excluding TTOs, ASO, INC, STP, CON) TTO (excluding TTOs, INC) CL

Table VII- Regression analysis ICU measures in VQR1 (2004-2010)

	ITMS1	ITMS2	ITMS3	ITMS4	ITMS5	ITMS8
Constant	-3,826***	-3,112***	-2,112**	-1,179**	0,269***	-4,259***
HR		-1,003***				
P	0,830***	1,694***	0,485***	0,457***	0,599***	0,751***
R					0,552***	
X			0,519**			
PAT	0,456***		0,373**			
UPG	0,132**	0,146**	0,386**			
CT		0,439***			0,284***	
FIN	-0,259**			-0,399***		
AS/M	0,153**					
OTM				0,217**		
COAI			0,311***			
Adjusted R2	0.778	0.711	0.529	0.374	0.416	0.691
F-Value	50,197***	44,037***	14,122***	11,449***	17,650***	79,107***

Notes: *, **, *** represent 10, 5 and 1 percent respectively

Table VIII. Regression analysis: ICU measures in VQR2 (2011-2014)

	No.Pat	FundsPat	ASOAct	CT_funds	INC	STP	CON	TTO	PubEng	CL
Constant										0.567***
R	0.119**	0.122**	0.193***	0.135***	0.215***					- 0.269*
P										
FIN2	0.240***			-0.351 ***		0.561***				
HRF				0.655***						
HR_CL									0.345***	0.669***
UniPat			0.546***	0.666***						
CT_Funds	0.484***	0.542***				-0.361***	-0.271**			0.373***
ASO	0.373***	0.399***			0.436***			0.324***		
INC			0.216***							
CON				-0.161 ***						
TTOs										0.146***
F-Value	96.297 ***	79.705 ***	35.945 ***	46.707 ***	12.315 ***	9.158 ***	6.653 **	8.499 ***	7.059 ***	32.890 ***

Notes: *, **, *** represent 10, 5 and 1 percent respectively

Table IX. Regression analysis: third mission and local context

	GDP	EMP	Newhi	Surv	Innov	ExR&D	EUPat	CUfirm	EmpGra	PubGo
<i>2004-2010, VQR1</i>										
ITMS1	0.619***	0.488***	0.240**	0.274**	0.591***		0.589***	0.601***	0.506***	
ITMS3	0.326***		0.293**	0.262**	0.463***		0.443***	0.470***		
ITMS5		0.378**							0.224**	
ITMS6										0.304***
ITMS7	0.287***						-0.249**	-0.281**		
<i>2011-2014, VQR2</i>										
CT_funds	0.409***				0.426***					
UniPatent										
ASOAct										
STP										
TTO						-0.270**				

Notes: *, **, *** represent 10, 5 and 1 percent respectively