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Combining universities third mission and place-based industrial development

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Abstract

Drawing on the two models of the University centric industrial district (Patton and Kenney, 2009) and the Civic University (Goddard and Vallance, 2013), the paper develops a framework on the role of universities in local development processes. Such framework develops around three concepts: first, the degree of synergy between the different activities that are promoted by the university in relation to its third mission, from the implementation of single technology transfer activities to the organization of system-based actions; secondly, the degree of alignment between the goal of the university third mission and projects of local development, from a complete misalignment to a complete alignment that can lead to a sustainable local growth; third, the degree of disciplinary specialisation of university research and third mission activities, from a complete specialisation to a multi-disciplinary attitude. The paper includes some exemplification and a tentative application of the framework on the problems of industrial recovery in Italy.

Keywords: University third mission, Civic University, University centric industrial district

1. Introduction

A quite recent literature discusses the role that universities can play in the development of local and regional innovation systems, mostly through the development of the university third mission. Such literature has theorized – and, in some cases, has also empirically shown – that by stimulating the creation of innovative enterprises, providing skilled human capital (also) to local firms, triggering local-based university-industry collaborations, and – more generally – producing knowledge spill-overs, the universities can bring a valuable contribution to the cities and regions where they are located (Gunasekara, 2006; Mayer, 2007; Goddard and Puukka, 2008; Benneworth and Sanderson, 2009; Dalziel et al., 2009; Bagchi-Sen and Lawton-Smith, 2012; Goddard and Vallance, 2013).

This literature focuses on the characteristics of the territorial system, but often neglects the complexity of the university system. On the other hand, most of the contributions on the university third function often neglects the difficulties in interaction with place-specific networks of social and business actors. The paper aims to reconcile the two perspectives, in order to understand the mechanisms through which the universities can interact positively with the places where they are located.

Sections 2 to 5 present a review on the third mission, discussing how the individual initiatives of researchers or groups of research may be supported and complemented by the functions of knowledge transfer offices, and how such functions may permeate more or less deeply an University's structure and its relations with territorial and

business systems. Three sets of relations are considered in this last regard, i.e. knowledge transfer with SMEs and exchange with large firms, contributions to projects of business cluster innovation and territorial development, integration within systemic frames of local, regional and national policies of industrial and territorial development.

Sections 6 to 8 illustrate two models that allow elaborating on the above concepts, identify a set of factors crucial to a wide and fruitful functioning of third mission, and together help generating an integrated framework on aligned and sustainable strategies of development. The two models on the role of universities in local development processes are the so-called University Research Centric District (Patton and Kenney, 2009) and the Civic University (Goddard and Vallance, 2013). The integrated framework develops around three variables. Firstly, the synergy between the different functions that is promoted by the university in relation to its third mission is more or less strong and extensive, from the implementation of single technology transfer activities to the organization of system-based actions. Secondly, the alignment between the goals of the university third mission and the projects of local development varies from a complete misalignment to an effective alignment. Thirdly, the disciplinary specialisation of university research and third mission activities is more or less stringent, from a complete specialisation to a multi-disciplinary attitude.

Section 9 concludes, before the final remarks, with a reflection on the barriers that traditionally play adversely against a wider and deeper application of virtuous relations in a specific national context, Italy, and highlights some drivers that could help progress towards more effective relations in the present context of difficult industrial recovery.

2. University third mission

The history of many universities in Europe, the United States, and other parts of the world illustrate how they have emerged as a result of interests and visions of development cultivated within the host cities. Thus, the university's commitment to the city, one of the cores of what acknowledged currently as the third mission, was an integral part of the original mission of those universities (Bender, 1988; Goddard and Vallance, 2013).

However, the connection between universities and their host cities gradually weakened between the late XIX and the first half of the XX century. This was due to two main forces that tended to modify the reach and mission of universities. One was the growing disciplinary specialisation of research and teaching activities. On the other hand, the demand for non-local or universalistic research and education was increasing as central public administrations, top professionals, and large enterprises featuring the second industrial revolution were building up national institutional and business systems. As Goddard and Vallance (2013) put forward, many universities remained in their cities of origin, but no longer belonged to them.

However, such decoupling process is complex and uneven, and some universities (and cities) have preserved the original imprint. This has been the case for many small and/or local universities, but also for some universities with a national or international

standing. The modern third mission emerges during the XX century in these latter organizations¹. At that time, such mission was seen as something new with respect to the two universalistic missions of higher education and research.

Nowadays, third mission (or third stream) activities are "... concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments. In other words, third stream activities are about interaction between universities and the rest of society" (Molas-Gallart et al, 2002, p. 2)². This interaction is commonly associated to the economic exploitation of knowledge produced by the university, and in particular to the traditional fields of the so-called technology transfer, such as university patents management and marketing, spin-off creation, university-industry research, creation and management of scientific and technological parks, etc. The common feature of these activities is that knowledge produced by the university, at some stage of its development, takes on the nature of a private good, thus giving rise to problems of regulation (Bercovitz & Feldman 2006; Del Re, 2016).

Third mission activities include also those more directly addressed to social or cultural fields. They include for example the management of cultural heritage (e.g. museums or archaeological areas), the implementation of activities aimed at supporting public health (e.g. university hospitals), education (e.g. recurrent training courses for professionals and lifelong learning), the organization of cultural and civil events (e.g. public debates on humanistic or technological culture). These activities are countless. Their recognition and measurement is made more difficult by the fact that many of them are carried out just by the individual initiative of university researchers, i.e. outside a formal organization by university structures.

A further dimension of third mission activities lies in their connection to the first and second mission. On the one hand, the results of the first and second mission are fundamental supply factors for the third mission: the generation of academic patents, industry-university contracts and laboratories for innovation, innovative spin-off is weak without good research; as well as effective job-placement of graduates is limited without good higher education. Given such connections, it is important that part of the revenues generated by the third mission go to funding the other missions (Molas-Gallart & Castro-Martinez, 2007). However, the connection would be less likely to occur without the intermediary action performed by well-coordinated third mission functions.

Finally, third mission activities take place in a broader academic institutional and organizational context. Therefore, the ties with national and international university system and the territorial systems (local and global) in which the university operates are the obvious counterpart of third stream activities (Lawton Smith & Bagchi-Sen 2012).

In particular, concerning the territorial system, universities may be important contributors to regional and local development processes. Starting from the seminal contribution of Anselin et al. (2000), literature has found empirical evidence about the fact that the presence of universities has positive geographic spill-overs. In particular,

¹See "Ideas of Universities", chapter 9 of Anderson (2006). See also Clark (1998); Etzkowitz (2003); Lawton Smith & Bagchi-Sen (2012).

²See also Bozeman (2000); Bercovitz & Feldman (2006).

they influence the innovative capacity of local firms, by strengthening the culture and the creative atmosphere of the region, supplying local markets with highly educated new entrant workers, and providing image effects, thanks to excellence in higher education and research and in place-generic third stream functions (Power & Malmberg 2008). It is remarked also that, even when local networks with business communities are not so strong nor successful, positive spill-overs may be observed (Huggins et al. 2008).

3. Contemporary opportunities and barriers to third mission activities played by academics

Consider contemporary market opportunities and challenges in industrialized and industrializing countries. Many are related to the growing possibilities of application of new manufacturing and service technologies (industry 4.0, smart manufacturing, servitization), which are based on a combination of artificial intelligence, new materials, 3D printing, internet of things, big data, open innovation (Hermann et al., 2015). They require non-trivial organizational adaptations, and push firms of different size, sector, and territorial context, to seek specific and high-value knowledge and expertise. Similar needs confront cities and regions struck by the opportunities and challenges of smart city/smart land solutions. Those solutions should integrate digital technologies and platforms with new ways of supporting, managing, or e-governing the urban and territorial fields of mobility, energy and water supplies, sustainable architecture, security and welfare services, valorisation of cultural and landscape heritage. Local communities of practices together with regional or even world-class hubs are also part of the pools of actors to be involved (Allwinkle & Cruickshank, 2011; Bonomi & Masiero, 2014).

Such conditions pull an increasing need of university third mission, even in the worlds of small firms that normally have not great traditions of interaction with universities, as they rely more on models of learning and creativity on the job (Becattini et al., 2009). Is that pull enough to bring about a large amount of good interactions and results? Various types of barriers interfere, if third mission activities are left just to the individual initiative of university research (and/or higher education) groups (Etzkowitz, 2003).

Suppose that a small firm, starting from a traditional approach, would try to contact some research group within a local university for developing an internal solution, matching it with new technologies, so introducing an innovation on larger markets or value chains. Firstly, the management probably has not a previous experience of contacts with the university, so the first difficulty is to identify the right university partner to work with. Even when the firm is able to identify a university researcher who has a scientific expertise close to the technological domain of interest, this does not guarantee that the cooperation will start or develop. The researcher is not always used to solve practical problems, the time horizons of small firms and university groups are quite different, and the budget that a single small firm is able or willing to invest has often a reduced size.

All such factors tend to generate only a limited commitment of the researcher to the definition of suitable solutions. Moreover, even when the collaboration produces

successful results, the researcher is not able to help the entrepreneur in protecting the intellectual property or adapting its business model to the new technological solution. The business models should include features such as: a) increasing qualification of workers, young people in particular; b) use of digital technologies; c) strengthening of open networks of innovation and knowledge; d) active involvement in global value chains (Chesbrough et al. 2012). Other types of experts should intervene, and even when they are present within the university, not necessarily the researcher has the knowledge and the incentives for contacting them.

Similar problems are met by single research groups when they push for a direct economic or social transfer of pieces of new knowledge they have been developing, for example trying to implement its valorisation by means of patents or academic spin-offs (Etzkowitz, 2003). Or, when they have to exchange with stronger business partners, like large (multinational) enterprises, ready to acquire the valuable applied knowledge of the group, but trying to pay just the marginal cost of adjustments asked to the researcher for aligning the solution to the specific needs of the company. Actually, large enterprises are increasingly looking for external sources of inventions, as well as licensing and trading high technology businesses, managing strategically large patent archives, co-developing and designing innovation and technological platforms together with universities, innovative SMEs, and joint-ventures with other large companies, etc (Chesbrough et al., 2006). The single university groups quite rarely are able to reduce the risk that those strong partners play predatory or rent-seeking strategies.

Finally, as recalled before, contemporary technological opportunities and challenges extend to the designing and building of various types of local public and collective infrastructure with smart city/smart land or city/regions approaches. Here, digital technologies, together with other solutions, apply extensively and reflexively in order to increase local environmental sustainability and social inclusion, cultural identity and development, participation to local e-government processes, but also as a source of qualified technological demand and service competitiveness for local business clusters. Single professors and single research (and/or higher education) groups operating in certain disciplines are normally asked to be involved in consultancy, professional contributions, innovative projects for public and collective bodies, in particular local ones – let call them “local institutions”. However, what smart city/smart land would ask really is a system-approach to territorial development or a triple (or quadruple) - helix model of smart cities involving policy-makers, academic bodies, business, and civil society actors (Leydesdorff & Deakin, 2011). No single university group is normally able to span and provide the implied set of scientific-technological-organizational inputs. Nor local institutions and business actors are usually able to orchestrate a set of different university research groups.

It is not surprising that specific functions set up by the governing bodies of the universities (be they central or decentralized) accompany the emersion and strengthening of third mission activities, even before the last wave of technological opportunities and challenges. They include the definition of regulations (eventually transposing national laws) about patents, spin-offs, contract research, cultural events etc., as well as the creation of specialised offices, variously named and covering in different ways the various fields of support to the third mission. Examples include

industrial liaison offices, technology transfer offices, innovation divisions, job-placement, seedbeds/incubators, competence centres, etc. (Berkovitz & Feldmann, 2006; Power & Malberg, 2007). In what follows, we refer to the central university structure helping its third mission as the “knowledge transfer office” (KTO in what follows: Trueman et al., 2014). Next Sections 4 and 5 recall what type of support they may provide to wider positive effects of third mission activities implemented by university groups, as well as the difficulties related to such job.

4. The difficult job of knowledge transfer offices

Knowledge transfer offices (KTO) are managing structures where administrative personnel, expert entrepreneurial academics, and innovation professionals, perform control, consultancy and provision of specific resources for supporting and regulating individual third mission activities on behalf of the governing bodies of the university; as well as, sometimes, coordination with the other university missions. A University KTO may include the support to all third streams activities, or it may be (more or less) coordinated with other structures, centralized or decentralized; KTO and related structures may be in-house offices/centres or separated organisations (Trueman et al., 2014). In the latter case, the university undersigns agreements in order to combine its own strategies and resources with those of the external entity.

KTO are activated in order to address problems and barriers like those recalled in Section 3. It is quite easy to see that this is not just an administrative job. Think for example about the matching between a local small firm looking for a research support and a university group. Firstly, the existence of the KTO has to be known. This asks usually intensive communication activities and persistent relationships between the KTO and the local business associations. Secondly, when contacted by a small firm, the KTO should be able to use archives of university expertise, classified by technology domains, and search such archives to identify the best match between firms’ needs and university expertise. After having identified a matching, the KTO has to help the parties to define the collaboration goals. When financial resources, timing, and/or firm’s approaches are inconsistent with collaboration goals, the KTO has to involve management experts within the university, able in particular to help towards the introduction of new business models with features like those recalled in the previous Section. If cross-disciplinary research is needed, the KTO, better if helped by the competence of open innovation intermediaries, should liaise among research groups of various technological domains inside the university or even with other universities.

The employment of one or more graduates with an education related to the innovation project may be one of the more effective solutions for improving the business model of the small firm, and strengthening its internal technological competence and absorptive capacity. The KTO may help if it includes or it is well coordinated with the university job-placement office (Alexander and Martin, 2013)³.

³ Unfortunately, as noted by Stephan (2009), universities often do not track these processes, and in particular the job placement of their alumni. This does not allow fully appreciate the extent of knowledge and technology transfer.

Another important support in the same direction is the matching of the small firm with networks of business innovators (Dahlstrand, 1999; Bellandi & Caloffi, 2016). Therefore, the KTO has also to cultivate networks of external collaborations and working groups with business associations. Much more important are the direct relations of the KTO with innovative start-ups and SMEs led by entrepreneurial teams who have already introduced university scientific-technological-organizational inputs in their production and trade processes.

This consideration takes to the classical fields of the third mission represented by academic spin-offs and patents⁴. The KTO has to include or coordinate with university patent offices and entrepreneurship support offices (or even spin-off incubators). They scout and help the academic promoters of potential translation to face the several barriers implied by the difference between an academic project and a private business plan, and in particular by the specific uncertainties of market innovation. Quite often, patents and spin-offs are seen just as a way to translate directly a high innovative potential of some research results into commercial vehicles able to bring back financial resources to the university research groups. Spin-offs in particular may also help in providing good jobs for young graduates related to the same groups. However, in a wider perspective, patents and spin-offs are potentially also a powerful tool of networking with and by means of business innovators. In an even wider perspective, the success of those vehicles should be evaluated looking at their ability to develop 'pieces of knowledge' that can be integrated into broader technology platforms and business clusters together with other well-established companies (Ramaciotti and Daniele, 2016). Academic spin-offs may help in bringing change in the entrepreneurial culture of small firms and SMEs clusters, and university research groups as well, by operating as bridges between traditional networks of firms and universities.

Of course, patents and spin-offs are also vehicles of knowledge transfer with large firms. The KTO main job here, after matching, is to educate and help the research groups in understanding the organizational complexities of such strong business partners, but also in limiting the opportunistic strategies that the same partners have the ability to adopt (Siegel et al., 2003). It is not easy to block them, if the university does not insert in larger institutional networks, under appropriate regional and national government strategies. These frames should aim at giving selective incentives to the local investments of large firms, towards a long run perspective of co-development. In particular, it is important to link the incentives to the presence of technological, cultural, civil national infrastructures that give stability to long-term investments (Belliandi & Caloffi, 2016).

Actually, the strategies of the university's government bodies may contemplate the contribution to such frames, not only for what they mean to selective business incentives, but more generally for cluster innovation and territorial development. In

⁴ Spin-offs begin usually as innovative start-ups officially recognized by an university according to academic and national rules, founded on ideas for innovative products or services that spring as a joint-result from research projects, patents, and/or scientific expertise of university researchers. Such enterprises often involve also graduate students, PhDs, or post-doc (Grandi and Grimaldi, 2003; Clarysse and Moray, 2004). University patents (together with other tools related to intellectual property) protect (potential) inventions developed by university inventors (individual researchers or more often groups of research). They are framed within university rules, under national and international regulations and structures (Mowery et al., 2002; Del Re, 2016).

such cases, the KTO is possibly asked to mobilize and orchestrate different university groups and networks with business actors for the participation of the university to fora on broad innovation projects, as those on smart city investments. Besides the coordination of the complex scientific and technological sides, such projects should help in strengthening and adapting entrepreneurship and social innovation cultures, trust relations, and skills within business clusters and social networks towards local open innovation and cultural development. It is quite evident that such a job is not third mission, but a mission impossible for the KTO, if not supported by an enduring alignment of strategic perspectives between university government bodies, local institutions, and business and social actors, under eco-system or three-helix approaches (Leydesdorff & Deakin, 2011; Trueman et al., 2014).

5. Different university approaches to the third mission

A complex web of relationships potentially connects the university third mission with the first and second ones, as well as with business, territorial and university actors, resources, regulations, and processes of organization, production and communication. The web may be activated more or less extensively and strategically. A strong activation corresponds to the insertion of the third mission within logics of local open innovation and cultural development. The Figure 1 (Appendix) summarizes such potential web⁵.

Lines A, B, and C define the central circle of relationships between the three missions, bringing effects from higher education and research to innovation and employment, feed-backs to higher education and research, and systematic third mission contributions to supporting and balancing the previous effects and feedbacks. Lines D, E, F, and G refer to the circles of relationships between the single university and the systems in which it is included, namely the university system and the territorial systems. Lines H and I refer respectively to the enhancement of the value of local factors thanks to national and international applications, and to the local attraction of non-local factors.

In a university founded on the two traditional missions of higher education and research, effects A and feed-backs B are largely not governed, though possibly strengthened by individual initiatives of teachers and researchers, being left respectively to the absorptive capacity of the territory and to the funding decisions of the state and of private donors encouraged by positive effects. The dashed lines refer precisely to effects and feed backs not supported by the organization of third mission contributions. The continuous lines between A, B, and C point to the enhanced effects and feedbacks allowed by systematic third mission contributions, as those described in the last Section as the tasks of a university KTO.

There are many possible combinations of direct, indirect, internal and external relationships, leading to different results, even in consideration of the diversities among universities in terms of scope, size, etc. Moreover, even the territorial contexts

⁵ The source of Figure 1 is the KTO of the University of Florence (Italy) in 2014. One of the authors of this paper was president of that KTO in the period. See also Mazzi et al. (2015). Trueman et al. (2014) report a good set of examples of strong activation around Europe; see Bercovitz & Feldman (2006) for examples of stronger or weaker activation in USA.

are heterogeneous, in terms of size, social capital, industrial specialization and human capital, institutional density and regulations, variability and cohesion of policy strategic approaches. Therefore, different universities have different approaches towards the third mission (Bonaccorsi & Daraio, 2008; Trueman et al., 2014). Typologies may be considered in this regard. A quite crude one just distinguishes between those that engage purposefully with technological transfer, job-placement, cultural divulgation, etc. and those that do not engage. We propose, also considering the various combinations implicit in Figure 1, a classification articulated in four types:

- a) *Ivory towers*, i.e. universities that are sheltered behind the first two missions; third mission does not find any room in these universities, which can be either national or international research excellences, or just teaching universities (in the core, only the dotted lines of A and B, no C).
- b) *Reticent universities*, which recognize that researchers can pursue individual third stream activities, but are mainly concerned by the dangers to the university's traditional missions brought by possible conflicts of interest⁶. The university third mission "strategy" in these cases concerns almost exclusively the field of regulations (in the core, the dotted lines of A and B, no C a part from administrative offices overseeing the application of regulations; relations E and F active for regulation).
- c) *Tolerant universities*, which create KTO dedicated to support one or more types of third stream tools, as if they were separate fields pushed by the particular interests of specific technological disciplines, like engineering, pharmaceuticals, etc. (C is present, but does not balance between A and B);
- d) *System-based entrepreneurial universities*, which deliberately include third mission as an essential component of the economic and social sustainability of the first two missions, and exploit largely the effects and feedbacks illustrated in Figure 1.

The first three types include research, teaching, and broad-scope universities. The first two types champion traditional approaches to academic organization, as opposed to more innovative or so-called entrepreneurial approaches, in the meaning proposed by Clark (1998)⁷. The third type may correspond both to traditional and entrepreneurial approaches. The fourth type champions the entrepreneurial approach, and invest persistently and strategically in knowledge alliances internal and external to the university.

Though contributing also to linear modes of knowledge production, the characterizing mode of the system-based entrepreneurial university is the co-production of knowledge in contexts of application (Gibbons et al., 1994). Third mission regulations and events have a systemic character, i.e. they target the whole system of first,

⁶ As when a professor employs a lot of his/her working days for contracted research to detriment of teaching and scientific publications. The potential conflict may concern larger spheres in types (c) and (d), and the balancing functions of third mission are fundamental to avoid subjugating universities to commercial logics.

⁷ In a sequel to his own book, Burton Clark (2001) maintains that the umbrella conception of the entrepreneurial university "stresses a forward-looking orientation, a willingness to seek out the new frontiers of knowledge. It stresses that the university is engaged in the pursuit of opportunities beyond means that are currently available" (p. 23); furthermore: "Entrepreneurial character in universities does not stifle the collegial spirit; it does not make universities handmaidens of industry; and it does not commercialize universities and turn them into all-purpose shopping malls. On all three counts it moves in the opposite direction" (p. 10).

second and third missions. The system is strengthened by the creation of centres (with qualified staff) that support the development of synergies among the three missions. In particular, the KTO spans over or connects not only the classical fields of technological transfer (patents, spin-offs, industrial liaison), but also job placement, entrepreneurial and soft-skills schools for students and academics, cultural divulgation, etc. External knowledge alliances are supported by facilities under or around the KTO, such as joint laboratories, competence centres, co-workings, spin-offs incubators, science/technological parks.

They may play an active and deliberate role in local development processes. However, in order to understand possibilities of success, we need to consider, as illustrated in Section 4, the other party involved, namely territorial systems, and local ones in particular with their institutions and business and social actors.

In the next three Sections we consider two models of system-based entrepreneurial universities investing in projects for business cluster innovation and territorial development in the places where they are located: the University research-centric district (URCD), and the Civic University. The first one focuses on variables related to the degree of alignment between the goals of the university third mission and the projects of local business development. The second one considers more directly variables related to the degree of disciplinary specialisation of university research and third mission activities and its relation to projects of territorial and cultural development. Both refer also to variables concerning the interplay between local and global relations.

6. System-based entrepreneurial universities and University research-centric districts

The University research-centric district (URCD) model has been proposed by Patton & Kenney (2009), looking at and comparing the experiences of various top level USA universities. We illustrate here the model, adding references both to more recent literature and to concepts already met in the previous Sections.

In some cases, a city with industrial traditions or an industrial district with an urban character has been hosting a university along a fair period. Here, networks of entrepreneurs have developed and partially overlap with academic networks thanks to joint research activities, participation to the same communities of practice, placement of graduates. These connections are partly spontaneous, resulting from geographical proximity and shared local traditions, and partly lie on deliberate strategies implemented both by the university (third mission) and by the business community (e.g. cultural associations that favour matching between industry and university teams). Furthermore, scouting of academic entrepreneurs, entrepreneurship tutoring and mentoring initiatives are promoted directly by the university (e.g. through a university incubator), by other organisations (e.g. business angels, professionals funded by local or regional governments, association of managers or innovators), or as a joint-product of university-industry projects.

Such pro-active "atmosphere" provides a constant support to the initial stages of development of university spin-off and other innovative start-ups, which are the most difficult and uncertain (Clarysse & Moray, 2004). Indeed, the local industry cluster can

generate a demand for products and services supplied by those spin-offs, and successful spin-offs can enrich the local clusters with new competencies and entrepreneurial projects. Possibly new specialisations emerge as the building blocks for the development of new industries⁸. Here, in particular, networks of open professional teams bridging between university and industry help firms absorb external technologies and develop new businesses.

Networks with external actors increase the possibility of successful development of new industries. They are first of all business networks helped by the relation of the university with foreign universities featuring URCD qualities⁹, firms of immigrant entrepreneurs that constitutes trade platforms with the home countries, multinational companies that are located in the URCD and participate to open innovation processes (Saxenian & Sabel, 2009). Wide social networks are also important, such as those of academic start-uppers who keep good relationships with their URCD even after having left during the acceleration phase; graduate students who have successful careers in external business locations and play as alumni with their university; graduate students who train to create and maintain inter-cultural bridges (Youtie & Shapira, 2008).

The URCD model centres on one of the most powerful instruments of the third mission, i.e. the spin-offs, but it includes other tools and aspects as well. All of them have a strong capacity of expansion thanks to the adoption, by the university, of a system-based vision of the third mission. The key aspect of the model, however, relates to the fact that the existence and success of a URCD depends not only on the university features and capabilities, but also on the characteristics of the local system. In particular, and this is what is most interesting in general terms, successful URCD are characterised by a certain degree of alignment between the fields of excellence in university research/education and the fields of industry specialization of local business clusters. Alignment means that there is correspondence between the scientific and teaching fields cultivated by the university and the knowledge and skills required for cluster reproduction, innovation and development. Moreover, university bodies, local institutions, and business and social actors must agree upon the importance of cultivating mutual relationships¹⁰. The model focuses on these two aspects, although it recognizes that there are also other external or local variables, which are not predictable, that have an influence on the probability of success of the URCD. The model in the next Section allows shedding light on some among those other variables.

⁸ Best (2009) talks of "manufactory of species" in such types of industrial districts.

⁹ We would suggest a quadrilateral network: business A, university A, university B, business B.

¹⁰ Patton and Kenney (2009) compare two cases of URCD: the first centred on the University of Wisconsin at Madison (UWM), the second on the University of Illinois at Urbana-Champaign (UIUC). UWM is aligned and UIUC is not aligned with processes of local development. So, only the first case can be seen as a successful URCD. The 8 cases of European universities illustrated in Trueman et al. (2014), with system-based knowledge transfer structures and processes within local and regional innovation ecosystems seem to exemplify well other cases of successful URCD. A model case, within the fast growing Chinese university and knowledge transfer system, is Tongji University (one of the Chinese top-class), the surrounding area (Yangpu District), and a related "creative" (centered on architectural design and civil engineering services) cluster in Shanghai (Cai & Liu, 2014).

7. Civic universities

The model of the Civic University helps explain some of the variables that may be targeted by strategies aiming at a fruitful alignment between industry and academia (Goddard et al., 2012; Goddard & Vallance, 2013). Even in this case we illustrate the model adding references both to various recent literature and to concepts already met in Sections 2 to 5. While the next Section discusses a more direct relation with the URCD model.

The authors of this model start their reflection from the debate on the university's ability to adapt to the constantly changing opportunities and challenges coming from the contemporary society (Rubin, 1979). The traditional university structure, with its "professional bureaucracies" and its disciplinary specialisation, does not make it a very adaptive place. As noted by Lam (2005), the individual professors can be very innovative in their field, but the typical difficulties of coordination between different functions and disciplines make the university, as a whole, not easily adaptable. In terms of third mission models, the common types are the Ivory Tower, the Reticent, and the Tolerant (Section 5)¹¹.

A crucial stimulus may be given by local experiences, when a university, or at least some of its more influential academic components, are involved in helping the city to respond to challenges such as urban sustainability, innovation in health structures and cultural heritage protection, or the smart city/smart land projects recalled in Section 5.

Multi-disciplinarity is needed because "... achieving more sustainable urban development needs inputs from social scientists with interests in such topics as household behaviour, urban governance and economic regulation, as well as engineers focused on technical solutions such as energy use and distribution. Likewise, improving urban public health and the quality of life of an ageing population is not simply a matter for medical scientists. And enhancing the cultural vitality of cities in a digital age increasingly requires a blend of academic skills, which includes computer scientists as well as artists, musicians and creative writers" (Goddard & Vallance, 2013, p.151).

Environmental sustainability, population aging, immigration, the regeneration of entrepreneurial attitudes, possibly inserted within the promotion of smart city/smart land solutions, are important examples of local problems that require a strong degree of multi-disciplinary approaches to be addressed. Groups of researchers specialised in different disciplines need to intervene, along with public and private local actors, under a system-based approach to the third mission. An example is the creation, within or throughout the KTO, of intermediaries (centres or institutes) that carry out multi-disciplinary matching for research, innovation and development projects, and strengthen the interface between the university knowledge production and the local public and business innovation needs.

On the other hand, universities capable to play such multi-disciplinary games "... should not be confined to working with their immediate city but rather use the 'local' as a crucible in which to forge a more open institution able to address multi-scalar

¹¹ See also Clark (1998); Lee (2007); Mosey et al. (2008).

challenges like sustainable development” (Goddard et al., 2012, p. 60). Local applications of higher education and research projects are seen as laboratories for the development of solutions that, when successful, are extended on a larger scale. Eventually the multi-disciplinary challenges in the life of contemporary cities (with related local and regional systems) and their use as a crucible for multi-scale solutions gives a specific and unique identity to the university and its specializations. This is a Civic University¹².

Figure 2 illustrates a way that we propose for depicting the main trade-off at the core of the model of the Civic University, and to which such model may give a balanced solution. The axis “local/global” refers to the territorial scale of the targets/audiences /stakeholders of the university research (and higher education) groups. The axis “multi-disciplinary/disciplinary specialisation” refers to the degree of disciplinary specialisation that is featuring the core of the university research groups together with the possible bridging function of innovation intermediaries (see also Gibbons et al. 1994). The downward sloping line is meant to draw the trade-off between the values of the two variables in terms of potential sustainability of the university projects. The top-level universalistic un-embedded university plays at the extreme of the southeast quarter; teaching colleges and small localist universities play at the extreme of the northwest quarter.

The first ones tend to be Ivory towers or Reticent in third mission activities; but cases of Tolerant or System-based entrepreneurial top global /disciplinary universities may play in highly specialised and remunerative projects at national and international levels, without being much involved in local economic and cultural development. As such they are not Civic Universities nor are the basis of a successful URCD. The localist/multidisciplinary universities are Tolerant to third mission activities or even organize some System-based functions, they help the local context in which embed with a variety of knowledge resources; but their competence basis does not extend so far to support highly innovative and complex solutions at non-local scales. They are not full-fledged Civic Universities, even if they have Civic propensities, and cannot support a successful URCD.

The circle that surrounds the intersection of the two axes identifies a mix between the two variables that is likely to characterise System-based entrepreneurial universities with national and international standing, which are playing as Civic Universities. They may correspond to a successful URCD, or may not. In the next Section, we go a bit deeper on the nature of such combination.

¹² Goddard & Vallance (2013) recall, as examples of Civic Universities strategies, the case of the University of Newcastle, the University of Birmingham, the University College of London in U.K. As a general category of re-emergence of Civic University attitudes in USA, they recall the cases of the Public and Grand Land Universities. Considering the literature, among the top global universities, MIT and Stanford in USA and Cambridge and Oxford in U.K. seem to include also civic university features, while John Hopkins in USA seem to exemplify the case of a globalist/disciplinary oriented university (Anderson 2006; Bercovitz & Feldmann, 2006). In China, Tongji University of Shanghai (see note 10), with its involvement in the urban and business regeneration of the surrounding Yangpu District, seems also a case of a top university with civic features (Cai & Liu, 2014).

8. University, city, and local development: the possibilities of alignment

We try here to illustrate how the logics of the two previous models (in Sections 6 and 7) interrelate. Consider, on one hand, that even if not all the resources of a Civic University have applications to projects supporting the highly innovative solutions needed by local clusters open to global challenges, the multidisciplinary mobilization around local projects of environmental sustainability, social innovation, and cultural enhancement may constitute a propitious field for them (Goddard & Vallance, 2013, chap. 10). Furthermore, the other main requirement of an URCD, i.e. the alignment between the strategic vision of the university leadership and that of other local actors, may be helped precisely by the development of projects peculiar to Civic Universities. On the other hand, the need of up-grading and differentiation imposed by the development of a successful URCD may push the involvement of the university in Civic projects.

Are there mechanisms that favour such paths of alignment?

Let us see and start with the vertical axis of Figure 2, which refers to the degree of multi/disciplinary specialisations. It is possible that at some time a Civic university does not host any (higher education and) research group specialised in the field that more closely corresponds to the technological or organizational core of the local cluster. Nevertheless, being a System-based entrepreneurial university with Civic initiatives, some intermediaries or group of researchers having 'bridging' skills are operative (Sections 5 and 7) and may favour the matching with the local industry. In particular, the bridging academic skills can be used to develop successful variations of the core technology of the local business clusters, also related to the development of the local projects. On the other hand, consider a university in a successful URCD, being prominent in the core research and higher education specializations needed by the local business cluster. The global success of the cluster require adapting the organizational and productive core of the same cluster, with an increasing introduction of cultural, professional and social competencies in art and humanities, social sciences, psychology, health, urban planning, etc. (Gibbons et al., 1994). More in general, the local infrastructure of public goods supporting the business cluster, and especially its SMEs populations, need to be improved in specific ways (Bellandi & Caloffi, 2016). All this pushes both a multi-disciplinary mobilization and the involvement of university and business actors in projects of urban and cultural development.

Consider now the balance between local and global orientation, on the horizontal axis of Figure 2. This in a way is characteristic also of a successful URCD, meaning that the core of local projects of business development has the possibility to reach national and international applications. Therefore, the university leadership willing to support the civic engagement of the university has the possibility to communicate to a wide local audience that it can create value for the city. Meanwhile, the preservation of disciplinary specialisation within multi-disciplinary contributions, orchestrated by multi-disciplinary intermediaries, allows to progress also in terms of codified science and scientific publications. To the extent that local/global combinations generate value for the local area, the leadership of local institutions may find an enduring consensus within the city and the business and social actors to support the university with

resources controlled at the local level. On the other side, in a Civic university both the possibility to cultivate science results and the prospects of returns contributing to expensive research facilities allow the university leadership to pull high rank academic groups within the circle of strategic actions. They can be aimed not only at civic engagement, but also at the needs of development of local business clusters, more easily so of course if there is already a potential alignment between the scientific specializations of such research groups and the technological fields of the local clusters.

Obviously, the cognitive fragmentation and the presence of different and sometimes conflicting interests in the academia, in the local institutions, and in social and business networks, as well as the presence of organisational inertia, can hinder the emergence of appropriate leaderships and their pro-active strategies.

A particular but non-infrequent problem of fragmentation concern metropolitan areas (and regions) including more than one university with national/international standing and with willingness to play in territorial projects of innovation and development. Of course, this is the case of every global city but also of many post-industrial regions. Solutions of various type can be envisaged, even if none is easy given the traditions of independency of the universities in many countries. However, there are experiences by which some collaboration between the universities of the same area is reached, in terms of sectoral/territorial specialization on large investments in research and didactic structures, and/or in terms of construction of joint platforms also in third mission fields¹³.

When windows of opportunity open up (see also Section 2), the trade-offs between multi-disciplinary applications and disciplinary specialization, as well as between local and global levels, can be leveraged by local policy and academic leaderships in order to promote university engagement in local development processes.

9. Some reflections on the Italian case

We would like to conclude this paper proposing a general view on the possible importance that models of System-based entrepreneurial university would play in a specific national context, which is contemporary Italy¹⁴.

Since 2008, Italian manufacture has experienced a process of decline, and many have called for a strategy to promote a manufacturing recovery¹⁵. The university can give an important contribution to the implementation of such strategy, providing new knowledge to be included in manufacturing processes and their change, as well as in other stages of related value chains. Universities can also play a wider proactive role in the design and implementation of projects on material and immaterial innovation

¹³ In Trueman et al. (2014), examples of fruitful collaborations between system-based entrepreneurial universities in large metropolitan areas or industrial regions concern Chalmers University of Technology and Gothenburg University in the Gothenburg metropolitan area (SWE); Hamburg University of Technology, Hamburg University, and Hamburg University of Applied Sciences in the Hamburg metropolitan areas (GER); Polytechnic University of Turin and Turin University in the metropolitan area of Turin (ITA).

¹⁴ In what follows, we take advantage of materials published in Italian in Caloffi et al. (2014) and Bellandi (2017).

¹⁵ On a rich set of contributions on the strategies for the Italian recovery see Cappellin et al. (2017), in particular the English synopsis.

infrastructures for a variety of local systems. This would demand the adoption of System-based entrepreneurial approaches to the third mission of the universities. Italian universities have important traditions and successes, both in research and in education. However, many difficulties are still present with third mission.

Firstly, as for the industry side, the number of large enterprises in Italy has decreased in the last decades, and the latter have gradually reduced their investment in R&D (Sterlacchini, 2014). However, urban clusters and clusters specialised in mechanics, electronics, biomedical and creative industries, whose number is increasing, are characterised by a strong presence of medium-sized firms, which often collaborate with universities (Coltorti & Venanzi 2014). The situation is different in clusters specialised in typical made in Italy sectors (like those realizing products for the person and the home, and food), as well as in rural and tourist clusters, or in urban clusters characterized by a high density of craftsmanship, tourism and social services, where such type of collaborations is more difficult. Here innovation is based traditionally on learning by doing, using and interacting between producers, often with weak interaction between them and university education and research¹⁶. A recent survey show nonetheless that a growing number of small firms develop innovations through external collaborations, also with universities (Brancati, 2016). URCD and Civic University strategies could be built starting from such premises.

Secondly, the lack of a history of System-based approaches to third mission in Italian universities negatively affects the current attempts to strengthen the contribution of university to place-based industrial recovery¹⁷. Institutional learning, within universities, among them, and with local/regional government and business clusters, would help translating objectives and strategies into effective contributions to the recovery of Italian industry. However, such learning and its beneficial support depend also on the contradictory effects of strong local (sub-regional) traditions on regional coordination, of the low persistency in policies, and of emulation among localities and universities. An important push to the development of URCD logics, as we have seen in section 6, is lent by university spin-offs. In Italy, their number has started to increase rapidly since the early 2000s. Given the innovative and linking nature of spin-offs, they are a target of regional and national innovation policies. Italian regional policies have developed in different ways in the last decades, with regions that are more active on this field while others are less (Caloffi et al. 2014). The national government has implemented some specific initiatives supporting spin-offs. They have a small size per se. However, they are included in a field of policies that have had recently a quite strong impulse¹⁸. Other initiatives, trying to strengthen networks of firms, universities, various public and private research organisations, including those operating in innovation support, are regional and national platforms for innovation in specific sectoral and technological fields, like the regional technological districts and the national technological clusters (Bellandi & Caloffi, 2016). Even if all these policies

¹⁶ See Jensen et al. (2007), and more in general Becattini et al. (2009).

¹⁷ See ANVUR, *Report on the state of the university and research system*, Rome, 2013 and CRUI Foundation, *Observatory University-Business Report 2015*, Rome, 2015.

¹⁸ For innovative start-ups: DL 179/2012, art. 25; for innovative SMEs: DL 3/2015, art. 4. See startup.registroimprese.it and www.smartstart.invitalia.it. Other initiatives concern the tax credits for R&D (including external research and relationships with innovative start-ups), the patent box, the enterprise networks for digital craftsmanship (Bellandi, 2017).

are not specifically designed to strengthen the relations between universities and local ecosystems, they can create the conditions for their development.

A third important set of contradictory effects concerns the recent reduction of State funding to public academies and research in Italy (as in other countries: Christopherson et al. 2014). Such reduction pushes Italian universities towards a stronger orientation to the third mission, in search of new economic sources, and to a quite rapid overcoming of cultural barriers to the creation of relations with local and regional business, institutional and civic actors. However, it makes difficult to invest in the expansion of third mission's tools and attitudes, as reduction has been too strong, too fast, and not yet compensated by a real autonomy of universities from a burden of state constraints on administration (Gherardini, 2015; Viesti, 2016). The reduction of the Italian State ordinary funding of universities also tends to damage the long lasting inner source of the third mission, which are the results of the first two missions: the social progress of science and culture, and the higher education of a mass of brilliant young people to critical competencies for our age's complex societies.

10. Final remarks

We have seen, in this paper, that the interplay between barriers and drivers to third mission engagement of universities in innovation and developmental projects may be traced along three levels/types of interaction. The first one is the introduction of scientific-technological-organizational inputs within the productive organization of SMEs, and the implementation of knowledge transfer and co-development activities with large firms and their business networks. The second is the contribution to projects of territorial development for socio-economic eco-systems. The last is the inclusion within systemic frames of local, regional and national policies of industrial and territorial development. Furthermore, the integration of two models of system-based entrepreneurial university, i.e. the University Research Centric District (URCD) and the Civic University, gives clues for understanding how apposite strategies of academic, policy, social and business actors may target barriers and drivers to engagement, in order to increase the possibilities of success.

Despite the fact that System-based approaches to the third mission have an increasing diffusion around the world, we can suppose that Civic Universities and URCDs are distributed not homogeneously between regional and national contexts. This has consequences on competitive advantages. For example, in Italy, struggling to recover from the deep and long crisis started in 2008, such approaches probably are not so numerous nor strong, and thus many of the strategies and tools described in Sections 5 to 8 are only imperfectly available. This would mean that many of the Italian SMEs that want to innovate, go global, and perform external research will continue to do so, with some help from the universities. On average, they will have to bear higher costs of access and transaction than foreign competitors based in cities where such models of university engagement have a stronger tradition, like in USA and UK, and large part of North Europe.

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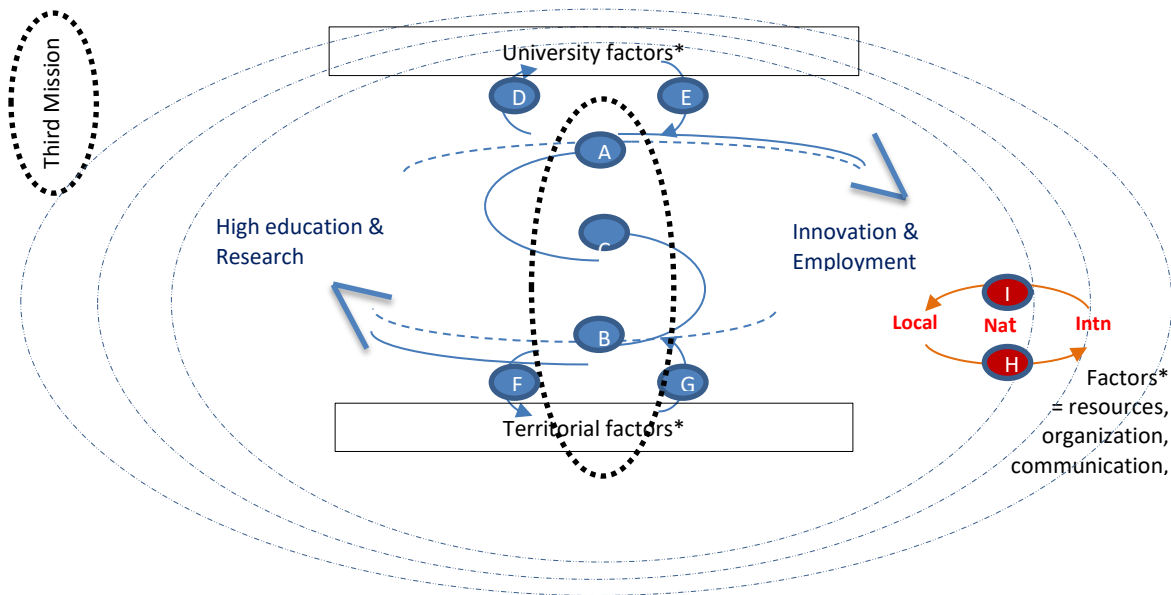
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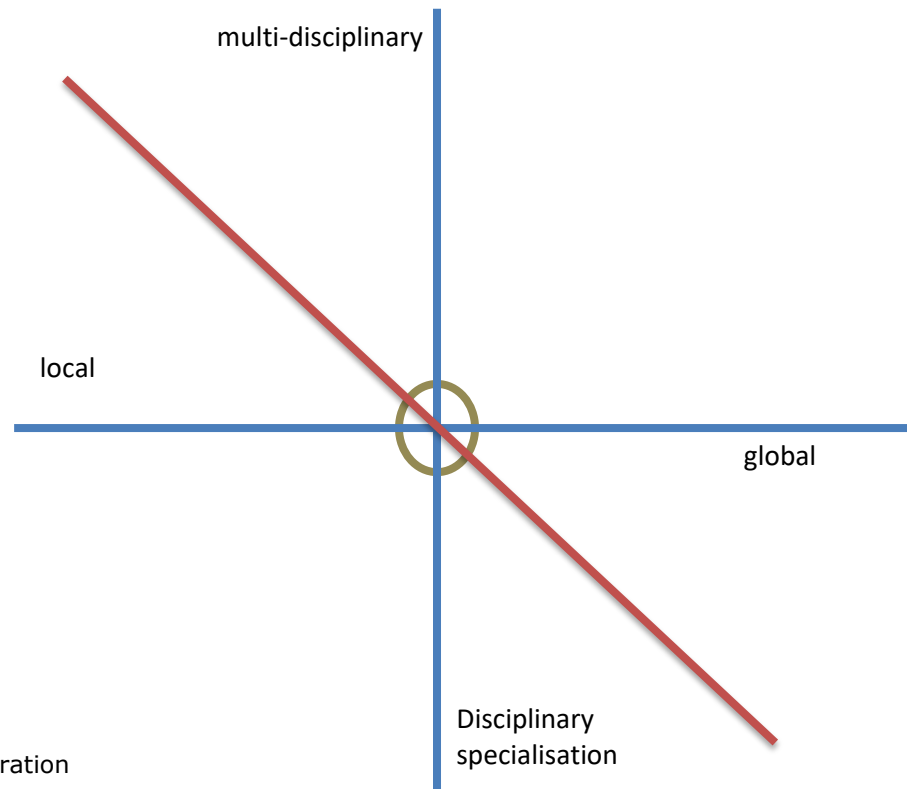
Appendix

Figure 1. The relationship between the university missions, and territorial and institutional (university) factors



Source: CsaVRI –Centre of services for enhancement of research and management of the Incubator at the University of Florence - ITA (2014). Notes to the figure: see the text.

Figure 2. Main variables of the Civic University



Source: Authors' elaboration
Notes to figure: see the text.