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University Knowledge Transfer Offices and Social Responsibility

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Abstract: Numerous studies and reviews about University Knowledge Transfer Offices (UKTO) have been written, but there are few that focus on Social Responsibility (SR). We present a systematic review of the research on both fields. We consider not only logics from agency theory and resource-based view, but also the dynamic approach from institutional theory, as they aim to generate sustainable economic and social value. The evolution of Knowledge Transfer Offices depends on their role as brokers of collaborations among different stakeholders, according to their mission and capacity to confront the innovation gap. We follow the line of SR viewed as a response to the specific demands of large stakeholders. Building upon recent conceptualizations of different theories, we develop an integrative model for understanding the institutional effects of the UKTO on university social responsibility.

Keywords: knowledge transfer office; social responsibility; institutional approach; brokers; stakeholders; university–industry relations

1. Introduction

This paper aims at reviewing Knowledge Transfer literature as well as Social Responsibility (SR) in Higher Education in order to understand the responsibility of all stakeholders involved in the interaction process from a dynamic point of view. Our objective is to review critically the literature around University Knowledge Transfer Offices (UKTOs) and SR according to institutional theory for further understanding on partners' collaboration in social responsibility of UKTOs in a dynamic approach. The "institutional approach" underlines that the most important role of a Technology Office (TO) is to build legitimacy for new technology [1].

As an institutional phenomenon, CSR (Corporate Social Responsibility or SR) is increasingly prevalent and visible within organizations as a mechanism to energize and motivate stakeholders, as well as manage societal perceptions and expectations on the role and utility of business in societies and communities beyond the core function of producing and selling goods to a defined consumer market [2]. The general contribution of university knowledge to industrial innovation has long been acknowledged [3,4], and has more recently been the target of systematic efforts to develop University–Industry Knowledge Transfer processes among different stakeholders [5–7].

UKTOs have been well-known since the 1970s, and formerly referred to as UTTOs (University Technology Transfer Offices). Nowadays, we can find different names for the UKTO,

such as University Innovation Office. The UKTO activity involves serving the research community, managing intellectual property and establishing connections with commercialization partners. Nowadays, the European Union prefers the name “UKTO” instead of “UTTO” in order to implement a Code of Practice, launched in 2008, when delineating different specific transfer practices considering tacit and explicit knowledge that flows among all research institutions of the member states. The Code of Practice concerns the management of intellectual property (IP) in knowledge transfer activities. The objective of the European Knowledge Transfer Policy Surveys in 2010 and 2012 was monitoring the status of implementation of the European Commission’s “Recommendation on the management of intellectual property in Knowledge transfer activities and Code of Practices for universities and other public research organizations”. A comparison of European performance with USA outcomes shows that USA has been the most efficient producer of invention disclosures, patent applications and license incomes [8].

Stakeholder collaboration is an important, but sometimes forgotten, element of the process of SR [9]. The three fundamental research lines for SR in academic literature [10], while not mutually exclusive, can be characterized as stakeholder driven, performance driven or motivation driven. These three approaches have made significant contributions to SR research, but the overemphasis on the content of its activities and reports has been criticized as leading to neglect the institutional factors that might shape or trigger such activities [10,11]. Moreover, as SR can be contextualized depending on the stakeholders involved and their requirements, how these groups collaborate with the mission of every UKTO should be better understood. Although SR has become a pervasive topic in the business literature, only a small number of scientific studies currently address the topic of SR in Higher Education [12]. It has been difficult to measure how successfully universities engage in such transfer activities, mainly because there is no agreement upon a set of measurement tools. Unico, the UK’s leading Technology Transfer association, took a first step towards a solution in 2011. To find measurement tools, the stakeholders involved in the process of knowledge transfer need to find and agree on a common way to define, quantify and qualify the performance of knowledge transfer activities [13]. Their results show that universities should focus on directly measuring the knowledge transfer activities that they undertake: networks, continuing professional development, consultancy, collaborative research, contract research, licensing, spin-offs, teaching and other measures, including publications and physical migration of students to industry.

The UKTO coordinates connections with the different leaders and stakeholders that participate in the technology transfer community. Innovations are, to an increasing extent, seen as the result of an interactive process of knowledge creation, diffusion and application. According to innovation system models, businesses, the science sector, and policy actors are involved in this process. A number of studies of intermediaries have been undertaken, in particular the Triple-Helix model. These are at an international, national or regional level, and positioned from a macro perspective. Collaboration between industry and universities faces significant challenges, so some studies seek to unpack the nature of the obstacle of collaborations, exploring the influence of different mechanisms in lowering barriers related to the orientation of universities [14–16]. Other studies have provided a good understanding of the different channels available for knowledge interaction among the stakeholders [1] but there is a lack of studies that exploring the micro level.

Many papers have studied transfer offices. From an empirical perspective, there is a central focus on identifying the critical factor that enable or impede knowledge transfer, whereas. From a more conceptual perspective, these studies are predominantly focused around the paradigm of “incomplete information”. Within “agency theory”, a UKTO can be seen as an “agent” that mediates relationships between politicians and scientists [1]. With such a large body of diverse research in this area, a number of papers try to synthesize the research. Markman, et al. [17] suggest organizing the multiplicity of “channels of transfer” by elaborating a taxonomy around the main modes of commercialization. Currently, there are no studies that explore the inter-organizational collaboration among different agents (i.e., intermediaries or stakeholders) that are involved in knowledge transfer.

Inter-organizational collaboration is necessary to build a network of academic entrepreneurs, investors, small and large business, and other institutions, within which the university can partner to advance its intellectual property portfolio toward prototypes, development, and sale of commercial products.

The study of inter-organizational collaborations in knowledge transfer communities is becoming a fertile area of inquiry. Leislichng et al. [18] conceptualizes inter-organizational interaction quality as a crucial relation-specific asset representing an integral factor in generating regional rents in technology transfer. Lawrence et al. [19] argue that collaboration can act as a source of change in institutional fields through the generation of new practices. An important issue in understanding collaboration as a source of change in institutional fields relies on examining the relationships between the characteristics of the collaboration and the emergence of new practices. The analysis reveals the very important function of brokerage, which all stakeholders and leaders use in making possible collaborations for facilitating knowledge and learning in their community. Institutional scholars have long acknowledged that the institutional setting can influence the organizational options available to decision makers [20]. The ideas of bridging and brokerage have a long tradition in social network analysis [21–23]. Burt [22,23] developed the notion that being in a position of control over bridging ties can empower actors and promote activities. Brokerage is a process by which an actor facilitates transactions between other actors [22,23].

Here, the main question is how to accomplish the social responsibility of UKTOs when collaboration acts as a source of change. The study of the impact of knowledge transfer activities on university's performance is scarce [9]. Thus, a better understanding of the process that explain knowledge transfer activities remains a key issue for academics and policy makers [1,3]. The crucial question relies in the analysis of the role brokerage plays in making possible collaboration and learning in the community. This paper approaches this issue in a different way than that of the traditional literature: a "dynamic approach" is needed to study the interaction processes among stakeholders, as the traditional explanation of factors (barriers and drivers) around technology gap between transferors and transferees is insufficient [24]. Essentially, because innovation is an extraordinarily complex process within the interaction process of different agents that are influenced at various national, industrial and firm levels. The dynamic approach shares the perspective with the dynamic capability concept [1] and global value chains in innovation and technology transfer [24,25]. In parallel, the literature of SR in Higher Education hardly mentions the importance of stakeholder engagement and collaboration within the SR process [9], even though this is considered one of the key qualities of corporate SR [12].

The paper is organized as follows. We begin by outlining the main role of University Knowledge Transfer Offices (UKTOs). Section 2 contributes to understanding the mission and core competences of UKTOs in the innovation process. Later, we analyze the institutional collaborations in these communities following Lawrence [19]. Based on our review of the literature, we analyze the institutional effects of these collaborations. We suggest introducing these effects in the University Social Responsibility (SR) report of UKTOs. Together, this review provokes discussion and provides fuel for further studies of inter-organizational responsibility and learning in university innovation communities.

2. Theory and Practice of Knowledge Transfer Office

In the late 1970s, USA research universities were often criticized for being more adept at developing new technologies than facilitating their commercialization into the private sector. Furthermore, it was asserted that the long lag between the discovery and commercialization of new knowledge at the university had weakened the global competitiveness of American firms [26]. As a consequence, in 1980, the USA Congress attempted to remove potential obstacles to university technology transfer by passing the Bayh-Dole Act. The framers of this legislation asserted that university ownership and management of intellectual property would accelerate the commercialization of new technologies and promote economic development and entrepreneurial activity. In the aftermath

of this legislation, almost all research universities in the U.S. established technology transfer offices (TTOs) to manage and protect their intellectual property.

2.1. Mission of University Knowledge Transfer office (UKTO)

The university–industry–government interdependence model, which promotes a triple-helix of networks of relationships, is now a classical view. Knowledge transfer organizations have evolved, according to this evolutionary interdependence, to intermediate their institution’s relationships and projects. The recent focus on open innovation [27] and various extensions of the triple-helix to higher dimensions, quadruple, quintuple and N-tuple helices, extend the partner reach and complexity of intermediation further [1]. Now, the triple-helix (industry–university–government) include new dimensions: media and environmental challenges.

Whilst commercialization clearly represents an important way for academic research to contribute to economy and society, there are multiple other ways in which university research is transferred [15]. According to the position of the university–industry relationship within the wider spectrum of science–industry, the key university technology transfer commercialization mechanisms are [6]:

- Commercialization of licensing agreements;
- Collaborative research partnership, research services, and consultancy; and
- University-based start-ups or academic entrepreneurship.

There is a large body of diverse research in this area. Authors such as Markman et al. [17] suggest organizing the multiplicity of “channels of transfer” by elaborating a taxonomy around the key modes of commercialization. Siegel et al. [13,28] focus on the more practical necessity of defining a coherent and feasible technology transfer strategy, and suggest that this is a mechanism to enable the assessment of UKTO performance. Alexander et al. [1] consider the resource-based theory of the firm, and more precisely the core competence approach to develop a conceptual framework that facilitates a coherent strategy and provides an ability to identify key indicators to assess UKTO activities.

These activities can potentially result in economic profit for the university, apart from other benefits to their partners (e.g., additional sponsored research, hiring of graduate students and post-doctoral fellows), and job creation in the local region. Knowledge Transfer (KT) includes elements of Knowledge Management such as discovery, articulation, acquisition, communication, internalization, application and absorption of knowledge, among others. It appears that such issues studied in the context of the business and management literature on inter- and intra-firm KT, should be considered in the context of university–industry relations [29].

In the interface between universities and firms, Alexander et al. [1] highlight four core competences, each corresponding to four key outcomes of engagement:

- (1) Set up and Managing Research Project: This relates to the identification of the type of research projects, the collation of costs (and therefore establishing a price), the control of the key phases of negotiation, the authorization of, and follow-up on, progress of each contract.
- (2) Patent and Entrepreneurship: It is the ability for a UKTO to enable the transfer of intellectual property (IP) from public research teams to private firms and to facilitate entrepreneurial activity. This relates to the usual activities surrounding the protection of IP, the process of patenting, the establishment of technology offers, and licensing.
- (3) Knowledge Sharing and Support Services to Enterprises: This competence is the ability to promote and develop knowledge-based support services for enterprise, and share best-practices between public and private research partners. For instance, the “sharing of facilities” can help a firm to build prototypes or access equipment. To compliment this, training or the provision of continuing professional development for companies can be developed by UKTOs.
- (4) Boundary Spanning through human resources: The fourth competence relates to the capability of establishing knowledge-based boundary-spanning activities through the effective mobilization of

people (human resources). This relates to an ability to create knowledge through externalization and socialization, as promoted by Nonaka [30]. A key concept in this is the “network as knowledge” [31]. This could be realized by the organization of joint conferences, for example.

The process by which a technical idea of possible commercial value is converted into one or more commercially successful products is highly complex, poorly documented, and seldom studied. Aueswarld and Branscomb [32] studied that the information asymmetries of information and motivation between intermediaries, as well as institutional “gaps” may systematically discourage private investment into early stage technology development. Understanding the invention to innovation transition is essential to more efficiently convert research into products. This is the main mission of UKTOs. Within “Agency Theory”, a UKTO can be understood as an “agent” that mediates in the relationships among different partners [1].

The invention to innovation transition presents the following stages [32]:

- (1) Research projects lead to an invention.
- (2) Invention of a technical concept that is protected, perhaps by a patent. Both research projects and invention of a technical concept, may be publicly funded. The technical entrepreneurs who created the concept in phase two, may have little business experience, but they have a high commitment to their technical vision. Troy and Werle [33] explain the patent markets and suggest that the emergence of a well-functioning market for patented new technological knowledge is confronted with several obstacles, which can be characterized as different facets of uncertainty. They are included in the process of creation of innovative knowledge, in its transformation into a fictitious knowledge commodity (patent), in its uniqueness, in the strategy of transaction partners, in the estimation of the future market potential of final products (based on the patents), and generally in the problem of incomplete and asymmetric information. In addition, a commonly accepted model of determining a patent’s value is missing.
- (3) Early Stage Technology Development of Innovation (ESTDI). This is the most critical phase in the transition from invention to innovation, the technology is reduced to industrial practice, a production process is defined from which costs can be estimated, and a market appropriate to the demonstrated performance specifications is identified and quantified. Not only business angels and technology labs help with the funding in this phase, but also the “3Fs”: fools, friends and family. This space can be understood as a sea of life and death of business and technical ideas, of “big fish” and “little fish” contending, with survival going to the creative, the agile, the persistent. Thus, Aueswarld and Branscomb [32] propose an alternative image than the “Valley of Death” used by congressmen in USA: the “Darwinian Sea”.
- (4) Product Development (PD). A pilot line is produced and the enterprise is ready to enter the market. At this point, an innovation is achieved. Business Angels and Venture Capitalists introduce financial funds in this phase.
- (5) Production and Marketing. The product goes to the market, and the business is viable. The venture capital industry, always looking for opportunities to invest where the returns may be high enough to justify the business risks, are unlikely to take the opportunity seriously until Phase 5. In some cases, they will invest, in an exploratory way, during Phases 3 and 4.
- (6) Setting up global activities while still being in the start-phase remains a very complex task. After all, global start-ups do not only have to deal with the usual problems associated with the launching of a new venture, such as accumulating resources, building reputation, finding partners and attracting customers. The main current needs of global academic start-ups and the support offered by universities to fulfill them are related to the lack of commitment towards internationalization, lack of managerial international skills and lack of resources for the internationalization [34]. In this sense, universities can play an important role helping academic entrepreneurs to overcome these needs, as well as creating an international entrepreneurial culture for the development of potential global start-ups in the academic environment.

In Table 1, we propose a model to identify key stakeholders that collaborates with UKTO according to the innovation stage involved. Wright et al. [35] suggest that it is appropriate to pay more attention to entrepreneurship in technology transfer. While some studies about UKTO have expressed crucial insights on technology commercialization, to the best of our knowledge [12,13,28,36], the extant research has yet to address the institutional collaboration of UKTOs with different stakeholders in promoting new patterns of continuous learning in the technology and knowledge transfer community.

Table 1. Stakeholders around KTO according to different innovation steps.

Innovation Steps	Stakeholders Apart from Academic Researchers	UKTO Competences
Research Projects	-Transfer Office staff -University managers -National and International Government Agencies -Other Universities and Research Centers -Firms	1. Set up and managing Research Project
Invention and Patents	Intermediaries in Patent Offices	2. Patent and Entrepreneurship
Early Stage Development of Innovation: Innovation gap: Capital and Entrepreneurial gap	-Intermediaries in the Patent Market: suppliers and sellers of technology -Business Angels and seed capital -Dealmakers: accountants, executives	3. Knowledge Sharing (publications) and Support Services to Enterprises 4. Boundary-Spanning through Human Resource: Student Placements, Networks, Secondment Joint Conferences.
Product Development	-Large and small firms (suppliers and partners of complementary assets) -Venture Capital -Other investment funds	
Product and Marketing	-Venture Capital -Other investment funds -Large and small firms (suppliers and partners of complementary assets) -Intermediaries specialized in global business	

The multiple challenges that confront technology entrepreneurs seeking to sail the “innovation gap” that may exist even in the countries with relatively strong and productive innovation system. The existence of this sort of “innovation gap” is controversial. The “capital gap” side can be overcome with the development of venture capital industry. However, still there is space for “entrepreneurial gap”, i.e., coordination of multiple resources that scientists and technologists face when becoming a business manager. The coordination of enabling infrastructure and “complementary assets” that may require market acceptance—suppliers of new kinds of components and machines, new forms of distribution and service, training in use of new technology, ancillary products and software, and broadened market scope. Bridging and overcoming the possible barriers that can provoke innovation gap (entrepreneurial, technical and financial gaps), is the main responsibility of UKTOs. Stakeholders’ collaboration around the main competences of UKTO office allow innovation in quadruple helix ecosystem [1,37].

2.2. UKTO and Inter-Organizational Collaborations among Stakeholders. An Institutional Perspective

A range of different definitions of collaborations exists in the literature. Lawrence et al. [19] define collaboration as a cooperative, inter-organizational relationship that is negotiated in an ongoing communicative process and that relies on neither market nor hierarchical mechanisms of control [19,38,39]. This definition of collaboration is inclusive enough to encompass a wide range of collaborative arrangements and networks and yet provides a set of critical characteristics that distinguish collaboration from other forms of inter-organizational activity. Most importantly, their definition distinguishes collaboration from those inter-organizational relationships that are cooperative, but in which cooperation is either purchased (as in supplier relationship) or based on some form of legitimate authority (as in a relationship between a state regulatory agency and a firm operating

within its jurisdiction). This distinction is critical because collaboration tends to affect change in institutional fields in a different way than markets and hierarchies [39].

An institutional field develops, through the processes of structuration, whereby patterns of social action produce and reproduce the institutions and relationships that constitute the field [35]. Through repeated interactions, groups of organizations develop common understandings and practices that form the institutions that define the field and, at the same time, these institutions shape the ongoing patterns of interaction from which they are produced.

An important issue in understanding collaboration as a source of change in institutional fields lies in examining the relationships between the characteristics of the collaboration and the emergence of proto-institutions. In order to examine the characteristics of collaboration, DiMaggio and Powells [40] develop three dimensions:

- (1) Interactions: The pattern of interactions among collaborating organizations.
- (2) Structures and holes: The structure of coalition formed by collaborating partners and brokers that span boundaries.
- (3) Information flow: The pattern of information sharing among collaborating partners through procedures and routines.

Having coded these three dimensions, Lawrence et al. [19] looked for ways to condense this conceptualization into a smaller number of simpler, broader dimensions, in order to classify the collaborations. They identify two aggregate dimensions: involvement and embeddedness.

Collaborations can involve high or low levels of involvement among the collaborating partners. This dimension focuses on the internal dynamics of the collaboration—the ways the participating organizations relate to each other. UKTOs leaders play a pivotal role in the technology transfer ecosystem. Understanding the involvement and embeddedness of every participant allows the UKTO leader to establish and implement strategic models of Knowledge Transfer.

Specific characteristics of UKTOs might impede knowledge sharing efficiently in the collaborations. Some tacit knowledge cannot be expressed or shared at all. As a result, two parties may possess different views on their environment and may not be able to explain the view fully to others. As a consequence of those different views, they might disagree on modes of cooperation. Knowledge sharing requires trust [41]. Therefore, networks coordination, e.g., teamwork, networking, liaison, need to be based on trust to be effective in knowledge sharing. This suggests that more theorizing is needed, regarding the extent to which human actors can affect (or not) the flow of action in practice given that knowledge, practice, people and material are intertwined [42,43].

Burt [22] demonstrates that brokers, individuals who connect otherwise disconnected actors, can exploit structural holes to advance more quickly in their own interests. An individual who works with others who do not otherwise interact can control information and shape collegial and managerial perceptions. Predating Burt's structural hole theory, Fleming and Waguespack [21] illustrate a widespread correlation among ability, ties across multiple organizations, and leadership. They describe how boundary spanners usually contribute the best engineering: identify, translate, and relay information within and across engineering firms, and often assume managerial authority. Burt [23] defines a broker as the only social connection or bridge among a group of actors and argues that brokering enhances both career mobility and promotion. The focal actor who brokers among colleagues thus occupies and exploits a structural hole.

The definition of brokers is shifted from a functional role towards that of mediating information and purposefully making connections. The number of brokers in the local economy may be more important than the local number of individuals involved in the network.

The concept of brokerage has been used by scholars to examine the dynamics of regional entrepreneurship economies. Brokers function as intermediaries between typical entrepreneurs and investors in a social capital network, and their mediation facilitates the birth of new firms that support the growth of entrepreneurial economies. Feldman and Zoller [44] extend the concept

of brokerage to consider intentional acts to connect disparate actors in a social capital network. Thus, dealmakers organize locally embedded social capital to form the backbone of the regional entrepreneurial economy to form the backbone of the regional embedded social capital to form the backbone of the regional economy, and thereby motivate new firm formation. Kenney and Patton [45] examine the entrepreneurial professional services that support the creation of new firms and find that professional networks are global rather than local. This is not surprising when considering that accountants and attorneys serve an important role in new firm formation, however, their skills may be highly specialized and they may have more allegiance to their profession or guild than to their local economy. There is no reason to expect professionals to be particularly loyal to one region exclusively. Their presence may be a reflection of the success of the region rather than a sufficient underlying condition for the formation of a regional economy.

Brokers can span boundaries, but not all boundary spanners broker. Individuals who broker collaborations are more likely to assume leadership. Consistent with the argument that they must overcome lack of trust, brokers also encounter difficulties when they attempt to span technological boundaries within the community. Boundary spanners, in contrast, do not suffer from a lack of trust and are more likely than brokers to assume leadership positions. In summary, future leaders are most likely to be individuals that make a strong technical contribution from a structural position that can bind the community together.

The social capital of brokerage depends on trust—since value created by brokers by definition involves new, and so incompletely understood, combinations of previously disconnected ideas—but trust is often argued to require network closure, precisely the condition that brokers rise above [23]. UKTO leaders, manages and creates a network of investors and start-ups in science parks and/or incubators spaces. Resource allocation relies and trusts on social ties and signaling quality [26]. UKTOs leadership can facilitate the understanding between both parts when helping in translating narratives and entrepreneurial stories.

Technology and Knowledge transfer communities provide an opportunity to develop theories of human and social capital in a novel context. Close collaboration may help to overcome barriers between firms and universities [14,46]. Originally developed by Lave and Wenger [47], the Community of Practices approach has been used to facilitate knowledge transfer communities in a wide variety of inter and intra-organizational environments [48]. The value of the Community of Practice approach lies in its focus on the interactions among community members. Brown and Duguid [49] refer to practice as the way work and collaboration is done, and a growing emphasis has been places on practice as a locus of learning and knowledge transfer in the interactions.

3. Institutional Effects and Social Responsibility

Pattit et al. [20], drawing on institutional theory, examine how institutions have influenced technology development trends in the USA since two centuries ago. They integrate insights from both the economics and sociology branches to institutional theory, and show that both formal and informal institutional rules and constraints played a role in the initial rise of markets for technology, their decline during the early of last century and their eventual return at the end of last century. SR itself has become a strongly institutionalized feature of the contemporary corporate landscape in advanced industrial economies. The idea that organizations should engage in some form of responsible behavior has become a legitimate expectation [50].

As a set of management practices, SR has spread globally, far beyond its origins in the USA and UK. Given the different political institutions and historical legacies involved, SR has come to take on very different meanings across different institutional settings. The liberal concept of SR as something voluntary and subordinate to shareholder interests reflects the institutional makeup of the USA and UK. However, its concept exhibits a stronger tension with institutions characterized by mandatory forms of institutionalized social solidarity. The way that SR, as an Anglo-American construct, has spread to, and become embedded within different societies can be seen as a source of institutional innovation and

a phenomenon that continues to generate variety. Witt and Redding [51] provide an analysis of how senior executive managers in five countries conceive of SR. Significantly, their analysis confirms that there are variants of each form. In particular, their analysis indicates significant variety among different kinds of “implicit” SR, distinguishing between stakeholder-oriented notions of SR (e.g., Japan and South Korea) and production-oriented (e.g., Germany). This variety highlights variation in the salience of different stakeholders in every country. The ensuing constellation of actors, issues, and institutions constitute a complex adaptive system [52] that evolves over time in a particular geographic region.

We are particularly interested in collaborative institutions, which emphasize inclusive participation of multiple stakeholders in the core competences of UKTO. Drawing on institutional theory and work on organizational structuration, Lawrence et al. [19] suggest that collaboration can play a role in the production of new institutions by facilitating their creation and making them available inter-organizationally. They refer to practices and rules that are narrowly diffused and only weakly entrenched, but that have the potential to become widely institutionalized, as “proto-institutions”; that is, “new and innovative future practices. Only after a proto-institution appears through collaboration in the field, can it be adopted by other organizations and become institutionalized. This process depends on the specific characteristics of a collaboration—that the extent to which structuration is facilitated through the development of proto-institutions will vary significantly across collaborations.

High involvement and high embeddedness in network collaborations is associated with the development of institution creation through new practices. High involvement facilitates the inter-organizational learning necessary for the invention of new practices, technologies and rules beyond the boundaries of the collaborative relationship.

The deep, operational ties, two-way information flows, and partnering that characterize high-involvement collaborations foster the development of new practices [53]. Once the new practice or rule is developed within the collaboration, its diffusion depends on the way in which the collaboration is connected to third parties and involves flows of information out from the primary collaborating partners to others in the field.

The chaotic character of the “innovation gap” provides a wide range of alternative ways to address issues of technical, financial and institutional risk, to identify markets that do not yet exist, and to match up people and money from disparate sources. UKTOs, in collaboration with all the stakeholders involved, define a model and strategy of technology transfer considering risk level associated to the university inventors and spin-out community together with the growth rate of university income and job creation in the region. UKTOs brokerage promotes new rules, and incentives to facilitate the conversion of knowledge into socio-economic benefits. Thanks to the continued and intensified cooperation, universities, research institutes, companies and other stakeholders, have developed a better mutual understanding of needs, constraints, regulations and requirements.

In response to market inefficiencies (capital gap and patent gap), many institutional arrangements have been developed for funding early stage technology. Champions of early stage technology projects make use of a wide variety of funding options to keep their projects alive. These include not only successive rounds of equity offerings, but also contract work, income from licensing partners, the sale of spin-off firms, old-fashioned cost-cutting, angel networks, fund and investments, university and corporate equity investments, seed investments and certain experiential programs by Administration Agencies. Besides, substantial, unappreciated, informal, funding channels can be much larger than formal capital investment; it shows the relevance of funding gap filling mechanisms. The proliferation of new institutional practices is as much an indication of the particular informational challenges and structural disjunctions that define the “innovation gap” as it is one of a resolution to the challenge.

New practices around licensing and creation start-ups, require to explore new incentives that overcome innovation gap. Lilischkis [54] also supports that the development of non-monetary knowledge transfer incentives as well as formal UKTO collaboration, could also be beneficial. The most fundamental, yet under-appreciated, characteristic of Knowledge Transfer is that in reality involves

not only transmission or “transfer”, of “deliverables”, but also knowledge transformation [54]. In the context of industrial innovation, new knowledge is very often a creative combination of already existing knowledge. However, the ability of firms to engage in such knowledge transformation is limited by their absorptive capacity [55], which by itself is sufficient to question the utility of simple transfer of codified knowledge from universities to firm (via IP protection and licensing). “Knowledge transformation” may take many forms, and this is the reason why it is a concept closely related to the “relational intensity” and the “complexity” of knowledge involved.

According to Ponomariov and Boardman [29], University–industry knowledge transfer (UI-KT) channels can be described by their key characteristics:

- (1) An important dimension is the “level of knowledge transformation” that takes place in the transfer and the relational intensity (i.e., the extent of direct personal involvement). Knowledge is not just information, but also incorporates more intangible aspects (tacit “know how”). Knowledge Transfer (KT) channels involve some degree of interaction with the knowledge creator to allow the transfer to be successfully realized.
- (2) Another dimension is the “significance to industry”. Surveys of industry representatives yield similar and robust overall rankings channels; scientific publications and collaborative research are some of the highly KT channels for industry, while commercialization of property rights and exchange of personnel are rated below.
- (3) “Knowledge finalization” and the “degree of channel formalization” are additional dimensions. Knowledge finalization refers to the degree to which a project can be contained in discrete deliverables or is more open-ended, and it approximates the type of knowledge involved in KT. The appropriateness and complexity of knowledge will influence the type of KT channel that is used. Channel formalization refers to the extent to which the interaction is institutionalized and/or guided by formal rules and procedures.

Alexander et al. [1] consider five characteristics to assess knowledge transfer channels: formal or informal way of interaction, geographic proximity (extent of face-to-face interaction), knowledge transferred (degree of explicitness), mode of conflict resolution (third party intervention), and relational embeddedness (previous human resource engagement). Trusting relationships can progressively strengthen the development of collective “new practices and norms”. These shared opinions, alignment of common practice as well as collective action may reflect the “progressive constitution” of “communities of practice”.

At the individual knowledge transfer channels, the most commonly mentioned in the literature are scientific publications, professional meetings and conferences, informal interactions with faculty; collaborative research and research partnerships; contract research; academic consulting; hiring of recent graduates; institution development and creation of physical facilities; commercialization of property rights; and personnel exchanges and mobility.

As a knowledge transfer channel, Intellectual Property transfers (patenting, licensing and spin-off formation) are characterized with a high degree of formalization since such activities are codified and governed at the university level, typically by a designated transfer office (UKTO). The process of spin-off company creation is nominally a knowledge transfer channel, although it does not actually involve direct transfer of knowledge to the private sector in the same sense as other channels. Instead universities choose to pursue their invention by establishing a company for that specific purpose. Consequently, the majority research in this area is concentrated on the individual and institutional factors that may predict start up formation, rather than on any underlying knowledge transfer process [56]. The area of spin-off has received substantial attention, although this remains one of the rarest forms of (UI-KT).

Prominent researchers motivated by opportunities to commercialize research are also likely to be involved in spin-off companies. Commercialization orientation is, however, less common among

scientists. Many scientists are primarily motivated by enhancing their academic standing, rather than just the potential for profit or commercialization [57].

The commercialization of knowledge transfer channels is also highly incongruent with the norms of open science. Faculty who are involved in commercialization are primarily motivated by the prospect of bringing their invention to market, as well as monetary rewards [58].

The EU recommended member states to take steps to ensure the widest possible implementation of the Code of Practice launched in 2008. The Code of Practice in the UE considers the creation of coherent portfolios of Intellectual Property (IP) by the universities and research centers, and, where appropriate, the setting-up of patent/IP pools including intellectual property of other public research organizations. This could ease exploitation, through critical mass and reduced transaction costs for third parties. Finally, UKTOs role in transfers, not based in IP/patents, is a difficult one. UKTOs are the guardians of this institutional IP. This influences their role in transfer channels, which is not primarily based on IP. R&D collaborations, contract research, and consultancy services were mentioned as more important transfer channels than licensing out internally generated IPRs. However, these activities are fully within the responsibility of faculty and staff and UKTOs can do little to support them, except for influencing the framework conditions.

Enabling knowledge transfer depends on effective balance incentives and controls, and effective governance mechanisms. Capitalizing on innovation opportunities does not come without investment and very hard work among all stakeholders involved in the process. The existence of patent traders depends on patent market inefficiencies due to its uncertainty about information asymmetry. Without uncertainty, intermediaries would not be needed. University–Industry relationships are likely to be plagued with several difficulties due to a weak attitudinal alignment among partners, as well as uncertainty over the economic rent and its long-term impact on university core aims [55].

Classical governance mechanisms can be set along a continuum from market (coordination by price), to hierarchy [1]. Within this continuum, and set in the context of higher education and industry interaction, are partnering (or relational) and contracting (or transactional). Relational governance is more focused on these competences: Knowledge Sharing Competence and support services to enterprise, and Boundary Spanning through Human Resource, whilst Transactional governance is more focused on patent and entrepreneurship. UKTO usually focus toward the “setup and management of research projects”. Alexander et al. [1] found that UKTOs offer a similar set of activities but it can also be noted that each UKTO uses it to different extents. The capability to use multiple forms of governance could be a condition of organizational performance. Alexander et al. [1] launch the question if the focus toward transactional governance is really the best way to transfer patents from public research teams into the private firms, and also to enhance the creation of spin-outs, or could be considered that a greater focus toward boundary-spanning through human resource and knowledge sharing and support services for enterprises be a more efficient strategy to transfer knowledge.

An important challenge is to develop a better understanding of the interdependencies within partners and knowledge transfer activities (the “ecosystem”). The word “ecosystem” is often used as a metaphor and there are different views of what constitutes an ecosystem [1,37]. In the knowledge and technological transfer context, a pragmatic approach towards understanding this “system” is through the interrelationship of different partners along different knowledge transfer channels and competences. A firm employing a doctoral student could also present an opportunity to enjoy a closer link with a research center, to develop new collaborative projects or to buy patents and/or eventually to publish in professional journals—a multiplicity of activity arising from one initial one—and therefore gain an understanding of drivers for developing an overarching mode of governance that stimulates longevity and sustainable systems or activity. This governance could be achieved by considering the three dimensions explained before, to develop collaboration across different partners: pattern of interactions and knowledge transfer channels, structures (formal vs. informal) and information flow. While static routines and patterns exhibit formal iterations, dynamic routines exhibit informal interactions, and thus dynamic routines exhibit a relational bias and static routines a transactional bias.

UKTO' Social Responsibility

Social Responsibility (SR) has become a pervasive topic in the business literature, but has largely neglected the role of institutions. Institutional theory going beyond grounding SR in the voluntary behavior of organizations, and understanding the larger historical and political determinants of whether and in what forms organizations take on social responsibility [50]. Over the last two decades, the issue for organizations seems to be no longer about whether or not to engage in CSR, but rather on how to conduct SR in a strategically and effective planned manner with a clear and demonstrable narrative of its impact on organizations and community.

Social Responsibility of KTOs involves challenging and developing the practices of the whole Knowledge Transfer system of the university. First, the university and UKTO should define the mission and strategy of the whole KTO according to their resources and the quality of their patents and research groups.

The UKTO mission is very important in the overall mission of the university and research centers. Most importantly, universities should match their commercialization and spin-off objectives with appropriate resource–capability mixes, with realistic consideration given to their scientific and technological base [17].

The findings demonstrate that universities' approach to knowledge transfer is shaped by institutional and organizational resources, in particular their ethos and research quality, rather than the capability to undertake knowledge transfer through a Technology Transfer Office (TTO). Strategic priorities for knowledge transfer are reflected in activity, in terms of the dominance of specific knowledge transfer channels, the partners with which universities engage and the geography of business engagement [59]. Two basic missions can be differentiated [59]:

- (1) Some universities could follow a fairly narrow strategy focusing on world-class innovations, or High Research Intensity (HRI) Strategy.
- (2) While others, perhaps the majority, should pursue a more modest approach developing broader innovations that are more appropriate in a regional and local context. These universities can exploit the patent of the most innovative to develop new spin-offs on their context. The mission shift toward evaluating the commercial feasibility of all new inventions in their region. This is called Low Research Intensity (LRI) Strategy.

In particular, HRI universities are more likely to emphasize knowledge transfer activities related to the development and exploitation of IP and maximizing the return on research while LRI universities stress their potential contribution to human capital development [59]. In both cases, a key aspect in knowledge transfer governance is to develop new practices around IP management. All their data must be fully integrated in a knowledge and technology transfer data management system. The value of Patents in the Balance Sheet and the Revenue show the economic results of UKTOs. The ability to manage Intellectual Property (IP) has been described as "IP capability" and involves assessment of IP as well as maintaining IP protection. UKTOs should be able to assess ownership of the invention, which requires information on how the research that spawned the invention was funded, who was involved, and whether there is any background IP. IP valuation also entails estimation of market size, and the value that the invention potentially will add to the firm's existing range of products, services and process. This can be difficult in the case of a radically new technology for which there is no defined market. The patentability of an invention can be assessed without a thorough commercial assessment. However, since the value of patent depends on the scope of its claims, it is desirable to understand that commercial value of the technology and the dynamics of the prospective marketplace before drafting the patent claims. Understanding the technology's value is useful also for licensing and spin-out activity. The UKTO represents the university's interests in these negotiations and UKTO managers interpret what these interests are and how to best serve them [7].

This is because technological catch-up is an extraordinarily complex process within which, the interaction processes between indigenous and overseas knowledge sources are influenced by

various national and international partners, and thus it is often necessary to view the issue from different angles for different industries as well as for different countries [24].

Although the positive effect of universities on business innovation has been widely investigated through the use of firm-level innovation data, bibliometric data or patent citation studies, what is less well-known is how these benefits are affected by organizational and institutional differences among universities. Assefa and Frostell [60] discuss an approach for assessing indicators for the social sustainability of technical systems. Social sustainability is approached from the perspective of one of its ingredients, namely “social acceptance”. Since the early 1990s, the concept of sustainability has enjoyed widespread coverage in the literature and in discussions at different levels of society. The most widely used definition of sustainability refers to three dimensions: ecological, economic, and social systems. There are those who maintain that sustainable development is better defined in the form of normative judgments, such as goals and targets coded in formal agreements, treaties, and declarations, not in the form of semantic or philosophical clarification. In scientifically identifying needed goals and targets, additional research on essential limits, boundaries, and thresholds for meeting human needs and preserving life support systems is required [61]. Sachs [62] distinguishes between partial sustainability and whole sustainability. To realize whole sustainability, the following criteria (related to the three dimensions plus a fourth dimension focusing on political systems) should be met simultaneously:

- Ecological sustainability: Conservation of the natural capital of nature supplemented by environmental and territorial sustainability, the former related to the resilience of natural ecosystems used as sinks, the latter evaluating the spatial distribution of human activities and rural-urban configurations.
- Economic sustainability: Taken broadly, the efficiency of economic systems (institutions, policies, and rules of functioning) to ensure continuous socially equitable, quantitative, and qualitative progress. This dimension ensures that an economic system is able to produce goods and services on a continuing basis. It also maintains manageable levels of government and external debt, and avoids sectorial imbalances that damage agricultural or industrial production.
- Social, political and cultural sustainability: The social dimension in Harris and Goodwin [63] is echoed in the term of human development, defined as progress toward enabling all human beings to satisfy their essential needs, to achieve a reasonable level of comfort; to live lives of meaning and interest; and to share fairly in opportunities for health and education. Political sustainability provides a satisfying overall framework for national and international governance.

UKTO efforts to build legitimacy and shape identity is complicated by overlapping logics of commercialization stakeholders and academia, and, as a consequence the multiple, sometimes competing demands inherent in their multiple principal relationship [5].

A study like this provides a platform for starting up discussions and enhancing understanding about the opportunities and challenges of assessing the social aspects of technologies (Figure 1) according to the SR strategy of the university. UKTO leaves a territorial footprint that impacts both academic and entrepreneurial stakeholders. It is this footprint what calls for social responsibility within UKTOs. Garde et al. [64] indicate that the challenges of University Social Responsibility are not being faced and it is not being used by as a differentiated factor in the pursuit of positional or competitive advantage. Regarding this issue, Rodríguez-Bolivar et al. [65] show that development of information and technology could further encourage the implantation of Social Responsibility at universities.

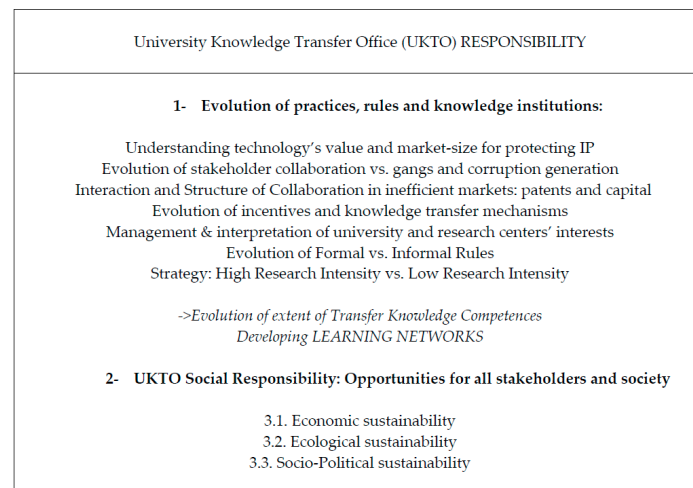


Figure 1. UKTO Responsibility.

UKTOs leaders need to consider the opportunities involved for all stakeholders in Technology Transfer community. Management by Values suggested by Martin Rubio et al. [66] can enhance the motivation, knowledge shared and governance mechanisms. The distributed leadership in networks depends on the values shared in the networks. To be an effective leader, UKTO leader must become a leader of leaders. In complex networks, effective leadership will entail common dimensions of vision and trust, through common values. Such kind of leadership can affect collaborations and keep knowledge diffusion practices.

Developing a sustainable knowledge transfer mission consider responsibilities of performing due diligence, marketing of technology and monitoring a growing intellectual property and license portfolio. Public Knowledge Transfer Plan allow stakeholders to consider the participation with a research institution or university that state if they follow a world-class technology partner or an institution that depends from different technology provider and ensure a modest approach.

We encourage future empirical research on knowledge transfer community considering knowledge brokers, IP data management, innovation gap, licensing agreements and the evolution of the pattern interactions among different stakeholders. We emphasized the consideration of Social Responsibility and university organizational and research strategy objectives in global chains of knowledge transfer to obtain deeper insight into the process of collaboration among global and local partners [18,25,59].

Although organizations have acknowledged the importance of SR and a wide variety of initiatives have come to light, the recent spate of corporate scandals, accounting frauds, allegations of executive greed, and dubious business practices has given ammunition to critics who have leveled a variety of charges ranging from deception and manipulating perceptions to piecemeal adhocism [10].

Due to the explosive impact of corruption in some countries we encourage to study the effects of possible criminal gangs across these networks. These gangs take the most of patent inefficiency market and financial gap to make unethical money from participants. Criminal organizations, as institutional gangs, inhabit dynamic environments where the pressures of competition constantly challenge their existence [67]. Research has already begun to uncover factors that might lead to corruption and CSIR (Corporate Social Irresponsibility) [68]. Wang et al. [2] indicate that organizations often adopt responsibility policies without changing their practices accordingly. For responsibility and sustainability activities to be implemented across firms, external stakeholders must be able to detect those firms that say one thing but do another. Information asymmetry offers and important reasons as to why stakeholders do not detect whether firms actually implement policy.

Drawing from the relational view, Lesiching et al. [18], among others, introduce inter-organizational quality as an important relation-specific asset that facilitates the completion of successful technology transfer. However, empirical research on quality of interactions between organizations remains limited. This study is among the few to provide insights into the social responsibility of partners and thus contributes to a deeper understanding of the exchange process that occur in knowledge transfer process.

4. Conclusions and Discussion

Establishing effective inter-organizational relationship is a daunting process. Each stakeholder has his or her own values, norms, principles and beliefs, where the incompatibility among institutional collaborators can create disagreement and conflicts. UKTOs operate in a pluralistic context, characterized by competing strategic demands and potentially divergent stakeholder goals. In order to advance knowledge in this arena, this paper examines the social responsibility of collaboration among stakeholders engaged in knowledge transfer. Though it has been understood that there are barriers to substantial collaboration, few studies have attempted to analyze the social responsibility of the brokerage processes in which these intermediaries are involved.

Our approach provides a window for dealing with the innovation gap at early research innovation stage. The innovation gap includes the financial gap and the entrepreneurial gap (innovation gap). The solutions for these problems are found in the inter-organizational collaboration; that is, in the networks between university and different stakeholders. The way investors (e.g., business angels) evaluate business plans can depend on the collaboration promoted by UKTO as central brokers in the investment process. UKTOs can enhance better practices to improve the financial capability of academic entrepreneurs as well as developing entrepreneurship culture in every region. The UKTOs managers are responsible for mediating among academics, university governance, investors and IP managers. Institutional theory is a promising venue to explore how the boundaries among stakeholders around knowledge transfer are constructed in different ways, and improve our understanding of the effectiveness of SR.

Learning in networks and communities suggests that organizations learn through interaction with other organizations to improve their performance. New forms of knowledge exploitation and the creation of technology markets require the design of appropriate financial instruments to support the circulation and commercialization of knowledge.

Universities are in a current state of transition, whereby they are expected to develop a wide range of relationships with stakeholders in order to enhance regional innovation system. IP transactions are often an element of complexity in relations. Alexander et al. [1] assess knowledge transfer mechanisms, and indicate the core competences of UKTOs. Knowledge transfer is shaped by institutional and organizational resources in terms of the dominance of specific knowledge transfer channels, the partners with which universities engage and the geography of business engagement. Miller [69] finds that there is a lack of studies that explore business model innovation as a result of multiple stakeholder influences. Miller et al. [70] identify five factors, namely human centric factors, organizational factors, knowledge characteristics, power relationships and network characteristics, that mediate both the ability of stakeholders to engage in KT and the effectiveness of knowledge acquisition, assimilation, transformation and exploitation.

We contribute to the line of analyzing stakeholders' relationships in the Knowledge Transfer communities that make possible new practices to satisfy UKTO mission and its social responsibility. Formal and informal collaborations provide space for new practices around the core competences of knowledge transfer office: set up and managing a project, patents and entrepreneurship, human resource placement and knowledge sharing. If open innovation reflects the free transfer of knowledge among multiple partners, then it could be understood that relational governance of knowledge transfer office is a better strategy, however this is simplistic. Different levels of "openness" occur in open innovation, and it is important to understand the consequence of the strategy on the intensity of

research activity in the university, apart from government policy, IP regulation in this country and region. While collaboration experience and breadth of interactions equip partners to handle conflicts of interest in research priorities, they do not help intermediaries to handle IP regulation, sanctions and policies.

In relation with the diversity in the university sector and how this is reflected in knowledge transfer activity, our study shows that it is important to recognize every partner and their collaboration with the strategic priorities and responsibilities for knowledge transfer, their capability to deliver this and the scale and scope of knowledge transfer activity. Further, if differentiation in knowledge transfer activity and partners exists among universities, in an open innovation “N-tuple helix”, in the knowledge ecosystem where global and local interact in global chains of knowledge, it is needed a critical collaboration that bridges distance in technical, financial, institutional and entrepreneurial gaps for promoting innovation. This paper has shed some light in the diplomacy behind collaborations in a systematic literature review of university transfer’ social responsibility. We have developed an institutional framework that considers the core competences of university transfer offices and their strategies for every kind of university (more or less research intensity oriented). As knowledge and production value chains are increasingly internationally segmented due to globalization, some partners are becoming global. Accordingly, they are needed new formal and informal practices among stakeholders according to the core competences and the social responsibility of knowledge transfer offices.

Institutional theory is a promising venue to explore how the boundaries between university, business, media, society and environmental goals are constructed in different ways, and improve our understanding of the effectiveness of SR within the wider field of economic governance of UKTO governance.

The limitations of this work provide venues for further research in both fields: knowledge transfer and social responsibility in higher education. Researchers should continue to examine empirically and theoretically, the complex role of collaborations and interactions in the “N-tuple” helix of the knowledge ecosystem of this century. Understanding SR as an institution of wider social governance seems to be a promising avenue of research at a time when longstanding rules, actors, and markets that have governed the global economy appear to be more and more in an ongoing state of change. Today’s climate of heightened scrutiny toward corporate behavior underscores, perhaps as never before, the need for conceptual robustness to guide SR initiatives undertaken by organizations.

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