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A literature review of intellectual property management in technology transfer offices: From appropriation to utilization

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ABSTRACT

This paper presents a systematic literature review of the intersection between intellectual property (IP) management and technology transfer offices (TTOs) in the context of universities in order to understand how TTOs manage IP. IP management is an important issue, as it both enables and restricts the utilization of research results and impacts the competitiveness of technology-based businesses. The literature review shows that previous studies of IP management in TTOs tend to adopt a simplistic view of IP management, recommending that all valuable inventions should be patented. Moreover, academic research into TTOs and actual TTO practices both appear to focus on improving efficiency and outputs measured in terms of numbers of patents, licenses and spin-offs. We call this established view the *appropriation mode of TTOs* and question it based on the logics of publicly funded research and modern IP management. In its place, we suggest the *utilization mode of TTOs*, in which TTOs manage IP from publicly funded research in order to govern innovation processes and enable utilization of research results in a broader sense. Several recommendations are provided for both researchers and practitioners.

1. Introduction

The commercialization of university research is a growing field of both academic study and practice [1,2]. In 1980, the US enacted the Patent and Trademark Law Amendments Act, better known as the Bayh-Dole Act. That act allowed universities, small businesses and non-profit institutions to claim ownership of inventions made in research and development (R&D) with US federal research funding (as opposed to requiring institutions and businesses to assign ownership to the federal government, as was the case before 1980). Consequently, American universities began setting up technology transfer offices (TTOs) to support the commercialization of research [3,4], a trend that spread internationally, partly inspired by the success of a few TTOs at American universities. TTOs typically support the protection of inventions, the start-up of firms and the transfer of technologies from universities, and the role of TTOs tends to be closely related to patenting, licensing and spin-offs [5]. TTOs' practices include activities such as receiving disclosures regarding inventions, patenting, making economic assessments, deciding on appropriate commercialization strategies and assisting researchers in carrying out the chosen strategy [6,7].

However, research has questioned how well TTOs function within universities [8]. For example, Greenbaum and Scott [9] see the extensive growth of TTOs as an unwanted result of the Bayh-Dole Act, going so far as to state that most TTOs "are underfunded and understaffed, will never turn a profit, drain limited university resources and potentially hinder innovation and knowledge transfer" (p. 55). These studies have raised concerns about universities taking ownership of intellectual property (IP) due to the inefficiency and ineffectiveness of TTOs. The argument is that it might be counterproductive to let universities and TTOs take control over IP that could come to better use under public or individual ownership [8,9], in the latter case using the so-called professor's privilege to allow university employees to take ownership of their inventions, as is done in Sweden.

The question of how TTOs (should) manage IP is the core issue considered by this paper. The TTO function was largely developed in parallel with the so-called pro-patent era [10] beginning in the 1980s, during which significant focus was placed on increasing patenting [11]. A patent gives its owner "the right to prevent third parties from making, using or selling the [patented] invention without their owners' consent" (http://www.epo.org/applying/basics.html), and patents have gained major importance for the competitiveness of many technology-based firms [12,13]. Patents have also become the key mechanism for commercialization among TTOs, and a main focus of both research and practice has been on TTOs' use of patenting and licensing [14,15].

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Intellectual property rights (IPRs) now tend to be the success factor on which universities focus rather than how to create and deliver value from inventions more generally [16].

However, patenting comes at costs to both societies and firms. At the society level, patents are related to incentives to invest in innovation, but they are also related to temporary monopolistic inefficiencies [10]. At the firm level, the management of patents has been identified as a challenge for individuals and small and medium-sized enterprises (SMEs). To obtain a patent for an invention, a patent application must be drafted, registered and prosecuted with one or more patent offices, a process which requires both financial resources and legal competences. Any granted patents must also be monitored and enforced to provide the monopolistic benefits that patents are intended to confer. Research further points to the limited resources that individuals and SMEs have for obtaining, monitoring and enforcing IPRs [17,18], showing that patents are not as useful for small firms as for large firms [19].[1] Furthermore, current studies and practices of IP management in the private sector increasingly endorse alternative or complementary strategies to patenting, such as openly publishing new inventions and research results or cheaply/freely licensing them [20–24]. Such “open” strategies may be especially relevant for publicly funded research [25–27].

One of the foundational reasons for publicly funding research at universities is that it allows for research that is not privately appropriable to sufficient extent for private actors to conduct it without financial support. The efficiency of having universities appropriate the results of research can thus be questioned. One message from recent research in this context is that universities and TTOs should use a strategic approach when addressing issues of intellectual property [5]. Another message from recent research is that having TTOs take ownership and commercialize research results is ineffective and inefficient, especially from the larger society's point of view [8]. Given these mixed messages, the central question arises of whether and how IP related to university research is and should be managed by TTOs. In this paper we therefore probe the question of how TTOs manage IP by undertaking a systematic literature review of the growing field of academic literature on TTOs and IP. We discuss the reviewed literature by analysing the role of TTOs in publicly funded research universities and their IP management in light of much recent literature on the plethora of IP strategies used by private firms. In doing so, we try to contribute to the small but growing literature stream that constructively critiques the established view of TTOs and how IP should be managed in them [8,9,28–30].

2. Method

We employed a systematic literature review to investigate the state of the art in terms of research on TTOs and the work of TTOs with regard to patenting and IP management, as well as the academic view of how TTOs should manage IP. All literature in the research area of Business Economics in the ISI Web of Science database was searched for the topics ((“technology transfer office*”) OR incubator* OR (“science park*”)) AND (patent* OR (“intellectual propert*”)). Incubators and science parks were included as alternative concepts as these are closely related to TTOs, constitute other forms of network mechanisms for universities, and are often set up as collaborative organizations to TTOs [15]. The topic search is a text search that searches titles, abstracts, and keywords. The first search was performed on 9 October 2014, and identified 112 publications up until mid-2014. To update the results, a follow-up search was performed on 8 February 2018, identifying 99 additional publications appearing between 2014 and 2018.

After reading the abstracts and excluding articles that were not within the scope of this research (as well as publications in non-English languages), 108 papers were read in full and coded independently by both authors. Any differences in coding were discussed to reach the final coding, which is shown in the appendix. Two main dimensions were identified. The first dimension was the organizational focus of the reviewed publications, i.e. whether they focused on TTOs, incubators, science parks, universities or start-up firms related to these organizations. The second dimension was the use of and focus on patents and IP in the reviewed publications as an output measure or research method (e.g. as an indicator of innovativeness) or on patents and IP as a (strategic) activity and focus in its own right (e.g. how these organizations support the patenting process of firms).

By conducting the literature review in a systematic way, we increased the reproducibility of the review [31]. A possible limitation of the paper is that we did not construct additional search strings based on the identified dimensions, nor did we use the snowball technique to use the identified papers to discover additional papers mentioning the dimensions indirectly or by ways that were not captured by the original search strings. However, in this particular paper we were interested in the intersection between the fields. It was therefore of importance that the papers included both IP management and at least one technology transfer actor.

3. Results from the literature review

3.1. The role of TTOs in research universities

The main role of TTOs is to support the commercialization of research output. Creation of new firms and licensing of intellectual property are commonly viewed as the two main channels for commercializing university research [5]. Siegel and Wright [4] note that the literature on TTOs has traditionally focused on patenting and licensing, while spin-offs have more recently become increasingly recognized as important means for commercialization. Graff et al. [32] suggest that TTOs should only be considered as one among many channels to commercialize research and that the investment in a TTO may not be equally worthwhile for all universities. Aldridge and Audretsch [33] find that 70% of US scientists use their university's TTO to commercialize their research, while the remaining 30% of scientists use a “backdoor” and do not use the TTO.

Several studies have investigated the motives for researchers to commercialize their inventions. Huang et al. [34] find that seniority, publishing and attitudes towards open science are strongly related to patenting behavior while Lawson [35] finds that researchers with public funding are more likely to patent compared to those with private funding. Others emphasize the support that researchers need [36] and the division of royalties between the inventor and the department [37] as important factors for increasing patent activity at universities. Similarly, Feldman et al. [38] identify equity as an important mechanism for managing commercialization of intellectual property in universities as it incentivizes and enables firms and entrepreneurial researchers while also increasing the university's revenue potential and making universities more entrepreneurial, at least according to some views of entrepreneurial universities.

While TTOs may play an important role in this commercialization process, previous studies have suggested that other parts of universities can take on complementary roles to share some of the duties of TTOs. For example, Caldera and Debande [39] find that universities that have both a TTO and a science park tend to perform better because the two organizations complement each other. Related results by Squicciarini [40] show that science park tenants are more likely to patent, while results by Wright et al. [41] show that entrepreneurs seek complementary assets when deciding to locate in a science park. Incubators, in contrast, seem to have a smaller role in the technology transfer context, at least historically. Markman et al. [42] find that incubators are generally not linked to the technology transfer strategy or the TTO.

[1] At the same time, several studies have pointed at the positive correlation between patenting and venture capital (VC) investments among start-ups [88–90], and VC is often crucial for these firms' survival and growth.

Similarly, Siegel and Phan [43] report that the role of the incubator is to support the research of university scientists while the patenting takes place in the TTO. The general incubator literature, in contrast, views incubators as organizations that are active during the entire process from inception of idea to commercialization and launching of a viable and freestanding enterprise [44–46].

3.2. The processes in and of TTOs

Several authors emphasize the role of TTOs as gap-fillers and intermediaries between universities and industry in the commercialization process. TTOs could arguably decrease information asymmetry between industry and university scientists [32,42,47,48], and patents may further impact the attempt to overcome the gap between university research and industry development and commercialization in that they incentivize researchers to "push" their inventions out to industry [49]. Furthermore, patenting enables researchers to delegate the search for application and commercialization opportunities to TTOs, enabling specialization.

However, IPR issues often present a major hurdle for many entrepreneurial firms [4,17], and one of the main questions here is how TTOs manage IP and support inventors and entrepreneurs in managing IP. The academic literature tends to use a rather simplistic perspective when describing how IP is managed by universities in different geographical locations [50–52], or by different types of universities [53,54]. Schoen et al. [7] provide one of few studies focusing explicitly on IP management in TTOs. According to that study, the TTO process typically includes "disclosing inventions, conducting early economic assessment, deciding if the invention should be patented, filing the patent, searching for licensees, negotiating the contract conditions (with industry partner or spin-off companies), and monitoring royalties" (p. 446). A similar description of the general TTO process is provided by Kamariah et al. [6]; also identifying the main commercialization modes of licensing and spin-offs. According to Markman et al. [42] TTOs typically license patented technologies through one of three main modes: "(a) licensing in exchange for sponsored research, (b) licensing for equity in a company, and (c) licensing for cash" (p. 242). The latter mode is the most common one among TTOs in general, while TTOs that are for-profit are relatively more likely than others to use venture creations.

Taking a step back, a number of studies focus on the beginning of the technology transfer process. These studies present how invention disclosures from scientists are reviewed in TTOs and how a decision of whether to patent is then made in the TTO [32,55]. Some TTOs are more proactive in trying to increase the probability of scientists applying for a patent [56] and in scouting internally for inventions [7]. Del Campo et al. [57] argue that many TTOs need to improve their ability to and speed with which they screen inventions so that the window of opportunity is not missed due to a lengthy process. The TTO also needs to interact with researchers in order to strengthen IP claims. However, Schoen et al. [7] show that only a few TTOs include inventors in their patenting and commercialization decisions. Siegel et al. [5] also emphasize the important role of the inventor; for instance, researchers can create hold-ups if their competence is needed in subsequent product development and commercialization. Therefore "TTOs need to ensure that IP is clean, well defined, and protected before trying to raise commercial interests" [5] (p. 655). There is thus an underlying assumption that everything that is to be commercialized should be patented, and scientists' preference for publishing rather than patenting is sometimes seen as an obstacle for TTOs [58].

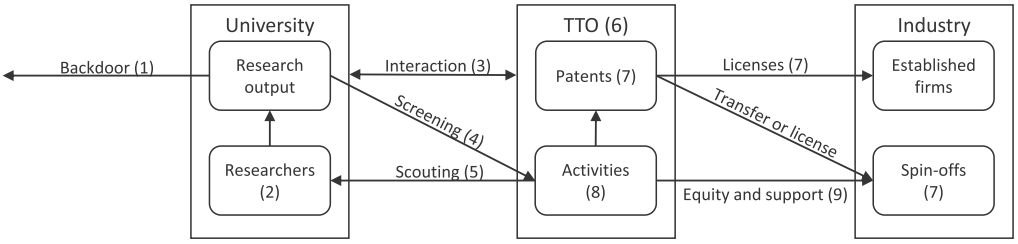
In order to be successful in commercialization, TTOs need to not only collect, screen, and protect inventions but also develop relationships with industry and understand many issues affecting inventions within the fields of research with which they are dealing; inventors may thus be an especially relevant resource in this process given their networks and knowledge in the relevant fields and industries. Despite the importance of involving inventors to speed up identification of potential licensees and thereby improve commercialization [42], research indicates that relationships between TTOs and inventors are often distant [59].

TTOs are also involved in the creation of spin-offs [60,61]. Differences in regional preferences [62] as well as national preferences with regard to modes of commercialization have been found [63]. In addition to patenting, licensing, and spin-offs, TTOs sometime utilize other modes of commercialization and technology transfer, such as sponsored research or consulting [4], in which IP management also plays a crucial role, even though it has not necessarily been emphasized in the TTO literature [64]. Hall et al. [28] further contrast the common focus on licensing and spin-offs in the TTO literature by pinpointing the limitations of legal means of appropriation, such as patents, and asking for a broader take on IP management in the university setting, including different forms of open innovation. This is in line with the argument of Kenney and Patton [8], who highlight the inefficiencies of university ownership and technology transfer through TTOs and suggest either inventor ownership or public ownership (i.e., providing the inventions to the public domain) as alternative modes of enabling utilization of research.

3.3. Patents and other measures of TTO productivity

Similar to Rothaermel et al. [15] we find several studies that describe the factors that influence the performance of TTOs [65]. These studies tend to provide advice to universities regarding how to increase their technology transfer productivity. For instance Feng et al. [66], suggest that universities should recruit outstanding researchers, encourage university-industry collaboration and develop IT infrastructures that facilitate collaboration between universities and industry. Other studies focus on the activities that the TTO undertakes to improve results, such as instituting advising hours [67], creating a patent culture [68] and shifting focus from basic to applied research [69]. Markman et al. [70] show the positive relationship between innovation speed and TTO success in the US (in terms of licensing revenues and new venture formation). Innovation speed, in turn, is influenced by TTO resources and competence, as these speed up the matching process between university inventions and industrial commercialization. An important implication emerging from the results in the Markman et al. [70] study is that it is important for universities to recruit and retain competent employees in their TTOs. Studies also include investigations of national economic and policy factors [71], university-wide factors [72], and TTO internal factors, such as experience, maturity, size, availability of complementary resources such as science parks, nature of human resources, missions and objectives, and equity or fee strategies [14,39,59,73–78]. All in all, this extends the review results by Siegel and Phan [43] on the effectiveness of TTOs, which showed that effective technology transfer through TTOs is dependent upon organizational cultures, pecuniary and non-pecuniary incentive structures for researchers, and human resource practices of the TTO.

A common denominator of the above-described studies that focus on factors that improve the performance of TTOs is the assumption that increased patenting is a sign of good performance of the TTO. This finding is in line with those of previous reviews [15]. On the policy level, patents are interrelated with policy shifts such as passage of the Bayh-Dole Act and productivity studies of TTOs use patents, R&D agreements, licenses and start-ups as output measures [79]. Already in 2008 Sorensen and Chambers [30] argued that many studies of the economic role of TTOs use the wrong measure of success when they focus on patents, numbers of spinoffs and numbers of licenses instead of focusing on how well TTOs enable access to knowledge protected and held by universities and their faculties; thus, there is a need for a better understanding of the overall effects of TTOs such as innovation and economic development [29], especially as a very small number of



Notes:
(1) The use of the backdoor for commercialization (e.g., Aldridge & Audretsch 2010)
(2) Researcher factors impacting commercialization (e.g., Huang et al. 2011)
(3) Interaction with incubators and science parks (e.g., Caldera & Debande 2010; Siegel & Phan 2005)
(4) Screening of inventions (e.g., Graff et al. 2012; Apple 2008)
(5) Scouting for inventions (e.g., Hellmann 2007)
(6) The role of the TTO (e.g., Graff et al. 2002; Markman et al. 2005)
(7) Productivity measures (e.g., Bigliardi et al. 2015; Alessandrini et al. 2013) commercialization modes (e.g., Bengtsson 2017; Hall et al. 2014)
(8) Activities of the TTO (e.g., Schoen et al. 2014; Wright et al. 2008)
(9) Equity and support to spin-offs (e.g., Feldman et al. 2002)

Fig. 1. Illustrative summary of review results.

university patents account for most of the financial returns within each academic field [3,32].

Fig. 1 illustrates the main findings of our literature review, as presented in this chapter. The figure includes several identified themes and reference examples for every theme.

4. Discussion

The starting point of many of the papers in the literature review is that there has been an increased interest in technology transfer since the Bayh-Dole act [4,9], with a focus on how research results are commercialized through patents, licenses and spin-offs. Consequently, several studies present assessments of efficiency and productivity [14,80]. These studies measure the number of patents, license agreements and spin-offs and then present the results either in isolation or in relation to structures, practices and resources [72,81]. However, when it comes to actual management of IP, this literature review points to a view of IP management in the extant literature that is too simplistic. Few strategic choices are considered and many of the choices seems to be of an 'either or' nature [8]. In general, the literature reviewed herein seems to assume that promising or valuable innovations are and should be patented, licensed and/or spun off (see section 3.3). However, the broader literature on IP management, typically in relation to private businesses, indicates that IP management is actually a rather complex phenomenon involving several related actors, several related inventions in technical systems, and several different types of IPRs and contracts [10,12]; it is therefore unfortunate that it is treated in such a simplistic manner in the technology transfer context.

Therefore, the important question is not how efficient TTOs are at reaching their goal, which has been a common theme of extant literature, but rather how effective they are, i.e., whether or not they have the right goal. We first discuss this by analysing the review results in light of the role of the university as a publicly funded research institution. We then discuss the view of IP management in TTO research and practice as compared to literature on IP management in private firms.

4.1. The (new) role of TTOs in the public research university

The main rationale of having a patent system is (1) that it incentivizes investments in innovation and (2) that it diffuses knowledge through patent publications. This rationale is primarily focused on private actors, so what does our review tell us about this rationale in the context of publicly funded research universities and their associated TTOs?

First, while our review shows that TTOs are often measured and evaluated based upon their volume of patenting and licensing [14,15,39,81], the review also shows that university researchers are not primarily incentivized by large potential earnings from patented innovations. This is indicated by the fact that TTOs struggle with researchers that want to publish their results as soon as possible instead of patenting them [58]. Thus, patents do not necessarily provide incentives for making technological progress on the individual researcher level in publicly funded research.

Second, research is often publicly funded for the reason that the research results would not be privately appropriable to a sufficient degree for private actors to undertake it, even with the available patent system. So, while the patent system may incentivize private actors to invest in R&D, publicly funded research is not in need of this incentive as society provides the means for doing the R&D. Therefore, it is surprising that the TTO literature has to date mainly focused on privatizing and commercializing research results, without much apparent consideration of the larger welfare effects. We call this the *appropriation mode of TTOs* (see Table 1). This mode assumes that TTOs should commercialize research results by privatizing it and selling it, leading to TTO activities such as evaluating research results, protecting them, searching for buyers, and contracting with commercial licensees. While we identify some well-articulated criticism of this perspective in previous works [8,9,28–30], the TTO literature still primarily assumes a model of privatizing and commercializing research output. This seems to also hold for actual TTO practices. For example, a study on university-industry partnerships found that industry funding is, somewhat paradoxically, more strongly correlated with the propensity for university owned patents than with the propensity for industry owned patents [35].

Our criticism of the literature does not imply that we argue that TTOs should never patent. It is important to acknowledge the fact that in some cases, society is better off if publicly funded research output is actually privatized, especially in cases when complementary private investments in continuous R&D and application technologies are necessary and when exclusive rights of the basic R&D results may incentivize such continuous investments. Moreover, privatizing research

Table 1
The appropriation vs. utilization modes of TTOs.

	Appropriation mode of TTOs	Utilization mode of TTOs
Aim	Maximizing private value	Maximizing total welfare
Success measure	Patents, licenses, spin-offs	To be developed
Main activity	Evaluation, search, contracting	Diffusion, support, contracting
Role of IP	Innovation protection	Innovation governance

output may be used for enabling better innovation governance, for example by allowing licensees of research results to use and develop technologies [21], such as licensing derivative inventions and technologies under certain conditions. This, however, requires more granular IP management. Consequently, we argue that the view of TTOs needs to shift from the appropriation mode to the *utilization mode*, in which the aim is to maximize total welfare rather than private value, through activities that promote diffusion, support use of research, and govern continued innovation processes (see Table 1). This may be especially important when addressing grand challenges, such as environmental sustainability, where the private appropriation model may be insufficient and/or values are difficult to appropriately account for [82,83].

The performance of TTOs is perhaps thus not best evaluated by measures such as the number of patents filed and/or granted or the number of license deals completed. Such transaction-oriented performance measures need to be complemented by measures that better represent the main goal of TTOs, which should be how well they enable the external use of university research output. Broadening the view of the entrepreneurial university, and the related shift from an appropriation mode to a utilization mode of the TTO, then requires new ways of looking at TTO success and more generally entrepreneurial outcome from universities [84].

4.2. IP management for innovation governance in TTOs

In the utilization mode, TTOs must consider a broader set of questions than what is currently done in their IP management, including questions such as who funds research, the intention of funding and performing the research, who could best develop and commercialize the research results, and what spill-overs are acceptable or even desirable. Depending on the answers to these and other questions, TTOs can manage IP to promote the collection of benefits from and further development of research results. However, research and practice of TTOs currently have a view of IP management where patent protection is the default and predominant means (and measure) of commercialization of research.

Above, we argue that there is a need to shift from an appropriation mode of TTOs to a utilization mode of TTOs. This means that the practice of and research into technology transfer would likely benefit from a broadened view of how IPRs can be used to enable utilization of research, shifting from innovation protection to innovation governance [82]. Several recommendations can be given with regard to future avenues for research and current TTO practices regarding IP management.

First, both research into TTOs and the practices of TTOs need to adopt a more comprehensive and fine-grained view of IP, including not only patents but also other IPRs, such as trade secret rights, copyrights and design rights [85]. This is increasingly relevant in the age of digitalization, where patent rights to inventions may be complemented with rights to data and trade secrets [86].

Second, there is a need to adopt a more comprehensive view toward and practice of licensing, in which direct licensing for cash or equity is complemented with more complex licensing setups, including cross-licensing [21,87]. This is especially relevant for complex technologies that are based on several complementary inventions that may have been invented by different actors. In such cases, traditional licensing setups and spin-off strategies may not be sufficiently adaptive to a larger ecosystem of interdependent actors. In some cases, free licenses may be useful for enabling wide use of technologies and application of research results. Free licensing also relates to other options, such as publishing and strategically disclosing inventions rather than protecting them [22,23]. These types of strategies actually seem to be well aligned with researcher incentives, who mainly want to publish and receive recognition for their research results, albeit against many TTOs' current ambitions of licensing or selling IPRs for cash [58].

Third, TTOs clearly function as a type of intermediary in open innovation activities between universities and external actors, typically promoting the external commercialization of university research output. However, open innovation comes in many forms, one of which is the open accessibility of research results [21]. Recently there has been a shift in innovation policy and public funding toward requiring results of publicly funded research to be more accessible, for example research funded by the European Commission [25], a shift that is well aligned with the argument of this article. However, at the same time, research results may need to be protected in many cases to incentivize investments in complementary technologies and downstream development, production and marketing, as those investments may be difficult to recoup if there is immediate competition [13,21]. In such cases, licensing of protected technologies may benefit from being complemented with service agreements through which experienced university researchers with in-depth knowledge and competence can help licensees to make the most of the licensed technologies.

Finally, new measures of TTO success need to be developed to substitute or at least complement the current measures, which are focused on numbers of patents, licenses and spin-offs (see Table 1). In developing such measures, the utilization rather than the commercialization of research output should be in focus. This is an important task for both TTOs in practice and for investigation by academic research.

5. Conclusions and future research

This paper has presented a systematic literature review of the intersection between IP management and TTOs to discover how TTOs manage IP. The literature review shows that research on IP management in TTOs is limited and simplistic. One conclusion is that the literature mainly takes a transaction-oriented view of TTOs, emphasizing patenting and licensing, in what we call the appropriation mode of TTOs. The focus on increasing the patent output of TTOs and the simplistic view of IP management in this mode may be counterproductive, if not for individual universities, then for the larger society as a whole. Future research and practice must consider both a broader range and a finer granularity of strategies and strategy combinations rather than focusing on a limited set of strategies in isolation. In this new utilization mode of TTOs, less focus should initially be on efficiency and more focus should be placed on effectiveness. Universities are important actors in addressing the grand challenges of our society, and their strategic direction should not be guided by what can be easily measured but instead by where and how research results can best be put to use.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.techsoc.2019.04.008.

Appendix. Reviewed and coded articles

Reference	Actor in focus					View of IP	
	University	TTO	Incubator	Science park	Firm	Output	Activity
Albahari, A., Perez-Canto, S., Barge-Gil, A., & Modrego, A. (2017). Technology Parks verus Science Parks: Does the univeristy make the difference? *Technological Forecasting and Social Change*, 116, 13–28.	✓		✓			✓	
Aldridge, T., & Audretsch, D.B. (2010). Does policy influence the commercialization route? Evidence from National Institutes of Health funded scientists. *Research Policy*, 39, 583–588.		✓					✓
Alessandrini, M., Klose, K., & Pepper, M.S. (2013). University entrepreneurship in South Africa: Developments in technology transfer practices. *Innovation: Management, policy & practice*, 15(2), 205–214.	✓					✓	
Alshumaimri, A., Aldridge, T., & Audretsch, D.B. (2010). The university technology transfer revolution in Saudi Arabia. *Journal of Technology Transfer*, 35, 585–596.	✓						✓
Anderson, T.R., Daim, T.U., & Lavoie, F.F. (2007). Measuring the efficiency of university technology transfer. *Technovation*, 27, 306–318.		✓				✓	
Apple, K. (2008). Evaluating University Technology Transfer Offices. In Acs, Z. & Stough, R. (Eds.), *Public Policy in an Entrepreneurial Economy,* 17, 139–157.		✓	✓				✓
Arque-Castells, P., Cartaxo, R.M., Garcia-Quevedo, J., & Godinho, M.M. (2016). Royalty sharing, effort and invention in universities: Evidence from Portugal and Spain. *Research Policy*, 45 (9): 1858–1872.	✓					✓	
Audretsch, D.B., Lehmann, E.E., & Wright, M. (2014). Technology transfer in a global economy. *Journal of Technology Transfer*, 39(3): 301–312.	✓				✓		✓
Baldini, N. (2010). Do royalties really foster university patenting activity? An answer from Italy. *Technovation*, 30, 109–116.	✓					✓	
Baldini, N. (2009). Implementing Bayh-Dole-like laws: Faculty problems and their impact on university patenting activity. *Research Policy*, 38, 1217–1224.	✓					✓	✓
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