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Citation: McDonagh, L., Bonadio, E. & Alba Betancourt, A. (2020). Social Innovation and University Intellectual Property: Insights from the UK and Mexico. *European Intellectual Property Review*, 42(5), pp. 293-304.

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Social Innovation and University Intellectual Property: Insights from the UK and Mexico

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Abstract

University intellectual property policies, and the accompanying strategies for incubation of IP via licensing and spin outs, have not received much analysis from academic lawyers. Moreover, despite the success of universities in the UK at generating income from IP, not much is known about how transferable this success is when considered in the light of a rapidly growing middle-income developing economy such as Mexico's. In this article we analyse critically some of the key tenets of IP policies at universities in the UK to identify what the key legal principles underpinning university innovation are. We further consider the potential application of these principles in Mexico, where so far only a limited number of universities have developed IP policies and strategies in line with the incubator model. We explain how universities in Mexico could implement these research findings in their own IP policies. We further note that the mere provision of an IP policy is not a panacea – on its own it is insufficient for ensuring technology transfer and it may even encourage unnecessary patenting. Further investment in infrastructure and in establishing a culture of incubation and entrepreneurship is also required.

Introduction

Universities play a public role in every society, and university-led research can prove valuable for tackling societal problems, including those related to the environment, social care and public health.¹ Likewise, when public universities create research that is potentially of

¹ K.R. Fabrizio and A. Di Minin, 'Commercializing the Laboratory: Faculty Patenting and the Open Science Environment' 37 (2008) Research Policy 914.

commercial value, it is logical that this innovative research benefit the public.² When considering how best this can be achieved it is imperative to consider the appropriate role for intellectual property (IP) rights, such as copyright, trade marks, trade secrets, and especially, patents. It is further necessary to assess the most common methods of IP commercialization: (a) licensing of IP to external companies; and (b) setting up spin-out companies to manufacture, market and distribute products and services.^{3 4 5}

IP commercialisation revenues have been growing steadily in recent years – the overall annual total for UK universities’ IP revenues amounts to more than £150m.⁶ Yet, it is worth noting that this success has been uneven, with a relatively small number of large research-intensive universities achieving the most lucrative successes, while the majority of institutions focus on more modest efforts.⁷

Nonetheless, even modest successes are welcome because commercialisation of IP provides universities with an additional source of income that can be used to fund further research and development. Inevitably this process also has the long term effect of deepening universities’ links with the private sector within the economy – a move that brings opportunities but also

² M. Perkmann and N. Walsh, ‘Relationship-based university industry links and open innovation: towards a research agenda’ 9 (2007) *International Journal of Management Reviews* 259.

³ S. Öcalan Özel and J. Pénin, ‘Exclusive or open? An economic analysis of university intellectual property patenting and licensing strategies’ 21 (2016) *Journal of Innovation Economics & Management* 133.

⁴ M. Fressoli, E. Around and D. Abrol, ‘When grassroots innovation movements encounter mainstream institutions: Implications for models of inclusive innovation’ 4 (2014) *Innovation and Development* 277, G. Seyfang, S. Hielscher and T. Hargreaves, ‘A grassroots sustainable energy niche? Reflections on community energy in the UK’ 13 (2014) *Environmental Innovation and Societal Transitions* 21, and D. Hernandez-Sanchez, Jose Luis Leyva-Montiel and M. Angel Perez-Angon, ‘University-industry collaboration: A successful case in the electronics and software design area in Mexico’ 41 (2016) *Interciencia* 668.

⁵ N. Hewitt-Dundas, ‘Profiling UK University Spin-outs’ Enterprise Research Centre Paper No. 35 (2015) - <https://www.enterpriseresearch.ac.uk/wp-content/uploads/2015/07/ERC-ResPap35-M.-Hewitt-Dundas.pdf>

⁶ HEFCE *Higher Education Business and Community Interaction Survey 2015-16* (October 2017/23): “There has been an increase in total income from IP of 13 per cent, from £155 million to £176 million in 2015-16. This includes a 37 per cent rise in IP income from licensing and other sources (but excluding sales of shares). This increase follows a rise of 25 per cent in 2014-15. There are noticeable differences in IP income by partner and type of licence. Large business spending on non-software licences showed another strong increase, growing by 48 per cent to £100 million. Income from non-software licensing to small-and-medium-sized enterprises (SMEs) also increased strongly, up by 43 per cent on 2014-15, reaching £16 million.”

<https://webarchive.nationalarchives.gov.uk/20180319114650/http://www.hefce.ac.uk/pubs/year/2017/201723/>

⁷ For example, here are the revenues for 2017-18 published by the 10 universities surveyed: Oxford University (£53m), Queen’s University Belfast (£22.1m), University College London (£14.7m), University of Sheffield (£12.7m), University of Cambridge (£8.1m), University of Leeds (£4.9m), King’s College London (£2.83m), University of Edinburgh (£2.39m), Newcastle University (£1.76m), City, University of London (£397,000) - <https://www.hesa.ac.uk/data-and-analysis/providers/business-community/table-4d>

significant challenges at a time when UK higher education is more market-driven, and more under pressure from market forces, than ever before.⁸

In light of this, it is crucial to ask a series of questions about the relationship between university IP commercialisation and innovation in the wider economy. What are the key legal principles embedded within UK university IP policies? What happens to university IP once it reaches the commercial stage?⁹ In particular, how do public institutions like universities deal with issues of commercial risk in the investment context? And if UK university IP commercialisation is a success-story, can developing and middle income countries – taking Mexico as an example – utilise IP policies to encourage university innovation as a tool of development?

In answering these questions our aim is to analyse comparatively IP policies, knowledge-exchange initiatives and commercialisation strategies in the UK and Mexico. We seek to shed light on university innovation in the UK and to evaluate what steps Mexico could take in developing IP policies and strategies for bringing research outcomes to society - and in doing so, link universities' innovative research centres with the local economy. In providing this analysis we draw upon existing literature, analysis of the IP policies of 10 major UK universities,¹⁰ and comments raised at two knowledge-exchange fora we held at UNAM, Mexico City (in May 2018 and May 2019) that included members of the Mexican Social Innovation Network (such as government representatives from science and technology ministries, scientists, and tech transfer officers from Mexico's major universities, including UNAM and Tecnológico de Monterrey).

In our conclusion we argue that despite challenges and potential pitfalls, the use of university IP continues to provide significant benefits to universities in the UK, as well as the wider economy, especially where the focus of university IP strategies is towards social enterprises rather than towards profit-driven companies. We highlight lessons that can be drawn from successful case studies in the UK, but note specific issues that must be examined and dealt with in light of Mexico's individual circumstances. We consider elements that might form the basis

⁸ BBC Radio 4, 'University Businesses', The Bottom Line (February 2019) -

<https://www.bbc.co.uk/programmes/m0002cgm>

See also <https://epsrc.ukri.org/newsevents/multimedia/ppnottinghamrollsroyce/>

⁹ https://www.wipo.int/sme/en/documents/academic_patenting.html

¹⁰ <https://www.city.ac.uk/research/research-and-enterprise/getting-started/city-schemes/london-city-incubator>

of the development of an IP policy for Mexican universities designed to promote social innovation in the local economy, currently a priority for UNAM and other Mexican institutions.

What are the Key Principles found in UK University IP Policies?

The first task that any university must do if it wants to commercialise its research is developing an IP policy. What are the key aspects of typical UK university IP policies and commercialisation strategies? We examined a sample of 10 IP policies at research-intensive institutions based on the public documents available on university websites.¹¹ Drawing on these policies, we outline here the main principles and provisions of a typical existing IP policy at a UK university.

IP ownership and confidentiality

Providing clarity on IP ownership is a key function of a university IP policy. Invariably, a university asserts in its IP policy (and sometimes in its employment contracts) that as a general principle it owns all IP generated by university staff.¹² This is a standard term common to all 10 university policies surveyed.

¹¹ As a sample of 10 UK research intensive universities, the below links to the IP policies of City, University of London, the University of Oxford, the University of Cambridge, University College London, King's College London, the University of Sheffield, Newcastle University, the University of Leeds, Queen's University Belfast and the University of Edinburgh demonstrate this intention:

https://www.city.ac.uk/_data/assets/pdf_file/0005/77063/City-University-London-IP-Policy-v0.86-1410101.pdf

<https://www.ox.ac.uk/students/academic/guidance/intellectual-property?wssl=1>

<https://www.enterprise.cam.ac.uk/intellectual-property/>

<https://www.ucl.ac.uk/library/ucl-copyright-advice/ucl-staff-ipr-policy>

<https://www.kcl.ac.uk/governancezone/Research/Intellectual-Property-Commercial-Exploitation-and-Financial-Benefit>

University of Sheffield IP policy

<https://www.sheffield.ac.uk/rs/commercialisation><https://www.ncl.ac.uk/media/wwwnclacuk/research/files/NU%20IP%20policy%20effective%201-8-18%20with%20all%20links%20and%20appendices%2011-9-18.pdf>

http://www.leeds.ac.uk/secretariat/documents/ipr_policy.pdf

<https://www.qub.ac.uk/Business/Commercialisation/IP-and-innovation/IP-policy/>

<https://www.ed.ac.uk/files/imports/fileManager/University-Policy-on-Exploitation-of-Intellectual-Property.pdf>

¹² See for example Queen's University IP Policy s. 10 and s. 14; University of Edinburgh IP Policy s. 3(3); Newcastle University IP Policy s 5; Newcastle University IP Policy s 3(2); City, University of London IP Policy s 4(1); University of Oxford IP policy (Statute XVI: Property, Contracts, and Trusts).

(2002) s. 5. (1)(a). UCL Policy Statement on Intellectual Property Rights/Copyright in relation to staff s 3-5.

University of Cambridge IP Policy s 5-8. KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 1-2.

Despite its ubiquity, there are exceptions to this term. Non-staff, such as postgraduate research students (for example PhD candidates) are in a different position – they may sign up to specific terms about IP ownership as a condition of their enrollment.¹³ Typically, universities assert ownership of IP in cases where the students are working in collaboration with university staff or as part of a funded project.¹⁴ With respect to undergraduate and taught postgraduate students, universities generally do not claim ownership of IP created by them, except where it negotiates and agrees otherwise.

Generally, academic publications are of little commercial value, therefore UK universities generally waive rights over the copyright in scholarly publications written by academics to pursue their careers, provided the material does not form part of a course or teaching materials for the university; however, the university may assert rights in underlying research/materials upon which the scholarly work is based, including software, data, databases, designs and patentable inventions.¹⁵

Ensuring confidentiality is also a paramount aim of university IP policies (present in all 10 policies examined). University researchers are typically under an obligation to guarantee secrecy before filing patent applications (aiming to safeguard the novelty of the invention and thus its patentability).¹⁶ Since this goes against academic instinct to publish and present results as quickly as possible, it is crucial that universities inform their researchers about this obligation.

¹³ University of Oxford IP policy s. 5. (1)(b); UCL Intellectual property rights: policy for students. KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 1-2.

¹⁴ University of Oxford IP policy s. 5. (3); UCL Intellectual property rights: policy for students. University of Cambridge IP Policy s 14. KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 1-2.

¹⁵ See for example Article 6(1) City, University of London IP Policy (2014); University of Oxford IP policy s. 6-8; UCL Policy Statement on Intellectual Property Rights/Copyright in relation to staff s 2. University of Cambridge IP Policy. KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 14. It is notable that despite universities commonly asserting rights over course materials, Rahmatian states that lecture slides are likely to fall outside of the typical ‘course of employment’ and thus should remain the property of the Lecturer along with the academic’s scholarly publications - A. Rahmatian, (2015) University academics as employees and creators of copyright works: university academics as owners of copyright? *European Intellectual Property Review*, 37(6), pp. 355-358. <http://eprints.gla.ac.uk/107291/7/107291.pdf>.

¹⁶ University of Oxford Regulations for the Administration of the University's Intellectual Property Policy (2002) s 1-2 UCL Policy Statement on Intellectual Property Rights/Copyright in relation to staff s 6. University of Cambridge IP Policy s 2 and 4; KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 14.

Similarly, transfer of any valuable university know-how – such as trade secrets - should always be covered by an adequate confidentiality agreement. Where a patent application is being contemplated concerning an invention disclosed in a thesis, regardless of ownership, then external examiners/reviewers are typically asked to sign a confidentiality undertaking. It may also be necessary for the thesis to be held in the university library on a restricted access basis until a patent application has been filed.¹⁷

The role of the Technology Transfer Office (TTO)

The university TTO is the initial place researchers go to in order to obtain advice on IP. This includes assessments to identify projects early on and advise on what may be patentable or protected by copyright, what may be kept as a trade secret, and what is required for branding (trademarks) etc.¹⁸ Researchers should: (i) assist in protecting university rights to the IP by keeping suitable records of creation wherever possible; (ii) obtain advice in relation to any invention of a technical nature, which might be protected by a patent, from the TTO to avoid any premature disclosure which may reduce the commercial impact;¹⁹ (iii) be prepared to discuss the invention or IP, its nature and applications with third parties subject to a confidentiality agreement, during the assessment or commercialisation process.²⁰ The active participation of the inventor(s) in the commercialisation of IP is often necessary for a successful outcome.

Commercialisation procedures, risk and governance

How do university IP policies envisage commercialisation? There are two principal ways: (a) facilitating a licence to an already established company in return for a fee or royalties; or (b)

¹⁷ See for example Article 6(2)(c) of the City, University of London IP Policy (2014).

¹⁸ Gabdullin Nikita, PhD Electrical Engineering, City, University of London - <https://www.city.ac.uk/research/research-and-enterprise/getting-started/city-schemes/london-city-incubator>. See <<https://www.city.ac.uk/business-services/case-studies/heliex-power>>; <<https://www.city.ac.uk/law/careers/pro-bono-professional/start-ed>>; for example Queen's University IP Policy s 13 and s 28(a); Newcastle University IP Policy s 5(9); City, University of London IP Policy s 9(4)(b).

²⁰ See University of Oxford Regulations for the Administration of the University's Intellectual Property Policy (2002) s 1-2; KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 6-7.

setting up a spin-out company as a vehicle for commercialisation such as the marketing and distribution of goods and/or services.²¹

Licensing is reasonably straight-forward and generally risk-free for universities: the university simply agrees a contract with a private company specifying the IP, the uses, the period of the licence term, and the fee/royalty rate for use. However, establishing a spin-out company is more onerous. It entails the creation of a new company, whose main target is the development and exploitation of university IP. Such company may seek investors who would subscribe for shares. Most UK universities are public institutions and many have limited experience of the kinds of risk-taking investment common in the private sector. So how does a university decide how to assess the risks of setting up a new spin-out company?

A research-intensive university with an interest in commercialisation usually features an entity equivalent to a university 'IP Commercialisation Board' (as it is known, for example, at City) or an 'IP & Licensing team' (as it is known at KCL) - or in some cases e.g. Oxford, UCL, Cambridge, etc. via a subsidiary entity such as Oxford Innovation Ltd, UCL Business, or Cambridge Enterprise.

The IP Commercialisation Board or equivalent is responsible for making recommendations concerning all transactions relating to spin-out companies, pending final approval by senior university authorities/committees/senates. In light of the risks involved (financial, reputational, etc.) should the venture not be successful, in deciding whether to approve the creation of a spin-out company the IP Commercialisation Board will weigh up a series of key factors, including: (i) the overall benefit to the university; (ii) the nature and value of the IP to be vested in the company; (iii) the viability of the business plan; (iv) the university's interests (e.g. risk, financial cost, opportunity cost, tax, etc); (v) insurance cover; (vi) legal agreements for securing funding; (vii) availability of an appropriate management team; (viii) any external partner organisations' reputation, financial position, contribution (e.g. equity holders/collaborators/funders); and (ix) whether to grant the spin-out access to university staff and facilities through contracted service agreements, or R&D contracts.²²

²¹ Queen's University IP Policy s 33; City, University of London IP Policy (2014) s 7(1).

²² See for example Article 7(2)(b) of City, University of London IP Policy (2014). KCL Code of Practice for Intellectual Property, Commercial Exploitation and Financial Benefits (2016) s 8-11.

Risk is a key issue as universities can be reluctant to put forward initial capital. Unless external investors agree to provide ‘seed investment’, this element of risk – in terms of the university risking its own funds - can lead to what is sometimes referred to as ‘valley of death’: the failure to find sufficient funds to develop the spin-out. This problem is well-known and has been the subject of discussions in the UK Parliament.²³

In terms of governance, for spin-outs a university researcher/inventor may participate as an executive or non-executive director, employee of, or service provider to the company, subject to university approval and any conflicts of interest being identified and mitigated.²⁴ The university typically reserves the right to appoint, remove or replace a director of its choice to the spin-out company’s board of directors, or to have an observer at board meetings.²⁵ If the university director leaves the university, it is expected they should resign from the board of the company.²⁶ The incorporation documents of the spin-out company should provide appropriate mechanisms for managing potential conflicts of interest.

Where universities intend to take a shareholding in the new spin-out company, the university is usually a minority shareholder.²⁷ The IP Commercialisation Board (or equivalent) will monitor university investment in these companies and make recommendations to university management concerning decisions regarding any sale of equity.

In this way, university IP policies envisage conflicts of interest in the commercial context being managed appropriately.²⁸ Other potential conflicts need to be managed as well. For example, academic researchers have an interest in disseminating the results of their research, e.g. via publication in journals, but this may collide with the business interests of a company. Take for example a scenario where a university researcher comes up with a potentially valuable invention and is simultaneously a manager of a spin-out company. The researcher’s first instinct may be to publish an academic paper in e.g. *Science* or *Nature* as soon as possible. Yet, as a manager within a company that could exploit the invention, the researcher is supposed to

²³ See the webpage <https://publications.parliament.uk/pa/cm201213/cmselect/cmsctech/348/348.pdf>.

²⁴ See for example City, University of London IP Policy (2014) s 7(3)(a). On the management of conflict of interests scenarios see also Appendix B of Newcastle University IP Policy s 3(11).

²⁵ See for example City, University of London IP Policy (2014) s 7(7)(a).

²⁶ See for example City, University of London IP Policy (2014) s 7(7)(b).

²⁷ See for example City, University of London IP Policy (2014) s 7(6)(b).

²⁸ UCL Guidance to Staff on IPR issues s. 9.

consider those interests as well. Therefore, what the researcher ought to do to manage this conflict of interest is to delay publication of his/her research until the IP issue has been resolved e.g. by filing a patent application.

Revenue-sharing

It is vital that university IP policies explain the extent to which researchers can benefit financially from IP commercialisation. In all 10 university policies examined, it is noted that a percentage of any net revenue generated from the commercial exploitation of IP is shared by the university with the inventors/creators.²⁹ Percentages can vary from institution to institution and depending on the size of the overall revenue, but as they are designed to incentivise staff to commercialise IP they are usually quite generous. At City researchers receive 100% of the first £10,000 of net revenue, and then a smaller share - 70%-50% - as the overall amount of revenue increases;³⁰ meanwhile, the KCL policy is only slightly less generous than City's – researchers are entitled to 90% of the first £10,000 net revenue and 70%-50%-33% on a sliding scale thereafter as revenues increase.³¹ At Oxford, researchers are entitled to 85.7% of net revenue up to £50,000, but a smaller share as the overall income increases.³² At UCL researchers receive 80% of the first £100,000 of net revenue, and a small share of increasing revenues thereafter;³³ while at Cambridge the policy is slightly more generous than UCL – researchers are given 90% of the first £100,000 net revenue and a smaller share of additional revenue above this amount.³⁴

Moreover, students - such as PhD candidates - are also entitled to receive a percentage of net revenues should they contribute to generate IP.³⁵ Students are typically given the same treatment as any other university IP creators in terms of percentages – in other words the university does not discriminate based on whether IP is created by experienced academics or young research students.

How does commercialisation occur? UK University spin-out success stories

²⁹ See for example Article 8(1)(a) of the City, University of London IP Policy (2014).

³⁰ See Annex 2 of City IP Policy.

³¹ KCL University IP Policy s 9.

³² Oxford University IP Policy s. 7(4).

³³ University College London (UCL) Revenue Sharing Policy Statement s. 3.

³⁴ University of Cambridge IP Policy – Schedule.

³⁵ See again Article 8(1)(a) of City Policy; UCL Intellectual property rights: policy for students.

Having identified the key principles of university IP policies, it is now time to turn to the issue of how IP commercialisation occurs in terms of impact/links with the private sector. Empirical research by Dahlborg et al. demonstrates that ‘small and medium-sized companies are the largest absorbers of academic patents’.³⁶ Given the centrality of SMEs to all modern economies, this fact is significant. Furthermore, some of these SMEs are university spin-outs operating as social enterprises – a type of company that differs from other categories of businesses, because these entities are not entirely profit-driven.³⁷ Focusing on their public/social oriented goals, social enterprises exist to commercialise university IP with revenues gained from IP being reinvested in the social enterprise, creating greater opportunities for public benefit.³⁸

So what are examples of successful UK university spin-outs? Taking the field of robotics as one example, the two leading UK robotics spin-out companies are Consequential Robotics (a spin-out from the University of Sheffield)³⁹ and Oxbotica (a spin out from the University of Oxford).⁴⁰ Consequential Robotics develops companion and assistive robotic systems that enhance quality of life as people age (e.g. companion robots). Oxbotica works to develop the next generation of autonomous vehicles. Both of these prominent spin-outs have benefited not only from the provision at the university level of a clear IP policy that facilitates the sharing of revenue between university and individual researchers, but also from the commercialisation strategies that underpin spin-outs. Clear contracts were drawn up between university and spin-out company. In each case the university was willing to provide organisational and financial support to these companies as they were getting started.

There are several other examples of successful spin-out in UK. The University of Oxford created in 2005 a company called Oxford Nanopore Technologies Limited, which produces

³⁶ C. Dahlborg, D. Lewensohn, R. Danell, and C. J. Sundberg, ‘To invent and let others innovate: a framework of academic patent transfer modes’ 42 (2017) *The Journal of Technology Transfer* 538, 538.

³⁷ J. West, A. Salter, W. Vanhaverbeke and H. Chesbrough, ‘Open innovation: The next decade’ 43 (2014) *Research Policy* 805.

³⁸ O. Gassmann, E. Enkel and H. Chesbrough, ‘The future of open innovation’ 40 (2010) *R&D Management* 212.

³⁹ See the webpage at www.sheffield.ac.uk/news/nr/university-spin-out-company-with-sebastian-conran-to-develop-next-generation-of-robots-1.576135.

⁴⁰ See the webpage at www.oxbotica.ai.

and sells nanopore sequencing products, with the company's value recently reaching £1.5 bn.⁴¹ The University of Cambridge has also given birth to successful spin-outs. It created Congenica which has launched a platform that highlights genetic disorders and rare diseases: in 2015 it was awarded £2 million by Genomics England to continue its research.⁴² Cambridge University also spin-out Lycotec, a biotech company famous for its “anti-aging” chocolate bar.⁴³ English universities other than Oxbridge are also very active when it comes to generating spin-outs. UCL and Imperial College, for example, created in 2015 Bio Nano Consulting, known for coming up with a £10 device that monitors kidney disease.⁴⁴ Spirogen is another company created by UCL in 2001, which develops antibody-drug technology aimed at treating cancer tumours. The company was then bought by AstraZeneca in 2013 in a \$ 440 million deal.⁴⁵ And the University of Manchester has spin-out C4X Discovery, which develops technology producing 3D structures of drug molecules, facilitating rapid, safe and cost-effective development of drugs. The company floated on the market of the London Stock Exchange with roughly £31 million placed.⁴⁶

Wales and Scotland also provide a fertile ecosystem where spin-out ventures have been successful. In 2009 the Welsh Institute for Minimal Access Therapy at the University of Cardiff created Ultravision, a company which has developed a device capable of handling the smoke during keyhole surgery in the abdomen. The product is distributed in 25 countries around the world, with the company securing £2.1 million to increase further the commercialisation.⁴⁷ The University of Edinburgh also created a health-related spin-out. In 2008 it gave life to NuCana Biomed which produces new generation of anti-cancer therapies. In 2011 the company secured £6.74 million in Series A venture capital financing.⁴⁸ A Series A investment was also secured by Clyde Biosciences, a company created in 2012 by the College of Medical Veterinary and

⁴¹ Clive Cookson, Oxford Nanopore value reaches £1.5bn as it taps Asia-Pacific funding, 20 March 2018, <https://www.ft.com/content/df80e218-2b85-11e8-a34a-7e7563b0b0f4>.

⁴² See also Amadeus Capital Press Release of 14 April 2015, at <https://www.amadeuscapital.com/congenica-genome-diagnostic-company-raises-2-2m>; Business weekly, What drives the success of Cambridge genomics biotech pioneer Congenica? 14 May 2019, at <https://www.businessweekly.co.uk/blog/business-weekly-guest-blog/what-drives-success-cambridge-genomics-biotech-pioneer-congenica>.

⁴³ See company's website at www.lycotec.com.

⁴⁴ See the company's website at www.bio-nano-consulting.com.

⁴⁵ See also www.genengnews.com/topics/drug-discovery/astrazeneca-acquires-spirogen-for-up-to-440m.

⁴⁶ See University of Manchester's press release of 14 October 2014, at <https://www.manchester.ac.uk/discover/news/article/?id=13069>

⁴⁷ See University of Cardiff press release of 30 March 2015; see also the webpage www.ncub.co.uk/success-stories/ultravision.html.

⁴⁸ See www.sofinnova.fr/nucana-biomed-secures-10-4-million-series-a-financing-to-accelerate-its-protide-anti-cancer-drugs-into-clinical-development.

Life Science at Glasgow University, which has developed innovative technology to assess drug toxicity for biotech and pharma companies. It obtained a £2 million Series A investment led by Epidarex Capital, a life science venture capital fund.⁴⁹ And the University of Dundee has spin-out Exscientia, which uses artificial intelligence to discover more effective drugs. This spin-out recently partnered with US biopharma company Celgene which contributed with a £19 million upfront investment.⁵⁰

The above success stories confirm that the commercialisation of academic innovation does produce tangible results, which benefits both investors and universities themselves, as profits are usually reinvested to fund and support further research. More broadly, the whole process has the effect of strengthening universities' ties with the private sector, bringing benefits to the national economy and accordingly to society.

Mexico - The current status of innovation and IP policies in Mexican Universities

Recognising the potential for economic and societal benefits, the Mexican government has in recent years sought to encourage its universities to commercialise university innovation through licensing and spin-outs, particularly in the areas of science and engineering. In recent years the Mexican government agencies of Science and Technology contributed to establishing a 'Red de Oficinas de Transferencia de Tecnología' (a network for the Universities and Research Institutes Technology Transfer Offices) and a 'Red de Innovación Social' (Mexican Social Innovation Network) to try to encourage the transfer of technology.

Given the proven link between university patents and SMEs⁵¹, improving the knowledge transfer mechanisms in Mexico between universities and the private sector could lead to a boost for Mexico's SME sector as well as providing university with IP revenue. Yet, although there are some notable positive exceptions, in general Mexican universities have yet to develop broad-scale, successful IP policies and strategies.⁵²

⁴⁹ See UK Business Angels Association, Clyde Biosciences Closes Series A Investment, 22 August 2019, at www.ukbaa.org.uk/news/clyde-biosciences-closes-series-a-investment.

⁵⁰ See BBC News, Major deal for AI drug discovery firm Exscientia 22 March 2019, at www.bbc.com/news/uk-scotland-scotland-business-47667125

⁵¹ C. Dahlborg, D. Lewensohn, R. Danell, and C. J. Sundberg, 'To invent and let others innovate: a framework of academic patent transfer modes' 42 (2017) *The Journal of Technology Transfer* 538, 538.

⁵² F.J. Cantu-Ortiz, N. Galeano, P. Mora-Castro & J. Fangmeyer Jr. 'Spreading academic entrepreneurship: Made in Mexico' *Business Horizons* 60 (2017) 541.

In Mexico the core aims of universities are traditionally understood to be research, education and the dissemination of culture.⁵³ This means that commercial exploitation of research outcomes is not seen as a priority; indeed, commercialisation is sometimes even viewed as being contrary to the goals of universities in Mexico (especially in public universities where it is expected all research outcomes should be made accessible to the public).⁵⁴ Despite this, the above UK examples demonstrate that universities that obtain economic benefits via commercialisation of research outcomes can use the revenues to fund further public-focused research – indicating that there are ways to manage such conflicts.⁵⁵ Furthermore, Mexican universities are expected to contribute to the technical and economic development of the wider country.⁵⁶ The creation of TTOs helps to achieve this, which inevitably brings IP issues into play.

Previous research (Martinez et al.) noted that, if Mexican Universities would define their IP policies, this would facilitate research agreements and the protection of innovative outcomes from research, as well as the distribution of the benefits obtained by the commercial exploitation of the creations.⁵⁷ Furthermore, Universities should enhance collaboration with the private sector, in order to maximise the benefits stemming from academic patents and transform research into industrial innovation.⁵⁸

⁵³ Instituto de Investigaciones Jurídicas de la UNAM, Foro Internacional sobre la Propiedad Intelectual, Mesa 4, ‘La Propiedad Intelectual Universitaria’ (2014) <<https://www.juridicas.unam.mx/videoteca/evento/foro-internacional-sobre-la-propiedad-intelectual/2014-09-26/mesa-4-la-propiedad-intelectual-en-las-universidades>>.

⁵⁴ This statement has been confirmed by the specialists attending the above mentioned forums in May 2018 and 2019 organized by the Institute of Juridical Research (UNAM) and City University of London. There is an ongoing debate regarding what the public Universities should make available for the public; given that they manage public funds, it is believed that they are bound by the transparency law to make their research outcomes free and publicly available. However in the above forums it was noted that the obligation of transparency of the management of the public funds should not be confused with a total “open access” policy for all the research outcomes.

⁵⁵ See World Intellectual Property Organization., ‘Frequently Asked Questions: IP Policies for Universities and Research Institutions’ <https://www.wipo.int/about-ip/en/universities_research/ip_policies/faqs/index.html> accessed 27 June 2019.

⁵⁶ CALDERÓN MARTÍNEZ, M. GUADALUPE; GARCÍA-QUEVEDO, JOSÉ “Transferencia de conocimiento y diagnóstico sobre determinantes en la producción de patentes en universidades públicas mexicanas” (2012) XVII Congreso Internacional de Contaduría Administración e Informática. Disponible en <<http://congreso.investiga.fca.unam.mx/es/docs/anteriores/xvii/docs/D13.pdf>>

⁵⁷ Calderón Martínez M.G, García-Quevedo J. “Knowledge transfer and university patents in Mexico” 2013, *Revista Latinoamericana de Administración* 26 (1), 33-60.

⁵⁸ Calderón Martínez M.G, García-Quevedo J. “Knowledge transfer and university patents in Mexico” 2013, *Revista Latinoamericana de Administración* 26 (1), 33-60

At present, the Mexican Science and Technology Council coordinates the TTOs network in the country. However, Mexican TTOs typically lack sufficiently defined IP policies and strategies to facilitate adequate agreements between inventors, authors, entrepreneurs, employees or students at the university (questions of how to deal with resources provided by third parties also arise). Given the lack of IP policies and strategies publicly available and the boundaries of the study, we examine here (i) the overall regulatory framework of Mexican laws covering university innovation at present, including labour and employment laws; (ii) two case studies – (a) Tecnológico de Monterrey’s university IP and (b) the policies of the local Government of Jalisco to encourage university innovation. Finally, we highlight the main issues we found in our research in Mexico, and address a suggestion to tackle them taking into consideration the UK learned experience.

Regulatory Framework

Mexican IP national law has been greatly influenced by international agreements such as NAFTA and TRIPS.⁵⁹ According to Aboites, TRIPS produced a profound change in Mexican law from 3 perspectives: i) expansion of the definition of patentable knowledge; ii) taking influence from US IP jurisprudence, which has tended to strengthen protection of IPRs; and iii) a shift from the open science model to one based on the commercialization of research results at the public universities.⁶⁰

Therefore, the legislative changes enacted in Mexico after TRIPS have favoured the production of academic patents in Mexico. On the face of it, this could be viewed as progress. However, an increase in academic-related patents would not per se be beneficial to the wider society unless these patents (and the protected technologies) are actually transferred to the local economy. Unfortunately, often inefficient patenting occurs in Mexico - for instance, UNAM is one of the most significant Mexican patentees judged by applications to IMPI; yet despite the large number of patents granted each year, very few are licensed or spun out into the local economy.⁶¹

⁵⁹ Several intellectual property specialists in Mexico stressed this point in the interviews conducted for this research.

⁶⁰ Jaime Aboites and Manuel Soria, *Economía Del Conocimiento y Propiedad Intelectual, Lecciones Para La Economía Mexicana*. (México Siglo XXI 2008).

⁶¹ According to the Economy Ministry of Mexico, from 2013 to 2018, UNAM presented 299 patent applications. See: Secretaría de Economía, *Universidades y centros de investigación nacionales que registran más patentes en México* (13 February 2019) <<https://www.gob.mx/se/articulos/universidades-y-centros-de->

One cause of this failure is a lack of domestic legislation for regulating the outcomes of research activity at universities.⁶² In the absence of a comprehensive regulatory approach, there exists a patchwork of different national laws governing the transfer of technology in Mexico. The first of these is Mexican Labour Law. Under Mexican IP law, inventions that arise in a working relationship – such as between a university employer and its researchers/employees - are regulated by labour law. Mexican Labour Law has three different rules for the exploitation of inventions: a) The name of the inventor shall be acknowledged; b) When the worker does research paid by the enterprise, the property of the invention (including the right to exploit) will be the employer's; the worker will nonetheless have the right to receive compensation supplementary to his salary, but only when the economic benefits of her invention are proportionally higher than her salary; and c) in any other case the IP rights over the invention will be owned by the people that made it (the employer will only have preferential right to the exclusive use of the invention, or acquisition of the relevant rights).⁶³ The above rules fail to define comprehensively the scope of the relationship between researchers and universities - e.g. applying rule (b) strictly to researchers could mean that they would never be able to hold economic rights over their inventions and would only receive compensation when the invention's economic benefits reach a relatively high level. Therefore, if the relationship between researchers and Universities is only ruled by the current labour law rule (instead of e.g. an IP policy that provides rules for management of royalties), there will be a lack of incentives for Mexican academics to protect and exploit the outcomes of their work.

Article 13 of the Science and Technology Law in Mexico is also relevant here. This law states that scientific and technological education is intended to be linked with the productive industries and the services sector, in line with the Mexican Federal Government's efforts to support scientific research, technological development and innovation. Article 14 states that CONACYT⁶⁴ is in charge of managing an information system which is intended to (i) be

[investigacion-nacionales-que-registran-mas-patentes-en-mexico?idiom=es](#)>. There is no hard data regarding the number of academic patents that have been licensed or are in use in the local economy, nevertheless several innovation key agents interviewed for this article agree that the number is very low in comparison to the patents granted.

⁶² María Guadalupe Calderón Martínez, *La Gestión de Patentes Universitarias: El Caso de La UNAM* (DGEI-UNAM 2013).

⁶³ Federal Labor Law of Mexico (last amended 2019) available at http://www.diputados.gob.mx/LeyesBiblio/pdf/125_020719.pdf, art. 163

⁶⁴ CONACYT is the Spanish acronym for the National Council of Science and Technology. It was created in 1970, as an autonomous and decentralized Council. In 2019, the Government of Lopez Obrador suggested to

accessible to the general public; and (ii) protect IP rights. This has proven to be a challenge in practice due to gaps in the knowledge of IP rights within the academic researcher community, and to the failure thus far to build a digital platform containing information comprising the total research outcomes of all the research centres in Mexico. This aspect of the regulatory system is therefore ineffective.

A further legal element is provided by the Mexican ‘Regulation of the National Researchers System’. Such system (known by its acronym SNI, in Spanish) is also managed by CONACYT. It operates based on a point system for academic career advancement and promotion in five different categories: candidate, level I, II, III and Emeritus. Depending on the ranking, the researcher will get a different economic incentive. The publication of research articles is a crucial part of the system; for our purposes, however, what is crucial is that obtaining a patent⁶⁵ boosts the researcher’s status. This has contributed to a rise in academic patenting at Mexican universities. Nevertheless, it also appears to have created a perverse incentive: although TTOs assist Mexican researchers in the filing process, the resulting patents rarely transcend the research stage. If innovation supposedly operates as a ‘lifecycle’, the cycle in Mexico has a broken link – there is insufficient activity between academia and the innovative private sector.⁶⁶

Finally, Universities that do not have a specific IP policy must nevertheless try to secure ‘extraordinary incomes’ for their employees - including the allocation of royalties derived from commercial exploitation of patented inventions. For instance, UNAM’s relevant regulation specifies that if inventions generate profits, these will be distributed as follows: 20% for central university; 30% for the centre or institute where the invention was generated. If the invention arises from a collaboration of different research institutes, this percentage will be distributed among them according to their agreement. Finally, 50% of the extraordinary income will be distributed among the inventors.⁶⁷ Yet, complexities arise due to the organic way projects develop at UNAM - there is not always a previous agreement between the researchers and the

add the term ‘Humanities’ as part of the name to enhance this area of research in the country. At the moment of writing, this has not been implemented.

⁶⁵ See ‘Criterios específicos de evaluación, área VII: Ingenierías’ *Specific criteria for evaluation, VII área: Engineer*. CONACYT (2019) available at: <https://www.conacyt.gob.mx/index.php/el-conacyt/sistema-nacional-de-investigadores/marco-legal/criterios-sni/13720-criterios-especificos-avii/file>.

⁶⁶ F.J. Cantu-Ortiz, N. Galeano, P. Mora-Castro & J. Fangmeyer Jr. ‘Spreading academic entrepreneurship: Made in Mexico’ *Business Horizons* 60 (2017) 541.

⁶⁷ Article 27, Regulation on extraordinary income, National Autonomous University of Mexico (UNAM) < http://www.abogadogeneral.unam.mx/legislacion/abogen/documento.html?doc_id=39>

institutes that develop IP. The lack of such agreements between researchers and institutions demonstrates a lack of organization with respect to the commercialisation of inventions.

In the absence of a specific university IP policy, the above portrayed regulations have a direct impact on the protection and exploitation of inventions. Yet, one of the most important private universities in Mexico, Tecnológico de Monterrey, has developed such a policy, and as explored below, it has been using a model called RESPITIA to encourage university innovation. Furthermore, the local government of Jalisco has encouraged the functioning of the innovation ecosystem within its territory, which will also be highlighted below.

Case studies

- Mexican case study 1: the RESPITA model at Tecnológico de Monterrey

Tecnológico de Monterrey is a private University found in 1943 in Mexico. It is currently one of the top 5 universities in Latin America and it has 26 campuses around the country; it has built an education model called ‘Modelo Tec21’ that enhances entrepreneurship with a social perspective.⁶⁸ Cantu-Ortiz et al. note that the RESPITA (Research-Ecosystem-People-IntellectualProperty-Transfer-Alignment) model put into place at Tecnológico de Monterrey during 2010-2015 encouraged the launch of 16 small companies and supported 32 IP applications (most of which were for patents).⁶⁹ While the model was therefore a moderate success, Cantu-Ortiz et al. identify some key flaws centring on the IP policy used (which dated from 2007). A specific problem concerns a lack of clarity on revenue-sharing and potential conflicts of interest:

- ‘For example, although inventor ownership rights encourage more faculty entrepreneurship (Kenney & Patton, 2011), the 2007 policy stipulated that the technologies developed at the university belonged to the institution and that only 30% of patent royalties would be awarded to researcher-inventors. The policy did not consider potential conflicts of interest for professors where both inventors of intellectual property and equity-holders in a new spin-off company. It also limited the

⁶⁸ See Tecnológico de Monterrey website, available at <https://tec.mx>

⁶⁹ F.J. Cantu-Ortiz, N. Galeano, P. Mora-Castro & J. Fangmeyer Jr. ‘Spreading academic entrepreneurship: Made in Mexico’ *Business Horizons* 60 (2017) 541.

university's flexibility to reap financial returns through technology transfer. This means that the university could not hold equity in spin-off companies and could only recuperate its investment in the incubation cells through licensing fees.'⁷⁰

The above authors note that a recent IP policy change at Tecnológico de Monterrey gives a larger share or benefit to inventors:

- 'According to the new program, the university provides research and development funding to an inventor and retains rights to just 50% of the royalties (down from 70%) generated from intellectual property licenses. The TTO has made new financial arrangements that allow it to hold a share of equity in university spin-offs, and it negotiates for some percentage of equity in the spin-offs it assists'.⁷¹

Ultimately, Cantu-Ortiz et al. remark upon a key point that sums up the difficulties with turning patent applications into successful examples of technology transfer in Mexico:

- 'Just as in developed economies, an intangible resource——entrepreneurial culture——was key for entrepreneurs in Mexico; in fact, it was the most important resource.'⁷²

Developing an IP policy is the first step towards developing this entrepreneurial culture at universities – but by itself it is insufficient. Structures must be put in place to incubate and facilitate an open, transparent and supportive process for the commercialisation of IP, whether via licensing or spin out. University incubators of the kind several UK academic institutions have created can prove important in this regard.

⁷⁰ Ibid.

⁷¹ Ibid.

⁷² Ibid.

Mexican case study 2: Jalisco

Jalisco is a region of 8.2m people in the centre-west of Mexico. It is known around the world for being the birthplace of Tequila and Mariachi.⁷³ In 2000, Jalisco's State Government created the Local Science and Technology Council to develop its innovation ecosystem (linked to the National Development Plan, where the priority areas are those focused on solving social problems, such as health, with the aid of technology).

From informal discussions with Larissa Cruz of the Ministry of Innovation, Science and Technology,⁷⁴ we learned that even though the Council was funded in the year 2000, there was an absence of programs to promote IP protection in highly technological sectors. This is why in 2013, the Ministry of Innovation, Science and Technology was created –with a new law being passed in 2014 to define strategically the paths to enhance innovation.⁷⁵ Government actors in the region have been developing a range of creative clusters in the region featuring the ‘quadruple helix’: academy, industry, society and government.⁷⁶ In particular, the innovation ecosystem has been enhanced by: (i) establishing an open channel of communication between innovation stakeholders and the government, so that the regional government can, where possible, address innovators’ needs by reforming the legal framework; and (ii) setting up public forums and workshops on IP, and providing personalised IP guidance – e.g if certain issues turn out to be too complex, researchers can obtain pro bono advice from specialists at AMPPI⁷⁷, ANADE⁷⁸ and IMPI⁷⁹ - all of whom are willing to give pro bono advice on how to increase the viability of research projects. These strategies have led to Jalisco being viewed as the ‘Silicon Valley of Latin America’.⁸⁰

⁷³ Mónica Balleza Ramírez and Gobierno de Jalisco Secretaría de Promoción Económica, ‘Desarrollo Económico de Jalisco, Retrospectiva y Retos’ (2013) <http://comunidadmexicana.org.mx/documents/Libro_Desarrollo_Economico_de_Jalisco_retrospectiva_retos.pdf> accessed 27 June 2019.

⁷⁴ Larissa Cruz is, at the moment of writing, the Director of Intellectual Property within the Ministry of Innovation, Science and Technology of Jalisco.

⁷⁵ Ley de Ciencia, Desarrollo Tecnológico e Innovación del Estado de Jalisco, *Science, Technology Development and Innovation Law of Jalisco* (2014) available at: <https://transparencia.info.jalisco.gob.mx/sites/default/files/Ley%20de%20Ciencia%20Desarrollo%20Tecnologico%20e%20Innovacion.pdf>

⁷⁶ Patricia Romo, ‘Jalisco Se Consolida Como Capital de La Innovación | El Economista’ *El Economista* (9 February 2016) <<https://www.eleconomista.com.mx/estados/Jalisco-se-consolida-como-capital-de-la-innovacion-20160209-0113.html>> accessed 27 June 2019.

⁷⁷ Acronym of the Mexican Association for the protection of Intellectual Property (Asociación Mexicana para la Protección de la Propiedad Intelectual).

⁷⁸ Acronym for the National Association of Enterprise lawyers (Asociación Nacional de Abogados de Empresa).

⁷⁹ Acronym for the Mexican Institute of Industrial Property (Instituto Mexicano de Propiedad Industrial).

⁸⁰ See: Yanin Alfaro, ‘La estrategia de Guadalajara para ser el Silicon Valley de Latinoamérica’ *Entrepreneur* (26 December, 2017) <<https://www.entrepreneur.com/article/290658>> accessed 20 June 2019.; Sonia Corona

The Jalisco Ministry of Innovation has also established three programmes:

- PROPIN: a special programme which aims to promote IP knowledge and use (focusing on inventors, entrepreneurs, SMEs etc.);
- an enterprise programme which aims to consolidate indicators relevant to enterprises and start-up companies; and
- a universities' programme which aims to contribute financially to the annual costs of protecting IP.

It is the third programme that is particularly relevant here. For universities to participate, they must fulfil certain conditions: (i) they must develop a set of rules and norms to regulate IP and commercialization of inventions (e.g. an IP policy); and (ii) they should develop a technology portfolio available for possible investors from the private sector. Moreover, each year the Jalisco Innovation Ministry assesses whether the universities that participate fulfil their commitments. Several private law firms have been integrated into the programme. The Innovation Ministry only allows law firms with offices in Jalisco to participate. The law firms can assist universities in obtaining, licensing and litigating IP.

The above strategy has been so successful that in only 3 years of its application, Jalisco has moved from 5th to 2nd place as of 2019 in the amount of patents registered by a 'Local Entity' in Mexico (second only to Mexico City).⁸¹

After highlighting Jalisco's success story of enhancing the innovation ecosystem in the region, we now proceed to highlight the problems encountered at the broader national level.

Key problems and lessons learned

'El Silicon Valley mexicano está en Jalisco' *El País* (12 March, 2017) <https://elpais.com/tecnologia/2017/03/12/actualidad/1489275848_767120.html> accessed 20 June 2019.

⁸¹ Patricia Romo, 'Jalisco Es El Segundo Estado Con Más Patentes e Invenciones de México | *El Economista* (19 May 2019) <<https://www.eleconomista.com.mx/estados/Jalisco-es-el-segundo-estado-con-mas-patentes-e-invenciones-de-Mexico-20190519-0028.html>>.

Mexico is divided in 32 regions- States.

In this section we provide general concerns about the current IP regulation at Mexican universities that were expressed by participants at the IP forum events held at UNAM in May 2018 and 2019⁸²:

1. Bureaucracy in universities' internal process. The excessive bureaucracy discourages the participation of private enterprises and reduces their propensity to collaborate with research centres. This means that, even when private enterprises are willing to collaborate with universities, their contract processes make it really hard for them to materialize agreements. For example, National Research Centres that depend on the above mentioned CONACYT are very strict - they seem to have an exacerbated surveillance system.
2. Lack of IP knowledge. Many Mexican researchers are still not fully aware of the different forms of IP rights available to protect the outcome of their research and the various different advantages of them. There is thus need to fill that awareness gap, by strengthening the IP culture within the research community.
3. Lack of incentives. The National Research System (SNI) does not give incentives to researchers to become entrepreneurs, neither to make their research outcome available to society in other ways. Researchers are therefore less likely to look for ways of achieving this. Conversely, in Jalisco the local government does encourage researchers to become entrepreneurs, by giving them an incentive similar to the SNI, if they follow the process within their universities. However, this is not the case for the rest of the country.
4. Students. Apart from Jalisco, where there is a strong support network and funding is available for IP application⁸³ and exploitation, researchers and students can be concerned about the time a patent application takes – indeed, it can divert energies away from research. Moreover, currently the law does not provide for Mexican students - e.g.

⁸² Participants of the forums included representatives of the Intellectual Property Office of Mexico, patent lawyers from leading Mexican IP law firms, TTOs representatives and researchers from several Mexican universities.

⁸³ For instance, the government of Jalisco has an agreement with the local patent office, in order to process patent applications -where the stakeholders are part of the programs- in a maximum of 2 years.

PhD candidates and post-graduate students - to receive any portion of the revenues generated by the commercialization of the IP they have contributed to create.

5. Open access. It is widely believed within the Mexican academic community that science and research done in public universities should be accessible as much as possible to the whole population.⁸⁴ Universities and research centres should therefore include in their IP policies mechanisms that make sure that appropriate assessments are carried out to balance between IP management and open access for research outcomes.
6. Mismanagement of funding. Possible corruption of people involved in the management of public funding for innovation at universities and research centres has deeply affected the allocation and distribution of funds for crucial areas of research. This has generated a certain reluctance on the part of authorities when it comes to commercialising research outcomes and sharing royalties.
7. Lack of a regulatory framework. The introduction of a stronger legal framework that incentivises researchers, promotes the virtuous circle of knowledge and boosts the whole academic community in Mexico is needed.⁸⁵

Conclusion

UK universities tend to follow a standard model of IP creation, knowledge transfer, and IP commercialisation, leading to opportunities for spin-outs and generation of licensing income. This UK model is based on the provision of (i) clear and precise IP policies and (ii) the promotion of an entrepreneurial incubation culture, including providing access to funding for start-ups, spin-outs or social enterprises, both internally (within the university) or externally (through investment by private companies). This model has not been as successful thus far in

⁸⁴ In 2019 there has been a proposal from CONACYT concerning changes in the National Law of Science and Technology, in order to build a repository that publishes all outcomes of the research fund by the Council. The scientific community has been debating this proposal before the Parliament, so that they may acknowledge the positive and negative sides of this. See: '*Memorias Conversatorio para el análisis del Sistema Nacional de Ciencia, Tecnología e Innovación*' Report of the Dialogue for the análisis of the National System of Science, Technology and Innovation, Foro Consultivo Científico y Tecnológico (2019) available at: https://foroconsultivo.org.mx/FCCyT/libros_editados/conversatorio_sistema_cti.pdf.

⁸⁵ The current legal framework in Mexico does not promote the virtuous circle of knowledge. This challenge was also identified by the 'Asociación Mexicana de Inversión de Impacto' *Mexican Association for Impact Investment* in the report of Impact Investment in Mexico, published in 2018 available at: <https://ethos.org.mx/es/ethos-publications/inversion-de-impacto-en-mexico-2/>.

developing countries such as Mexico despite high levels of academic and scientific achievement and research at the national institutions (e.g. at UNAM).

We note that there are lessons that can be drawn from UK universities' IP policies, but there are also issues that must be examined and dealt with in light of Mexico's specific circumstances, including PhD and Master's students' IP rights; corruption and bureaucracy; and the adoption of an encouragement/incubator model rather than a punitive one which may end up disincentivising researchers by instilling fears of disrespecting IP policies' terms and conditions. Our analysis provides that a clear IPR policy should be developed for Mexican universities. It would be beneficial to tailor IP policies for specific Mexican institutions based on each university's needs; and rather than exporting a particular model of IP generation and commercialisation, it is necessary to build an incubation culture from the ground up, considering the characteristics of the local economy. This incubator model brings together scientists and engineers, technology transfer officers, managers, lawyers, etc.

With respect to the role of IP law more generally, we demonstrate that even – as in Tecnológico de Monterrey – where there is an IP policy, this is by itself insufficient. IP policy on its own is only a single factor in the lifecycle of innovation. Without cultural and infrastructural support aimed to develop an 'entrepreneurial culture', an IP policy is unlikely to lead to success. This shows the fragility of IP law as a framework for incentivising and rewarding creativity – as we note in this article, incentives to patent can even lead to perverse outcomes where patents are filed and granted but then are never actually transferred into the local economy. For IP to truly benefit the university and society at large, investment is required at an early stage to facilitate networking connections with local investors and entrepreneurs. Considering the above experiences and literature surveyed in the UK and Mexico, a key imperative emerges: the need to facilitate an entrepreneurial culture within the university sector in Mexico. The incubator model – bringing together scientists and engineers, technology transfer officers, managers, lawyers, etc. – can help to facilitate this. In particular, the use of the incubator model at Mexican universities can provide targeted internal innovation support – including IP licensing - in the context of social enterprises.⁸⁶ Jalisco is one state in Mexico where there are signs of success but other states in Mexico are falling behind.

⁸⁶ C. Dahlborg, D. Lewensohn, R. Danell, and C. J. Sundberg, 'To invent and let others innovate: a framework of academic patent transfer modes' 42 (2017) *The Journal of Technology Transfer* 538, 538.