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PUTTING THE REGION FIRST: KNOWLEDGE TRANSFER AT UNIVERSITIES IN GREATER MANCHESTER

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Putting the region first:
Knowledge Transfer at Universities in Greater Manchester

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Abstract

Knowledge transfer has become one of the major policy goals of governments across the world and is being encouraged at the national and EU level. While policy makers and academics continue to look for a knowledge transfer model that will work for all universities, some recent analyses have shown that specific local and historic conditions that affect a university's ability to engage with the region need to be considered. This paper looks at the knowledge transfer activities of the three universities in the Greater Manchester area. All three universities are closely linked to their local environment and can trace their origin to the mid-19th century and the development of Manchester as the "first industrial city". Differences in research priorities and funding (cuts) have affected their development and left us with three distinct knowledge transfer strategies.

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1 Introduction

Policy makers and academia are increasingly discussing the role of universities in engaging and fostering communities and regions (e.g. Etzkowitz et al. 2000; Arbo and Benneworth 2007). The policy discourse on the role of universities is dominated by knowledge and technology transfer objectives that stress the importance of university-business links and commercialisation of university research for wealth creation and regional economic development (Etzkowitz et al., 2000).

While knowledge and technology transfer and regional engagement have been encouraged through central government incentives and most universities now have technology transfer offices, the types and levels of engagement and commercialisation differ between universities (Andersen and Rossi, 2011) and regions (Phan and Siegel, 2006). Phan and Siegel (2006), suggesting, therefore, that university development can be seen as a co-evolutionary process, and that institutional theory and evolutionary economics could form a suitable approach to explaining the differences in university technology transfer across institutions and regions. Roles performed by universities, including regional roles, are path-dependent and are influenced by the university's adaptation processes and its environment. In this context, Feldman and Desrochers (2003) point out that a university's culture and institutional context, expressed through its history and mission, strongly influence its ability to successfully engage in knowledge transfer (Kenney and Goe, 2004).

In this paper we focus on the development of three universities in the Manchester region and their almost 200 year history. As a centre of the industrial revolution, Manchester can be considered the world's first industrial city (Hall, 1998). The development of its universities is closely linked to that of the local industry, championing a new type of educational development driven by the demands of local businessmen that is also representative of other industrial cities in the UK.

In what follows we first discuss the importance of universities for regional development and the co-evolution of universities in regions. Section 3 will discuss the current missions of universities in Manchester and the history of their interactions with industry. We first use current data to illustrate the different knowledge transfer roles of the three universities. The historic perspective then enhances our understanding of the three organisations, their importance for the local economy and how historic development has created three distinct knowledge transfer strategies. Finally, in section 4 we will look at how this co-evolutionary process still shapes knowledge transfer today. Section 5 concludes.

2 Universities and their regions

2.1 Contribution to regional economic development

The past twenty years have seen a growing interest in both research and policy circles in the nature and implications of the so-called knowledge-based economy, and specifically the contribution of academia to economic development and innovation. The objectives and outcomes of university knowledge and technology transfer and their economic impacts at the regional, national and international levels have been investigated by a large and growing literature. Universities have traditionally been an important source for knowledge creation and economic growth as they support industrial innovation through solving fundamental research problems (e.g. Aghion et al., 2008; Gibbons and Johnston, 1975; Nelson, 1986) and contribute directly through licensing of inventions resulting from their research (e.g. Henderson et al., 1998; Thursby and Kemp, 2002). Modern science and technology industries have been built on the expertise of university research. Discoveries at research institutions provided the basis for many new commercial opportunities leading to the development of new industries (in the case of biotechnology or microelectronics) and transforming existing ones. Driven by economic changes in the 1970s which saw industries under-investing in research and shrinking university budgets, policy makers have emphasised that links between the science base and industry would improve regional economic growth and competitiveness. Encouraging such links and the successful commercialisation of university inventions have since become major policy goals in the US and in Europe. Governments across the world are providing incentives for researchers to engage in research partnerships with industry and other external partners, to undertake projects with greater commercial prospects, and to offer courses tailored to the demands of local industries (Drucker and Goldstein, 2007). In the UK, for instance, since the 1980s government reports have emphasised the importance of university-industry partnerships and research driven by societal needs and technology foresight (Tapper, 2007). The university's role in the region and in regional development has become a particular focus for analysis and policy (Chatterton and Goddard 2000; Uyarra 2010).

Universities contribute to regional economic growth through knowledge production, dissemination and transfer. In addition they perform an important anchoring role within the region through their sheer size (and associated role as major employers and sources of local goods and services) and volume of investment in both infrastructure and buildings (Drucker and Goldstein, 2007). In addition, they take on the role of regional leadership through strong

historical links with the region and contribute to the cultural landscape (Boucher et al., 2003), shaping regional identity (Breznitz and Feldman, 2012).

Despite these varying roles, most conceptualisations of the university's wider regional and societal impact focus on the commercial or entrepreneurial aspects of the university and see collaboration with industry, knowledge transfer or commercialisation as the main emerging missions alongside research and teaching (Uyarra, 2010). Studies that measure the regional economic impact of universities have found that spillovers from academia are localised, including the location of spin-off companies, and that co-location with universities is linked to increased innovative activity in firms and regions (see Drucker and Goldstein, 2007 for a review of the literature). However, at the same time authors have found disparities concerning the extent to which regions benefit from such spillovers and the extent to which universities perform these roles (Drucker and Goldstein, 2007). Both depend on the type of institution as well as regional characteristics. Leading institutions create the greatest overall contribution to their region simply by size (Huggins and Johnston, 2009) while at the same time they are less engaged than new institutions, perhaps because they are more concerned with national and international university rankings rather than their regional development role (Boucher et al., 2003). In the region, the level of regional control and funding power positively affects the extent to which regional actors benefit from university knowledge, as does regional identity (Boucher et al., 2003). Moreover, universities in smaller more peripheral regions, which are more dependent upon universities (Huggins and Johnston, 2009), adopt a more active local development role (Boucher et al., 2003). Existing approaches and studies investigating the relationship between universities and their regions often fail to capture the interdependence between the two. Universities not only create spillovers but are influenced and shaped by their regions, including their knowledge and technology transfer mechanisms. Therefore this paper adopts a co-evolution approach (Lewin et al., 1999) that considers the interplay between the adaptation of universities, their knowledge transfer dynamics and the dynamics of the institutional systems within which universities are embedded.

2.2 Universities and their co-evolution in regions

The co-evolutionary framework incorporates an embeddedness view where universities not only providing solutions to economic problems but shape and are shaped by networks, politics and regions. Following previous work on the co-evolution of firms (Lewin et al.,

1999; Dosi and Marengo, 2007; Geels, 2014), we can address the co-evolution of universities and their environment, including various regional actors, social movements and politics.

Co-evolution of universities is an outcome of internal and external developments. In the context of universities the main channels that influence the university system are funding structure, regional (student) population and economy, as well as advancements in science. The university affects all these through active engagement in teaching, research and external funding acquisition and collaboration. The establishment of links with industry and other external actors, in particular, is one of the primary manifestations of universities' regional impact. Universities thus evolve with the surrounding industry and the demand for collaboration and skilled human capital.

In terms of theory the co-evolutionary framework has used insights from evolutionary economics and institutional theory (Geels, 2014). Evolutionary theory considers processes that are path-dependent and therefore assumes a persistent heterogeneity between organisations (Dosi, 2000). Organisations adapt to environmental pressures by selecting or reinforcing existing organisational forms while resisting more complex changes. Also, a university's adaptation to external pressures due to changes in the regional or political landscape is likely to be enabled and restricted by its unique historical path dependence in terms of knowledge transfer adaptation. Institutional theory also addresses the importance of pressures and norms to which organisations conform (DiMaggio and Powell, 1983; Scott, 1995). Organisations are influenced by the institutional environment in which they operate. In the case of universities these can be government regulations, professional standards and other leading international universities. For example, following the success of technology transfer in some universities, others adopted similar regulations first through mimicking and later in response to government and funding pressure.

Both theories traditionally assume a passive view of the organisation which adapt to selection environments and isomorphic institutional pressures (Geels, 2014). However, two-way interactions exist between organisations and their environment.

We need to keep in mind that organisations are embedded in social and political structures (Polanyi, 1944) and can use their power to shape these. In the co-evolution framework organisations interpret pressures from the environment and make strategic decisions regarding their future. If organisations interpret changes or pressures as temporary they will take no action. An increase in environmental pressures may cause them to leave their path-dependent adaptation strategy and instead explore new strategies (Lewin et al., 1999).

Initially strategies will be aimed at defending the organisation against external pressures, but as pressures increase the organisation will seek to change and adapt to meet new challenges. In the case of universities this includes collective actions to defend themselves against governmental policies. Large universities may be able to shape policy and regional markets by virtue of their economic and political power, and may guide the strategy of other universities. When faced with increasing performance problems, organisations can be expected to intensify their restructuring strategy, first by changing elements close to their existing organisation, for example improving their general efficiency or making symbolic changes to mission statements (Geels, 2014). Only if problems are recognised as structural, more radical adaptive actions are taken resulting in new organisational forms or collaborations (Lewin et al., 1999), and a foundational redevelopment of the organisation including its values and core competencies (Geels, 2014). The theory also concludes that organisations that do not experience external pressures remain locked in their historic path.

3 Co-evolution of universities in the Manchester region

3.1 Contribution to regional economic development

The analysis focuses on the two Manchester universities, the University of Manchester and Manchester Metropolitan University (MMU), both situated in close proximity to one another, as well as the University of Salford, located 2 miles to the west.

The University of Manchester is the most research intensive of the three, ranking highly in UK and international university league tables. They employ almost six times as many staff in science, engineering and technology (SET) than the other two universities (see Table 1). This is also reflected in a much higher number of PhD students, publications and research income in SET subjects. MMU on the other hand is primarily a teaching institution, as reflected in the low number of staff and low levels of research income. The University of Salford, despite being much smaller than the two Manchester institutions, and having more students per academic staff than the University of Manchester, attracts similar levels of research funding per academic and has more publications per member of staff.

Table 1: University basic statistics (for 2012/13)

	University of Manchester	MMU	University of Salford
Undergraduate Students Total	26,955	26,214	15,580
Undergraduate Students SET	9,769	8,275	4,385
Staff Total	4,115	1,546	1,044
Staff SET	1,662	364	208
PhD Total	3,720	615	625
PhD SET	2,090	255	320
Publications SET (2008)	1,698	103	361
Research Council funding SET (2008)	58,880,000	773,000	3,666,000
Quality related HEFCE funding SET (2008)	22,086,682	635,332	4,321,200

Note: HEFCE – Higher Education Funding Council for England
Source: Higher Education Statistical Agency (HESA)

An analysis of present university strategies (as stated on their websites) and knowledge transfer data (from the Higher Education-Business and Community Interaction (HE-BCI)¹ survey) will provide a first picture of further differences between the three universities in terms of regional engagement. The University of Manchester describes itself as a world-class research university with a vision to provide top research and to attract excellent researchers (UoM, 2011). It aims to provide research with a wider economic impact and identifies its three main contributions to economic development as technology transfer, engaging in research collaboration with industry and as meeting national skill needs. These indicate a supra-regional orientation and a focus on innovation.

MMU identifies itself as a university “for world class professionals” and puts learning and student development at the core of its strategy (MMU, 2011). Its main three contributions to economic impact were identified as widening participation, meeting regional skill needs, as well as research collaboration with industry. MMU thus has a primarily regional focus and an interest in serving needs of the local industry and in enabling students to join higher education and to be entrepreneurial.

Finally, the University of Salford describes itself as the “enterprising university” with strong community links. At present it sees its main economic contributions as developing local partnerships, engaging in research collaboration with industry and widening participation. This regional strategy that primarily aims to benefit small local businesses has been expanded in the University’s latest strategic plan, with a goal to join the top league of UK research

¹ HE-BCI is an annual survey conducted since 2001, taking into account third stream income, university mission statements and non-commercial activities

institutions. The University has further recognised that it is lagging behind in knowledge transfer and aims to better exploit its opportunities for innovation (UoS, 2009). Thus, Salford is currently at a point of reorientation and expansion in an attempt to move closer to the University of Manchester.

A university's knowledge transfer culture is also reflected in its ties with external partners. The HE-BCI survey, conducted annually by the Higher Education Funding Councils, gives some evidence of the levels of engagement with businesses and the extent of commercialisation activities. Here we report numbers from the academic year 2006/2007, the year before the financial crisis, which brought about changes that will be discussed in more detail in section 4. Further, it is the last year that MMU reports details on engagement with the region.

The HE-BCI survey asked university managers about several channels of industry engagement, the types of companies and where they were located. Details of income generated through each channel are reported in Table 2. The survey revealed that the University of Manchester generates the greatest amount of income from businesses, reflecting their stronger research focus. However, Salford generates more income from small and medium sized enterprises (SMEs), especially through consultancy contracts. MMU and Salford receive most of their income from local businesses. More than 90% of their business research, consultancy and teaching contract earnings come from within the region, while less than one sixth of the University of Manchester's business contracts are in the region. Salford creates the largest local income.

Table 2: University Knowledge Transfer Activities (in 2006/7)

* in £000s	University of Manchester	MMU	University of Salford
Contracts Large Businesses (in Region)	9,005 (904)	552 (497)	109 (97)
Contracts with SMEs (in Region)	777 (561)	100 (100)	927 (927)
Consultancy contracts large business (in Region)	1,517 (108)	571 (514)	890 (801)
Consultancy contracts SMEs (in Region)	137 (79)	246 (246)	1,092 (985)
Courses for large business (in Region)	2,291 (293)	199 (179)	137 (129)
Courses for SMEs (in Region)	32 (0)	451 (451)	113 (113)
IP Income	5,016	* 3	10
Spin-off turnover	14,847	* 298	7,500
Staff dedicated to knowledge transfer	38	21	58
Staff involved with businesses	50%	20%	35%

* IP information missing for MMU for 2006/7. 2008/9 Values are displayed.

Source: HE-BCI

In terms of patent and licencing income, MMU and Salford lag behind. Neither university has a convincing intellectual property (IP) strategy, and this is reflected in their inability to generate any returns from their research activities. Nevertheless, Salford has generated some profitable spin-off companies. MMU also supports such entrepreneurial activities, but financial data is not available pre 2008. The figures for the academic year 2008/09, just following the crisis, indicate some spin-off activity but far less than the other two institutions. The spin-off turnover generated at the University of Manchester, considering its size and research capacity, is not as high as could be expected, perhaps due to its primary focus on invention licensing.

Finally, we look at the number of knowledge transfer support staff and members of staff involved with businesses as reported in the HE-BCI survey. All three universities have a technology transfer office (TTO) and Salford has the largest number of knowledge transfer professionals. The share of academic staff involved in knowledge transfer activities is highest at the University of Manchester but has been increasing at all three institutions.

3.2 Foundation of higher education institutions in the 19th century

University development and roles performed by universities can be seen as co-evolutionary processes. We therefore need to look at the start of the higher education development in Manchester to understand how these three quite different institutions could form and how they shaped their region and national politics.

Higher education in England at the beginning of the 19th century was dominated by Cambridge and Oxford and calls for reform were left unaddressed. With the start of a scientific age that contributed to the wealth and growth of industrial cities, came a requirement for technical education and scientific knowledge. The religiously driven education at the two traditional universities was no longer apt as it did not provide sufficient levels of training in mathematics, sciences and engineering. Moreover, it barred nonconformist students from entering their institutions. The situation was very different in Scotland where universities could flourish and were independent of the Church (Nature, 1876a). Though the University of London was established as a secular degree awarding body, a desire for a more localised education, especially across the industrial North of England arose (Thompson, 1886). It was these elements of a scientific age and religious struggle combined with a spirit of enterprise and innovation that would drive the foundation of

educational institutions in the Manchester area, which, in 1800, emerged as the world's leading industrial city (Hall, 1998). Thus, universities developed out of the interaction between forms of social movements and economic organisations, and technical change.

In Manchester the first technical colleges were established following initiatives of local businessmen and the nonconformist church. In 1783, the College of Arts and Sciences was founded, offering evening classes to suit the schedule of working men, but due to "a superstitious fear of a tendency of a taste for knowledge to unfit young men for ordinary business" (Wheeler, 1836: 491) the institution was soon closed. There was a perception at the time, that "higher education spoilt youths for business" (Thompson, 1886: 3). Similarly, the nonconformist college founded in 1786, the Manchester New Academy, had to move to York due to a "lack of energy" on the side of the original supporters (Wheeler, 1836).

From 1790 onwards the population of Manchester grew rapidly from "less than fifty to three hundred thousand inhabitants, with a total of nearly a million people living in the surrounding conurbation" (Platt, 2005: 16-17) in 1835, making the Manchester-Salford area the second most populated in the UK. The increase in wealth amongst merchants led to an increased requirement for education and culture, resulting in the establishment of, amongst others, the Royal Manchester Institution in 1823 and the Manchester Mechanics' Institute in 1824 (Wheeler, 1836) which also held lectures in Salford until Salford opened its own institute in 1838.

While the Mechanics' Institute aimed to help craftsmen learn basic sciences it did not offer systematic courses (Thompson, 1886). Efforts to establish a college or university of general education in Manchester started in 1829. In 1836 Harry Longueville Jones presented a document entitled 'Plan of a University for the town of Manchester':

"In all directions the circle of Manchester is full of life and intelligence, manufactures of every kind occupy the inhabitants of the towns; the movement of money is immense; commercial activity is carried to an extraordinary pitch; mechanical ingenuity receives there daily new developments; the minds of men are in a state of electric communication of ideas; their political sentiments indicate the restless vigour of a rising and sturdy people; their religious opinions are full of fervour and piety. Yet one thing still is wanting - the vast population of South Lancashire wants a centre of intelligence and moral improvement; it requires one if not two 'seminaries of sound learning and religious education'."

(Jones, 1836: 8, as quoted in Thompson, 1886: 21)

The attempts to establish a university were abandoned the following year due to the small number of enrolled students (Nature, 1876a). Also the Manchester New College, which was

moved back to Manchester in 1940 struggled with student numbers as did similar establishments founded in Salford. This struggle was primarily attributed to the rapid industrial development that required a large working force and drew urgency away from education (Thompson, 1886). It may also be due to the insecure financial situation of these early institutions and an inadequate system of elementary education to prepare for higher technical instruction (Cowan, 1968). These early pressures caused the young institutions to fail as they were yet unable to adapt to regional social and economic requirements.

The foundations for a university in Manchester were laid when Owen's College was founded in 1851 with the endowment from a local textile merchant, who remarked in his will that the college should teach "in such branches of learning and science as were then and might be thereafter usually taught in the English Universities" (Nature, 1876b). The new institution drew from both the renewed interest in education and substantial commitment from both social institutions and economic actors. The institution also adapted a more rigorous strategy to attract students and teaching staff and expressed a strong vision for expansion. From the very first moment the college aimed to become a university, as further asserted in 1873 by one of its professors, Sir Benjamin Brodie:

"[I]f I say that this is the foundation of an university, I say so from what appears to me to be a very good reason, for I believe that Owen's College boasts all the essential constituents of an university; and I have no doubt that before long it will go forth into the world equipped as an university in every respect"

(Nature, 1873: 508).

Further, the college received considerable sponsorship for its expansion from local business men and local councils without any aid from the state. The college offered day and evening courses without requiring any religious training, thus serving the working people and avoiding religious struggle. The push towards the status of a university grew and in 1880 Owen's College was granted the Royal Charter as the first constituent college of Victoria University, a new university not attached to any of the traditional institutions.

"The Owens College was the first example of the successful establishment in a manufacturing town of an institution which gave to all corners a University education. [...] In the midst of a great democratic movement, it has been practically proved that culture and learning need not be the exclusive property of the few"

(Nature, 1887: 385).

The regional political context was also favourable to the establishment of a university. The regional authorities took great interest in education and, in interaction with social movements

and economic actors, were able to provide an environment that prepared the people of Manchester for higher education. Manchester and Salford were at the forefront regarding educational matters, being amongst the first towns to appoint a School Board, following the 1870 Elementary Education Act², to better coordinate educational efforts in the area. The school boards started offering evening classes themselves, which were to complement the existing educational efforts, but led to some competition with existing colleges in the case of Salford, accelerating their failure (Cowan, 1968). In Manchester, on the other hand, school board education complemented the Technical School that had been formed from the Mechanic's Institute in 1883. With the demise of technical colleges in Salford, the school board was the main provider of education and in 1896, following the Technical Instruction Act 1889³, founded the municipal Salford Technical Institute, the predecessor of the University of Salford. Also the Manchester Technical College became a Municipal Technical School, following the 1902 Education Act⁴. Mechanical engineering, chemical works, textiles and construction were the dominant industries in Salford and also led the choice of subjects offered by the new municipal technical institute, instituting the importance of industry-led courses. Thus, the active interaction between political institutions, social movement and economic organisations led to the co-evolution of a higher education system that served the provision of skilled human capital to local industry.

Neither of the two technical institutes in Manchester and Salford had the same vision as Owen's College to become a university. Instead they saw their primary mission as providing "systematic instruction in those branches of knowledge which have direct bearing upon the leading industries of the district" (Powell and Dayson, 2013). This highlights the importance of internal strategies for university development.

In summary, at the turn of the century, Manchester and Salford boasted a well-integrated educational system that offered courses for all levels of qualification and that allowed working people to proceed into higher education. According to Simmons (1901) the investment provided for education and the participation in technical education was amongst the highest in England. He went on to remark:

"In the arrangements which the Technical Instruction Committee of its City Council and its School Board jointly have made to secure the co-ordination of all educational

² The Elementary Education Act of 1870 recommended the establishment of school boards to provide elementary education.

³ The Technical Instruction Act of 1889 allowed local authorities to offer technical or manual education.

⁴ The Education Act of 1902 allowed local authorities to offer higher education.

efforts within their borders, and so avoid that over-lapping which is such a prolific source of loss and disappointment in many other districts, this centre of the great cotton industry may well serve as an example of a community where the first object of public men is to secure educational efficiency and not to assist the glorification of a particular board or committee.”

(Simmons, 1901: 336)

The efforts of local businessmen to provide the working population with higher education proved successful. With financial resources made available by the wealthy people of Manchester and the support of the local authorities, institutions were formed, giving evidence of successful interaction. The close co-evolution of science and industry enabled Manchester to attract leading teachers to its institutions. With the efforts of the school board, a system for providing education at all levels was in place in 1900; the Manchester-Salford area offered one university, two colleges of technology and several smaller local colleges offering evening and non-degree courses.

3.3 The 20th century: Expansion and knowledge transfer

University foundations in Manchester and government policy

In 1905 the University of Manchester was officially instituted with the dissolution of Victoria University. The municipal technical school became the constituent college of the university whilst retaining some independence (later named Municipal College of Technology). Salford received royal assent and became the Royal Technical Institute (later Royal Technical College) in 1886 as a consequence of Salford's status as centre of technical competence and instruction that was recognised beyond the Manchester region.

After the war central government increased its commitment to higher education and pushed for expansion of higher education. As early as 1912, there had been a requirement for more advanced education of engineers as was pioneered in Germany and Switzerland. The incoming Labour government appointed committees to consider higher technological education and the demand for scientific manpower. The committees recommended an expansion of universities, the transformation of technical colleges into universities and the creation of 'institutes of technology' as a strategy to increase the number of students in science and technology (Bocock and Taylor, 2003). While this development led some universities to increase their science and technology courses, as was the case in Manchester through the collaboration of the University and the College of Technology, the government did not compel universities to offer more professional courses and they remained autonomous

in their decision making and their structures remained unchanged (Bocock and Taylor, 2003). This development reflects the first stage of strategic reorientations of organisations, where political pressures are considered temporary and no or minor changes are made to operational regimes (Geels, 2014).

However, in 1955, control of the higher education institutions was transferred from local authorities to central government, due to their increasing financial dependence and the inability of local authorities to meet these financial requirements. Through efforts by its Vice Chancellor, the Municipal College of Technology received university status in 1956 and all its non-degree courses were moved to a technical school in 1966. It was now called the University of Manchester Institute of Science and Technology (UMIST). The links between regional governments and universities were thus cut and universities were more likely to be subjected to national policies that could now be better enforced through their dependence on centralised public funding.

The Royal Technical College Salford was designated as a College of Advanced Technology in 1960 following a government initiative on technical education. It was encouraged to increase its share of advanced university courses and aimed to focus on sandwich courses in collaboration with local firms while continuing to offer technician education (Brentnall, 1957). Following the Robbins Report in 1963 it was awarded the status of university in 1967. In its founding charter it pledges to 'foster an academic environment which is enterprising and applied to business and the professions'. Its technical education was moved to a newly formed technical college. Thus, while offering more advanced technical education, the links to local industry were retained. The policy co-evolved with the university and enabled it to build on its established strengths and strategies with no need for radical re-orientation.

The removal of regional control and downsizing of technician education coupled with the national focus on rankings and internationalisation that ensued left a gap in regional education. In 1964, the incoming Labour government found that universities were not doing enough to accommodate wider participation and economic growth. They established a public sector of higher education with the formation of polytechnics that were to become the people's universities to provide higher technical education (Tapper, 2007). In 1970, thus, the Manchester Polytechnic was formed from a number of professional colleges in Manchester and placed under the control of the local authority. However, in 1992, as part of a greater reform on higher education funding that also attempted to break the financial ties with local authorities, these polytechnics gained the status of universities (Tapper, 2007) and MMU was

founded. The Manchester-Salford area thus became the home of a fourth university until the University of Manchester and UMIST finally merged in 2004.

Following the co-evolution of universities in interaction with regional authorities and social and economic movements in the 19th century, the 20th century was marked by restructuring that put institutions under central government control and enforced stricter rules on the types of courses that could be offered, thus partially breaking the links with the region. These developments reflect the second stage of strategic reorientations of organisations (Geels, 2014). Political pressures are noticed and courses are adjusted to meet the needs of the funding regime.

Universities and their role in the region

In this age of expansion and centralisation of higher education, Manchester's institutions sustained their links to local businesses and continued offering industrial services thus pursuing a similar strategy to before. During the first half of the 20th century higher education institutions were under the jurisdiction of local education authorities and part of a local education strategy that also emphasised relations with local businesses. There were links between the technical colleges and the surrounding industry through sandwich courses and industry led courses in areas of interest to the engineering, chemical, textile, mining, building and printing industries. The College of Technology conducted industrial research, often in collaboration with firms of the local area (BoE, 1918). Salford would set up a committee of industry representatives to provide advice, a move that was unusual in the first half of the 20th century (Powell and Dayson, 2013) but reflected the organisation's overall strategy to maintain close links with local businesses. Manchester Polytechnic would retain the profile of a vocational college until 1992 when it became a university.

Also the University of Manchester was concerned about its linkages with local businesses. In 1938, the Vice Chancellor of the university issued a document titled "A Partnership between Science and Industry" which emphasized the university's role in training students for employment in industry. The University set up a committee to investigate research policies putting particularly emphasis on industry needs (UoM, 2010). A Joint Research Council (JRC) of the Manchester Chamber of Commerce and the University of Manchester was set up in 1944 as a direct effort of regional and university actors. Its aims were similar to those commonly found in present day policy reports on the role of science for economic growth. They were concerned with the application of science, the appointment of knowledge transfer professionals, the provision of technologies to small firms, encouraging innovation in

industry, as well as investigating scientifically the needs of local businesses while considering economic and sociological problems (Nature, 1944, 1949). No similar body existed at the time “and it quickly became instrumental in promoting Manchester as the new centre of direct university-industry co-operation” (UoM, 2010). The interaction between the regional authority’s education and development policies and the University’s strategy thus enabled the establishment of new knowledge transfer activities that considered the expanding science base of the university. Through the integration of the technical college into the University and the activities of the JRC, the University retained close links to local businesses and continued to drive innovation in the area.

The JRC also received continuing support from the central government and after 1959 focussed its activities on providing technical information services to local businesses. Set up in 1948, the Manchester Technical Information Service (MANTIS) originally acted as a technical library and later provided technical advice in conjunction with the JRC and the central government. This also provided the first example of cooperation between local organisations and regional representatives of the central government (Taylor, 1966). The developments in Manchester also informed policies of the central government, giving evidence of how higher education institutions shape politics in a co-evolutionary framework. As part of the government’s “Industrial Liaison Officer” (ILO) scheme to establish industry-science links across the country, MANTIS was moved to UMIST and became part of its Bureau of Industrial Liaison in 1964 with the goal to further promote industry-science links. In 1965 government also took a more active role in providing its own joint research initiatives, including in Manchester, and the JRC was dissolved (UoM, 2010). The central government thus adopted successful initiatives pioneered in Manchester to apply them across the country. However, the government’s ILO scheme was discontinued in 1973 and the Bureau lost its government support. It subsequently continued to operate but without the involvement of its original founders and support from the central government it became primarily oriented towards its own academic activities and less concerned with regional needs. The change of policy strategy thus changed the way universities in Manchester engaged with local businesses. Government’s emphasis on excellence and a funding regime concerned with national and international rankings thus gradually transformed universities, leading them to drop part of their traditional civic mission. These developments reflect the second stage of strategic reorientations of organisations, where political pressures are interpreted as

concerning operational issues and retrenchment strategies are taken to improve efficiency of the organisation and symbolic changes to mission statements are made (Geels, 2014).

Formation of institutional companies for technology transfer

While during the first half of the 20th century the link between universities and local businesses was organised primarily through training activities and collaborations, the second half of the 20th century saw the emergence of an internally focussed knowledge transfer strategy that sought the commercialisation of academic activities. While liaison offices such as the one established at UMIST remained the main structure for forging links with industry in the UK during the 1970s and 1980s, some universities set up their own limited liability companies to actively market their inventions. This allowed the adoption of a commercial approach which could be considered beneficial for successful technology transfer (European Research Associates, 1988) and could help protect academics from the pressure of prospective industry partners (Ashworth, 2009). The University of Salford set up a company, Salford University Business Services Ltd⁵ (SUBS), initiated in 1969 with a government grant, to coordinate links with industry. This included better coordination of graduate placements and industry-led courses with the objective of raising income for the university. It grew to become one of the largest and most successful university consultancy and technology transfer companies in the UK and presents one of the most interesting examples of science-industry collaboration (European Research Associates, 1988; Richardson, 1995). It primarily provided support to SMEs in the region. University strategy thus changed to seize additional financial sources through links with local industry. This development was partially spurred by the increased costs for research and universities' increasing dependence from government.

Further, due to the severe financial crisis in the 1970s that led to a determination within the government to cut public expenditure, the university funding budget was reduced by 18% (Ashworth, 2009). These developments pushed universities to adopt a more pro-active strategy to promote excellence and to monetise on their scientific knowledge. These developments reflect the third stage of strategic reorientations of organisations. Political pressures are increasingly threatening the existence of universities, leading to strategic changes involving new collaborations and the exploration of new income sources (Geels, 2014).

⁵ previously Salford University Industrial Centre Ltd, renamed in 1986.

The University of Manchester thus followed Salford's lead by forming Vuman Ltd. in 1981, a limited liability company that acted as a contractor on behalf of the University to enable successful knowledge transfer. Already since 1972 it had been offering services to industry through its University Research Consultancy Service and the first license agreement was reached in 1976. Vuman bundled these activities and those already offered by individual departments with a primary focus on licensing and spin-off formation (UoM, 2000). This was perhaps a reaction to the patent act of 1977 that allowed universities to own university inventions and encouraged a more rigorous intellectual property regime. This development was rather different to that in Salford, where the focus was on consultancy and graduate placement. In 1985 Vuman had a turnover of £1 million (European Research Associates, 1988). At UMIST, which had hosted the Manchester industrial liaison officer and had operated an internal liaison office after 1973, a limited liability company, UMIST Ventures Ltd (UML), was incorporated in 1989. Similar to Vuman, UML primarily focuses on commercialisation of university inventions and spin-off formation. Research collaborations were fostered to benefit the university.⁶

Meanwhile, the Manchester Polytechnic, not a full university at the time of these developments but a local authority institution, was limited in the exploitation of its inventions until 1985, when the Further Education Act⁷ enabled it to commercialise work carried out by its staff. However, also following these changes it did not set up an exploitation company, but continued to offer its set of business-led courses and services to SMEs. Following the award of university status in 1992, it had an integrated 'Metropolitan research, innovation and consultancy' unit (METRIC) that combined consultancy and technology transfer services with general research contract and assessment services. Additionally, in 2000 the university set up an external relations division with a business partnership officer to establish a central contact point for external partners. It was thus the last organisation in Manchester to take a more proactive role in technology transfer.

New forms of institutional regional involvement

Salford and other technical universities experienced the most dramatic cut in public funding during the early 1980s. The University Grants Committee (UGC), which held responsibility

⁶ In 2004 it merged with the University of Manchester's innovation company.

⁷ The Further Education Act of 1985 enabled local authorities to supply "goods and services through further education establishments".

for distributing funding to universities, took a decision to cut grants selectively (Tapper, 2007). Block funding to universities was thus reduced and replaced with selective and excellence based grants. Salford was faced with a 44% cut in funding forcing it to downsize significantly, but the existence and success of SUBS helped it to survive. It launched a 'Campaign to Promote the University of Salford' (CAMPUS) as a charitable trust in coordination with SUBS. In total 200 companies contributed to the campaign that managed to raise almost £3 million from consultancy work and £700,000 from professional education in 1984/85. This amount was much higher than that raised by any other UK university (European Research Associates, 1988). The success of the campaign suggests that UGC was paying too much attention to public grants in its assessment and not to industry links and that indeed it had wanted the entrepreneurial university model to fail (Redfearn, 1981; Powell and Dayson, 2013). Following its successful campaign, Salford increased the share of funding from contractual sources to almost 50% in 1989 (Ashworth, 2009). CAMPUS continued its activities and established several funding streams to sponsor knowledge transfer and enable researchers to hold joint appointments in industry and academia (European Research Associates, 1988). This immense pressure and the ensuing developments can be considered as the fourth stage of strategic reorientations of organisations (Geels, 2014). Salford was forced to examine deep structural elements and allowed for a foundational redevelopment of the university, including changes to core competencies and organisational model.

Salford and Manchester have thus been at the forefront of industry-science links throughout their histories. Other universities followed their lead and established central commercialisation units throughout the 1990s and 2000s. Around this time, faced with further changes to government funding and a recession, Salford's commercialization company SUBS started to lose money (Powell and Dayson, 2013). In this environment Salford decided to change its approach to business liaison by establishing entrepreneurial activities as the third pillar of the university in an effort to become the first truly entrepreneurial university. SUBS was dissolved in 1998 and replaced by a new division that placed regional engagement at the centre of the university. Managerial and administrative changes followed and Salford established itself as 'Academic Enterprise' that not only focused on links with industry but also on those with other actors in the community. As such, it may have been instrumental in driving the development towards the engaged university and predated the government's interest in impact and a formal third mission for universities (Powell and Dayson, 2013).

These developments again highlight how institutions not only adapt to government policy but actively inform it.

4 Importance of co-evolution for knowledge transfer today

A look at the historic development of universities in the Greater Manchester region and their approaches to knowledge transfer shows that it is important to take into account the co-evolution of universities within the science system when evaluating knowledge transfer activities today. In section 3 we saw that the three universities understand themselves and their knowledge transfer role quite differently. This was apparent not only from their strategy statements but also from the amount of external income that could be sourced through various knowledge transfer channels. The University of Manchester was from its founding days driven to become a leading research university and while it maintained links to local businesses these were mainly aimed at increasing the university's revenue and providing a better teaching experience to its students. Especially after the Manchester Joint Research Council was dissolved in the 1960s, the university primarily forged a transfer strategy aimed at exploitation and research income creation. As a result it now is one of the leading research universities in the UK, generating a large share of its income from contracts with large firms all across the UK and the world.

The University of Salford, on the other hand, always saw itself as an institute of technology that was serving its region and the regional economy. As such it maintained close linkages with local businesses and regional authorities throughout its entire history and was continuously on the forefront of developing new ways to engage with local businesses, for example by opening one of the first knowledge transfer offices in the UK. These close links came to its aid when it was faced with severe funding cuts and enabled it to become one of the first universities to generate a significant amount of income from external sources. The close relationship with the region was further emphasised when it became the first UK university to fully take on a third mission. Throughout its history it has aimed at giving back to the region and establishing truly mutual links. The results of this development can be seen in the high amount of external income from primarily small local businesses and its successful start-up policies. It has, however, neglected to commercialise its own IP, perhaps partly due to a lesser focus on research than the University of Manchester. These shortcomings are addressed in its 2009 strategy document (UoS, 2009).

Finally, MMU, the last university to form in Manchester, has maintained a local profile due to its much longer history of providing local education and consultancy, which represented

one of its main missions up to 1992. MMU was also up until 1985 legally limited in its ability to develop an IP strategy and did not do so until 2000. This would suggest that MMU should exhibit lower levels of exploitative technology transfer and lower levels of research partnerships. In section 2 we saw that MMU is indeed still little involved in direct technology transfer through start-up creation and patenting. It does, however, provide a large amount of professional teaching to local businesses and has a relatively high income from research and consultancy contracts with local firms, though less so than Salford.

The historic perspective thus shows that knowledge transfer at universities is driven by a process leading back at least 100 years. It also shows how universities and their strategies are affected by external developments. Higher education institutions in Greater Manchester first provided education to meet the needs of industry in a vibrant industrial city and financial crises that led to funding cuts and changes in educational policy, affected how universities related to the region.

In 2008, the UK was again hit by a financial crisis leading to a reduction in GDP of 7.2% between 2008 and 2009 and the UK's austerity policy led to a further decrease in university funding. It also affected the cashflow of businesses in the Greater Manchester region and their intentions for investment (GMCC, 2013), including investment in academic research. Table 3 illustrates how the latest crisis has impacted the three universities. It reports the values for 2011/12 and the percentage change since 2006/7.⁸ Regional values were not available for MMU, but we can infer from previous years that more than 90% of income will have come from within the region. The numbers show that income streams from local companies have decreased significantly and have badly affected the two universities that primarily rely on such regional links. While the local income of the University of Manchester also decreased, their income from UK and international companies increased sufficiently to leave them with an overall increase from industry contracts of more than 50%. At the same time Salford and MMU, whose main links are with local firms, registered a decrease in overall business income of 25% and 37% compared to 2006/7. This shows that the local strategy left them very vulnerable when local firms were hit by the crisis.

Looking at IP income we see that there has been a sharp decrease for the University of Manchester of almost 70%. This value is up from 2010/11 but still far behind the high IP income levels of 2006/7. MMU and Salford were largely missing any convincing IP strategy

⁸ Values for 2007 were reported in Table 2. The percentage changes in income are calculated adjusting for annual inflation.

before the crisis and have only now started to become more active, showing a first modest IP income increase. All three universities have been able to maintain their start-up activities, with modest increases for the University of Manchester and a small decrease for Salford, suggesting that these start-ups were less affected by the crisis. This again emphasises the importance of viewing differences in university's knowledge transfer success as a path dependent process. Institutional structures established prior to the crisis, affected the knowledge transfer profile we observe today.

**Table 3: University Knowledge Transfer Activities.
Value in 2011/12 and percentage changes in real terms since 2006/7**

in £000s	University of Manchester		MMU		University of Salford	
	total	region	total	region	total	region
Contracts Large Businesses	16,564	968	436	-	285	200
	+63%	-5%	-30%	-	+131%	+82%
Contracts with SMEs	727	389	1	-	469	217
	-17%	-39%	-99%	-	-55%	-79%
Consultancy contracts large businesses	2,777	50	400*	-	805	253
	+62%	-59%	-38%	-	-20%	-72%
Consultancy contracts SMEs	198	47	84	-	464	272
	+28%	-47%	-70%	-	-62%	-76%
Courses for large business	4276	99	700*	-	127	86
	+65%	-70%	+211%	-	-18%	-41%
Courses for SMEs	46	0	169	-	186	156
	+27%	0%	-67%	-	+45%	+22%
Change in overall income from businesses	+58%	-29%	-25%	-	-37%	-66%
	total	diff	total	diff	total	diff
IP Income	1,826	68%	3	-	50	340%
Spin-off turnover	18,164	8%	405	-	8,128	-4%

* 2010/11 values are reported for MMU in some instances. MMU reports are subject to large variation and should be read with caution.

Source: HE-BCI

5 Conclusions

This paper has investigated the historic co-evolutionary development of universities in the Manchester region to make two contributions to literature. Firstly, it can be used to address the research agenda on turbulences in the science (funding) system and how they affect the role of universities in their regions. Especially in view of the last financial crisis and the fresh changes to the funding of universities in the UK this historical analysis helps to understand

the strategic decisions taken by universities. The analysis in section 3 showed that substantial reorientation of university strategy to address changes in the science system involves initial resistance followed by gradual remodelling of organisational and knowledge transfer structures, including new methods of funding acquisition, monetising on scientific knowledge and changes in core missions. These developments represent those observed in the co-evolution of firms in industries (Geels, 2014).

The paper also provides a showcase for using a historic co-evolution approach to understand the development of universities' regional role. In doing so we can address causal mechanisms in knowledge transfer. This paper focussed on the ranges of local and national pressures that shaped the development paths of universities' knowledge transfer strategies. The analysis shows that science-industry links have been common place in the UK throughout the 19th and 20th century and that universities have adopted knowledge transfer strategies as early as the 1940s. These roles were formalised in relation to the educational and research goals of the individual institutions, providing further evidence of path-dependency.

The historic co-evolutionary analysis adds further complexity to the simple statement that "the period from which a university originates in the UK also tends to have a strong correlation with the type of institution it has grown to become" (Goddard et al., 2014: 5). The picture is more complex than this, as all universities in Manchester trace their roots to the industrial revolution and developments prior to the award of university status have been instrumental in shaping their future paths. The development of these universities has led to a number of distinct university groupings within the UK with distinct regional development and knowledge transfer roles (Goddard et al., 2014). However, these groupings are increasingly moving towards becoming the same type of institution through homogenous national policy that emphasises excellence and international rankings.

The historic perspective thus shows that the policy of the UK education authorities to evaluate universities based on measurable outcomes and to distribute grants according to a standardised assessment, has denied the complementary diversity that had developed up until 1980. It disregards the autonomy of the institutions in terms of developing a knowledge transfer strategy best suited to the institutional and regional conditions. Even within a single region, three different strategies could develop in parallel serving different purposes and audiences, thus complementing each other. This complementary co-evolution is important in a region with high economic activity and needs to be preserved.

The universities of Greater Manchester have reacted differently to the needs of their region. Throughout history they have been shown to take a proactive role in shaping their relationships with industry, including in response to changing demand conditions. They have put the needs of the region first and as such have benefitted from these links as well as contributed to the economic development in the region. The decline in research income for the more locally oriented institutions, Salford and MMU, could be seen as a weakness of a local strategy leaving them more vulnerable, but at the same time these two universities will be instrumental in rebuilding the local economy following the recent economic crisis.

As a consequence, governments and academics need to accept that different institutions can perform different roles regarding knowledge transfer. The push over the last 30 years to homogenise higher education and to create direct competition where there used to be complementarity has created a strain for universities and for their regions. This could lead to these universities becoming less innovative in their approach to knowledge transfer, rather leading them solely to adapt new policy requirements.

More research is clearly needed to investigate how university strategies and new governance modes for knowledge transfer have shaped their environment. This paper also did not provide a full analysis of other local actors in the Manchester region that might have affect university strategies. Specifically, research collaborations within a firm's strategic portfolio that may evolve with firm strategy and competitive dynamics need to be considered. A dynamic analysis that considers the demands of local industry would provide the comprehensive background for exploring university-industry relationships and how they change over time. These are important question for future research.

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