

Actors, Adaptive Capability and New Path Creation: Urban Leadership in the Post-industrial City

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Introduction

Many city regions have seen dramatic changes in their local economy in the face of ‘de-industrialisation’ driven by a combination of globalisation and technological change. Despite this, some cities have successfully managed to weather these changes with ‘phoenix industries’ arising in former industrial areas. In these circumstances a city’s adaptive capability – that is its ability to turn historic strengths or capabilities to new uses, thereby creating new development paths is critical. Not only does this require an industry base with the potential for transformation, also present must be an institutional infrastructure to facilitate transformation and individual and organisational actors able to provide the leadership to drive forward the transformation process.

This paper presents an in-depth case study that explores the emergence of a notable bioscience cluster in the city of Nottingham in the East Midlands region of the UK. This cluster symbolises the city’s transition from its industrial past to its post-industrial present. And yet the cluster has only emerged comparatively recently. Once heavily reliant on the manufacture of textiles produced by large numbers of small firms, by the middle of the twentieth century, the city’s future was seemingly secure thanks to the development of a more diverse industrial base. At its heart were a trio of large firms that made up the city’s ‘big three’ manufacturing employers, based around three very different industries: tobacco, cycles and pharmaceuticals. However, by the end of the century two out of the three had ceased operations in the city with the loss of thousands of manufacturing jobs. Meanwhile the start of the new millennium saw the third firm close its large purpose-built research facility in the city in order to focus on its retailing arm.

We explore the manner in which capabilities linked to this constellation of firms were redeployed to take advantage of emerging opportunities, including an increase in the pace of industry consolidation and the growth of open innovation in the pharmaceuticals sector, in the creation of a new development path. This path was the product of what at the time was a novel exercise in industrial regeneration, whereby industrial research laboratories that had hitherto

been the source of a major pharmaceutical company's innovations, were transformed into the UK's biggest bioscience incubator.

Previous studies have highlighted the importance of factors like relevant skills, technical knowledge and organisational networks, we place particular emphasis on the decision-making processes that brought about the transformation, the influence of policy interventions and the roles of the key actors within such processes. Adopting Kingdon's (1995) multiple streams framework (MSF) as an analytical lens, the paper deconstructs the complex and ambiguous decision-process in order to explain the emergence of the new development path and the resulting bioscience based industrial cluster that emerged. We show that central to the process of re-tasking physical assets and mobilizing knowledge assets that were the legacy of one of the city's historic industrial strengths, were three streams of activity. These comprised problems, politics and policies identified by the MSF that converged at a critical point in time to create a window of opportunity that enabled local decision makers to take the role of policy entrepreneur in order to facilitate the emergence of a new development path.

The study explores how it was that bioscience came to be such a prominent feature on the agenda of local policymakers and other actors responsible for the development of the local economy. The key actors involved in kick-starting the initial development of this cluster are identified and their various roles in the creation of a new development path that built on historic strengths and yet was quantitatively different is analysed. We show how their leadership of this novel exercise was critical, not only in terms of opportunity recognition but also in facilitating the implementation of the transformation. This serves to highlight the individual and organisational capabilities needed as part of the decision-making processes surrounding transformations of this kind. The paper concludes by considering the wider applicability and policy challenges associated with this model of development for similar city-regions.

The Case Study

A recently published growth plan for the city of Nottingham (Nottingham City Council, 2012) prioritized bioscience as one of three 'growth sectors' in which the city had a competitive advantage, noting its potential contribution to the development and growth of the city's economy. Indeed previous regional economic strategies (EMDA 2003, 2006) and the strategic economic plans of the D2N2 Local Enterprise Partnership (2012, 2014) also identified this sector in similar terms (Rossiter 2016 forthcoming). Similarly the city was one

of just six cities in the UK to have been designated a 'science city' (Charles and Wray, 2015). This emphasis on science reflected the emergence of an embryonic industrial cluster based on bioscience located within the city.

At the heart of this cluster is BioCity, a biotechnology and healthcare incubator opened in 2003. Now home to some 60 bioscience and healthcare businesses that vary in size from small start-up and spin-off firms to more mature enterprises that have become established firms employing more than 50 staff. Unlike most other biotechnology incubators, BioCity is unusual in that it was neither purpose-built nor based on the campus of and operated by a university. Instead BioCity is an independently operated facility housed in the former research laboratories of Boots Pharmaceutical division. It was here in the 1960s that the painkiller *ibuprofen* was discovered.

BioCity is unusual in that it is not located within the so-called 'golden triangle' of Cambridge, Oxford and London, which forms the heart of the UK's life science research base. Not only that, BioCity isn't even located in or close to one of the biotechnology clusters identified in the Sainsbury Report (DTI, 1999) into UK biotechnology clusters. Indeed, a centenary history of Nottingham published just two years before had concluded that "Nottingham's record in science based industries is not encouraging" (Chapman 1997: 501). At more than 120,000 square feet of rentable space, BioCity is the UK's largest biotechnology incubator. One of the distinguishing features of BioCity is that its firms are more diverse than those found in conventional biotechnology incubators. According to a survey of BioCity's tenants (Smith and Ehret, 2010) only about one third of the incubator's 40 or so science based tenants are conventional biotechnology start-ups, that is to say they can be classified as classic drug discovery or 'product' biotechnology firms using what Pisano (2006) terms a 'monetization of intellectual property' (IP) business model. With this business model the company aims to capitalise on a scientific discovery by patenting it and then either licensing it or selling it to a third party with the resources to fully develop it. A much bigger proportion of BioCity's tenants are utilizing an alternative 'service' business model. They are effectively contract research organisations (CROs) providing a range of specialist services that typically facilitate the new product development process of third parties (Kasabov and Delbridge, 2008). These contract research services, often based on the possession of specialised tacit knowledge and cumulative experience, include outsourced R & D services, quality management and testing and data handling and storage.

Another feature of BioCity that makes it unusual is that it is in many respects more than an incubator. Its large size has meant that as well as housing new start-up businesses, through the provision of ‘grow-on space’, it is able to accommodate larger firms. Some of its tenants are start-ups that have not ‘flown the nest’. They are established businesses often employing quite a number of staff.

Insert Figure 1

Insert Table 1

Despite its novel features, or perhaps because of them, BioCity has been and continues to be remarkably successful. It has had no difficulty in finding tenants. As additional phases of the facility were opened in 2006 and 2009 following refurbishment (see figure 1) space being occupied rose steadily. Similarly the incubator has had little difficulty in attracting spin-offs from local universities (see table 1). BioCity has also proved to be a successful role model with a number of similar incubators being created in the years since it first opened. Typical is BioPark Herts based in the former research laboratories built and operated by the Swiss pharmaceutical giant, Roche.

Multiple Streams Framework

The multiple streams framework (MSF) was developed by the American political scientist John Kingdon (1995), as an evolution of the garbage can model of organisational decision making developed by Cohen et al (1972). Originally intended as an analytical tool to explain agenda setting in government in the US it has increasingly been used in the context of decision-making at a variety of levels. Unlike models of rational behaviour or simplistic linear representations of the policy process¹ it places emphasis on context and time (Ackrill et al., 2013). These give rise to ambiguity which Kingdom sees as a key feature of policy making. One of the particular strengths of the MSF is the scope that it provides to explore which issues gain attention and when, how and which actors are mobilized to participate in a

¹ See for example the ‘ROAEMEF’ policy cycle described in The Green Book (HM Treasury, 2011)

given decision. It is particularly suited to the analysis of decision making in the context of uncertainty and ambiguity.

Insert Figure 2

The MSF comprises five structural elements: the problem, politics and policy streams; together with the policy window and the policy entrepreneur (see figure 2). The problem stream refers to issues that capture widespread attention (Chow (2014), leading to pressure for them to be addressed. Just how these issues come to the fore can range from things like economic and social indicators (e.g. rates of unemployment) to ‘focusing events’ (Zahariadis, 2007: 72) like natural and man-made events that suddenly bring an issue to public attention. The policy stream in contrast comprises ideas or solutions available to address problems. The stream comprises ideas and potential solutions. Described by Kingdon (1995: 116) as a ‘primeval soup’, it is a stream in which ideas and solutions are formed, developed and ultimately either selected or rejected (Chow, 2014). As Zahariadis (2007) notes the number of ideas vying for attention is often large, but only a small number actually achieve serious consideration. The politics stream refers to public opinion (Chow, 2014) or what Zahariadis (2007) refers to as the ‘national mood’. It can also reflect the demands of interest groups.

When the three streams begin to converge, then according to Kingdon (1995: 20) a policy window or as it is sometimes termed a ‘window of opportunity’ (Ackrill et al., 2013) opens. These windows are characterised by conditions conducive to key actors, whom Kingdon (1995: 122) terms ‘policy entrepreneurs’, effecting a change of policy direction, paving the way for new ideas and new solutions to be given more serious consideration than they have met with in the past. Often there are one or more ‘focusing events’ that serve to open the window. This can happen very quickly and in the same way the window can close quickly. When a window does appear however, it is an opportunity for those actors advocating particular ideas to promote and push their ‘pet solutions’ (Zahariadis, 2007: 73).

Whether or not policy windows are exploited depends very much on the actions of ‘policy entrepreneurs’. They are actors who can be either individuals or corporate entities. Part of their role is often to facilitate the coupling of streams. At the same time policy entrepreneurs are actors who introduce and advocate their ideas and solutions through investing time and

energy in promoting them (Chow, 2014). They have to be able to attach problems to particular solutions and vice versa.

Edler and James (2015) note that the way in which a policy entrepreneur is able to play his or her role depends on a variety of factors. They suggest that these include (Edler and James, 2015: 1254): ‘the institutional and constitutional context, the capacities and skills of the entrepreneur, the actor networks that are involved or can be mobilised, the initial cognitive and normative differences between the various actors influencing and shaping the decision making process, and the mechanisms by which decision makers can and will exert power’.

A feature of their role is that policy entrepreneurs often have to act quickly as windows of opportunity typically don’t last long. The task of policy entrepreneurs in these circumstances often involves brokering in order to bring individuals together in order to achieve agreement on a particular solution.

Case Analysis: Applying the Multiple Streams Framework

The origins of Nottingham’s embryonic bioscience cluster coincide with the point at which the three streams of the MSF, namely problems, politics and policies, began to converge at the end of the 1990s. It is important to note that each stream functioned on a number of spatial scales. In part this was a function of the emergence at this time of a regional tier of government in the UK comprising devolved administrations in Scotland and Wales and Regional Development Agencies and Assemblies in England.

Problem stream

In the problem stream globalisation was impacting on the pharmaceutical industry. Pharmaceutical companies, no longer able to rely on being national champions, were increasingly consolidating in order to acquire international reach. This manifested itself in what has been described as a, ‘gigantic wave of mergers’ (Abelhauser et al., 2004) during the course of the 1990s (see table 2). At the same time research and development costs were escalating and the risks associated with bringing new drugs to market were increasing.

Nottingham based Boots was not immune to the process of globalisation. Regulatory problems in the United States in connection with its new heart drug *manoplax*, which had been developed in Nottingham over a period of more than 15 years and was only now coming onto the market, put the company's drug pipeline in doubt. This together with its relatively small size and the failure of an ambitious strategy to expand the firm's retail portfolio led Boots board to put its pharmaceutical division up for sale. It was bought by the German chemical multinational BASF in 1995, as part of a move to re-orientate its pharmaceutical business towards non-generic drugs (Abelhauser et al., 2004: 609). Henceforth it traded under the brand name Knoll pharmaceuticals.

Insert Table 2

At the same time as these developments were taking place on the international scene, at national level there was increasing concern in government about the performance of peripheral regions like the East Midlands, given the wide and persistent disparity in economic performance between such regions and London and the South East (HM Treasury and DTI, 2001). The 'regional problem' had re-emerged as a matter of national policy concern – in the context of national economic policy relating to productivity and competitiveness. There was an increasingly influential view in policy circles that if national economic performance was to be optimised, the performance of 'lagging regions' must be addressed. Soon after the Millennium these concerns found articulation in the Regional Economic Performance Public Service Agreement Target (HM Treasury, 2007).

At the local level these national preoccupations were mirrored in growing local concern during the course of the 1990s about the rapid decline of Nottingham's manufacturing base. Although originally a major centre of the textile industry (Chapman, 2002), the *Nottingham Local Economy Study* (Nottingham City Council, 1982) published by the city council in 1982 noted how the city's wealth had been built on the mass production of standardised goods where markets changed very little: underwear, bikes and cigarettes. But one of the co-authors of this report writing in 2000 described how,

'The markets and the products needed to compete in those markets, were hit by wave after wave of new competition leaving many of the city's traditional employers in a

state of shock. Some companies sent their production to low-wage countries as a way of clinging to their traditional markets while others failed to adapt, either shrinking drastically or closing down completely” (Totterdill, 2000: xi),

A senior city councillor writing in a study of Nottingham’s future prospects published in 2000, was blunt describing the city as suffering the effects of ‘de-industrialisation’ (Chapman, 2000: 21). This followed major plant closures in the city.

Increased car ownership combined with stiffer overseas competition saw Raleigh’s output and employment steadily decline (Chapman, 2006). Similarly employment at Players declined rapidly in the 1980s and 1990s as the company closed plants in Nottingham, in the face of increasing recognition of the health risks associated cigarette smoking. By the early 2000s both companies had ceased manufacturing operations in the city (ESRB, 2014). In 2001 another major manufacturer in the city, Royal Ordnance, also closed its plant in the city as its parent company, BAE Systems, transferred production to Barrow-in-Furness in Cumbria.

These job losses were to some extent offset by the growth of the service sector. New firms like the business services provider Experian expanded and inward investment brought new firms into the city, nonetheless there was great concern locally at this time about the rapid decline of manufacturing. The decline in manufacturing employment in the city that was evident by 2001 was what Zahariadis terms an indicator variable (2007: 70). It acted as a powerful indicator of significant problems with the condition of the local economy. Another indicator that went hand in hand with the employment figures as an indicator of local problems was the widely reported rise crime figures and anti-social behaviour, especially as this coincided with press interest in an apparent rise in gun crime in the city at about this time.

But it was what happened at the third of the city’s big three employers that was to become what Kingdom (1995: 94) refers to as a ‘focusing event’, that really drew the attention of the public and policymakers to problems with the local economy. This was the decision by BASF in late 2000 to pull out of pharmaceuticals. As a result its pharmaceutical arm was sold to Abbott Laboratories of the US in March 2001 for \$6.9billion. However the deal had especially serious consequences for Nottingham, as Abbott was keen to acquire the division’s intellectual property, but not the former Boots research laboratories in Nottingham. As a

result BASF was forced to close the site and make almost 500 research staff redundant. This single event coming on the back of a long line of plant closures, proved highly symbolic. More than this, it also proved to be a stimulus for action on the part of a number of key local players.

The laboratories had been built by Boots, a Nottingham based company founded by a local entrepreneur whose philanthropy was much in evidence across the city. In the 1960s when the city's economy was being lauded for its diverse strengths (Wells, 1966), these laboratories had produced one of the world's best known painkillers in the form of *ibuprofen*. Viewed from the perspective of their owner, these laboratories were an asset for its owner, BASF, but by virtue of the contaminated nature of the site, an ongoing liability of which it was keen to rid itself.

Politics stream

There were major developments in the politics stream during the course of the 1990s. The biggest of these was at the national level in the coming to power of New Labour in 1997. At a stroke there was a massive change in personnel as the Conservatives who had held power for 18 years were swept out of office by a New Labour landslide. Into power came the likes of Blair, Brown and Prescott with very different ideas about the running of the economy. This mirrored a significant shift in the national mood as neo-liberal ideas about the primacy of markets and market forces gave way to the 'third way' and a 'modernizing agenda' in which there was scope for the pursuit of partnerships between the private and public sectors. This marked a greater willingness on the part of government to intervene in the running of the economy and a greater acceptance by the public that this was an appropriate thing for government at all levels to carry out.

The change of mood at the national level was mirrored by change at the local level. This was aided by important changes at the local level in particular the emergence of new institutional arrangements. Nottingham City Council gained unitary status in 1998 and from this point onwards was able to fashion a more positive future for the city through taking an increasingly active role in economic development within the city. The publication of the city council's growth plan (Nottingham City Council, 2012) is but the latest indication of this shift.

Other institutional changes at the local level included the abolition in 2001 of the Training and Enterprise Councils (TECs) whose remit had included not merely training but economic intelligence as well. They were replaced by the more narrowly based Learning and Skills Council. Unlike the TECs which were very much locally based this was a central body that operated through local offices. Probably the biggest change to institutional arrangements certainly in Nottingham was the setting up of the regional development agencies (RDAs) in 1999. This had major implications for economic development at the local level. They not only had a specific remit to promote economic development at the local level, for the first time there was an agency able to exert a significant influence on the development of the local economy. Bodies like EMDA not only had a remit and resources to influence local economic development, they also had a growing capacity to influence other local actors. Nottingham was particularly fortunate in that its RDA, the East Midlands Development Agency (EMDA) was based in Nottingham. Not only that, it arrived on the scene at exactly the point in time when the problem stream was throwing up major challenges for the local economy. By accident of location, it is also noteworthy that EMDA's Apex Court offices overlooked the Pennyfoot Street laboratory site – the problems posed by its pending closure could hardly therefore fail to register on the agendas of senior decision makers.

Policy stream

Within the policy stream a number of new ideas and new solutions developed at the international level began to rapidly permeate national and local agendas. Most of these ideas were either developed in or certainly first advocated and tried out in the United States. They included clusters and cluster policy, open innovation and what has been termed 'academic capitalism' (Brown, 2016: 189).

Popularised by the American economist Michael Porter, clusters are localised concentrations of small firms working in related fields and cluster policy aimed to identify appropriate clusters and then provide them with support to enable them to expand and grow, thereby promoting national competitiveness. Building on the work of the British economist Alfred Marshall (1920) in the early years of the 20th century, Porter first advocated clusters in 1990 (Porter, 1990: 73) when he identified them as a major determinant of a country's national competitive advantage, and during the course of the following decade cluster policy was enthusiastically embraced by policymakers at all levels (Pitelis, 2012) ranging from the OECD and EU to national and regional governments the world over.

In the UK the idea of clusters was keenly endorsed by New Labour in the late 1990s, as part of a renewed and re-invigorated emphasis on regional policy but in a break with regional policies of the past which had adopted ‘spatial Keynesianism’ (Swords, 2013: 5), now emphasised more flexible supply side measures, such as clusters. According to Swords (2013: 1) cluster policy, ‘came to dominate local and regional economic development policy’ at this time. Thus when the new RDAs were formed at the end of the 1990s enthusiasm for clusters was at its height. At EMDA chief executive Martin Briggs speaking in 2001 described clusters as, ‘a useful conceptual organising principle for shaping economic and business growth at regional level’ (Rossiter, 2016).

Consequently RDAs were expected to be in the vanguard in implementing cluster policy in the UK, their task being to identify clusters in their region and then provide them with appropriate support. In Nottingham EMDA’s chairman Derek Mapp was keen that the agency should make an impact showing what it could achieve and the identification and support of priority clusters was duly accorded a high priority in the first regional economic strategy: “Prosperity through People” (EMDA 1999). The challenge for EMDA was how to make cluster policy a reality on the ground. The looming disposal by BASF of the Pennyfoot Street laboratory presented EMDA with an opportunity that proved just too good to pass-up. Even better, the opportunity on EMDA’s doorstep related to a sector that was the focus of growing interest within Government – the emerging biotechnology sector (Sainsbury 1999).

Another idea from the US which crossed the Atlantic at this time was the notion of ‘academic capitalism’ (Brown, 2016: 189). Originating in the US at universities like Stanford in California and the Massachusetts Institute of Technology in Boston, and given academic credibility by writers such as Etzkowitz (1993) through the concept of the ‘triple helix’, this was the idea that universities are ‘good at creating businesses’ (Collini, 2012) and that academics should be encouraged to commercialise their research. According to Brown and Mason, (2014) this idea was espoused most strongly in ‘mission oriented’ countries like the UK and the US as a way of boosting innovation and entrepreneurial activity at the level of the local level.

Thus during the course of the decade of the 1990s, universities were increasingly encouraged by government to pursue a ‘third mission’ linked to commercialisation of research. As a

result there was increasing pressure on universities in Britain for greater engagement within what has been described as their local entrepreneurial ‘milieu’ (Collini, 2012). This led to the provision on many university campuses of facilities like technology transfer offices, science parks and incubator facilities.

The third and final idea making rapid in-roads at this time was open innovation, was another that began in the US, but impacted not just at the national level but at the local level as well. This was the idea that rather than trying to make scientific discoveries and develop new technologies themselves, companies could buy in intellectual property from others and then commercialise it. Given academic credibility by Henry Chesbrough (2003) at the Haas School of Business at the University of California, open innovation was rapidly taken up by science based industries like pharmaceuticals, where many companies begin to cut back on their in-house research facilities, leading to the destruction of important parts of the science base in some localities. This was a trend to which both BASF and Boots had to respond- in part a reason for the disposal of the site – but it also can be seen as creating a ready market for the services of independent biotechnology related research companies of the type that would come to occupy BioCity.

A Window of Opportunity

While the three streams: problems, politics and policies often operated on different spatial scales, it is clear that during the course of the 1990s they were increasingly moving towards convergence. This created what Kingdom (1995) terms a ‘window of opportunity’. Problems were mounting in the pharmaceutical sector at the international and national levels, while at the local level the city of Nottingham was facing a sharp decline in manufacturing employment. This in a city once characterised by authors like Alan Sillitoe and D.H.Lawrence as an industrial city on the basis of manufacturing employment. At the same time in the politics stream, new institutional players were emerging especially at the local level. They increasingly had both the mandate and the means to become involved in the problem stream in ways that had not existed in the past. Similarly in the policy stream new ideas and solutions were coming into vogue.

However it was a decision taken in Germany that was to prove the ‘focusing event’ that actually through open the ‘window of opportunity’. This was the decision by BASF to exit the pharmaceutical sector and in particular the nature of the deal whereby the Knoll Pharmaceuticals business was sold to to Abbott Laboratories of the US early in 2001 (Abelhauser et al., 2004). Abbott’s motives for the deal very quickly became clear. The deal involved the acquisition of the intellectual property (i.e. the drugs and drug pipelines) developed in the former Boots laboratories at Pennyfoot Street in the Nottingham but not the site itself or the staff. This proved to be a critical juncture. BASF had little choice but to close the facility and make nearly 500 highly qualified staff redundant. This directed attention to the wider problem of the decline Nottingham’s industrial base. Hence the sale to Abbott Laboratories proved to be what Zahariadis (2007, 72) terms a ‘focusing event’, serving to couple the three streams together at a critical moment in time, and creating a ‘window of opportunity’. This in turn created a fertile environment for various actors in Kingdon’s (1995, 165) words, “*to push their pet solutions*”.

Policy Entrepreneurs

A number of potential solutions to the problem of what to do with the former Boots research laboratories, were to emerge from a variety of actors able to play the part of Kingdon’s (1995, 179) ‘policy entrepreneur’. The most obvious solution was for BASF as the principal actor, to find another pharmaceutical manufacturer or a firm working in a similar field, to purchase the facility and make use of it and the well-equipped laboratories within it to carry out similar or related scientific research. But as one former employee noted, “*nobody wanted the site when we tried to sell it for its existing purpose – that was clear*”. Hence despite the company’s best efforts it very quickly became apparent that this was not a viable option. A second solution also involved BASF demolishing the buildings, cleaning up the site and selling it to a developer able to put the site to an alternative use. However this proved not to be a feasible option because much of the land was badly contaminated through earlier industrial activity meaning that, as the source quoted earlier noted, “*it would not be worth anything*”. Remediation to a standard commensurate with residential or other commercial use was considered prohibitively expensive.

At this point Barry Stickings, BASF’s UK chief executive, began to look at alternative ways of off-loading the facility which was rapidly becoming a significant liability. Unable to sell it and with demolition infeasible because of the potential cost of the clean-up required,

Stickings turned to the city's universities. Nottingham University had already been the beneficiary of significant largesse from Boots, since its founder, Jesse Boot, had many years earlier given the university its main campus in the form of a 300 acre park to the west of the city. Instead Stickings turned to the city's former polytechnic, which had only recently been designated as a university. Staff from Nottingham Trent University, including its vice chancellor Ray Cowell, were invited to view the facility. It quickly became apparent that the university wanted to remove much of the laboratory space and replace it with lecture theatres and teaching rooms.

However this solution too rapidly proved problematic. To facilitate conversion, the university looked to EMDA the region's development agency. They appear to have been reluctant to support this, possibly because as a 'new kid on the block' they were reluctant to be seen to be supporting one university and not the other. Similarly, a teaching use for the facility may not have been seen as sufficiently close to the Agency's economic development remit and priorities for the Region. Just as this potential solution was beginning to run into the sand another emerged.

When the closure of the site was first announced several of BASF's employees, including a number of senior scientific staff, began making plans to establish a spin-off business. Aware of changes taking place within the pharmaceutical industry, in particular moves by some companies to make use of an open innovation model by outsourcing what had previously been internal research activities, they were keen to move into the field of contract research services by utilizing their prior expertise and experience. Thus a team of specialists in obesity treatments, set up a company called RenaSci Ltd, providing "*contract screening and expert services*". BASF's management were aware of these plans since they had allowed the obesity specialists to remain on site. They were pressing BASF's management to be allowed to rent laboratory space. Nor were they the only ones keen to rent space. A Cambridge based company also expressed a keen interest in renting specialist chemistry laboratory space at this time.

Thus another potential solution began to emerge in the 'soup of ideas' surrounding the window of opportunity. This was the idea that the redundant research laboratories might be turned into some form of incubator housing small start-up and spin-off bioscience businesses. It was a novel solution to the problems facing BASF's management. Bioscience incubators

were a comparatively new idea in the UK at this time. They were relatively small facilities located on university campuses and owned and operated by the universities themselves. The idea that the former Boots laboratories could be used as an incubator was on an altogether different scale. Furthermore, unlike existing bioscience incubators such as the Babraham incubator at Cambridge, the facility was not located in the bioscience 'golden triangle' of Cambridge, London and Oxford.

For Barry Stickings and the BASF management the idea of turning the redundant laboratories into an incubator had a number of attractions. It was a way of off-loading what for BASF was a redundant asset. And yet at the same time it offered the prospect of preserving some of the science based expertise that the facility had accumulated along with some of the jobs associated with it. Not only that, it was a very creative and novel solution to a problem that had strong destructive overtones, not least because the site was adjacent to a large area of semi-derelict brownfield land that had been vacant and desolate for many years. However it was also a solution surrounded by risk and uncertainty. There was no precedent for this kind of facility and it was difficult to see how it could be implemented.

At this point another actor became engaged in the problem - the newly created development agency, EMDA. As noted earlier it possessed both a mandate and the means to assist BASF in implementing the idea for a bioscience incubator facility. It was keen to implement the government's new policies not just for regional development but for clusters and academic entrepreneurship as well. On all three of these counts the creation of a bioscience incubator was a good fit. Not only that, the problem of what to do with the former Boots laboratories was prominent in agency thinking due to the accident of proximity noted above..

The solution that eventually emerged involved three institutions behaving entrepreneurially. BASF initiated the process by gifting the laboratories to Nottingham Trent University while at the same agreeing to underwrite the operating costs until the university was ready to take it over. Nottingham was notably entrepreneurial (or acquisitive) in both taking the site on and then agreeing to allow the facility to be used as a bioscience incubator. EMDA played a key brokerage role, requiring the involvement of both local universities and agreeing to fund the re-furbishment of the facility - on the condition that it was then operated by a joint venture comprising itself and the two universities.

Discussion and conclusion

Looking back more than a decade after BioCity opened, the idea of converting the former research laboratories of a pharmaceutical manufacturer into a bioscience incubator seems logical and almost unsurprising, especially since a number of similar conversions have now taken place elsewhere. But at the time this was a novel and pioneering idea, a unique solution to the problem of what to do with redundant industrial buildings especially ones which incorporate every specialised facilities.

With hindsight there were several favourable factors at work as the MSF has made clear. For one thing the necessary ingredients were present. This involved much more than simply the provision of an appropriate facility capable of being turned into an incubator. Also present was strong science based in the form of two universities, one of which was capable of supplying new bioscience spin-off companies looking for a suitable home, along with one of the largest and newest teaching hospitals in the country together with a history of drug development in the industrial sector in the city and a pool of highly skilled and highly qualified scientists.

Nor was it merely the presence of appropriate ingredients. Timing was critical too. De-industrialisation and the loss of well-paid skilled jobs in the manufacturing sector had been high on the city's agenda for some considerable time. Not only that, the closure of the Boots laboratories was highly symbolic in terms of the local community. Boots originated in Nottingham and had a very close association with the city that stretched back more than a century. And the research laboratories were a prominent local landmark close to the city centre. Just as these negative aspects had come into heightened relief at this time so it coincided with new ideas like open innovation, clusters and academic capitalism coming to prominence. Along with new ideas were new institutional arrangements ranging from Nottingham City Council's unitary status to the establishment of a regional development agency based in Nottingham.

But despite these apparent positive signs there was also a huge amount of uncertainty surrounding the project. There was no precedent for this kind of conversion especially since BioCity was so much bigger than existing incubators. One could not be certain how much refurbishment of equipment and facilities was required. The incubator would be located outside the core bioscience regions. It wasn't on a university campus and it wasn't directly

controlled and operated by a university. Under these circumstances it was far from clear that the incubator was a viable proposition and that it would be possible to fill it with tenants.

What is clear is that in these circumstances agency was hugely important. The conversion into a bioscience incubator simply would not have happened without the intervention of a small number of key actors who in Kingdon's (1995) words fulfilled the role of policy entrepreneurs and invest time and energy in promoting this particular solution.

Who were the key actors? And what was their role? Barry Stickings, BASF's CEO in the UK was clearly one of the key actors. His actions mark him out as a policy entrepreneur. He appears to have been a primary originator of this novel solution to the problem of what to do with the facility. Certainly he was the one who set the ball rolling when it became clear that more conventional solutions weren't feasible. He was someone willing to invest time and energy in promoting this solution in various quarters. At the very least his advocacy seems to have been critical in convincing his masters in Germany that this was a viable option and one that would minimise the company's liability. What is particularly interesting is that having kick-started this idea and got it accepted he stuck with it even to the point of getting BASF to underwrite the operating costs while the laboratories were being readied for use. This was a key intervention in shaping the future development of the incubator. His leadership seems to have been crucial.

The other key actor would appear to have been EMDA. It not only provided vitally important financial support to fund the actual conversion of the facility into rentable laboratories, it also brokered a deal whereby the two rival universities agreed to work together as part of a joint venture to operate and manage the facility. Other key actors were the universities themselves and in particular their respective vice chancellors Ray Cowell and Sir Colin Campbell. Last but by no means least were the founders of RenaSci Ltd. Their vision of the viability of using their expertise as scientists working for Boots and latterly BASF to create a contract research organisation (CRO) offering services to pharmaceutical companies and hospitals played a vital role both in terms of the origin of the incubator concept and demonstrating its viability.

Each of these actors played a very different role, but in each case they provided the necessary leadership – leadership that included the imagination to see what was possible, to act at the

appropriate moment, in the appropriate way and to commit to a novel form of industrial re-generation.

Finally it is worth reflecting that the case of BioCity and the embryonic cluster of which it forms a key part, provides a valuable corrective to the somewhat discredited notion of clusters (Martin and Sunley, 2003). At the very least BioCity may have gone some way to rehabilitate the cluster concept, given its success in attracting bioscience start-ups, in supporting them and helping some of the at least migrate to larger premises in and around the city of Nottingham. It suggests that in the right local circumstances, policy intervention can indeed stimulate the development of a cluster – not unlike the case of wind power in the North East (Dawley et al., 2015).

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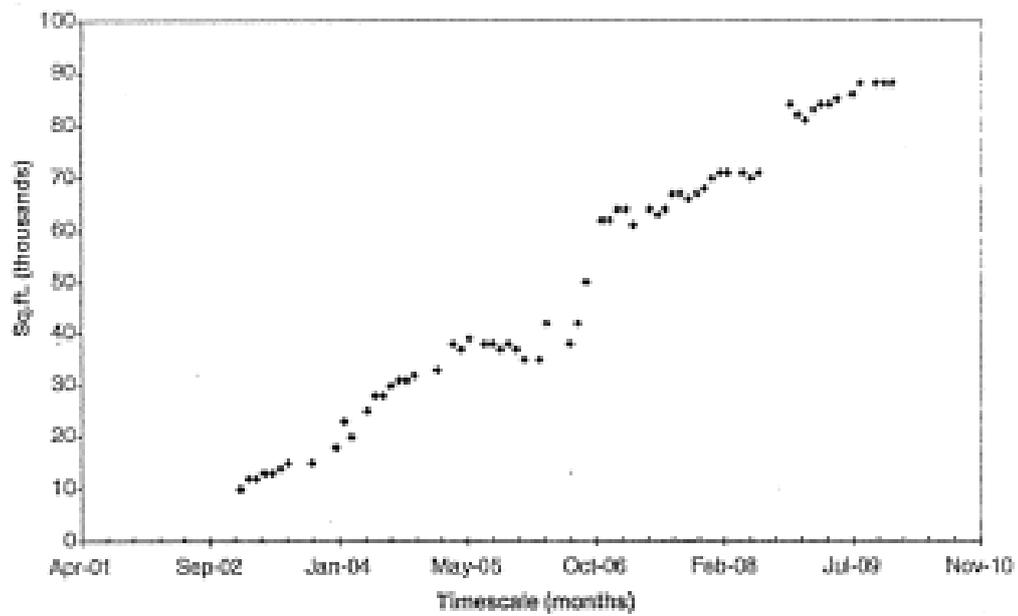
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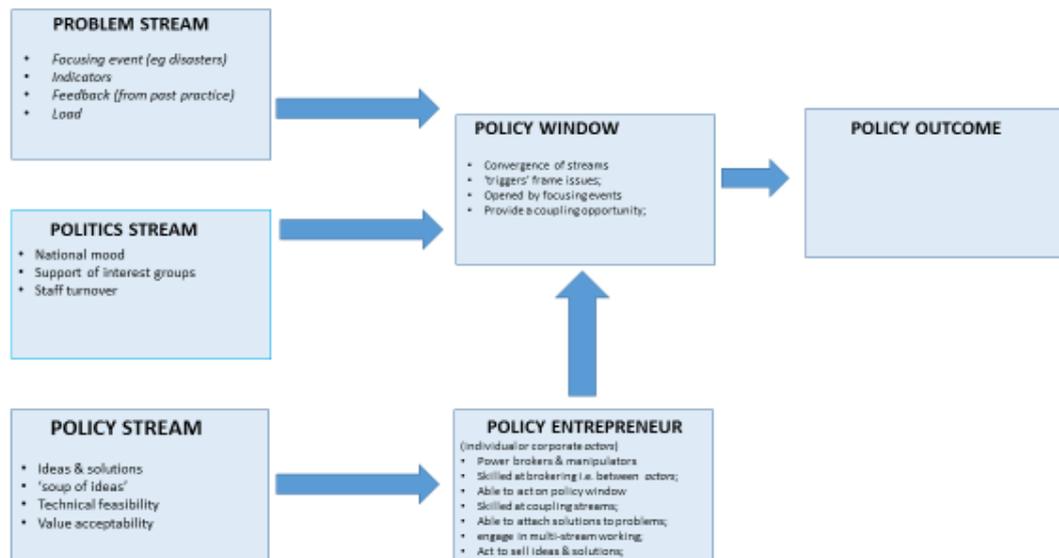
Figure 1

Growth of Occupancy at BioCity



Source: Smith and Ehret (2013: 72)

Figure 2
Multiple Streams Framework



from: Zahariadis(2007)and Rossiter & Price(2013)

Source: Zahariadis (2007: 71)

Table 1
University spin-off companies at BioCity

| | Company | Description | Start | University | Business model |
|-----|-------------------------------------|--|--------------|-------------------|-----------------------|
| 1. | <i>CellAura Ltd</i> | Produces fluorescent agonists and antagonists for use in molecular pharmacology and imaging at the single cell level | 2003 | Nottingham | Service |
| 2. | <i>CompanDX Ltd</i> | Utilizes a range of proteomic genomic bioinformatics technologies to enable the discovery of novel biomarkers | 2008 | Nottingham Trent | Service |
| 3. | <i>Critical Pharmaceuticals Ltd</i> | Developing proprietary drug delivery technologies for injectable sustained release drugs | 2004 | Nottingham | Product |
| 4. | <i>CrossGen Ltd</i> | Developing microarrays using genome hybridization technology for species without sequenced genomes | 2005 | Nottingham | Service |
| 5. | <i>Eminate Ltd</i> | Designs commercial applications of micro and nano particles, coatings and powders | 2006 | Nottingham | Product |
| 6. | <i>Haemostatix Ltd</i> | Developing a protein based products to prevent or control different forms of bleeding | 2003 | Leicester | Product |
| 7. | <i>Monica Healthcare Ltd</i> | Developing wearable devices utilizing wireless technologies for use in obstetric applications | 2005 | Nottingham | Product |
| 8. | <i>Oxtox Ltd</i> | Developing a drug sensor that uses a novel technology to detect whether a person is under the influence of drugs | 2006 | Nottingham | Product |
| 9. | <i>Pharminox Ltd</i> | Developing novel small molecule drugs for use in the treatment of cancer | 2002 | Oxford | Product |
| 10. | <i>Promethean Particles Ltd</i> | Develops and manufactures bespoke nanoparticles for use in a range of industries | 2008 | Oxford | Service |
| 11. | <i>q-flo Ltd</i> | Commercialising a continuous process to manufacture yarns of carbon nanotubes | n/a | Cambridge | Product |
| 12. | <i>RegenTec Ltd</i> | Produces injectable scaffolds for use in regenerative medicine | 2001 | Nottingham | Product |
| 13. | <i>X-Link Ltd</i> | Developing applications of the transglutaminase family of enzymes for wound healing and scar management | 2000 | Nottingham Trent | Product |

Source: Ehret, McDonald-Junor and Smith (2012)

Table 2**Mergers and acquisitions in pharmaceuticals, 1989-2000**

| Year | Companies | Countries |
|------|--|-------------------------|
| 1989 | Dow/Marion | US/US |
| | Bristol-Myers/Squibb | US/US |
| | SmithKline/Beecham | US/UK |
| 1990 | Rhône-Poulenc/Rorer | France/US |
| | Roche/Genentech | Switzerland/US |
| 1994 | SmithKline Beecham/Sterling Health | UK/US |
| | BASF/Boots | Germany/UK |
| | American Home Products/ American Cynamid | US/US |
| | El Sanofi/Sterling Drug | France/US |
| | Roche/Syntex | Switzerland/US |
| 1995 | Glaxo/Wellcome | UK/UK |
| | Hoescht/Marion Merrell Dow | Germany/US |
| | Pharmacia/Upjohn | Sweden/US |
| | Rhône-Poulenc/Fisons | France/UK |
| 1996 | Ciba-Geigy/Sandoz | Switzerland/Switzerland |
| 1997 | Roche/Boehringer | Switzerland/Germany |
| 1999 | Hoescht/ Rhône-Poulenc | Germany/France |
| | Astra/Zeneca | Sweden/UK |
| 2000 | Glaxo Wellcome/SmithKline Beecham | UK/UK |
| | Pfizer/Warner-Lambert | US/US |

Source: Owen (1999)

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