

Coming Together - Success Through Clustering

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The concept of clusters promises to be a winning solution for regions wanting a slice of the cake in new technological fields. In the textbook it all seems very simple. Take a region, throw in scientists and venture capital, then just wait for success. In reality though, it proves quite different - and difficult. In this article the authors take a closer look at the four biotech clusters of Berlin, Massachusetts, Paris and Singapore. The authors explore what governments have done in each, the successes so far and the lessons to be drawn for executives.

The formation of geographical clusters in particular industries or sectors can produce remarkable results. Throughout the world and across a broad range of industries, going at least as far back as the Lancashire cotton mills at the very beginning of the Industrial Revolution, the clustering of businesses connected with a particular activity has often been the key to higher productivity, increased competitiveness and industrial development.

While many clusters have developed almost by accident, both business and governments have come to recognise the benefits provided by this industrial model and have actively fostered cluster creation. While the rewards can be immense, getting it wrong can result in a wasted investment of finance and energy and a setback for the businesses involved. And, while clusters can offer significant benefits to firms in terms of productivity and innovation, they are not all the same. Each type requires different strategies for ensuring that participation results in a positive impact.

So how do different types of cluster operate? What are the key success factors for an effective cluster? And what do businesses and policy makers need to do to get the most out of clusters?

This article, which includes evidence from a recent in-depth study of over a dozen clusters in the life-sciences sector, provides a valuable explanation of what can make clusters a success and how the forward-looking company can use clustering to provide a profound boost to its own performance.

The Benefits of Clustering

Industry clusters are not a new concept. More than a century ago the economist Alfred Marshall¹ pointed out the benefits that could be gained from a location within the

¹ A. Marshall 1890. Principles of Economics.

same geographical area of many players in an industry sector. But in the last decade the importance of clusters has been increasingly recognised, and clustering has now become a key issue both for businesses looking to improve competitiveness and policy makers looking to accelerate regional economic development.

The key benefit of clustering is improved competitiveness, which comes through increased productivity, leading to comparative advantage. Being part of a cluster allows companies to operate more productively in sourcing inputs for four reasons:

- Better access to employees and suppliers: companies can tap into an existing pool of specialised and experienced employees, thereby lowering search and transaction costs in recruiting. The presence of a “critical mass” of people with similar skills and interests can also make it easier to attract further talented people from other locations. Similarly, access to a deep and specialised supplier base is provided. Sourcing locally instead of from distant suppliers can lower transaction costs, while proximity improves communication and commitment. Clustering favours a networking organisation for companies, interacting with suppliers, clients, partners, R&D institutions and service providers. In addition, cluster networks have greater purchasing power than individual companies.
- Improved access to information: by fostering both formal and informal personal ties, proximity facilitates the flow of information.
- Complementarities: they arise when products or services complement one another in meeting customers’ needs. Within the biomedical sector, for example, the testing of new drugs or devices is complementary to the R&D and product development steps.
- Access to public institutions and public goods: public goods enhance productivity in the private sector. The most visible public goods pertain to infrastructures in transportation, real estate, educational programs and testing laboratories, but less tangible public goods

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such as support for networking and communication can be at least as important.

Clusters also enhance the direction and pace of innovation, which underpins future productivity growth. They can give companies:

- A better understanding of their customers’ needs, having a better window on the market than isolated competitors do, facilitated by the ease of making site visits and frequent face-to-face contact.
- The capacity and the flexibility to act rapidly. A company within a cluster can often source what it needs to implement innovations more quickly than others. It can also find logistic or financial support.
- Benefits from positive externalities created by knowledge providers such as university laboratories and public or private R&D centres. The technology transfer from fundamental research to applied innovations is facilitated by partnerships and close cooperation.

Types of Clusters

As Porter² puts it, “clusters are geographic concentrations of interconnected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition”. They include, for example, suppliers of specialised inputs such as components, machinery and services, and providers of specialised infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies or common inputs. Finally, many clusters include governmental and other institutions - such as universities, standards-setting agencies, think-tanks, vocational training providers and trade associations - that provide specialised training, education, information, research and technical support. For instance, a cluster in the biomedical sector involves a

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² M. Porter 1998. “Clusters and the new Economics of Competition”, Harvard Business Review. Nov./Dec.


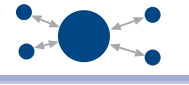


combination of hospitals, research centres, pharmaceutical companies, medical devices companies, service companies, biotech companies and others, not merely located in the same region, but with active interactions and relationships between them.

In Porter's analysis scheme³, the regional dynamics of a cluster involve four pillars:

- the existence of the production factors capital, workforce, and knowledge;
- a local context for rivalry between firms promoting emulation;
- existing demand conditions to drive the supply; and
- an industry able to support investment and technological advance.

Clusters promote both competition and cooperation. Rivals compete intensively to win and retain customers. Without vigorous competition, a cluster will fail. There is also cooperation, much of it vertical, involving companies in related industries and local institutions. Competition can coexist with cooperation because they occur on different dimensions and among different players.

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Exhibit 1 Markusen's Typology of Industry Clusters		
Cluster type	Characteristics of member firms	
Marshallian	Small and medium sized locally-owned firms	
Hub-and-spoke	One or several large firms with numerous smaller suppliers and service firms	
Satellite platforms	Medium and large branch plants	
State-anchored	Large public or non-profit entity and related supplying service firms	

Source: Arthur D. Little analysis

³ M. Porter 1990. The Competitive Advantage of Nations.

That said, clusters are not uniform in character. Industry clusters differ from one another based on size, characteristics of the core or dominant sector, purchase-sale linkages among firms and the extent of inter-firm cooperation and collaboration. Markusen⁴ groups industry clusters into four general types based on shared characteristics. Each type of cluster has a unique structure and set of inter-firm relationships, and thus each type requires different strategies for development. Industry cluster development is not a "one size fits all" endeavour.

Clustering by Accident ...

Several important examples of clustering have arisen by a combination of circumstances rather than formal planning.

To become a cluster, a region must embrace a set of core competences that give it a hard-to-measure but real distinctiveness. For instance, the high-technology industries of Massachusetts did not emerge by accident but were largely a legacy of World War II and Cold War research. This research was concentrated in Cambridge because of the presence of universities, in their origin the product of the need of Puritans for a place to train preachers. At each stage there was a clear reason for what happened, but nobody could possibly have predicted the sequence. As Paul Krugman puts it: "most people in Greater Boston are not brilliant, but the core of brilliant people gives it a special competence in the knowledge industry"⁵.

The high-technology cluster around Ottawa is another example. The presence of public R&D activities in the mid-20th century, followed by the growth of Nortel's R&D in the locality, has led to the spawning of many companies in the telecoms and related spheres, resulting in a well established cluster covering a broad range of information and communications technologies.

In Ile-de-France - where Cuvier put forth the first comparative human anatomy and Louis Pasteur discovered that

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⁴ A. Markusen 1996. "Sticky Places in Slipping Space: a Typology of Industrial Districts", Economic Geography.

⁵ P. Krugman. The Unofficial Paul Krugman Archive, www.pkarchive.org.

Clustering is more than just agglomeration, but agglomeration is a good foundation from which to build true interactive, cooperative cluster behaviour.

microorganisms cause fermentation and developed the rabies vaccination in 1885 - a long tradition of medical research has nurtured a range of research organisations, universities and private companies working in the field. Cluster growth reflects geography. Transportation costs provide a simple illustration: firms facing location choices make their decisions, in part, to minimise their transportation costs. The impact of transportation costs on the agglomeration of firms tends to have a U shape. At very high transport costs, there cannot be agglomeration: "the world consists of self-sufficient peasants". At very low transport and communication costs, there is little incentive for agglomeration: necessary inputs can be delivered to wherever the factor costs are lowest. It is in an intermediate range that agglomeration can be most advantageous. Where transportation is not a sufficient reason, there may be other driving forces for firms to agglomerate - for example to benefit from economies of scale in production, or to exchange and to benefit from flexible and skilled workforce. Clustering is more than just agglomeration, but agglomeration is a good foundation from which to build true interactive, cooperative cluster behaviour.

Clustering takes place on a level that is typically smaller than the national. In the United States, cluster development has covered limited parts of states, such as the North Carolina Biotechnology Triangle, route 128 in Massachusetts in the 1970s, and Silicon Valley in California in the 1990s. In Europe, the region is often considered by governments as the appropriate level for cluster support and this is the basis on which significant intervention has been made by the UK's Regional Development Agencies.

However, clusters do not neatly confine themselves to administrative boundaries. As an example, a large cross-border region, Medicon Valley, which encompasses the Greater Copenhagen area of Denmark and the Skåne region of Sweden, houses a wide range of biotechnological and pharmaceutical activities.

Governments and public agencies have sought to encourage cluster development by deliberate policy. The best approaches combine action on a number of fronts to provide an environment of comprehensive support for company formation and growth within the cluster.

... or by Design

Recognising the benefits to be gained from clustering, many governments and public agencies have sought to encourage cluster development by deliberate policy. Many drivers are available to foster clustering. Action can focus on tax policy, state support for innovation, state-funded seed capital, the cost of doing business, R&D investment, attraction of talented staff and other themes. Facilitating the development of an infrastructure of professional, legal, financial and other specialist services is key. The best approaches combine action on a number of fronts to provide an environment of comprehensive support for company formation and growth within the cluster.

For example, in September 2004 the French government launched a competition addressed to all sectors of activity, designating selected collective industrial initiatives as "competitiveness clusters". The scheme generated about 104 applications in various fields, from low-tech sectors such as jewellery and the shoe industry to high-tech fields such as medical technologies, information and complex systems technology. The French organisation in charge of regional planning⁶ focused on three criteria to select clusters:

- Combination of firms, educational establishments and research centres in a given geographical area;
- Partnerships between public and private organisations aimed at creating synergies around R&D cooperation projects;
- Critical mass - the ability to achieve international visibility.

Our own work on the Ile-de-France biomedical initiative showed that, in this area, an international standard of excellence was established, although the field of action was focused at the regional level.

⁶ DATAR, Délégation à l'Aménagement du Territoire et à l'Action Régionale.

There are many other examples. The case of Biopolis in Singapore, which aspires to be a world-class biomedical sciences research and development centre, shows the rapid effect that such a coordinated policy approach can achieve. On a less lavish scale, regional action in the UK - for example in London, the North West and Scotland - has helped to build and sustain a UK lead in many aspects of the life sciences, while interventions in other regions such as Yorkshire and the Humber and the North East have helped to develop clusters of specific niche excellence in fields such as stem cell biology.

Life Sciences Clusters - a Case Study

The life sciences offer an exceptionally good illustration of the power of clustering as a driver for economic development. There are several reasons for this:

- The multidisciplinary nature of the life sciences - chemistry, physics, IT and informatics - are all key enabling technologies. As a result, life science clusters typically show considerable supply-chain relationships;
- Technical, financial, legislative and regulatory issues are such that few companies in the life sciences have all the skills to take a product to market on their own. Opportunities for collaboration abound;
- The development of strong regional or cluster networking organisations. The best-performing clusters have the strongest networks;
- In this relatively immature - though rapidly developing - industry, links to a research base are vital for many companies and, indeed, may be a source of new entrants to the market both through traditional spin-out activities as well as “spin-in” activity - the attraction of new companies to a specific location;
- Clusters provide opportunities for staff development and promotion - for example, career progression may involve a series of moves between relatively small companies;

The life sciences offer an exceptionally good illustration of the power of clustering as a driver for economic development for various reasons.

- Anecdotal evidence suggests that investors may prefer that the companies they invest in are located close together in order to improve links between them, as well as being close to the investor;
- The development of dedicated business support services alongside specific technical expertise - including specialists in bioscience law and IP management.

Some of the most famous biotech companies were born in life sciences clusters benefiting from externalities. For instance Biogen, founded in Cambridge, MA in 1978, and Genzyme in 1981, grew and achieved success within an existing cluster. Their founders graduated from MIT and found in Massachusetts a concentrated customer base - reducing risks and making it easier for them to spot market opportunities

We have reviewed the recent performance of more than a dozen European life sciences clusters. While the extent and availability of finance (including angel and venture capital funding) is a key factor that influences their development, a diverse range of other factors also contribute.

Seven Key Success Factors for Cluster Development

In our work in several regions, we have noted seven key success factors to be taken into account in cluster development. All require co-operation between cluster companies and the relevant public-sector agencies. Most require the involvement and support of other players too - universities and training organisations, specialist service providers and so on.

1. A diverse and dense industrial network of companies including start-ups, mature companies (medical devices and pharmaceutical companies) and associated services providers;
2. Strong scientific and research capabilities with academic and private labs;
3. Easy access of all cluster stakeholders to sector-specific infrastructures (e.g. clinical research infrastructure);

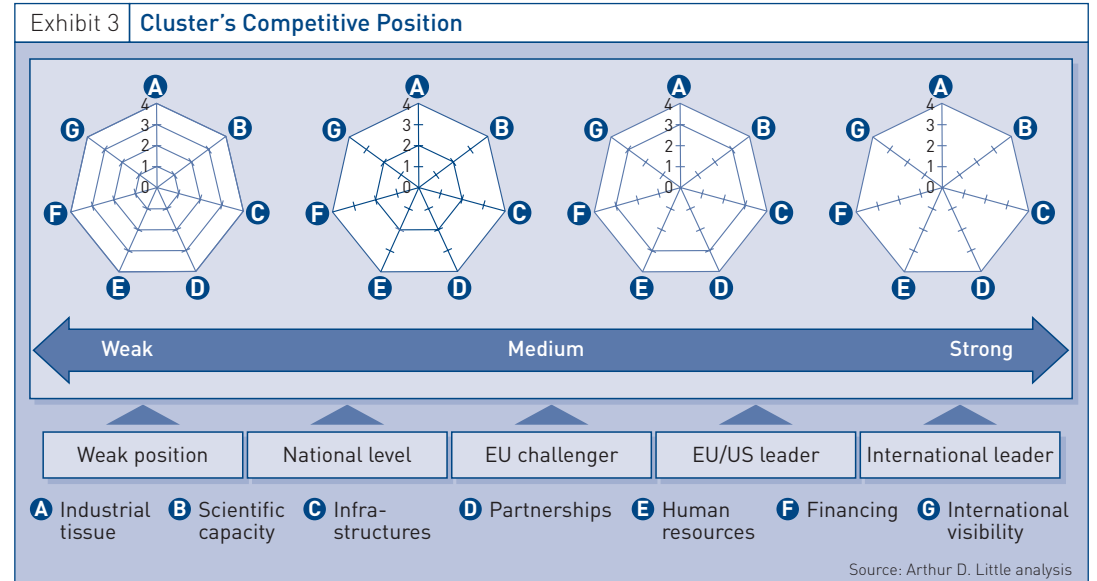
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4. Effective collaboration between stakeholders in the network, especially between private and public research institutions;
5. Availability of highly educated human resources with competencies adapted to industrial needs;
6. The availability of public and private funding such as seed funds, venture capital and public grants;
7. International reputation and visibility.

No one life-sciences cluster will have all of the necessary factors to the same extent. Indeed, the diversity of clusters across Europe is to be embraced, particularly if the industry is to survive the ebbs and flows that affect various technologies. However, growth can be deterred if key features are absent. For example, as a result of increasing costs and difficulties in recruitment of suitable staff and space constraints, Hematech - a US-based biotech company developing human polyclonal antibodies - relocated

Strategic objectives		Criteria		Cluster's performance
	Quantitative		Qualitative	
A Industrial tissue	Workforce / number / type of companies	Market share / technology domains	Integration of the pharma. value chain	0 Weak position
B Public and private scientific basis	Expertise level (patents, publications)		International reputation	1 National level
C Infra-structures	Number of square meter for company implantation		Easy access to large patient cohort for clinical trial	2 EU challenger
D Collaboration	Number of public/private partnership	Partnership quality and outputs	Collaborative culture within different players	3 EU/US leader
E Human resources	Number of graduated PhD	Student population	International mobility	4 International leader
F Financing	€M invested by public and private institutions		Easy access to financing from seed money to IPO	
G International visibility			Cluster's image and reputation	

Source: Arthur D. Little analysis



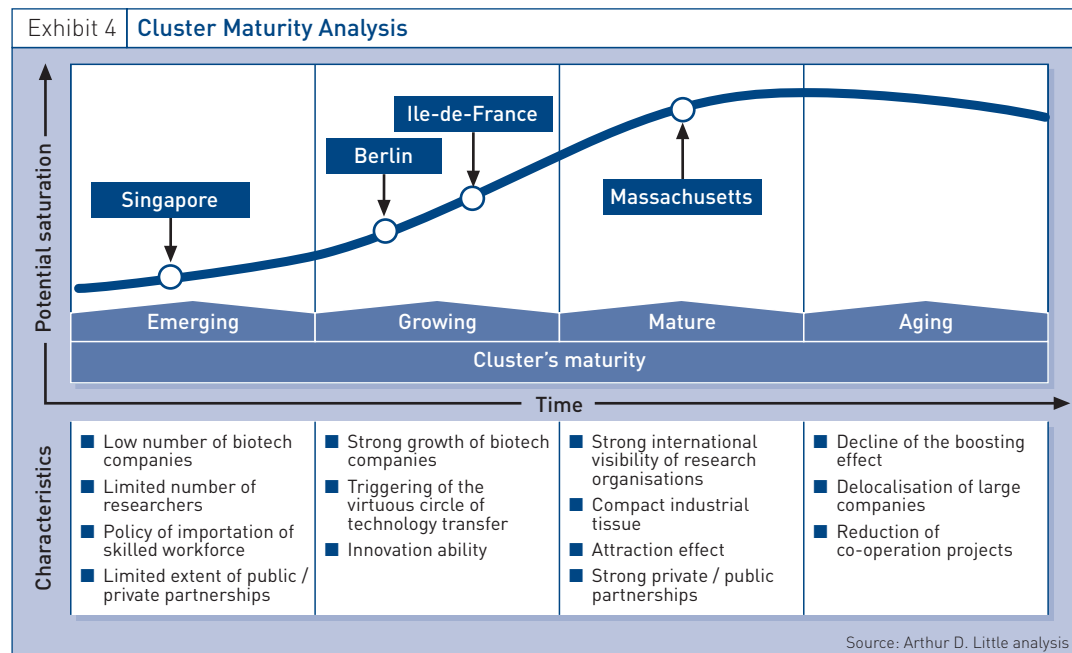
from the Biotechnology Park adjacent to the University of Massachusetts in Worcester to Sioux Falls, South Dakota.

A grid of indicators may be used to help benchmark a cluster's performance against these factors, and hence assess its global competitive position.

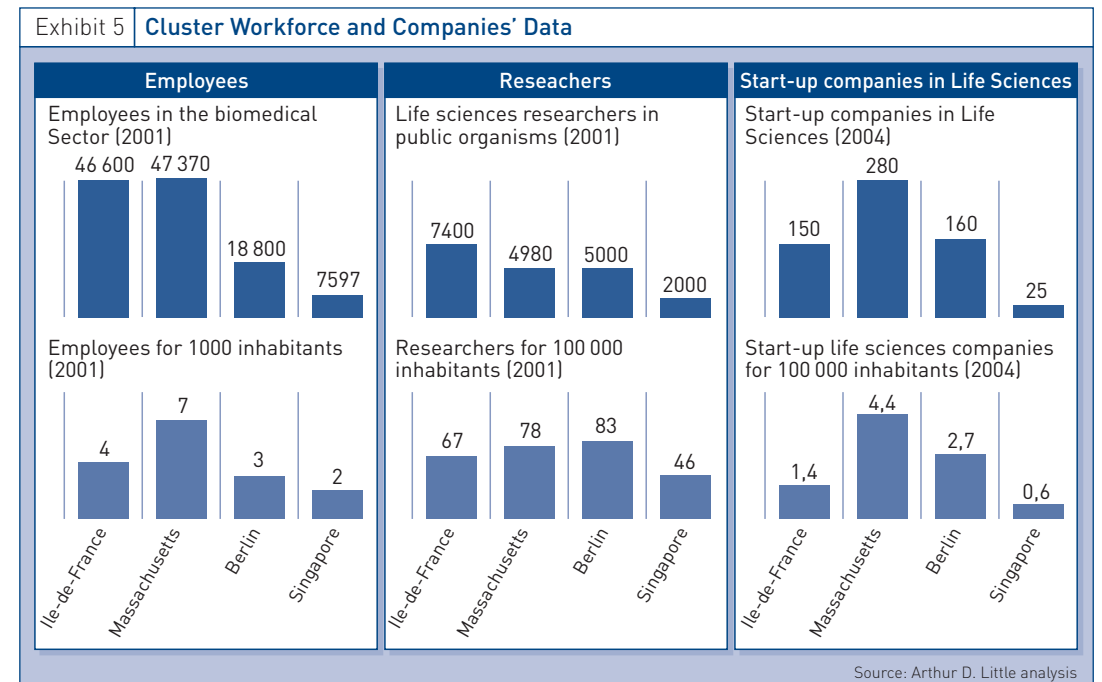
A Comparison of Four Internationally Recognised Biomedical Clusters

We conducted a comparative analysis of four bio-clusters of international repute: the Ile-de-France cluster; the Boston region of Massachusetts in North America; the Berlin area in Europe; and Singapore in Asia. They were chosen to cover the main economic zones and for their maturity. For Europe, Berlin is a fast-growing cluster, less mature than Cambridge, Ile-de-France or Medicon Valley. A three-dimensional analysis was conducted based on relevant indicators of each bio-cluster's general strategy, inventory of strengths and weaknesses, and ambition against a 2010 horizon.

As exhibit 4 illustrates, the clusters are representative of three stages of cluster development in the life sciences sector.



- The Ile-de-France bio-cluster has arrived at maturity after a growth phase in the early 2000s. The region, which was in the view of some the first biomedical region in Europe, shows a dense industrial network and strong public research. The region around Boston hosts one of the historically most mature bio-clusters, which is widely recognised as a global leader. Boosted by a strong international visibility, the Massachusetts cluster bases its performance on academic excellence and synergies between actors.
- After a late start, the Berlin/Brandenburg region cluster became the leading German bio-cluster by number of biotech companies. However, the cluster has suffered from decreasing public state intervention and the international financial constraints that have affected the biotechnology industry.
- Steered strongly by the state, the Singapore bio-cluster benefits from solid infrastructure investment, with government willingness to provide physical facilities in anticipation of - rather than in response to - need. Biomedical firms and organisations, although still



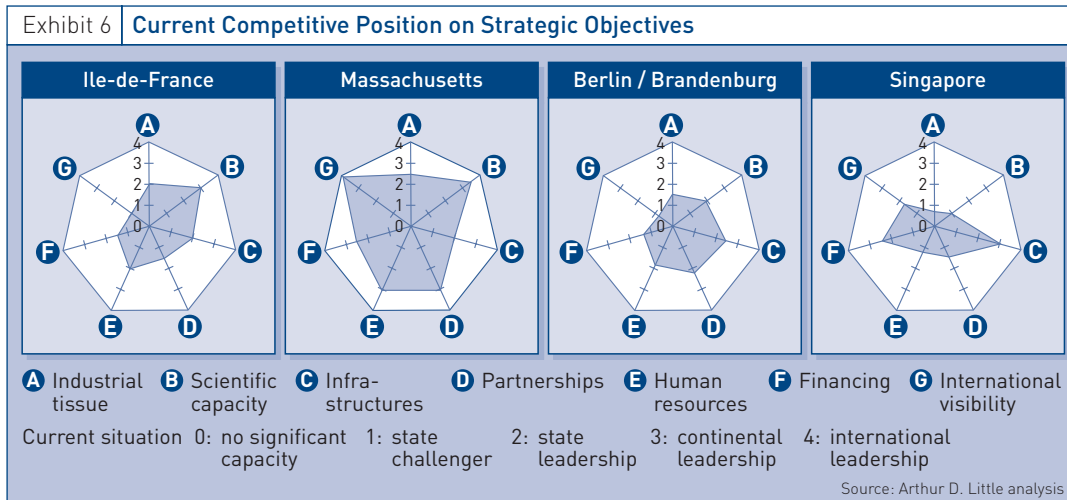
comparatively few in number, contribute to the dynamism of this bio-cluster.

The maturity of the clusters is reflected in the number of companies (exhibit 5). Ile-de-France benefits from a competitive position in terms of the number of jobs in the biomedical sector, and the number of researchers in public organisations is higher than in other recognised clusters. However, the region's cluster suffers from a lack of biotech companies, despite a population twice as high as Massachusetts or Berlin/Brandenburg.

Size is, of course, not the sole factor of interest and we used the seven key success factors suggested above to examine the competitive position of each cluster. Exhibit 6 summarises our findings.

The Massachusetts biocluster, especially around Boston and Cambridge, reflects four main factors:

- Implementation of government policies since the early 1980s promoting technology transfer from American universities to private actors;

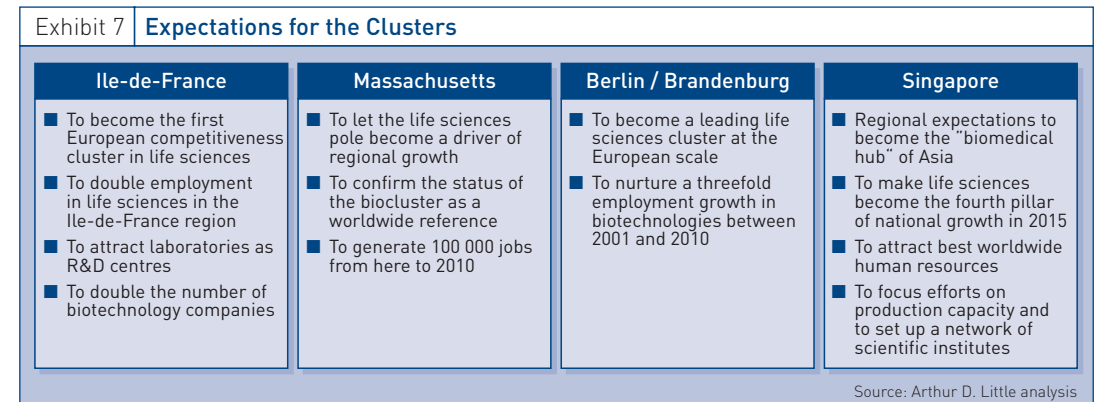


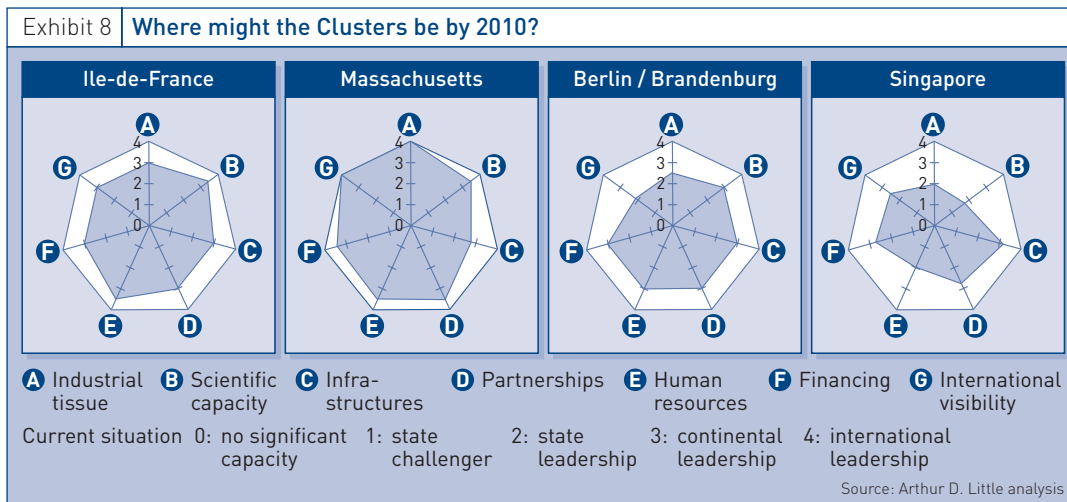
- Focus of scientific efforts in life sciences research and biotechnology;
- Entrepreneurial spirit, creating a genuine biotechnology industry;
- Development of a finance community able to finance company creation as well as providing significant investment in later-stage companies.

Moreover, territorial communities in the Boston area play a coordinating and animating role alongside private initiatives. They also conduct a dedicated real estate policy to meet growing demand for offices and laboratories.

- A different picture is presented by the Berlin/Brandenburg area, where public and private scientific capacity and performance lag behind the Ile-de-France or Massachusetts, while the industrial network is less comprehensive, with few large pharmaceutical laboratories. The Berlin cluster is notable for a high level of federal aid and for achieving Germany's highest number of biotechnology company creations - and a good level of collaboration between public and private organisations. The key lesson is that support needs to focus on the survival, growth and sustainability of firms as well as on their creation.

- Singapore is on its way to becoming an important competitive cluster. However, initiated in 2000, it still remains at the embryonic stage. It benefits from the construction of dedicated infrastructure and from a strong international visibility thanks to state policy. Through heavy investment the government has financed the creation of fundamental research institutes in the life sciences. However, scientific universities have difficulties recruiting students and are in the process of attracting European and US-educated staff. Singapore conducts an ambitious human resources strategy to hire both Asian and Western researchers.
- The Ile-de-France region is an excellent example of integration along the value chain of therapeutic innovation, which is a major criterion in evaluating the dynamism of a cluster. Indeed, the region hosts a large academic research base, several "big pharma" R&D centres (Sanofi-Aventis, Servier, Ipsen, Serono, GSK), production units, headquarters and a large network for clinical trials. By comparison, positioned upstream in the value chain, the Massachusetts bio-cluster's activity is less extended in clinical research and production because of high labour and clinical trials costs. On the same model, Berlin also focuses on the first stages of the value chain. The lack of critical mass of international big pharmaceuticals, historically located in other German regions, specifically Bavaria and the Ruhr, explains the relatively low production and marketing contribution to the cluster's activity.





Singapore's core competencies are currently in clinical development, manufacturing and marketing for Asia of health products but research capabilities are growing rapidly.

Aspirations

In an ever more competitive environment, the four bio-clusters have set expectations to become international or regional leaders by focusing on a set of specific objectives.

In international competition, to become a European or international leader means to be able to attract big companies, to attract the most gifted researchers, to generate innovation and to fuel economic growth. Thus a cluster has to implement an ambitious strategy driven by the set of key objectives - developing international visibility, partnerships and collaborations between actors, and matching human resources to industrial needs.

These four clusters illustrate different lessons. A fifth example - Scotland - shows how all these lessons can be drawn together. In late 2004 and early 2005, we worked with leading Scottish companies and public bodies to formulate a life sciences strategy for the country. Key features of the strategy are:

A cluster has to implement an ambitious strategy driven by the set of key objectives - developing international visibility, partnerships and collaborations between actors, and matching human resources to industrial needs. A fifth example - Scotland - shows how all these lessons can be drawn together.

- Active involvement of companies across the sector, both large and small, along with the research community and the public sector, to ensure that the strategy is business-led, with ambitious yet achievable goals - a partnership that reflects in microcosm Massachusetts' successful approach;
- Sustained and focused government backing in support of this business-led approach - reflecting on a more modest scale Singapore's public commitment;
- An explicit objective to develop companies of scale, recognising (and learning in part from the German experience) that emphasis on company creation alone is not a sound basis for long-term success;
- A commitment to sustain and build on a robust and internationally excellent research base, notably in academia - a key element in the success of the Ile-de-France and of other locations.

Launched by Scotland's Deputy First Minister, the strategy sets out a national vision for the life sciences over the next 15 years, against a fast-changing background both internationally and in Scotland. It identifies specific themes, objectives for the next three to five years and actions that need to be addressed in the short term, in the firm conviction that Scotland can build a globally facing and sustainable life sciences sector for the longer term.

Insights for the Executive: How Companies can get the most from Clusters

From our studies and experiences we have identified ten key lessons for the executive who wishes to obtain the greatest benefit from clusters:

1. **Set the strategic agenda**
Thriving companies are the drivers of economic growth within any cluster yet, all too often, cluster intervention strategies seek to increase cluster size through new company formation rather than supporting the growth of existing companies. By setting the

strategic agenda, existing companies have an opportunity to shape the longer-term future of the cluster.

2. Actively participate in cluster development

Setting the strategic agenda on its own is not sufficient. The most thriving clusters have active cluster networking groups, joint promotion of capabilities and strong interactions between all parties.

Supporting cluster development brings benefits to the cluster as a whole, but also to individual companies - the PR benefits of spearheading cluster development activities can be large. So be visible within the cluster, and support networking organisations.

3. Build links with other companies

A key success factor of the development of life science clusters in the US has been the establishment of strong collaborations between corporate players - something which has been often weaker in the UK.

4. Recognise the value of proximity

“Businesses are clear that proximity does matter.

Personal contact is the best form of communication, and distance affects the capacity of firms to collaborate with universities. This applies to large firms in strategic university relationships as well as to SMEs with a more regional outlook.” (Lambert Review of Business-University Collaboration, for the UK Government, para 5.19)

5. Insist on a flexible menu of support

Don't just take the standard package. There are many variants which could be particularly valuable, including, for example:

- a Tax incentives - the UK offers R&D tax credits and Sweden offers tax breaks for recruitment of executive teams for the first five years;
- b Relocation assistance;
- c Reservation of additional land for future development;

- d Infrastructure upgrades - kit-out of labs, flexible terms for repayment.

6. Know your way around the wider knowledge base

Be proactive in developing links with universities and other R&D players. Perhaps the most significant trend in new product and business creation over the past one to two decades has been the shift from doing it all in-house to innovating through alliances, networks and partnerships. This has been evident even among the largest firms, few of which can afford to maintain all the competencies they require internally. Instead, they decide on a relatively few things to be good at, and look outside for other skills, technologies and capabilities. It follows that having company staff with not only a wide and active contact network but a shrewd knowledge of who's good at what is increasingly a key competitive asset. Equally, retaining those people and getting them to share their knowledge and understanding of the R&D base are necessities, not optional extras.

7. Invest senior time in interacting with other firms as well as with the R&D base

Work with other firms to tackle issues beyond your own resources - in the true sense of clustering this will involve looking beyond other players in your own immediate field.

8. Offer recruitment help and career development support

Offer help and support to talented candidates, explicitly helping them chart a path that will keep them in the region, although probably passing through several firms. Work with cluster teams to develop recruitment/HR capabilities at the cluster level (i) to support recruitment into the cluster (ii) to support job retention within the cluster, and (iii) to assist companies to meet seasonal demand for key technical staff (and possibly smooth the ebbs and flows of such demand across companies).

9. Promote and publicise the cluster and its assets

Membership of a cluster allows you to punch above

your weight in PR terms (as Scotland, North West England and Singapore have done).

10. Know your strengths and your weaknesses

Particularly, understand the areas in which your cluster has a real distinctive edge. Not all clusters will be major international players across the board. Some smaller clusters will gain recognition for niche excellence.

Insights for the Policymaker: How Public Agencies can help develop Successful Bio-Clusters

1. Few regions are able to sustain a strong competitive position on the international stage. Those that do have capitalised on their existing structures, established a strong vision and implemented strategies to realise their potential and publicise priorities.
2. Know your strengths and your weaknesses - especially the areas in which your cluster has a real distinctive edge (refer to our bio-cluster comparison). Realism about a region's position is vital - its distinctive strengths (it's better to be one of only two or three places that excel in a particular niche, rather than one of a dozen) and its limitations. If the PR is seen to be out of step with reality, credibility is lost. Keep data current - especially data that is in the public domain e.g. jobs, investment, etc. Bio-clusters are dynamic and rapidly evolving. Current information is key to maintaining a strong presence.
3. Develop, inclusively and with a business lead, a shared vision and a 'stretch strategy' - but an achievable one - for growing the cluster, supported by a coherent action plan and agreement on who does what, together with regular review of progress against milestones.
4. Be visible for inward investment purposes - for example, ensure that potential inward investors get to know about site availability, and target the companies that broker inward investment deals.

5. Build effective partnerships among public organisations as well as firms, with all relevant public bodies pulling the same way and with a common message promoting the region. This is the Massachusetts lesson.
6. Engage people with in-depth industry experience as 'animators', people who will build up and facilitate business-oriented networks. This usually means individuals with extensive experience in core companies in the sector. Enthusiastic youngsters help, but are no substitute for well connected and highly credible business figures.
7. Recognise the breadth of the cluster - not just companies and suppliers but education providers, specialist service firms (e.g. specialist engineering contractors), professional services, etc. In this connection, standard industrial classifications have a pernicious impact in underestimating cluster size and significance, as they do not take into account firms that make vital contributions to the cluster but do not select that sector as their primary affiliation for classification purposes. Cluster mapping should not rely entirely on such (NACE or SIC) classification schemes.
8. Be comprehensive. Cluster support must be multifaceted - not just offering money and buildings but information, skills support, networking, advice and mentoring, etc. Coordination of approach and support for companies at all stages of their life cycle is essential. Too often support has been directed at new company creation, leaving companies to struggle and fail when funding dries up - with consequent damage to the region's reputation.
9. Develop a flexible menu of support - the menu should be comprehensive but firms should be able to "pick and choose" from it. Besides direct public support, try to ensure the adequate supply of all the resources for innovation - financial, human, information, physical infrastructure - whether from the private or the public sector.

10. Ensure that a strong research base is sustained in universities and research institutions, by providing incentives and support for smaller firms to engage in R&D, and by ensuring a favourable environment for larger companies to make R&D-related investments. Some levers for the latter may only work at national level (e.g. tax regimes) but others, such as flexible planning and development guidelines and support for skills, may be accessible regionally.
11. Ensure that the research base, including translational research and clinical trials facilities, are accessible to partners within and beyond the region. The development of the National Biomanufacturing Centre in Liverpool, UK, is a classic example.
12. Invest in skills - both by training and education within the region (led by businesses' understanding of future needs, not the inertia of education providers), and by schemes to attract and retain talent from elsewhere.
13. Be prepared to invest in physical and other infrastructure ahead of market demand. This is the Singapore lesson - showing how concerted state action can help fuel the creation of a cluster.
14. If you've got it, flaunt it. Publicise strengths, success stories and role models realistically but enthusiastically on the regional, national and international stages.

David Brown

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