IASP 2009 Conference

Science Parks as an Instrument of Regional Competitiveness: Measuring Success and Impact

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Executive Summary

This paper aims to contribute to the discussion on the benefits and problems associated with the evaluation of science and technology parks. These initiatives have become an important instrument of economic development across the world. While some are successful on their own account and do not need to rely on public sector funding and support, many can only go ahead when kick-started and/or sustained by public sector bodies. Support for such schemes can be expected to be significantly more forthcoming if there was a body of evidence for the range of impacts that are associated with science parks. Given the wealth of experience of science park schemes in member parks of the IASP, a structured approach to impact measurement and assessment could be a very useful tool.

The paper starts by referring to previous evaluation exercises, then introduces a theoretical impact evaluation framework and reports on experience in applying the model to a specific case (Tamar Science Park). It then broadens the discussion of evaluation issues and ends by making practical suggestions for next steps to be taken by the international science park community, including the establishment of a working group to develop a common set of guidelines to assist the process.

Introduction

Science and technology parks[3] have developed across the world for some 50 years. The early schemes in the United States and Europe were followed by developments across all continents and the movement to establish new schemes and to grow existing ones continues across the globe as evidenced by the stream of applications for membership received by IASP.

There is a wide range of benefits associated with science and technology parks for their local, regional and national economies and innovation systems and there is plenty of anecdotal evidence that science parks have positive impacts on a wide range of measures including the performance of indigenous businesses, entrepreneurship, company formation (including spin-out processes), inward investment, technology transfer, innovation performance, skills development and other indicators of economic progress.

However, there is less information on the exact nature of causalities and empirical substantiation of the ultimate impact on measurable economic units, in particular gross value added (GVA). Moreover, while some studies have aimed to track the development of companies located on science parks, measuring the development of employment, turnover, profits and exports, few of them make allowances for factors such as displacement (how much of the investment led to the crowding out of

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[3] In the remainder of this paper, we are using "science park" as a generic term which includes a range of initiatives including technology parks and larger scale technopoles.

opportunities for firms and individuals elsewhere in the economy), additionality/deadweight (how many of the impacts and benefits would have occurred anyway, without the science and technology park development) and multipliers (secondary effects running through expenditure and supply chains).

This paper provides some methodological guidance on how to undertake science park impact assessments. It is informed by practical experience of the two authors of undertaking such evaluation projects in the United Kingdom. In submitting the paper at the IASP Conference, our aim is to stimulate a discussion which could lead to the collection of impact and baseline[4] data by the international science park community, thereby galvanising support and commitment to science park projects across the world and helping to tease out learning lessons.

Science Park Impact Assessment – why is it important?

There are a number of reasons why impact assessments of science parks are important – and could become even more so as the credit crunch bites and public expenditure streams are under threats:

- **accountability**: science parks are often financially supported by public sector bodies (central governments, regional development agencies, local authorities) who expect achievement of specified objectives from their spending and are looking for evidence of the efficiency and effectiveness of their expenditure. Being able to track impacts stemming from science park developments is important to encourage public bodies to continue supporting new schemes and helping to grow and develop existing ones

- **options appraisals**: there are always competing demands for public sector expenditure and being able to demonstrate extensive impacts associated with investment in science parks will help to galvanise support for such schemes from public sector donors

- **performance information** – together with benchmarking data - can also offer valuable performance information for science park managers, their boards and wider stakeholders and provide feed-back on which aspects of the development to develop or modify.

In the United Kingdom, the move to more proactive government policies on a number of policy domains (businesses, people and regeneration) after 1999 and the regionalisation of many approaches to economic development has energised the need to collect impact information. The need for assessing impacts has been further emphasised through the creation of nine Regional Development Agencies in England (supplementing devolved delivery in Northern Ireland, Scotland and Wales) with central government funding (in particular through the Department for Business, Enterprise and Regulatory Reform (previously Department of Trade and Industry).

Prior research

Prior academic research on the measurable added value of science parks has been remarkable inconclusive. Most of these studies compare the performance of firms on science parks with

[4] There are benchmarking tools for innovation centres; for instance, EBN is licensed to confer the EC-BIC Trademark to schemes that comply with a range of assessment criteria such as number of SMEs supported, number of tenant enterprises and employment by tenant enterprises, jobs created and safeguarded, enterprise creation projects, business plans and start-ups and training attendance.

'matched' samples of firms not on parks and then assess whether there are any statistically significant differences in performance, such as changes in employment, turnover, profitability, research and development intensity, patent applications, the launch of new products and services, links with HEIs, survival/closure rates etc. Sqircciarini (2008) includes a useful table summarising these studies:

Figure 1. Overview of Science Parks' relative performance and impact evaluation studies

Authors	Country	Period analysed	Date published
Monck, Porter, Quintas, Storey and Wynarczyk	UK	1986	1988
Massey, Quintas and Wield (re-interpretation of study by Monck et al)	UK	1986	1992
Weaherhead and Storey (follow on study to Monck et al)	UK	1986 and 1992	1994, 1995
Westerhead (furher analysis of 1986 and 1992 data)	UK	1986 and 1992	1997
Siegel, Westhead and Wright	UK	1992	2003
UKSPA/Angle Technology	UK	2003	2003
Felstein	Israel	-	1994
Luger and Goldstein	US	1989	1991
Link and Scott	US	2001	2003
Link and Scott	US	1950-2002	2006
Appold	US	1960-1985	2004
Lofsten and Lindelof	Sweden	1994-1996	2001
Lofsten and Lindelof	Sweden	1999	2002,2005
Lofsten and Lindelof	Sweden	1999	2003.2004
Dettwiler, Lofsten and Lindelof	Sweden	1999	2006
Ferguson and Olofsson	Sweden	1995, 2002	2004
Chen, Wu and Lin	Taiwan	1991-1999	2006
Fukagawa	Japan	2001-2003	2006
Squicciarini	Finland	1970-2002	2008

Source: Squicciarini (2008) with additions

Most of these studies have concluded that the evidence that companies on science parks perform significantly better than off park companies is weak, despite acknowledging the higher quality of the business environment available on science parks for stimulating the formation and growth of new technology firms.

This paper explores whether there may be a number of shortcomings in the application of the match sample approach adopted in earlier studies which may help to explain why these studies have been more conclusive. The UKSPA survey by Angle Technology (2003) for example identifies a

discernable process of science park development which needs to be taken into account when comparing the impact and performance of science parks.[5]

Impact evaluation – the theoretical framework[6]

Evaluation is about assessing what can be significant in terms of policy impact but cannot simply be monitored, counted or even directly observed. It recognises the truth of the aphorism attributed to Einstein that "everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted".

The role of evaluation is to test the robustness of the rationale for an intervention and to track whether the desired impacts have been achieved. This is best done by use of a logic model which provides a framework for describing the theory, assumptions and evidence underlying an intervention and "links outcomes (both short term and long term) with programme activities/processes and the theoretical assumptions/principles of the programme."[7]

Various formulations are available for such logic models; Figure 1 has been developed by SQW as part of a framework which covers the full policy cycle starting at the stage of project appraisal and moving through to monitoring, impact assessment and finally learning, thereby opening the option for a new and improved policy delivery circle.

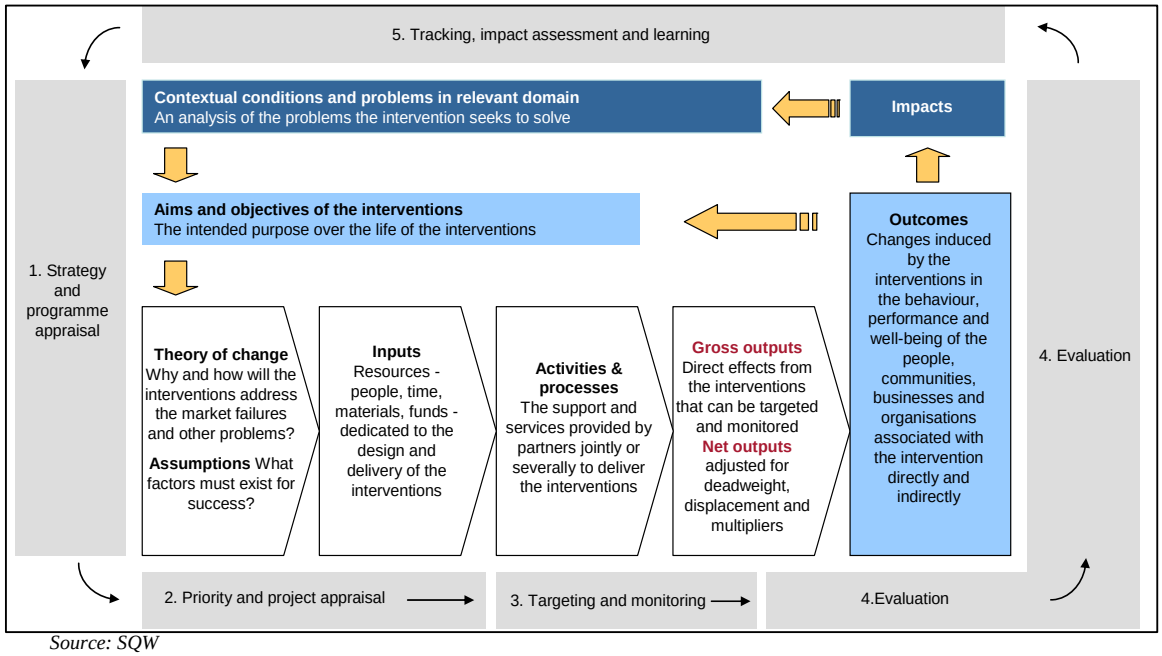
From SQW's review of the evidence of evaluation, it seems that policies and programmes often have poorly articulated rationales with little attention given to expectations with respect to outcomes and impacts. In other words, big chunks of the logic model are often missing or only faintly outlined. This may be because the interventions were responses to rapidly changing threats or opportunities when it seemed better for the public authorities to respond quickly. In such cases, the evaluation will involve a reconstruction of the rationale based on intentions staged at the time and within the context defined prevailing data and evidence.

[5] It should be noted that similar inconclusive results are being reported in recent academic studies on the impact and effectiveness of publicly funded business advice and training support for SMEs. This has arisen as a result of adopting a more rigorous approach in the comparison of performance of firms receiving or not receiving the 'treatment' being evaluated.

[6] SQW's impact assessment methodology is summarised in four publications: Learning from Evaluation. Evidence from economic development evaluations (November 2007); Learning more from evaluation "… not everything that counts can be counted" (November 2007); Jonathan Cook, Scott Dickinson, Daniel Heuman and Geoff White: Making the Most of Evaluation. SQW Viewpoint Series Issue 3: December 2008; Geoff White: Pushing at the boundaries of impact evaluation. A report on possibilities and issues. January 2009

[7] WK Kellogg Foundation: Logic Model Development Guide (January 2004)

Figure 1 Principles of the Impact Evaluation Framework (IEF)



Source: SQW

Figure 2 summarises the issues that need to be considered in the different stages of the evaluation process:

Figure 2: Issues to be considered in the evaluation of economic development interventions

Rationale	➔	Market failures, institutional and coordination failures and social equity failures
Intervention	➔	Public sector actions intended to address significant and persistent failures efficiently
Gross outputs	➔	Outputs generated amongst direct beneficiaries of the intervention
Less 'non-additional' outputs	➔	Outputs that would have been secured anyway by the beneficiaries (sometimes referred to as 'non-additional' outputs)
Equals **gross attributable outputs**	➔	Outputs that would not otherwise have been secured by beneficiaries (sometimes referred to as 'additional' outputs)
Gross attributable outputs relative to gross outputs = **gross attributable/gross output ratio**		
Less leakage	➔	Outputs that leak out of the target area (usually a spatially defined area)
Less displacement	➔	Reduction in outputs in the target area caused by the intervention. This can occur in product markets (e.g. amongst non-assisted businesses in the same market) and/or in factor markets (e.g. in capital and labour markets where the intervention encourages investment at the expense of investment that would otherwise have been made). Displacement will get higher as the target area is drawn wider.
Plus multipliers	➔	Further economic activity (e.g. jobs and income) associated with the additional income for those employed by the intervention (income multipliers) and/or with the purchase of supplies by businesses benefiting from the intervention (supply multipliers). The multiplier effect will tend to zero in areas where there is full utilisation of resources.
Equals **net outputs**	➔	The overall additional outputs generated by the intervention (e.g. skills attained, start-ups)
Net outputs relative to gross outputs = **net/gross output ratio**		
Allowing for knock-on, wider and longer term effects	➔	Improvements in the performance of beneficiaries and dynamic effects working through relative price changes and population movements that can crowd out or induce wider and longer term consequences for the volume and/or quality of outcomes.
… produces **outcomes**	➔	Improved employment rates, incomes and productivity amongst the businesses and people directly and indirectly affected by the intervention.
Comparing with contextual conditions	➔	Assessment of the contribution of the intervention to observed changes in the contextual conditions that gave rise to the intervention in the first place as measured through secondary data sources, administrative data and bespoke fieldwork (e.g. special household surveys)
… allows **impact** assessment	➔	Changes in contextual conditions attributable to the intervention.
Public sector **gross costs**	➔	The public sector costs associated with the delivery of the intervention - distinguishing between costs to the agency designing the intervention and to other public sector partners.
Private sector costs	➔	The costs to the private sector associated with the intervention.
Net costs	➔	Gross costs less any receipts or returns from assets created by the intervention
Value for money =		
Economy	➔	The unit costs of intervention delivery
Efficiency	➔	**Cost effectiveness ratio** = the unit costs of intervention outputs and/or outcomes
		Cost-benefit ratio = the costs of the intervention set against the benefits translated into money terms from its outputs and/or outcomes
Effectiveness	➔	The ratio of achieved outputs and/or outcomes against target outputs and/or outcomes
Deadweight	➔	Public sector spend associated with outputs/outcomes that would have been achieved without it

Note: The shaded rows represent the performance ratios typically considered in past evaluations

Strategic Added Value

An important issue for evaluation which is of relatively recent origin can be summarised in the term Strategic Added Value (SAV). This describes the contribution that a strategic agency, such as a science park, makes in achieving its objectives. It involves no programme spend by the agency in question but rather the exercise of influence over mainstream service providers who do hold budgets to behave and spend their money in different ways. SAV has been described in the terms set out in Figure 3.

Figure 3: Strategic Added Value

- creating confidence in the prospects for regional growth
- providing strategic leadership (of regional partners and stakeholders)
- exerting of strategic influence (over key partners and stakeholders)
- levering in investment from other sources
- developing synergy in activity of partners, stakeholders and target audiences
- stimulating a scaling up of beneficial activity
- enhancing the quality of a desirable regional economic activity
- encouraging engagement in the regional strategy

Source: SEEDA/LDA: SAV Technical Note

Applying the theoretical model : Evaluation of Tamar Science Park

SQW was commissioned in 2007 by the South West Regional Development Agency (SWRDA), the regional development agency responsible for the development of the counties in the south west of England, to undertake a process and impact evaluation of TSP in Plymouth.

Plymouth

Plymouth is a city and unitary authority area on the coast of Devon, England. It is built between the mouths of the rivers Plym to the east and Tamar to the west, located about 310 km south west of London. Plymouth's history goes back to the Bronze Age when a first trading settlement established itself which further developed and became a trading post during the Roman Empire. In 1620, the Pilgrim Fathers left Plymouth for the New World and established Plymouth Colony. Throughout the Industrial Revolution, Plymouth grew as a major shipping port, handling imports and passengers from the Americas and the construction of ships for the Royal Navy. Today, the city is home to over 250,000 people. The city's economy is still strongly influenced by shipbuilding and has the largest operational naval base in Western Europe (HMNB Devonport); while the economy has become more diversified and the service sector has grown significantly, there continues a need for diversification and the stimulation of knowledge-intensive businesses and jobs.

The University of Plymouth

With 30,000 students, the University of Plymouth is the fifth largest UK university (based on student population). The University is particularly renowned for its courses in maritime business, marine engineering, marine biology and Earth, ocean and environmental sciences and globally renowned for its courses in international shipping and logistics.

Tamar Science Park

TSP was incorporated in 1995 as a partnership between Plymouth City Council, the University of Plymouth and the regional agency concerned with business development and growth (Devon and

Cornwall Business Link). In addition to support from the three founding stakeholders, support was received from SWRDA, English Partnerships (a property and regeneration agency now incorporated into the Homes and Communities Agency) and through the European Regional Development Fund.

In terms of its property offer, the Park has been developed in phases; the latest (Phase 4) opened in 2008. Development started in 1996 and saw the establishment on site of the Hyperbaric (Diving Diseases) Medial Centre. In 1998, the opening of Phase 1 – the Innovation and Technology Transfer Centre (ITTC) paved the way for future developments. Building on the success of Phase 1, the second ITTC (Phase 2) opened in 2001 and Phase 3 was completed in 2003. Phases 1 to 4 extend to some 20,000 square metres of space and further phases are being planned.

The Peninsula Medical School opened in September 2004; it is located in the valley between TSP and Derriford Hospital. The Medical School has provided TSP with a flagship presence which is helping to draw medical research and business expertise to the area.

TSP is networked into its wider local, sub-regional and business community through a variety of channel:

- one-to-one business support: TSP offers intensive business advice to its tenant companies and extends this offer to companies outside the Park
- networking: TSP has been one of the prime movers in establishing the Plymouth Medical and Healthcare Sector Network which has a significant role in the development of the emerging cluster of life sciences organisations located at the Park and in the sub-region
- TSP, together with the University of Plymouth, established the Plymouth Innovation and Enterprise Hub which is concerned with energising the entrepreneurial characteristics of Plymouth and is depending TSP's outreach programme
- TSP is a member of the Plymouth Wealthy Theme Group which is addressing the diversification needs of Plymouth
- innovation: TSP promotes to its clients a range of skills and services available through the University including so-called Knowledge Transfer Partnerships (KTPs)
- entrepreneurship and start-ups: TSP manages a Proof of Concept Fund and is also very active in collaborating with schools and young people to promote entrepreneurial attitudes and opportunities.

The evaluation project

SQW was commissioned to undertake an evaluation project with the following objectives:

- assess the effectiveness, efficiency and economy of SWRDA's investment in TSP
- assess the impact of TSP upon individual company performance as well as determining whether there has been a sector-specific impact in the medical, science and knowledge industries

- test if the rationale for the project remains and if so how the identified need might be met and funded in the future
- benchmark and identify good practice lessons both for TSP itself and the Agency's investments and involvements in science parks.

The study methodology incorporated a number of elements:

- a desk-based review of the monitoring data and context with which TSP has been and is now operating
- review of the set-up and operation of TSP
- benchmarking exercise to draw out lessons for and from TSP
- survey of tenants which fed into our assessment of impact
- case studies of the wider Strategic Added Value (SAV) role of TSP.

The theoretical impact evaluation framework sets exacting standards for data collection and analysis. It lays the emphasis on the need for evidence to convert outputs from gross to net. In carrying out this evaluation, and following IEF guidelines, we had to consider both the direct and indirect effects resulting from SWRDA's investment. Given that the investment is purely physical development, the direct effects relate to the infrastructure and floorspace created, and the jobs that are located on this floorspace. These are clearly important, particularly given the sponsor's objective to provide catalytic investment that will enable the remainder of the science park to be developed. However, science parks by their nature are likely to attract existing businesses, and so a significant proportion of the jobs located on the park itself are unlikely to be additional. To rely on such a measure of impact would be entirely misleading and would miss the *raison d'être* for TSP. Rather, the objectives of the science park itself include helping knowledge-based businesses to grow and to contribute more widely to the growth of knowledge economy in Plymouth. While these are indirect effects of investment in science parks, they are vital in assessing impacts.

Key achievements

Since its opening in 1998, TSP has become a key player in the strategy to upgrade the economic base in Plymouth towards a more innovative and knowledge-based economic environment. The success in developing a science and technology park product in Plymouth is a successful outcome in its own right, given the historical context of naval and shipbuilding activities that characterise Plymouth and the city's relative peripherality. The key achievements of TSP include:

- making a real difference to tenants through its infrastructure and services as confirmed by the survey of tenants which was undertaken as part of the evaluation project and recognised through TSP achieving the Excellence in Technology Transfer Award conferred by the United Kingdom Science Park Association (UKSPA)
- playing an important role in attracting what is now the Peninsula College of Medicine and Dentistry to Plymouth and laying the seeds for a medical cluster

- playing an important role in local, sub-regional and regional networks, with a particular focus on health-related activities.

In terms of quantifiable impacts, the evaluation has demonstrated that the **direct** effects associated with the investment have been mixed. For example, the 'jobs created' outputs, which RDAs have been tasked to report on, have a high degree of displacement associated with them. On other output measures, for example 'land brought back into use' and 'commercial space created', we can be more confident of higher levels of additionality due to the strength of the rationale.

The focus in outputs, however, misses the key areas of impact associated with TSP because the nature of these is **indirect**. Some of these can be quantified through the contribution to business performance improvements. The tenant survey has demonstrated that TSP has contributed in a number of cases to business development:

- take-up of services has been high, in particular the one-to-one support delivered by TSP's senior managers

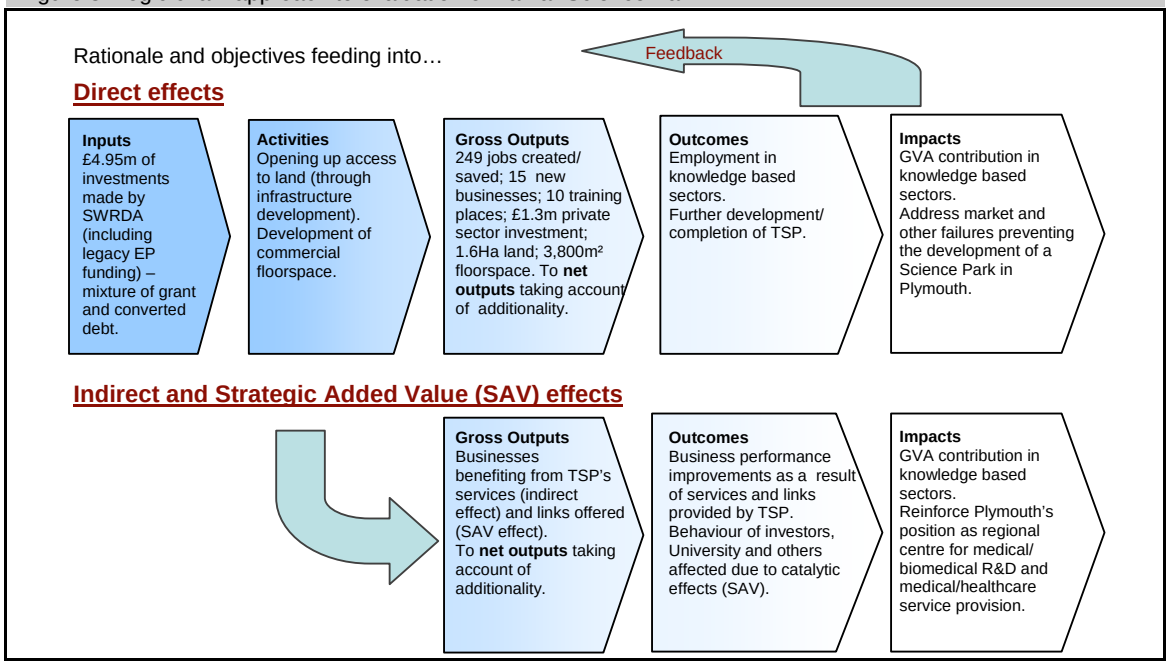
- tenants clearly value the services as a number of respondents to the survey highlighted that they have been able to derive benefit for their organisation that they would not have been able to do had TSP not existed.

Some of these effects on business performance have been quantified through turnover figures into GVA. Along with the direct effects through employment, our assessment estimated an overall GVA contribution (at the time of the evaluation study!) of just under £24 million to the economy of Plymouth and just under £12 million for the region as a whole. £10.20 million and £5.60 million of these impacts respectively can be attributed to SWRDA's investments. TSP as a project is clearly still ongoing and the impacts from the investment can be expected to continue to flow and even accelerate as the benefits from the infrastructure will be long-lasting.

On top of these impacts, TSP has made – and continues to make – a valuable contribution to wider economic development. This was demonstrated through the SAV case studies we undertook as part of the evaluation project, focusing on the impact on inward investment and the location of the Peninsula College of Medicine and Dentistry as well as through the links that TSP facilitates for its tenants and more widely for the economic development of Plymouth.

The logic chain approach to understand and assess the impact of TSP is depicted in Figure 3. The assessment of outcomes and impacts needs to feed back to the original rationale for public investment and the objectives of the project(s).

Figure 3: Logic chain approach to evaluation of Tamar Science Park



Evaluation issues

Comparing performance

A key element of all evaluations is to enable the performance of one science park to be compared with another; public sector policy makers also require a consistent approach to evaluation so that they can compare their investment in science parks with other economic development initiatives. This requires a common and robust methodology which takes account of specific characteristics of science parks, their local environment, scale, age and maturity.

Differences in the local and regional economy in which the science park is based will have a significant impact on its comparative performance. Evaluations need to take account of the strength of the knowledge economy in its main 'catchment area', and how it has changed since the park was established. With this understanding it is possible to place the performance of the science park in context in terms of supporting firms on the park (start ups, specific sectors, inward investors etc). At the same time, the evaluation needs to consider the additional benefits that the science park may have brought to the local area and the wide region, both from a business development perspective and also in the way that it complements other technology, business and economic initiatives.

A critical dimension for science parks in the UK has been how their relationship has developed with their local university or research institute, which in most cases have been important partners. In practice there are wide variations in both the quality and depth of this relationship. This reflects the capacity and emphasis placed by the university on knowledge exchange and commercialisation, the technological orientation of tenants on the park and the relationships that have been developed between key staff in the university and management team on the science park. Whilst the number of spin out companies on the science park is the most obvious measure, it is also important to track a

range of other measures, such as the number of graduates employed on the park, the number of joint research projects, the use of university facility facilities, the number of academics working in a consultancy capacity on the park and the involvement of the park in the university's entrepreneurship programmes.

In comparing science parks, it is also necessary to take into account what stage of development the science park has been reached. Science parks like businesses go through a critical development cycle[8]. This is a function of the size and age of the park, the skill mix and experience of the park's management team, the financial structure of the park and its relationship with other organisations locally and in the region. It is clearly unrealistic to expect that an early stage science park will have the capacity to achieve the same levels of engagement and output as a more mature science park. The evaluation needs to consider how long it has taken to reach key points on the development curve, what progress has been made in the last three to five years, whether the right conditions and incentives are in place to enabling the park to progress over the medium term, and the level of public sector investment that has been required to reach this point.

When to evaluate

The timing of the assessment is clearly a critical issue. If it is too early in the science park's development, the results will indicate high levels of start-up investment during the initial setting up period and few tangible results in terms of increased employment and GVA. If the first evaluation is undertaken too late, there is a danger that key historic information required for the evaluation will not be available. There will be a loss of institutional memory due to staff changes amongst the tenants and the park's management team. It also depends on the park having an effective performance monitoring system which takes account of data required for the evaluation. In our view, evaluations need to be built into the strategic planning process for the park from the outset and undertaken at regular (five yearly) intervals, rather than as a one off events.

Focus on employment and GVA

The most common measure used for assessing the impact and effectiveness of science parks is the net change in employment and gross value added per year, as this provides a relatively easy way of comparing the impact between science parks in different locations and with other economic development initiatives. Using these figures, public sector bodies will calculate the public sector cost per job and ratio of public sector input to GVA output as a way of comparing the 'performance' of their investment between schemes. However there are a number of methodological issues which need to be taken into account in the use of these measures to compare impact.

Sample

Most evaluations are based a snap shot of the park and its tenants at a moment in time. In the UK, a high proportion of the firms on the park tend to be very small and at an early stage in their development, and thus will not create many extra jobs or GVA in the early years of their development. Of these firms, only a minority will create a significant number of jobs and GVA (typically 10% of the firms will create 90% of the jobs), and this may not occur for five or ten years after they start up, by which time they may have left the park. It is therefore critical that the evaluation

[8] Angle Technology (2003)

also takes account of the firms who have left the park. Unless the park operates a very effective tracking system of their alumni, these firms would not be included in the impact assessment.

This problem is most apparent for parks with a significant number of early stage biotechnology based businesses, where the development period on the science park can extend over many years; once development has been completed, in many instances, production, sales and distribution will be undertaken in another location or the project may be licensed/sold to one of the large pharmaceutical companies. Meanwhile the measurable contribution of these firms to the science park in terms of employment and GVA may be minimal.

Survey

The use of company surveys is an essential part of any evaluation, as they provide independent feedback from the primary beneficiaries of science parks. However, they are time consuming and there may be a general reluctance of the chief executive or senior manager of these companies to set aside time to participate in the survey.

The success of surveys is dependent on being able to interview the person in the firm with the knowledge to provide comprehensive and reliable feedback on the contribution that the science park and its range of services have had across the main areas of its operations and on the overall performance of the business. The person also needs to be able to provide a historic perspective about why the company decided to come to the park in the first place. The company must also be prepared to make available financial and employment data enabling their performance to be tracked since moving to the science park.

Assessing additionality

To arrive at figures for the net impact of science parks, it is necessary to establish the counterfactual position – what would have happened if the firm had not come to the science park. Most academic research studies have used a matched sample of off-park firms as a control group to assess the net contribution of science parks. However for evaluations of individual science parks this is neither practical nor feasible. The use of control groups is expensive and time consuming; and there can be significant barriers in securing worthwhile interviews with the control group of off-park firms because they have no direct interest in the science park being evaluated.

There are also significant problems in building up a sample of off-firms which properly matches the sample of on-park firms. Until now the technique has been limited to larger research studies involving firms from several parks which in aggregate have been matched with off-park firms. In most of these studies, the sample of off-park firms were matched with on park firms in terms of their location, sector, number of employees and age. Despite these criteria, in a number of studies, samples of off park firms have tended to be made up of larger and more mature businesses, mainly because researchers have had difficulty in locating smaller and younger firms from published databases. The main problem is that these selection criteria bear no relationship to the key characteristics that influence the growth and development of firms in different sectors of the knowledge economy. It may explain to some extent why previous researchers have had difficulty in identifying statistically significant differences in performance between on and off park firms. In an evaluation of a particular park, the problem of getting a reliable sample of off-park companies from the same local area as the science park is more difficult due to the lower numbers involved in the sample.

A consequence of this is that most evaluation studies have had to rely on asking the beneficiaries to what extent the performance of their business would have been different had they not come to the science park. Essentially this technique attempts to tease out in what ways being on the science park has made a difference. This is clearly a somewhat subjective approach, and depends to some extent on the firm's relationship with the park and its management team. It also depends on the respondent's knowledge and awareness of the assistance provided by the science park and the extent that they are prepared to acknowledge the impact that this may have had on the performance of their business. Whilst this varies between companies, there is a tendency for managers of tenant firms to gloss over the value of the help and benefits of being on the park, often because it is taken for granted. Thus before reaching a judgement on the level of additionality of the park for each tenant, the research needs to take account of the park's case notes on each tenant (where they exist) and feedback from the park's management team.

Other key benefits of science parks

Whilst changes in employment and GVA provides a common currency for enabling impacts on different science parks to be determined and compared, it is important that the evaluation includes a portfolio of output and impact indicators to reflect the different facets of the park. These should include:

- **incubation work** – stimulating and supporting the start up and survival of knowledge based businesses with growth potential
- **innovation** – including research and development, collaboration with the university and the development of new and improved products and processes
- **improvements in the company's image and profile** - particularly with key customers and its ability to attract good quality applications for positions in the company
- **securing external investment for tenant companies** – including the engagement of the professional network in the development of business plans and the raising of equity and loan capital
- **recruitment and training of staff** – particularly the attraction of graduates from the local University
- **attraction of inward investment** - companies and projects from other parts of the country and from abroad.

The science park as an enabling initiative

Over time some science parks are playing an increasingly influential role (along with other bodies) in the stimulation and growth of the knowledge economy. Depending on the influence and standing of the science park, this can result in important knock-on and longer term effects which would not be captured by limiting the study to assessing changes in net employment and GVA effects amongst the tenant base. The main areas where science parks have influenced the thinking of other bodies include:

- simulating and supporting the commercialisation policies of the university or research Institute

- supporting the development of a more entrepreneurial culture and the imbedding of an enterprise agenda in the university or research Institute
- retention of graduates in the local area
- initiating and supporting specific cluster initiatives, due to the concentration of companies in key sectors on the park
- creating demand for professional services (lawyers, accountants, patent specialists, marketing and PR etc) orientated to the needs of companies in the knowledge economy
- contributing to the development of business angels and venture capital network in the region and local area by creating deal flow
- influence on the policies, priorities and implementation programmes of local and regional government bodies in the fields of business development, innovation and economic development.

Property dimension of the evaluation

There is an important property dimension that also needs to be taken into account – the extent that the science park is providing a particular range of premises in a quality environment not previously available in the local area. It is clearly important to assess the extent of any market failure and whether intervention by the public sector was necessary in that particular location.

The largest investment on a science park is the provision of serviced land and the development of suitable buildings, much of which in the UK has been developed with public sector funds, in the form of grants and, in some cases, loans to the science park. Public sector funds are playing three roles. Most importantly they are bringing forward the development of new premises, on the assumption that the science park would not have been developed without their intervention. Secondly, in most cases the rental income derived from these buildings, after deducting normal property costs, has covered part of the cost of the core team engaged to market and manage the science park. The size and scope of the services that a science park is able to provide is closely linked to the net income that the science park is able to generate after deducting property and financing costs. Thirdly, the land and premises developed with the help of public sector funds has enabled science parks to build up an asset base, providing the collateral for them to take out loans to fund the expansion of their parks. The provision of serviced land, together with the development of a track record of successful lettings, has also helped some science parks to attract private sector funding for the further development of the park, generally through a joint venture with a private developer.

The evaluation needs to cover a number of property related issues:

- **cost and quality of the development:** this is generally undertaken by comparing the specification, quality/suitability of the design and costs with other comparable developments. Care needs to be taken to ensure that comparable physical and cost figures are used to isolate issues such as the site costs, abnormal ground conditions, professional fees, financing charges etc as well as establishing the gross internal area and net lettable area which adopts a common approach to the areas taken up by plant rooms, an atrium, reception and management offices etc

- **changes in rent (and service charges) and how they compare with local values:** one of the benefits of science parks is that once established, in many instances, they are able to charge a rental premium compared with other premises in the local area, thus improving the opportunity to attract private sector funding for subsequent phases of the park

- **the return on investment for the property component:** This is clearly critical in presentations to potential property investors, who in the UK have traditionally been rather cautious in investing in science parks due to restrictive user clauses in planning agreements, short leases and a high proportion of very small tenants with weak covenants

- **net cost of investment by the public cost:** In some instances, parks may have received grant contributions from the public sector, often made at the start of the project to provide roads and utilities on the first phase of the site and construct the first premises. To determine the net cost of the public sector contribution to the science park, it will be necessary to assess the current market value of the land and premises. This should be deducted from the total development cost (and any private sector investment) to establish the net public sector contribution

- **value for money:** For evaluation purposes it would be reasonable to amortise the net public sector contribution over the first 20 years of the park's existence, establishing an annual charge for evaluation purposes. A similar approach may need to be adopted in relation to any public sector contributions made towards the general revenue budget of the science park, particularly during the formation period. This figure would then be used as the basis for calculating the gross and net public sector cost per job and the ratio of GVA to public sector investment. These figures are required by public sector bodies to enable them to assess the value-for-money for money of a science park, compared with other initiatives.

Implications for IASP and the science park movement

Value of evaluation

Good quality and objective evaluation of science parks will help to secure the backing of policy makers for their further development as relevant and important tools to support the competitiveness agendas of countries, regions and local areas, by creating a supportive and high profile environment enabling the knowledge economy to grow.

At a practical level, public bodies need impact and value-for-money data to guide them in future investment plans. These data will also enable new and existing science parks to improve the quality of their forward business plans and prepare specific proposals to pubic agencies for funding support.

Similarly the boards and chief executives of science parks need feedback on the performance and economic impact of their park and how it compares with others. The process will enable them to have a better understanding of the key factors influencing the impact of their park on their local and regional economy. The results of the evaluation will help them to set their long term targets and objectives, develop forward strategies and monitor progress, using key performance indicators.

Evaluations will also provide impartial feedback on the value of their park and how it compares with others to support the marketing of the science park and discussions with potential tenants.

Why are parks reluctant to evaluate

Despite the benefits of sound evaluation, science parks and funding bodies have been slow to realise the importance of evaluation as a tool to demonstrate the achievements of the park in facilitating knowledge exchange, business development and wider economic development to their stakeholders, funding partners and their own tenants.

Amongst some managers this may be due to a combination of scepticism, a reluctance for the performance of their park to be made public and fear about consequences of an evaluation. In part this may be because they would be concerned that a critical evaluation might reflect badly on them as managers and damage their relationship with their board of directors and external funders. Managers are also reluctant because evaluation can be an expensive and time consuming process which inevitably places extra demands on themselves and their staff and distracts them from their job of running the park.

We believe that a key reason for the limited number of science park evaluations may be because the process has not yet been accepted by the science parks, the funding bodies or their key stakeholders as a normal regular activity, compared to say schools, hospitals, local authorities, research institutes and university research. Currently the evaluation of science parks is not straightforward. There are few good examples and there is not yet a widely accepted methodology which captures and values all the most important features of a science park.

Actions by IASP and Country Science Park Associations

We recommend that the science park movement would benefit from the development of guidelines on the monitoring and evaluation of science parks. By encouraging the adoption of common procedures, it would enable the performance and impact of science parks to be compared, taking into account differences in the business model, stage of development and local economic circumstances. In the development of common methodologies, care will need to be taken to strike an appropriate balance between methods which focus on quantitative impact measures (net jobs and GVA after allowing for additionality and displacement effects) and methods that assess the value of the science park as an enabling infrastructure with a range of services to support business development.

We would encourage Country Science Park Associations and IASP to establish within their libraries a section which brings together all evaluation studies on science parks (and incubation centres), which should be accessible through the web. We believe that this should be feasible and in the best interest of science parks and their funders.

We therefore suggest that IASP, working closely with the main Country Science Park Associations, should establish a working party to explore the possibility of developing a common approach to evaluation

In conclusion, science parks, like cluster development initiatives are designed to create enabling environments. Assessing these developments solely in terms differences in the performance of firms received and not receiving the ‘treatment’ may be too limiting, and may overlook indirect and longer term effects.

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