



Swansea University  
Prifysgol Abertawe



## Cronfa - Swansea University Open Access Repository

---

This is an author produced version of a paper published in:

*Creating Entrepreneurial Space: Talking Through Multi-Voices, Reflections on Emerging Debates*

Cronfa URL for this paper:

<http://cronfa.swan.ac.uk/Record/cronfa41189>

---

### **Book chapter :**

Davies, G., Roderick, S., Williams, M. & Thomas, R. (2019). *Chapter 8 Reflections on Technium Swansea: Ambition, Learning and Patience*. *Creating Entrepreneurial Space: Talking Through Multi-Voices, Reflections on Emerging Debates*, (pp. 137-151).

<http://dx.doi.org/10.1108/S2040-72462019000009B008>

---

This item is brought to you by Swansea University. Any person downloading material is agreeing to abide by the terms of the repository licence. Copies of full text items may be used or reproduced in any format or medium, without prior permission for personal research or study, educational or non-commercial purposes only. The copyright for any work remains with the original author unless otherwise specified. The full-text must not be sold in any format or medium without the formal permission of the copyright holder.

Permission for multiple reproductions should be obtained from the original author.

Authors are personally responsible for adhering to copyright and publisher restrictions when uploading content to the repository.

<http://www.swansea.ac.uk/library/researchsupport/ris-support/>

## **Reflections on Technium Swansea: Ambition, Learning & Patience**

Gareth Huw Davies, Sian Roderick, Michael Williams & Roderick Thomas  
School of Management, Swansea University, Wales, UK

### **Abstract**

The Technium initiative started in 2001 with an initial Business and Innovation Centre established in the Swansea docklands area. Early success of this first Technium building led to the concept being rapidly proliferated into a pan-Wales network of primarily sector-focused centres. Whilst the Welsh Government withdrew its support for the Technium network initiative in 2010, the individual centres continued under a range of ownerships and the historic initiative is of continued interest, particularly in respect to regional policy.

A vibrant policy and practice debate subsequently emerged, together with strident media comment. Lack of coherence between Technium Centres and weaknesses in monitoring systems has meant this debate has been poorly informed. This case study helps address the evidence deficit within this debate by revisiting the initial Technium Swansea initiative and its subsequent development.

The case study provides insight into what can realistically be expected of such initiatives in the short, medium and long term, with realistic time-horizons for 'success' and the role of learning for knowledge-based development in similar initiatives and regions.

Keywords: Incubation, Clusters, Regional Innovation Systems, Regional Policy

### **Introduction**

The Technium initiative was created as a pan-Wales business incubation and support network during the period 2000-2010, as part of the then recently-devolved nation's efforts to support knowledge-based economic development. While the Technium Centres now operate independently, the initiative continues to feature in academic and policy debate as providing learning for support of knowledge-based enterprise in the context of regional economic development. The debate to date has focused predominantly on the fortunes of the 'network' which emerged, though without reference or detail relating to the initiative's initial stated ambitions.

This chapter uses the origins of the Technium initiative to explore implications for technology entrepreneurship support within regional economic development policy. The initiative's context also relates significantly to the role of universities and other agencies in supporting enterprise. The aim of this chapter is to revisit the original Technium ambition in order to identify learning from both its own progress and subsequent discourse.

The Technium initiative started in 2001 with an initial Business and Innovation Centre (BIC) in the Swansea docklands area, since rebranded as the 'SA1 Waterfront'. The Centre became a flagship project in the emerging economic development policy of the then recently-devolved Welsh Assembly Government and the longer-standing Welsh Development Agency (WDA). Early success of the first 'Technium' building led to the concept being rapidly proliferated into a pan-Wales network of primarily sector-focused Centres (WEFO, 2007).

Growing interest in knowledge-based economic development, particularly in the context of recently-devolved UK nations (Cooke, 2004; Huggins & Kitagawa, 2012) made the programme of significant interest, due mainly to its scale, nature and ambition. A vibrant policy debate subsequently emerged around the effectiveness of this concentrated capital investment (Cooke, 2004; Cooke & Clifton, 2005; Abbey, Davies, & Mainwaring, 2008), together with what could be viewed as sensational media comment.

This chapter works to address a widely accepted evidence deficit, revisiting the initial SA1 site to examine Technium Swansea (including its Technium 2 grow-on phase) and the subsequent development of companies observed during a 2007 benchmark study. The chapter undertakes this review within the initial and current contexts, with particular regard to the Centre's role within the sub-Regional Innovation System (RIS) described by Abbey et al. (2008).

### **Economic and Devolved Government Policy Context**

South west Wales was the crucible of the first Industrial Revolution, providing coal and steel that powered an empire. However, massive contraction of these industries which started with the Great Depression saw accelerated decline in the 1970s and 1980s (Morgan, 2001). This led to a regional development strategy delivered by the Welsh Development Agency, attracting significant inward investment and employment, primarily in branch plant manufacturing for multinational enterprises (Heidenreich et al., 1998). However, weak embeddedness (Phelps, Mackinnon, Stone, & Braidford, 2003) and emergence of lower cost destinations (Chen, 1996) saw investments and employment start to drift elsewhere. Continued contraction of heavy industries coupled with erosion of existing, and intense competition for new inward-investment manufacturing opportunities shifted economic policy towards development of indigenous and inward-investing knowledge-based enterprise, as called for by leading observers (Cooke & Clifton, 2005).

Devolution brought to Wales responsibility for its own economic policy, which led to a number of key strategies (WAG, 2004b, 2005, 2010; WG, 2013), with focus on innovation to develop technology clusters (WAG, 2003; WG, 2014) and the role of the regional science base which consisted primarily of university research output (WAG, 2009). This policy context had led to vibrant research and policy debate (Abbey et al., 2008; Salvador & Harding, 2006), including comparison with other devolved nations within the UK (Cooke & Clifton, 2005), and specifically the role of universities in economic development (Huggins & Kitagawa, 2012).

During the period prior comparatively low regional Business Expenditure on Research & Development (Rogers, 2006) to support innovation brought attention to the role of universities, during a period of particular interest from national (Lambert, 2003) and regional (WAG, 2004a) governments. Universities are intensely studied as drivers of innovation and regional development (Audretsch & Lehmann, 2005), including in their role of creating mass within peripheral regions (Siegel, Wright, & Lockett, 2007), though the mechanism by which this may occur remains subject to continued debate (Casper & Karamanos, 2003; Power & Malmberg, 2008; Huggins & Kitagawa, 2012).

In this context, the Technium network became a significant part of this policy agenda (WAG, 2003, 2004b), with this now historic initiative being of continued interest, particularly in respect to regional policy (Huggins & Kitagawa, 2012; Morgan, 2013; Cooke, 2013).

## **Theoretical Context**

The Technium initiative relates to a broad theoretical context involving regional development, urban regeneration, knowledge-based enterprise and University-Industry interaction. At its core, a primary stated ambition was cluster development, with the aim of providing high-value enterprise and employment within a Regional Innovation System (RIS).

Cluster theory, particularly since the concept was pioneered by Porter (1998), has drawn significant interest from policy makers (BEIS, 2017; DTI, 2001; EU, 2010) with the attraction of potential for sustained high value employment (McKinsey, 2014), greater productivity and firm growth (Porter, 2000) (Delgado, Porter, & Stern, 2010), and increased levels of innovation (Baptista & Swann, 1998).

There has been longstanding debate regarding government ability to 'programme' cluster development (Porter, 2000; Chiaroni & Chiesa, 2006; Menzel & Fornahl, 2009), while the effectiveness of programmed cluster development is challenged (Swords, 2013; Brakman & van Marrewijk, 2013), with efforts required to provide deeper understanding of the concept (Ketels, 2013). Embedded in much of this discussion is the role of universities as sources of knowledge and skills, particularly with regard to knowledge-based technology-focused sectors (Cooke, 2001; Porter, 2000; McKinsey, 2014).

The cluster concept aligns with the Innovation Systems concept introduced by Lundvall (1992) and Nelson (1993), and developed at a regional level (RIS) by researchers including specifically in the context of Wales (Heidenreich et al., 1998; Cooke, 2001), and sub-regionally with discussion of the role of Technium (Abbey et al., 2008; Cooke 2001) framed with five key linked concepts of *Region, Innovation, Network, Learning & Interaction*, which are useful in considering the role of Technium along with the 'programmed' cluster requirements identified by Su and Hung (2009) of: *a strong science and industry base; finance supporting mechanisms; entrepreneurship; social capital; and networking*.

More recently, this regional economic development context has evolved to include smart specialisation (Foray, 2014; Foray, David, & Hall, 2009), including specifically with regard to Wales (Morgan, 2013; Pugh, 2014) and Technium itself (Morgan, 2013).

## **Technium 1&2: Technium Swansea**

Technium Swansea was originally proposed as an independent Business Innovation Centre in south west Wales. The initial ERDF (European Regional Development Fund) 'Objective 2'-supported initiative involved a capital funding project running from September 1999 to December 2001. The project proposal (SIHE, 1999) presented a central objective that it "*supports the creation of a diversified industrial base and the successful exploitation of innovation*". This was positioned as a response to the 1998 RTP Action Plan (WDA, 1996) statements that "*Incubator facilities are a proven success in Wales and need to be developed further*" and for "*new forms of Higher Education/Business Interface to support wealth creation*". The initial project proposal also cited a report from consultants DTZ on 'Economic Strategy for Swansea' calling for flagship schemes which "*centre on physical building*" and "*brings together a number of firms which are succeeding through knowledge-driven strategies*".

The Technium 1 facility provided 1,400s.m. lettable space, which was then followed by 2,600s.m. of space in the Technium 2, subsequently combining to become Technium Swansea. Technium 2, per the project application, had the primary objective "*to help satisfy the demand created by the successful Technium 1 project*" (WDA, 2001). The project described anticipated "*longer-term tenancies*" stating that

“typically, a knowledge driven business would take 5 years to evolve”, and that supported companies would “eventually” be located in private sector facilities. The application also introduced the concept of an “emerging Technium network”. Evidence of demand for the project is presented as the growth of companies within the fully-occupied Technium 1 together with continued absence of suitable private sector facilities.

The Key Performance Indicators for the two projects also reflected a mission broader than solely relating to start-up and incubation of new firms. As shown in the summaries below (Tables 1 and 2), drawn as excerpts from the original project proposals, these KPIs included activity relating to engagement with existing enterprises and supporting safeguarding of jobs in the wider region.

**Technium 1:** Project Cost: £3,154,140 Grant: £1,558,320

ERDF Monitoring Indicator	Amount
Jobs created directly within Technium 1	6
New companies created within Technium 1	15
New products processes adopted by assisted SMEs	30
Number of existing SMEs contacted	600
New products and processes developed by assisted SMEs	60
R&D Centres Created	1
Jobs created within expanding SMEs and new companies in the period of the project	60
New productive linkages between SMEs and technology providers	90
Percentage increase in turnover in assisted SMEs	15%

Table 1: ‘Technium 1’ ERDF Project Indicators excerpt (SIHE, 1999)

**Technium 2:** Project Cost: £6,436,977 Grant: £3,288,257

ERDF Monitoring Indicator	Amount
Firms provided with advice on innovation and Research & Technology Development	300
Collaborative projects between firms and research institutions	50
Projects transferring environmental technology to the business sector	1
Creation of one innovation centre	1
Floor space constructed in innovation centre	39,000sq.ft.
New firms created including those from academic institutions	50
Increase in turnover of supported firms	£50 m
Gross new firms created	50
Gross jobs safeguarded	500
Gross jobs created in high technology sectors	150
New patents / trademarks registered	15
R&D expenditure	£10 m

Table 2: Technium 2: ERDF Project Indicators excerpt (WDA, 2001)

Technium 2 is explicitly defined in its ERDF funding application as an expansion of the first facility, though in parallel, by 2002 the ambition to realise a ‘network’ of sector-specific centres across Wales had been developed (Clement & Davies, 2002). This rollout of further Centres followed, supported primarily by ERDF and Welsh Government investment (WEFO, 2007). The transition to the following (2007-13 Convergence) EU Structural Funds Programme saw the request for further investment (WG, 2009), though Welsh Government withdrew its support for the Technium network in 2010 (WG, 2011).

Individual Centres continued under a range of ownerships, including Technium 1 & 2 which were sold by Welsh Government to the University of Wales Trinity Saint David, which continues to operate them as an integrated Business Innovation Centre.

### **Approach**

Recognising the study's ambition to explore how the Technium concept developed in terms of policy and practice, together with the inherent complexity presented earlier, a case study approach has been adopted. The aim of reviewing the initiative against its evolving context and accompanying discourse lends itself to this approach.

Drawing upon principles of Yin (2017), the retrospective nature of the study involves no control over events, while the unstructured existing literature makes for valuable though disparate inputs. Adopting this case study approach, this Chapter investigates Technium 1&2 Centres by reviewing their progress against their original objectives, using the case study approach below adapted from Stake (1995), and applied by Huxtable-Thomas, Hannon, and Thomas (2015) to examine a ESF (European Social Fund) activity, itself a retrospective review of a complex case in a similar context. This approach supports the inclusion of multiple contexts and aligns with the continued development of the research, including through an ongoing longitudinal study.

***“Take in Figure (No.1)”***

Figure 1: Case Approach, adapted from (Huxtable-Thomas et al., 2015)

As introduced in prior sections, the Technium case exists in the contexts of Regional Innovation Systems, Cluster Development, Local Regeneration and Welsh Government Economic Policy. It is approached in this chapter applying mixed methods (Creswell & Clark, 2007) involving;

- Review of the original Technium 1 & 2 project proposals provided by the project sponsors;
- A survey of Technium firms, undertaken in 2007, using data collection subsequently used in later studies of other knowledge-based development initiatives (RLP, 2013); and
- Review of current occupancy and recent notable throughput, drawn from Companies House, landlord and other public records

The above framework also supports integration of further data and methods to build upon findings from within this chapter and elsewhere. This incorporates insight from quantitative work such as that of DTZ (2010) and Murphy, Huggins, and Thompson (2015), along with qualitative work including that from Cooke (2004) and Pugh (2017). This approach has been adopted to also support continued development of the longitudinal study of Technium Swansea, as well as providing a basis for planned examination of the cases of other Technium centres.

### **Existing Discussion of Technium**

Technium has been a cause célèbre for academics and political pundits, though debated with limited data apart from headline figures, with the notable exception of the work of Murphy et al. (2015) and the facts contained within a report by DTZ (2009) as part of an evaluation undertaken for Welsh Government. Commentary from observers spanned from 2003 when UK Government was calling for its continued support (Lambert, 2003), through to Welsh Government withdrawing its support for the wider network in 2010 (WG, 2011), and beyond (Cooke, 2013).

Lack of coherence between Technium Centres and weaknesses in monitoring systems, as noted in the DTZ (2009) evaluation, has contributed to this debate being poorly informed. This echoed observation highlighting that limited, and often erroneously quoted, figures were misinforming the debate (Abbey et al., 2008). Indeed, lack of clarity even within the Welsh (Assembly) Government during the early stages (2003) was highlighted by Cooke (2004).

Much debate, has focused on the network, or simply the aggregate, of Technium Centres (Cooke, 2004) without consideration at the level of the individual centre. The discussion of Huggins and Kitagawa (2012) and insight of Murphy et al. (2015) recognises that the set of Centres is heterogenous, and noting much Technium success is associated with a small number of Centres. This is also reflected more recently by Cooke (2013), in his discussion of the positive and negative aspects of path inter-dependence, demonstrated respectively by the initial Technium 1, and the subsequent 'network' Centres.

A lack of management control/coherence (DTZ, 2009; Morgan, 2013) and an apparent focus on property development rather than operating as a knowledge/innovation initiative (Cooke, 2004) (Gibson, 2007) are central criticisms of Technium. These are accompanied by a charge of overcapacity in sectors/regions (Cooke, 2004) and weak academic links in some Centres (Huggins & Kitagawa, 2012) (Cooke, 2013). Further, it is regarded by some as there having been a missed opportunity to learn from the first Technium, prior to rollout of the network (Cooke, 2013; Morgan, 2013), or to establish a rationale for further intervention as firmly as for the first Centre (DTZ, 2009). It is suggested this may be

at least partly attributable to haste in exploiting the ERDF funding window which was open at the time (Cooke, 2013).

Positive contributions of Technium noted in the literature focus on its early stages, including initial performance in job creation and strong links with academia (Abbey et al., 2008; Huggins & Kitagawa, 2012), underscoring the importance of looking back to its origins.

An interesting more recent discussion is provided by Morgan (2013), presenting a comparison between more focused sector-specific smart specialization interventions and the state-orchestrated rather diverse foci of the Technium network. Ironically, the highly successful 'SPECIFIC' solar energy initiative offered by Morgan as an example of good practice has been based in the former Technium Sustainable Technologies centre, undertaking precisely the form of innovation desired by the original Technium vision.

However, perhaps the most notable aspects of the existing academic debate are the notable gaps, including any granularity, apart from work by Murphy et al. (2015), and sparse consideration of the years since withdrawal of Welsh Government support. Individual Technium Centres continue to operate with local management arrangements with new branding, and the lessons learned from the process appear to have informed subsequent incubation and acceleration activities across the region (Morgan, 2013; SU, 2017).

### **Survey Results and Documentary Evidence**

An initial baseline for a survey of Technium Swansea is provided by the initial Technium 1 project summary, cited in the DTZ (2010) report. The project phase ended in September 2001 reporting creation of 54 jobs (90% of 60 job target). A later survey of Technium Swansea firms was undertaken by Swansea University in June 2007, after the Technium 2 project phase had concluded in March 2006. This presented an 82% response rate (nine of 11 companies) from tenants. The respondents reported combined employment of growth of 116.5 FTE during the supported period, which aligns with the 110 (73% of 150 target) noted in the 2006 progress report (DTZ, 2010) and which would (or at least should according to the ERDF targets in Table 2) have also included wider sector employment created. Five of the respondent firms were founded prior to Technium, with combined employment of 25.5 FTE during their first year, though collectively added 44FTE in the period to 2007 (i.e. 48% of new employment).

While the DTZ (2009) evaluation refers to a lack of data relating to the nature of jobs created, notably in terms of graduate opportunities, the 2007 survey presents that 77% of employees are graduates, predominantly in science and engineering roles. The same percentage was observed in the proportion of graduates coming from Welsh universities. The proportion of employees with postgraduate qualifications was lower at 43%, and 24% of employees were female. All respondent companies stated that these higher-level skills were 'fundamental' to their activities. The survey also presents that five of nine companies involved founders from universities, with the majority (seven of nine) being in the age range 25-55 years. The remaining two companies were founded by a young inward-investor and local graduates.

Almost all respondents (eight of nine) reported collaborations with Further Education/Higher Education institutions in Wales, predominantly in Knowledge Transfer Partnerships and student placements.



Institutions involved included Gorseinon College, Cardiff University, Swansea Institute of Higher Education, and Swansea University. Collaboration with other Technium firms was reported by three respondents, though all reported collaborations with other Welsh/UK firms.

The survey data, essentially a 2007 census, together with ERDF-project monitoring information provide useful summaries at key points. This is of help primarily for reviewing Technium as a project (i.e. time and scope bound) but is limited in providing insight for any intended longer-term effect. Consideration beyond the walls and timescales of the ERDF-supported project is therefore required to investigate for the desired greater longer-term benefits, as noted by DTZ (2009).

Follow-up of the 2007 cohort shows that four subsequently 'graduating' companies relocated into the privately-financed Ethos building adjacent to Technium 1. This 4,000s.m. development now houses a diverse range of knowledge-based enterprise from software development through to advanced medical devices manufacturing services.

Of the 2007 cohort, all companies are still trading according to Companies House filings, with six companies having progressed to premises elsewhere in the region and the remaining three remaining in Technium but having grown to occupy more space (units). Those located elsewhere have remained in the Swansea area.

The current (2017) occupancy of Technium 1&2 includes 14 new tenants since the 2007 cohort. Notably this includes an inward-investing operation of financial services company OSTC, which alone employs 40 staff. Other companies include construction and digital/media technologies, reflecting strengths within the University of Wales Trinity Saint David.

The 2007 cohort has continued to develop both in-situ and further afield, while further companies have progressed through Technium Swansea since the survey. The survey data do not include a number of companies which entered and graduated from Technium without monitoring of their progress. For example, two Technium firms (one of which graduated prior to the survey), now manufacture products in partnership with a local subcontract manufacturing firm, supporting over 100 manufacturing jobs. However, this has only been shown through review of other initiatives (Davies, Roderick, & Williams, 2017).

## **Discussion**

The strong job creation of Technium 1&2 during their project phases supports earlier observation that much Technium network success was focused within certain sites (Huggins & Kitagawa, 2012), while the diversity of founders and throughput of firms into the region suggests a level of success against original objectives at a Centre level.

This sits in the context of the wider Welsh university sector during this period as already making a positive contribution to knowledge-based enterprise (Huggins & Cooke, 1997; Huggins, Jones, & Upton, 2008; WAG, 2004a), though with well-noted capacity challenges for HE to support such development, particularly in forming sufficient spin-outs to support the desired economic transformation (Brooksbank & Thomas, 2001; Cooke, 2004).

Focus on activity solely within the Centres, particularly from spin-out activity, during their initial project phase does however miss their wider purpose in both time and region. For example, research into the

regional Life Sciences & Health sector shows later meaningful recent job creation resulting from linkages between both former and current Technium firms; other regional firms; and research organisations (Davies et al., 2017). This echoes the observation in the DTZ (2009) report stating that evaluation of such initiatives should give focus to performance in subsequent growth of incubated firms, which is where and when the most significant benefits should be expected.

The above points draw attention to the fact that the Technium 1 project is heading towards two decades from its initiation, the time horizon point at which evaluation of such initiatives is deemed appropriate by the primary funders (EU, 2002, 2014). Much commentary on Technium arrived when Centres were in early stages of operation (Cooke, 2004), and even before the original 'typical' five years (SIHE, 1999) of company evolution described in the plans of the first Centre. Abbey et al. (2008) and Huggins and Kitagawa (2012) recognize the long-term nature of the initiatives, echoing the original stated purpose and ambitions. The continued activity of the Technium 1&2 Centres, and discussion thereof, two ERDF Programmes (14 years) later suggests that they are indeed part of established infrastructure rather than simply an historic project.

The structural and cultural changes sought by the initial project and related policies, and the observation by DTZ (2009) that Technium was a long-term, and infrastructure, initiative is not reflected in the evidence or most of the discussion previously produced. This disconnect between purpose and measurement challenges whether the targets attached to projects set *pro rata* against proportion of programme funding (CRG, 2003), were appropriate measures, both in nature and scale. Clearly a capital investment opportunity existed through the then ERDF programme, and seizing upon this is identified as a potential driver of the 'hasty' rollout (Cooke, 2013).

That Technium Swansea remains full with continued throughput of knowledge-based enterprise into the region suggests a level of success in its long-term aim of "*developing a culture which encourages and values innovation*" (SIHE, 1999). However, it is of note that this occupancy rate is above the 85% best practice referenced by DTZ (2009) which may create operational/capacity issues for the activity.

The SA1 Swansea docklands regeneration is still a work in progress, however the trend over the period since establishment of Technium Swansea has been of continuing inward-investment, including significant employment sites for insurance company Admiral and PRA Healthcare, along with recent announcement of an expanding private hospital. Continued investment by private enterprise, and the mixed development underway led by the University of Wales Trinity Saint David provides a foundation for the proposed next phase of SA1 development (SU, 2017).

The long-term nature of the endeavour, and its existence within an evolving region/economy accompanied by continuous technological change emphasises the need for proper consideration within such context. The follow-up of a number of Technium companies and noting of local regeneration activity underscores this need for context to be properly considered, recognising low initial levels of entrepreneurship (GEM, 2000), weak Business Expenditure on R&D (Rogers, 2006) and limited, though (since Technium 1) rapidly growing, in scale and quality, regional universities (Brooksbank & Thomas, 2001; SU, 2017).

Work such as that of Murphy et al. (2015) provides deeper understanding of the innovation activity within Technium, while the additional data and context introduced in this chapter show there is more to the Technium than headlines suggest.

Importantly, the *Learning* concept within RIS described by Cooke (2001) now appears to be more prominent within recent initiatives, such as the Institute of Life Science at Swansea University which co-locates science and business, with space for other essential innovation services such as finance, legal advice and accountancy, as suggested by Cooke (2004). This learning shows that the ‘experimental’ approach within Technium, has at least informed more recent efforts, with greater emphasis on smart specialisations, as called for by Morgan (2013). This deeper exploration of the initial Technium activity also sets the scene for a more insightful longitudinal study, including review of these initiatives involving both smart specialisation and diversity of enterprise and innovation.

### **Conclusion and Policy Implications**

In short, to paraphrase the Welsh poet Dylan Thomas (1954), this Chapter does not posit that Technium are ‘*wholly bad or good*’, but contributes to addressing the evidence deficit that has featured in prior debate of the initiative. In this respect it has highlighted the need to objectively consider with greater care and detail the role such activity can play within a region to support enterprise and innovation. Performance during the Technium Swansea project period broadly in line with the its ambitions, together with throughput of incubated companies, presents positively for the original initiative. Gibson (2007) noted a need for ‘evolution’ in commercialisation, which echoes with the call for learning from other observers (Cooke 2004, Heidenreich, & Braczyk, 2004; Huggins & Kitagawa, 2012). This suggests that the strategic ambition of developing knowledge-based enterprise requires more adaptive and informed policy and practice, though recognising how timescales and context need critical consideration.

This chapter has provided further perspective for developing appropriate expectations of such initiatives in the short, medium and long term, with realistic time-horizons for ‘success’. Indeed, even the guidance of the key funding partner, the EU Commission, suggests costs and benefits should be considered over a time horizon of 15-30 years (EU, 2002, 2014). This reflects the development of absorptive capacity and cycles of enterprise and innovation within supported firms, along with the evolution timescale of the initiative which supports them. In doing so it identifies a need for rational objective debate – with an approach to appraisal, evaluation and discourse that recognises such initiatives’ inherent complexity, and their role as limited components situated within a RIS.

The findings from observers (Abbey et al., 2008; Huggins & Kitagawa, 2012; P. Cooke, 2013; Morgan, 2013) are all valuable, however such insight is limited without continuous and more effective monitoring to inform such work. This is an important component in development and delivery of interventions (HMTreasury, 2003) with monitoring from prior activities playing a critical role in the cycle of setting out long-term objectives, determining relevant KPIs/monitoring arrangements, - and supporting governance & management that transcends political, funding and media cycles.

Technium 1&2 have highlighted the path dependency issues described by Cooke (2013), along with the long-term nature of such infrastructure development. It is therefore important that policy-makers both recognise and embrace this in formulation, delivery and oversight of future initiatives such as the Swansea Bay City Region City Deal (SU, 2017).

## References

- Abbey, J., Davies, G., & Mainwaring, L. (2008). Vorsprung durch Technium: Towards a system of Innovation in South-west Wales. *Regional Studies*, 42(2), 281-293.
- Audretsch, D. B., & Lehmann, E. E. (2005). Does the Knowledge Spillover Theory of Entrepreneurship hold for regions? *Research Policy*, 34(8), 1191-1202.  
doi:<http://dx.doi.org/10.1016/j.respol.2005.03.012>
- Baptista, R., & Swann, P. (1998). Do firms in clusters innovate more? *Research Policy*, 27(5), 525-540.
- BEIS. (2017). *Building our Industrial Strategy: Green Paper*. Online: HM Government.
- Brakman, S., & van Marrewijk, C. (2013). Reflections on cluster policies. *Cambridge Journal of Regions, Economy and Society*, 6(2), 217-231. doi:10.1093/cjres/rst001
- Brooksbank, D., & Thomas, B. (2001). An assessment of higher education spin-off enterprises in Wales. *Industry and Higher Education*, 15(6), 415-420.
- Casper, S., & Karamanos, A. (2003). Commercializing science in Europe: the Cambridge biotechnology cluster. *European Planning Studies*, 11(7), 805-822.
- Chen, C.-H. (1996). Regional determinants of foreign direct investment in mainland China. *Journal of economic studies*, 23(2), 18-30.
- Chiaroni, D., & Chiesa, V. (2006). Forms of creation of industrial clusters in biotechnology. *Technovation*, 26(9), 1064-1076. doi:<http://dx.doi.org/10.1016/j.technovation.2005.09.015>
- Clement, M., & Davies, S. (2002). *Technium concept*. Paper presented at the Education and Training in Optics and Photonics 2001.
- Cooke, P. (2001). Regional Innovation Systems, Clusters, and the Knowledge Economy. *Industrial and Corporate Change*, 10(4), 945-974. doi:10.1093/icc/10.4.945
- Cooke, P. (2004). The regional innovation system in Wales. *Regional Innovation Systems. The Role of Governances in a Globalized World*.
- Cooke, P. (2013). *Re-framing regional development: evolution, innovation and transition*: Routledge.
- Cooke, P., & Clifton, N. (2005). Visionary, precautionary and constrained 'varieties of devolution' in the economic governance of the devolved UK territories. *Regional Studies*, 39(4), 437-451.
- Cooke, P. N., Heidenreich, M., & Braczyk, H.-J. (2004). *Regional Innovation Systems: The role of governance in a globalized world*: Psychology Press.
- Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.
- CRG. (2003). *Mid-term Evaluation of the Objective 1 Programme for West Wales and the Valleys: Final Report*. Retrieved from
- Davies, G., Roderick, S., & Williams, M. (2017). *A Sub-Regional Innovation Ecosystem? Life Sciences & Health in the Swansea Bay City Region*. Paper presented at the 12th European Conference on Innovation and Entrepreneurship, Paris.
- Delgado, M., Porter, M. E., & Stern, S. (2010). Clusters and entrepreneurship. *Journal of Economic Geography*, 10(4), 495-518. doi:10.1093/jeg/lbq010
- DTI. (2001). *Business Clusters in the UK - a first assessment*.
- DTZ. (2009). *Evaluation of the Technium Programme, Final Report to the Welsh Assembly Government, Stage 1: Scoping and Review*. Online.
- DTZ. (2010). *Technium Case Studies: Appendix 1 to Evaluation of the Technium Programme Stage 1: Final Report*. Retrieved from Welsh Government Website:  
<http://gov.wales/docs/caecd/research/101119techniumcasestudyen.pdf>
- EU. (2002). *Guide to cost-benefit analysis of investment projects*. Web.
- EU. (2010). *Clusters and clustering policy: a guide for regional and local policy makers*. INNO Germany AG.

- EU. (2014). *Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020*. Web.
- Foray, D. (2014). *Smart specialisation: opportunities and challenges for regional innovation policy* (Vol. 79): Routledge.
- Foray, D., David, P. A., & Hall, B. (2009). Smart specialisation—the concept. *Knowledge economists policy brief*, 9(85), 100.
- GEM. (2000). *Global Entrepreneurship Monitor: 2000 Wales Executive Report*. Retrieved from
- Gibson, S. (2007). *Commercialisation in Wales - A Report by the Independent Task and Finish Group*. Retrieved from [www.assembly.wales/commercialisation\\_in\\_wales\\_-\\_gibson\\_review.pdf](http://www.assembly.wales/commercialisation_in_wales_-_gibson_review.pdf)
- Heidenreich, M. E., Clapson, M., Fine, B., Hall, T., Karan, P., Stapleton, K. E., . . . Tucker, B. (1998). Braczyk, Hans-Joachim, Cooke, Philip. *Urban Studies*, 35(8), 1411-1412.
- HMTreasury. (2003). *The green book Appraisal and evaluation in central government: Treasury guidance*. (0115601074). Norwich (United Kingdom): TSO.
- Huggins, R., & Cooke, P. (1997). The economic impact of Cardiff University: innovation, learning and job generation. *GeoJournal*, 41(4), 325-337.
- Huggins, R., Jones, M., & Upton, S. (2008). Universities as drivers of knowledge-based regional development: a triple helix analysis of Wales. *International Journal of Innovation and Regional Development*, 1(1), 24-47.
- Huggins, R., & Kitagawa, F. (2012). Regional Policy and University Knowledge Transfer: Perspectives from Devolved Regions in the UK. *Regional Studies*, 46(6), 817-832.  
doi:10.1080/00343404.2011.583913
- Huxtable-Thomas, L., Hannon, P., & Thomas, S. (2015). *Using a Mixed Method 'Petri-Dish' Diagram to Determine Complex Impacts of Leadership Development in Extant Entrepreneurs*. Paper presented at the 14th European Conference on Research Methodology for Business Management Studies.
- Ketels, C. (2013). Recent research on competitiveness and clusters: what are the implications for regional policy? *Cambridge Journal of Regions, Economy and Society*, 6(2), 269-284.  
doi:10.1093/cjres/rst008
- Lambert, R. (2003). *Lambert Review of Business-University Collaboration: Final Report*. HMSO.
- Lundvall, B.-Å. (1992). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*: Pinter, London.
- McKinsey. (2014). *Industrial revolutions: capturing the growth potential*. Centre for Cities.
- Menzel, M.-P., & Fornahl, D. (2009). Cluster life cycles—dimensions and rationales of cluster evolution. *Industrial and Corporate Change*, dtp036.
- Morgan, K. (2001). The new territorial politics: rivalry and justice in post-devolution Britain. *Regional Studies*, 35(4), 343-348.
- Morgan, K. (2013). The regional state in the era of Smart Specialisation. *Ekonomiaz*, 83(02), 103-126.
- Murphy, L., Huggins, R., & Thompson, P. (2015). Social capital and innovation: A comparative analysis of regional policies. *Environment and Planning C: Government and Policy*, 34(6), 1025-1057.  
doi:10.1177/0263774X15597448
- Nelson, R. R. (1993). *National innovation systems: a comparative analysis*: Oxford university press.
- Phelps, N. A., Mackinnon, D., Stone, I., & Braidford, P. (2003). Embedding the multinationals? Institutions and the development of overseas manufacturing affiliates in Wales and North East England. *Regional Studies*, 37(1), 27-40.
- Porter, M. E. (1998). *Clusters and the new economics of competition* (Vol. 76): Harvard Business Review Boston.
- Porter, M. E. (2000). Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, 14(1), 15-34.

- Power, D., & Malmberg, A. (2008). The contribution of universities to innovation and economic development: in what sense a regional problem? *Cambridge Journal of Regions, Economy and Society*, 1(2), 233-245.
- Pugh, R. (2017). Universities and economic development in lagging regions: 'Triple helix' policy in Wales. *Regional Studies*, 51(7), 982-993.
- Pugh, R. E. (2014). 'Old wine in new bottles'? Smart Specialisation in Wales. *Regional Studies, Regional Science*, 1(1), 152-157. doi:10.1080/21681376.2014.944209
- RPL. (2013). *Life Science Skills for Life*.
- Rogers, M. (2006). R&D and Productivity in the UK: evidence from firm-level data in the 1990s.
- Salvador, E., & Harding, R. (2006). Innovation policy at the regional level: the case of Wales. *International Journal of Foresight and Innovation Policy*, 2(3), 304-326.
- Siegel, D. S., Wright, M., & Lockett, A. (2007). The rise of entrepreneurial activity at universities: organizational and societal implications. *Industrial and Corporate Change*, 16(4), 489-504.
- SIHE. (1999). Creation of a Business and Innovation Centre for the South West Wales Area: Project Summary Sheet. Welsh European Programme Executive Ltd.
- Stake, R. E. (1995). *The art of case study research*: Sage.
- SU. (2017). *Internet Coast: Phase 1: City Deal Proposal Impact Appraisal*. Retrieved from School of Management:
- Su, Y.-S., & Hung, L.-C. (2009). Spontaneous vs. policy-driven: The origin and evolution of the biotechnology cluster. *Technological Forecasting and Social Change*, 76(5), 608-619.
- Swords, J. (2013). Michael Porter's cluster theory as a local and regional development tool: The rise and fall of cluster policy in the UK. *Local Economy*, 28(4), 369-383. doi:10.1177/0269094213475855
- Thomas, D. (1954). *Under milk wood*: New Directions Publishing.
- WAG. (2003). *Wales for Innovation*. Welsh Assembly Government.
- WAG. (2004a). *Knowledge Economy Nexus: Role of Higher Education in Wales*.
- WAG. (2004b). *A Winning Wales; The National Economic Development Strategy of the Welsh Assembly Government*. Welsh Assembly Government.
- WAG. (2005). *Wales: A Vibrant Economy: The Welsh Assembly Government's Strategic Framework for Economic Development Consultation Document*.
- WAG. (2009). *Science for Wales: A strategic agenda for science and innovation in Wales*.
- WAG. (2010). *Economic Renewal: a new direction*. Crown Copyright.
- WDA. (1996). *Wales Regional Technology Plan - An Innovation and Technology Strategy for Wales*.
- WDA. (2001). Technium II, A Business and Innovation Centre for the South West Wales Region, Grant Application. In W. D. Agency (Ed.): Welsh European Funding Office.
- WEFO. (2007). Approved Projects, 2000-2006 West Wales & Valleys Operational Programme. In W. G. Welsh European Funding Office (Ed.). Online.
- WG. (2009). Technium Pan-Wales. Retrieved from <http://gov.wales/funding/eu-funds/previous/searchprojects1/80312?lang=en>
- WG. (2011). Written Statement - Technium Update [Press release]. Retrieved from <http://gov.wales/about/cabinet/cabinetstatements/previous-administration/2011/techniumupdate/?lang=en>
- WG. (2013). *Sectors Delivery Plan*.
- WG. (2014). *Innovation Wales*.
- Yin, R. K. (2017). *Case study research and applications: Design and methods*: Sage publications.