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Universities and Economic Development in Lagging Regions: ‘triple helix’ policy in Wales

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Universities and Economic Development in Lagging Regions: ‘triple helix’ policy in Wales

Abstract

This paper considers the applicability and relevance of triple helix based policy and theory, in the weaker region context of Wales, where the success of such approaches has been questionable. It calls for a broader appreciation of the roles of universities in weaker regions beyond a narrow ‘third mission’ conceptualisation, moving away from a normative application of the triple helix in contexts very different from those in which it was originated. Instead, it supports the broadening of the original theory beyond the three key actors of university, government, and business, and an increasing focus on diverse regional settings and spaces.

Keywords

Innovation Policy; Weaker Regions; Triple Helix

Introduction

Universities, and the knowledge they hold, are increasingly seen as key stimulants of regional economic development and are often the focus of strategies to leverage the emergence of the knowledge-based economy (DRUCKER and GOLDSTEIN, 2007; SMITH, 2007). Universities are expected to take an active role in the development of their regions (GODDARD *et al.*, 2014) through activities such as technology transfer, university-industry partnerships, and educational curricula to match the demand of local industry, widely studied through case-studies and broader theorisation around the changing roles of universities. For example, the triple helix concept posits that interactions between university, industry, and government spheres drive innovation in the knowledge economy (ETZKOWITZ and LEYDESDORFF, 1997);

it is used to study economic development and knowledge exchange functions of universities, and to make policy recommendations (TODEVA, 2013).

Attempts have been made worldwide to replicate the best-practice of leading regions, which have successfully harnessed their universities to bring about regional economic development. However, the literature is less clear on the function and applicability of these approaches in the weaker/ peripheral/ uncompetitive regional contexts (cf. HUGGINS AND JOHNSTON, 2009). Adopting an approach developed in leading regions, and applying it wholesale in diverse and divergent regional contexts in a ‘copy and paste’ manner is recognised as problematic (GUNASEKARA, 2006; HOSPERS, 2006; PICCALUGA, 2006). There is a need for more investigation of the applicability of leading theories in weaker regions: efforts are being made to broaden the triple helix to incorporate more spheres through a quadruple and quintuple helix (CARAYANNIS AND CAMPBELL, 2012) and to test its application in developing settings (CAI, 2014; ETZKOWITZ, ET AL., 2005).

This paper explores the university-based approach to innovation and economic development in a weaker region within Europe - Wales - questioning its suitability in this context, as part of wider trend towards ‘one-size-fits-all’ innovation policy (cf. TÖDTLING and TRIPPL, 2005). Against a backdrop of a wider growth in regional innovation policy over the last two decades, it examines the increasing reliance on universities as economic drivers in Wales, and the specific interventions aimed at increasing university-industry collaboration. Interventions encountered issues relating to poor implementation and over-supply, resulting in a lack of engagement or buy-in from the business sphere. Relying on universities to drive innovation and economic growth in a narrow innovation-push conceptualisation, akin to the triple helix, may not best maximise the economic potential of universities in weaker regions. A less prescriptive theorisation of regional innovation and the role of universities is required so that

policymakers can adapt best-practice from elsewhere, sympathetic to regional specificities, considering the diverse roles universities play beyond the standard third mission activities.

Theoretical Foundations

Universities, as ‘knowledge factories’ (YOUTIE and SHAPIRA, 2008), are seen to play important roles at the local and regional levels (SMITH, 2007; HUGGINS and KITAGAWA, 2012). In triple helix terms, university, industry and government constitute the key institutional framework of post-industrial, knowledge-based societies (ETZKOWITZ AND KLOFSTEN, 2005). Spatial proximity to knowledge can bestow competitive advantage, and co-locating near knowledge producing universities has been found to positively correlate with innovation outcomes at the firm and regional level (AUDRETSCH and ALDRIDGE, 2009).

It is unsurprising that practitioners of regional innovation policy are interested in universities considering the range of roles they are seen to play in regional economic development (HOWELLS *et al.*, 2012; SRINIVAS and VILJAMAA, 2008). In particular, third mission activities, such as licensing, patenting, knowledge transfer, and spin-offs, have gained much attention from academics and policymakers due to their explicit and measurable economic impacts (MOWERY and SHANE, 2002). However, focussing on third mission activities alone can obscure the wide range of roles and activities universities undertake in interacting with businesses, government, and the wider community (GODDARD *et al.*, 2014).

The kinds of activities undertaken by universities, and their impact, is found to vary according to type of institution, discipline, and region, but this is not always recognised at the policy level; the presence of research-intensive universities is automatically assumed to positively influence the innovation activities of local firms (UYARRA, 2010). There is a danger that local firms do not possess the absorptive capacity or motivation to engage with universities in weaker regions such as Wales (HUGGINS and KITAGAWA, 2012). Regional

innovation policy (cf. BORRÁS and EDQUIST, 2013), is at the heart of public policy efforts to develop regional economies (BELLINI and LANDABASO, 2007; MCCANN and ORTEGA-ARGILES, 2013). Policies that develop a physical infrastructure to enable collaboration and spin-out have been popular, in particular science parks and incubators (PHAN *et al.*, 2005). Studies have found variable success of these strategies; some are hailed as exemplar innovation interventions (CASPER and KARAMANOS, 2003), yet others are more critical of their proliferation (MORGAN, 1997; GUNASEKARA, 2006).

Arguably instrumental in this proliferation of university-based policies are the theories presented as analytical frameworks and as policy blueprints for regional policymakers to adopt (IRAWATI and GEBHARDT, 2013). A prime example is the triple helix (ETZKOWITZ and LEYDESDORFF, 1997), which sits alongside other regional innovation theories bridging the gap between academic theory and policy practice; such as clusters, open innovation, the creative class, the learning region, and systems of innovation (PORTER, 1998; COOKE, 1992 ; LUNDVALL, 1992, 2007; FLORIDA, 1995; MORGAN, 1997; CHESBROUGH, 2003; RUTTEN and BOEKEMA, 2007etc.). The triple helix places universities at the heart of the innovation system, and allocates a crucial role to their third mission activities; government is seen as an enabler of interactions between universities and industry (ETZKOWITZ and LEYDESDORFF, 1997; ETZKOWITZ and RANGA, 2010). Studies have employed the triple helix as a framework for analysing policies and programmes to address economic development through a university-premised approach (e.g. ETZKOWITZ *et al.*, 2005; ETZKOWITZ and RANGA, 2010; LEYDESDORFF, 2012; TODEVA, 2013).

The triple helix is criticised for its restrictive nature in conceptualising only three groups of actors (CARAYANNIS and CAMPBELL, 2009; ARNKIL *et al.*, 2010), and its focus on a small set of exceptional examples (COOKE, 2004; UYARRA, 2010). In response, broader investigations include a wider set of actors and institutions, such as the quadruple helix including `non

governmental knowledge production, utilization, and renewal entities as well as other civil society entities, institutions and stakeholders' (CARAYANNIS AND CAMPBELL, 2011, p.330) or perhaps even an n-tuple of helices as more perspectives are added to the concept (LEYDESDORFF, 2012); these perspectives devote much more attention to the important but oft-overlooked issue of the culture of innovation. Increasingly, study of a wider range of regions, regional differences and the cultures and institutions that affect the functioning of the triple helix is taking place (ETZKOWITZ, 2008). Building on these perspectives, this paper further explores these theoretical and policy approaches in a weaker region context, where dependence on their universities for employment and innovation is high, but these universities generate less wealth than their more competitive regional counterparts (HUGGINS and JOHNSTON, 2009).

Case Study

Since devolution in 1999 Wales has pursued a distinctly regional approach to innovation and economic development, providing an interesting case study of regional policy evolution (HUGGINS and KITAGAWA, 2012, p. 818). Wales is one of the four home nations of the UK,ⁱ with a population of around three million, concentrated primarily in the south (BARRY, 2011). Whilst Wales is described in this study as a 'region', in reference to its economic status (as opposed to political or cultural) within the wider UK economy, it is important to appreciate the heterogeneity of the different sub-regions and common conceptions of Wales as a nation.

In addition to receiving the highest level of structural funding from Europe, the Welsh economy underperforms relative to the UK average. For example the employment rate is 3.5% lower with a higher proportion on claimants and economically inactive citizens, and proportionally more public sector employment and self employment (WELSH GOVERNMENT, 2015). Wales has the lowest GVA per head figure, currently at 71.4% of the UK average

across all regions (WELSH GOVERNMENT, 2015). As JONES-EVANS (2013) explains: Wales only accounts for 1.6% of all business R&D undertaken in the UK though it has 4.2% of total businesses, which can be at least partly explained by the relatively few large corporations with their own research and development functions. The Welsh economy is described as a branch plant economy due to high levels of foreign investment and reliance on FDI, which is seen to have contributed to a weak business and entrepreneurship culture (BALL, 2008, p.6). For example, of the companies making the recent Top 300 list of the largest companies in Wales, only around one third are British owned (WESTERN MAIL, 2015).

This study is built on a strong tradition of researching innovation and economic development in Wales (COOKE, 1992, 2004; MORGAN, 1997, 2012; LOVERING, 1999; BRISTOW, 2005). Scholars have noted the growing reliance on universities as innovation drivers, and the expansion of university-focussed programmes, often underpinned by European funds and policy trends (COOKE, 1992, 2004; ASHEIM, 2012). However, it is presently unclear how successful the university-centred approach to economic development has proved in Wales (JONES-EVANS and BRISTOW, 2010; HUGGINS and KITAGAWA, 2012).

Methods of Enquiry

This paper presents a case study of the last fifteen years of Welsh innovation policy, focussing on interventions taking a university-based approach to regional economic development. The case study methodology enables rich data to be generated from a variety of sources, critical for triangulation and substantiating the findings, increasing credibility and mitigating against anecdotalism (SILVERMAN, 2010; YIN, 2014). Numerous authors have made the case for qualitative research (e.g. CORBIN AND STRAUSS, 2008; SILVERMAN, 2010) and the two methods considered appropriate and practical for this study are policy review and semi-structured interviews. There is precedence in the policy studies literature of combining

these two methods to understand the policymaking process (HARRISON, 2001; BURNHAM, ET AL., 2004; GARNETT AND LYNCH, 2012).

The focus was on documents published by the Welsh Government, with UK and EU levels also studied to contextualise the wider policy trends and debates. Also consulted were published evaluations of programmes (e.g. DTZ, 2010; CMI, 2011). The formal analysis was of official government publications; news articles, political speeches, and blogs by political commentators were also consulted to illuminate the discussions and processes around the shaping and implementation of policy. The date range was devolution (1999) to 2013, and a broad definition of innovation policy was used, with overlapping spheres - science, economic and education - found to be important when considering the role of universities as economic drivers. The key trends in the evolution of policy and the main programmes addressing innovation and economic growth were identified. From this list, the programmes in the triple helix domain were further explored through interviews with key stakeholders to determine their nature and success.

Interviews have been found to be an effective method for exploring political topics, allowing us to understand policies and programmes through the perspectives of those who enact them (RUBIN AND RUBIN, 2005; SIMONS, 2009). 58 interviews were conducted with stakeholders from the three spheres (university, government and business) in a topical, semi-structured but flexible manner, with schedules pre-prepared. Interviews explored stakeholders' opinions regarding the evolution of innovation and economic policy in Wales, the most significant policies, their degree of success, and the barriers to innovation and economic development.

Programmes were included in this analysis if they aimed at increasing collaboration between stakeholders, where universities have a central role. The individual programmes were analysed and the common elements identified; inductive categories were created based on the

interventions' rationales and implementation. All the programmes included in the analysis were discussed by multiple stakeholders to include the interventions actually considered important by the people involved in their design, implementation, and use; this helped to obviate biases in the programme selection and to allow triangulation. Previous studies of innovation policies and programmes that have developed frameworks for categorising and understanding the range of interventions were drawn upon to create a typology of innovation support based on theory (NAUWELAERS and WINTJES, 2003; EDLER and GEORGHIOU, 2007; FLANAGAN *et al.*, 2011).

Analysis of Welsh Policy and Programmes

Wales is consistent with wider UK, European and global policy trends, where university-originated knowledge receives increased attention as a source of growth in the knowledge economy (KITSON *et al.*, 2009). In the early years of the Welsh Government, between 1999 and 2003, a number of key policies were published, including the first Innovation and Entrepreneurship plans (*IAP and EAP*). The approach was broad and systemic, aiming to create a culture of innovation over the long-term. Between 2003 and 2009, innovation falls off the policy agenda somewhat, driven instead through education and science policies with greater focus on universities. In the most recent period (2009 onwards) innovation returns to the forefront of the policy agenda, with the publication of the most recent economic, science, and innovation policies. The the smart specialisation agenda being pushed down from Europe comes to the fore.

University-based interventions have been allocated significant resources and constitute several flagship programmes, enjoying a prominent position in the innovation, science, economic, and higher education policies. Universities are central actors driving innovation and economic development; the focus is mainly on their knowledge-exchange and spin-out

functions. Universities' other roles are also recognised - teaching, research, cultural, community - but it is their third mission and economic roles that are emphasised. The strong presence of science and higher education policy resulted in a swing towards university-based approaches to innovation, premised on a linear understanding. A recent development was to establish what was referred to by a policymaker as a 'triple helix style' advisory panel of academic and business experts to assist the Welsh Government. The stated rationale uniting the different policy spheres considered (innovation, economic, education, science and strategic policies) is to create a 'learning country' through developing the knowledge-based economy with universities playing a central role. Welsh policy is premised on a model of pushing innovation out of universities into the business sphere, rather than building up the absorptive capacity and innovative capabilities of businesses.

Table 1

Four categories of triple helix interventions have been identified, based on their common characteristics and approach:

- Physical infrastructure for high-tech innovation activities (e.g. incubators), within or in conjunction with universities: Techniums, CETICs and HPC Wales.
- Enabling knowledge exchange between academia and industry, by funding or facilitating collaborations: Know How Wales, A4B, Expertise Wales Portal.
- Development of human capital as the means to transfer knowledge and innovation between academia and industry and increase collaboration: NRNs & Sêr Cymru, KESS, KTPs.
- Universities as network-enablers, increasing communication and collaboration by building up 'softer' links between stakeholders: Cardiff Innovation Network.

The two former groups represent the more traditional triple helix style of programmes that follow a linear model, assuming universities have the knowledge and innovation that business seeks, and that interventions can bridge the gap. The latter two take a wider view of universities' economic development roles and functions, incorporating 'softer' elements of human capital and network based interventions, along a more interactive or systemic understanding of innovation. In Table 2, the positive and negative elements of the interventions are presented, with an overall summary indicating whether each programme was considered successful. This is followed by a more detailed discussion of the two groups of interventions found to be more and less successful overall - the infrastructure and network-based approaches - because of the pertinent insights for theory building and policy practice that can arise from examining what has been found to work well, whilst avoiding future mistakes.

Table 2

The perceived success of programmes is mixed; by analysing the views of different stakeholder groups we can draw out the contrasts (and agreements) in their reviews. The general trend is that university actors value the triple helix programmes more than the business respondents, who instead focussed on efforts to address the physical infrastructure and skills and more general factors relating to the cultural environment for innovation and entrepreneurship.

The programmes receiving the most criticism from stakeholders were those providing the physical infrastructure to facilitate university-business interaction and spin-outs of academic research – Techniums, HPC Wales, and Spin Out/CETICs. The Technium programme is the largest innovation support in Wales to date, and rapidly expanded from an original (successful) centre in Swansea to ten across Convergence Wales. The programme ended in controversy, with significant negative press coverage and perceived wastage of public funds. Because of the Technium's high profile and its scale, it was widely discussed. The different groups were unusually congruous in their criticism of the programme, providing some common insights. The first is the importance of the 'softer' elements of the innovation support infrastructure, such as managerial advice, networking, and general support, which were lacking in the majority of the centres as they became increasingly focussed on the physical. This led to the programme losing its innovation credentials:

[Techniums] became a substitute for a property investment programme rather than an innovation programme. (Senior Policymaker, D)

[Techniums] weren't all proper innovation centres. (Ex-WDA Senior Official B)

These insights support COOKE'S (2004, p. 19) evaluation that Technium fell into the trap of replicating old incubation approaches that failed to prioritise management assistance (COOKE AND CLIFTON, 2005). The programme also lost its university ties as it expanded, and centres

were built in locations without links to universities nor structures put in place to facilitate the triple helix interactions. The other programmes in this vein - CETICs and Spin Out- whilst less frequently derided than the Technium programme, are regarded as failing to deliver results, a recurring theme.

The original mission, the ethos for the programmes, was more ambitious and proactive than the implementation that we've had over the last few years. (University Professor E)

Neither academic nor professional technology transfer respondents from universities were particularly positive about these efforts. Innovation policymakers also perceived a lack of success in interventions to provide the infrastructure for the Welsh triple helix. From the perspective of university stakeholders, in particular the academics interviewed, there is increasing pressure to conduct research, teaching and third mission activities with little perceived recognition for this work. The picture is not one of a well-functioning and organic triple helix, although we should perhaps question this policymakers' readiness to blame the universities:

We never managed to change the culture in the universities ... they would do it as long as there was Welsh Government or WDA funding. As soon as the funding stopped they didn't want to do it; and that's a big failure to me. (Senior Policymaker C)

Also identified was the mismatch between supply and demand, and that if demand for services and facilities is lacking amongst the businesses in a region, projects can become little more than 'cathedrals in the desert' (MORGAN, 1997; UYARRA, 2010). In the case of the Technium:

There was no critical network around it in some areas. I don't believe in some areas there has ever been a business case. There have never been businesses to populate that.
(Wales Director of Business Representative Organisation A)

This resulted in very low take up of the programmes; occupancy rates were as low as 4% in one of the Techniums (DTZ, 2010). Spin Out ran into similar problems: it was a smaller scale programme so its perceived failure was discussed less, but there was little support for the programme amongst the business sphere. In fact very few interviewees from the business sphere mentioned the triple helix interventions. One business respondent (from a life sciences SME) went as far as to say that these university-industry programmes are a waste of time, and not valued at all by businesses.

This view is challenged somewhat by the positive reviews a couple of the programmes received: KTPs and CIN. CIN is not actually a government programme, it is managed and delivered by Cardiff University, but emerged as a popular intervention amongst interviewees, and notably those from the business sphere (both large and small in various sectors), thus warranting discussion. CIN was set up to encourage networking between businesses and the university, running events and delivering other programmes and collaboration activities.ⁱⁱ It is much more focussed on the interactive and social elements of innovation than the programmes discussed above.

[CIN] was really good stuff. That's where innovation comes from, not Welsh Government. (Business Person J)

However, the demand from business is questioned:

I do think the Cardiff Innovation Network is a good one. It reaches out. Whether business responds is another issue. (Wales Director of Business Representative Organisation A)

The well-known KTP programme receives a number of positive reviews from university and government respondents, including the following:

We've had a huge amount of positive response and we've increased our funding for KTPs. Actually getting practical help into small business in a cost effective way. (Senior Policymaker C)

The KTP programme is obviously well established, generally regarded as being good value for money, provides benefits for universities and for companies. (University Professor E)

KTP emerges well from an official review conducted in Wales.ⁱⁱⁱ However, none of the positive reviews emanated from business respondents, again exposing a tension between the different groups over whether or not these interventions are actually delivering to their intended audience. It is perhaps unsurprising that such supports are valued by university stakeholders in light of the increasingly difficult financial situation universities face (DRUCKER AND GOLDSTEIN, 2007; GODDARD, ET AL., 2014).

The human capital based interventions (KTP, KESS, NRNs) are seen to be better value for money compared to the more costly infrastructural investments. The perceived usefulness of the CIN amongst business stakeholders suggests the merits of universities taking a 'softer' and more enabling role to allow the various actors and organisations to come together. From this programme's experience, government taking a backseat and allowing universities and business to work together could be a positive direction.

Discussion

The triple helix has been a key feature of the Welsh Government's approach following wider trends across Europe of a broadly innovation-push approach to driving the knowledge economy through universities. However, the Welsh efforts have met with mixed success; the positively received programmes in this domain are the exception rather than the rule, and take a broader interactive view of innovation and the role of universities therein. This section discusses why the triple helix approach has not been an overwhelming success in Wales, compared to exceptional leading regions where harnessing the potential of local universities is seen to have driven regional economic development.

Two main problems with the Welsh triple helix programmes are identified: the gap between design and implementation, and a supply and demand mismatch with too much focus on the innovation-push of universities instead of increasing the absorptive capacity and capabilities of the business sphere, resulting in a lack of business engagement in many programmes. This is partly due to the oversupply of supports, for example the Technium programme expected far too many incubator spaces to be filled considering the number of spin-outs and high-tech firms in Wales (COOKE and CLIFTON, 2005; DTZ, 2010), and the types of firms in a weaker region that may not particularly value or demand university based expertise and knowledge (COOKE, 2004; HUGGINS and KITAGAWA, 2012).

The perceived underperformance of many of these programmes leads us to question the efficacy of the triple helix as a framework for governments in weaker regions to follow. Certainly, the university-premised approach to innovation and economic development has not achieved the transformative effects hoped for. Three possible explanations are proposed. The first is that whilst the triple helix is an appropriate model for a weaker region to follow, issues in programme implementation explain the perceived failures. The second is that a university-

based approach to economic development is inappropriate in a weaker region and that such programmes underperform because of the lack of world-leading universities and knowledge-intensive firms. The third proposition is that a university-based approach can help, but that the narrow manner pursued in Wales akin to the triple helix is too restrictive and inappropriate for this context. A discussion of each proposition follows, concluding that the pursuit of a narrowly conceptualised triple helix in Wales has been problematic.

Regarding the first proposition, programme delivery and implementation: the ideas underpinning the programmes were seen as reasonable; however, programmes were repeatedly criticised by stakeholders from all groups for not delivering results. Programmes frequently ended without replacement, and problems with financing were common; those supported by European Structural Funds were widely perceived as being overly bureaucratic. Only two programmes (KTPs and CIN) emerge favourably. The rest of the suite have underperformed. From these experiences it is apparent that more attention needs to be paid to resolving delivery problems, and ensuring that the funding and administration structures are in place for the smooth running of the programmes.

Considering the second proposition, there is certainly support for taking a university-based approach to economic development in both exceptional and 'ordinary' regions (ASHEIM and COENEN, 2003; BENNEWORTH and CHARLES, 2005). The Welsh Government has attempted to incorporate best-practice from elsewhere, and is certainly not alone in this endeavour.

Looking beyond the purely economic factors, there are also wider socio-cultural benefits that universities can provide in weaker regions (DRUCKER and GOLDSTEIN, 2007; GODDARD *et al.*, 2014) and a strong argument can be made for a broader approach to maximise these impacts. On the other hand, weaker regions have been found to be organisationally thin, lacking research-intensive universities and firms (TÖDTLING and TRIPPL, 2005; DOLOREUX and

DIONNE, 2008). As such, it is not clear that the triple helix is appropriate in these settings, and the Wales experience questions the cost-effectiveness and usefulness of such approaches.

Instead of disregarding the university-based approach to economic development, this paper suggests that the third proposition is pertinent: the narrow conceptualisation of universities' roles and the design of programmes is problematic. More exploration of broader theoretical and policy approaches and their success in diverse regional settings beyond the exceptional is needed. Due to its leading-region origins (ARMSTRONG, 2001), the triple helix faces issues when applied in diverse regional contexts (COOKE, 2004; GUNASEKARA, 2004; BENNEWORTH and CHARLES, 2005). The triple helix in its original conceptualisation provides little space for third sector organisations, civil society, intermediaries, or other actors that may have an important role to play in the system. More investigation of these dynamics in heterogeneous settings is needed to provide appropriate conceptualisations for governments in weaker regions like Wales.

Another issue with the triple helix is that it is premised on an innovation push logic, requiring a strong business sphere to absorb the innovation and knowledge being pushed out of universities; this may not exist in less favoured regions (GUNASEKARA, 2006; HUGGINS and KITAGAWA, 2012) and a wider approach that focusses on strengthening the business sphere alongside the university one may be necessary. With a more balanced focus on developing both sides of the equation the Welsh programmes may have been better used by local businesses and thus a more effective spend of public resources. However, as COOKE (2004, p.4) explains, a problem with the triple helix is that it assumes government and industry would be willing to pay for privileged access to university-based knowledge and innovation. In a weaker region, with a higher proportion of firms engaging in traditional or non-knowledge based activities, demand for university knowledge and services may be lower.

The apparent lack of engagement with and appreciation of the Welsh programmes on behalf of business stakeholders suggests that this mismatch exists.

Conclusions

This paper, through a presentation of a case study of Welsh innovation interventions over the last fifteen years, explored the applicability of a triple helix based approach to driving regional innovation and economic development through universities. It has found that a narrow interpretation of the triple helix has dominated the Welsh Government's conceptualisation of innovation and universities' roles in the regional economy, yielding mixed results; in particular, the linear push out of universities into the business sphere is problematic, with a broader and better balanced approach needed. This is based on the perceived success of the human capital and network based interventions, and the underperformance of efforts focussed on infrastructure and linear knowledge exchange. It is not clear that the business sphere in Wales is engaging with and benefitting from past interventions; nor is it apparent that they are resulting in wider economic development outcomes. Considering the Welsh experience alongside the existing literature on the topic, two main policy recommendations are made: taking a broader and more interactive approach to university-industry engagement, and building the strength and capacity of the business sphere to absorb and utilise university-originated knowledge and innovation.

Whilst the triple helix programmes implemented in Wales have met with mixed results, Welsh policymakers have laudably attempted to incorporate best practice innovation policy. It is important to recognise the difficult situation faced by Welsh policymakers: the Welsh economy does not provide a strong foundation upon which to build a knowledge economy or 'learning country', and 'muted' university-business reactions are expected; the concentration of branch-plants, many of which lack R&D functions, could lead to further lack of

engagement in innovation schemes (JONES-EVANS, 2002; ABBEY *et al.*, 2008). Applying a one-size-fits-all approach such as the triple helix is problematic given the considerable differences in the capability of universities to transfer their knowledge, and of regional businesses to absorb that knowledge (HUGGINS *et al.*, 2008; HUGGINS and KITAGAWA, 2012). In Wales, as elsewhere (FONTES and COOMBS, 2001), there exists a mismatch between the science base and knowledge users, which is not being addressed by the programmes implemented.

The different economic and social contexts of weaker regions (cf. BENNEWORTH and CHARLES, 2005, p. 540) means that leading theories and blueprints may not be completely applicable. This paper broadly agrees with scholars who are critical of regional innovation theories that are premised on taking an approach that has worked well in a leading region and replicating it wholesale in diverse regional settings with little appreciation of the geographical, political, historical, social, and cultural contexts (COOKE, 2004; GUNASEKARA, 2004; HOSPERS, 2006). Whilst it is clearly necessary for policymakers to study best practice elsewhere and design the most effective innovation policy possible, a model that is too prescriptive and normative does not adapt to regional circumstances. The triple helix falls into such a category, and its application as a policy blueprint in Wales has largely failed to drive innovation through the university sphere.

This paper argues that the normative application of the triple helix model has led to narrow conceptualisations of universities' roles in the Welsh economy, and a consequently limited range of programmes. The wider economic, social, and cultural opportunities have not been appreciated, and in weaker regions these may be more important than purely third mission and knowledge-factory roles (DRUCKER and GOLDSTEIN, 2007; UYARRA, 2010; GODDARD *et al.*, 2014). Following the triple helix model has led to an over-emphasis on supply necessitating more demand side interventions (EDLER and GEORGHIOU, 2007). Governments

in weaker regions need to appreciate the multitude of roles universities can play beyond that advocated by the triple helix, and theorists must appreciate the problematic nature of prescribing normative policy fixes in weaker regions that are based on replicating the success of exceptional cases.

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ⁱ Alongside Scotland, Northern Ireland and England.

ⁱⁱ See <http://www.innovation-network.org.uk/> for current activities.

ⁱⁱⁱ It created £311.88 million of additional turnover, £2.05 million net additional value in GVA to the knowledge base of Wales, £78.19 million net additional GVA to companies and created 705 new jobs (CMI, 2011, p.3).