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Perspectives on innovation within medium-sized firms in Wales

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Introduction: innovation and policy in Wales

The Welsh economy is heading towards a post-Brexit future with historically lower levels of productivity continuing to leave the country lagging behind the UK average (Huggins and Williams, 2011; Welsh Government, 2017). An understanding of how new models of innovation are constructed and developed are then particularly important for policy makers and academia in Wales. As noted by Baughan (2015), innovation accounts for 25-50% of labour productivity growth.

The Welsh approach to innovation since devolution was initially formed through Wales for Innovation (WFI) - The Welsh Assembly Government's Action Plan for Innovation (Welsh Assembly Government, 2002), and more recently Innovation Wales (Welsh Government, 2013).

WFI was launched during the same period as the Entrepreneurship Action Plan for Wales (2000), but features little reference to this complementary policy apart from to state that "Activities will be undertaken in consultation with 'Entrepreneurship Action Plan' (EAP)" (Welsh Assembly Government, 2002, p.10). This kind of policy disconnect may explain why innovation within the start-up, micro, and small business environments is not a priority within the EAP. The WFI does however give this business community a focus, outlining high growth potential businesses as one of the five key pillars of the policy, which are:

- Communicating what can be achieved through more innovation.
- Developing more high growth potential businesses.
- Better equipping people to innovate.
- Simpler, more accessible, business innovation support.
- Maximising the economic development impact of our universities and colleges.

The goals above illustrate a combination of factors thought to influence innovation in Wales. However a top down public sector approach to innovation has been identified as problematic (see for example Rodríguez-Pose, 2013). The hegemony of the public sector and higher education institutions being the driving force behind innovation has been challenged by studies such as Thomas et al. (2009), and the failure of higher education-led interventions such as the Technium programme (Cooke and Clifton, 2005; DTZ, 2009; Pugh et al., 2018) has brought the wisdom of this approach into question in Wales. Yet both the WFI (2002) and more recently Innovation Wales (2013) have both put the higher education institutions (HEIs) at the centre of the policy intervention. WFI institutes both the aforementioned Technium programme, and the £9.3m Higher Education Economic Development (HEED) fund (Welsh Assembly Government, 2002). Innovation Wales focuses on the development of R&D, intellectual property, and an enlarged skills economy through HEIs. The correlation between investment in education/skills and economic growth is well documented (The World Bank, 2008; Hanushek, 2010).

However, the cocktail of actors, institutions and industry is complex and potentially needs to be viewed through a different lens, as de Laurentis, (2012, p. 1977) notes: “low density, peripherality, lack of dynamic innovative firms and institutions and the fact that they are simply knowledge and information poor” contributes to the innovation deficit in Wales. There is also a need for policy to recognise the importance of “private sector demand, rather than policy over-supply... as the means with which to achieve this” (Pugh et al., 2018, p. 1010). This demand-led approach to innovation is not present within policy interventions as both the WFI and Innovation Wales feature little reference to drivers from the private sector, which could explain the inconsistent approach of policy in Wales.

Open innovation policy interventions

Open innovation (OI) is defined by Chesbrough (2003, p.35) as developing increased research and development (R&D) activity to “commercialize internal ideas through channels outside of their current businesses to generate value for the organization”. This method of innovation is specifically being experimented with by the Welsh Government through its OI Development Awards in 2015 and the more recent SMARTCymru OI Feasibility call (Business Wales, 2018)). This allows businesses to explore the feasibility of conducting this form of externalised research and development activity. Therefore, this paper seeks to gain a better understanding of the business impact of OI practices within the Welsh context. More generally, it is widely accepted that successful innovation is often a collaborative and non-linear exercise, involving a range of public and private sector actors and institutions in a network of mutually reinforcing knowledge exchange (Thissen et al, 2013).

There is also a wealth of literature on how small businesses and start-ups use and benefit from OI to drive R&D activity (for example, Park, 2018 and Santoro et al., 2018). However there is a limited literature on the use of OI and its particular applicability for

medium-sized firms (Lichtenthaler, 2008) and thus related policy implications. Exploring OI for this size of business and in Wales represents a new contribution.

Existing literature on OI focuses, in the main, on the two areas in terms of size; namely SMEs as a collective entity, and large organisations (Chesbrough, 2003; Chesbrough and Crowther, 2006). This is potentially problematic in the case of generalisation of SMEs as a collective. There are distinct differences in resource, staff, innovation diffusion, and absorptive capacity between a micro or small enterprise with only 2-49 staff, as compared with a medium-sized enterprise which can have between 50-249 staff. Several authors have outlined the gaps in knowledge as there is “relatively limited research on OI in SMEs” (West et al., 2014, p. 809). Van de Vrande et al. (2009) puts this down to a lack of market need in this business demography as SMEs have a “lack of financial resources, scant opportunities to recruit specialized workers, and small innovation portfolios so that risks ... cannot be spread”. This generalisation describes the issues for smaller employers although studies such as Park (2018) and Santoro et al. (2018) have since challenged this theoretical hegemony. But suitably sized medium-sized enterprises have the resource and innovation portfolios to reduce these barriers and require further exploration of the opportunity within the research environment.

Ahn et al. (2016, pp. 1023–1024) also identifies the commercial opportunity of OI for medium sized enterprises ; “medium-sized firms rather than small firms can take a more open attitude towards OI.” A limited number of studies (Laursen and Salter, 2006; Keupp and Gassmann, 2009) have explored the relationship of perceived OI success and integration with business size. Keupp and Gassman’s study of Swiss innovation structure indicates that small technologically intensive firms are less open to external collaborators and that the level of innovation restriction is dependant on how “large a portion of the overall value they strive to appropriate”(Keupp and Gassmann, 2009, p.

338). Their findings do illustrate that firm size is a predictor of OI “breadth” (number of knowledge sources) and “depth” (level of collaboration with external sources), but they do not differentiate the number of employees per organisation to accurately illustrate the difference of application (Keupp and Gassmann, 2009, p. 332). The study does however suggest that regional structure provides no correlation with OI which would be an interesting hypothesis to test in Wales.

Podmetina et al. (2011) find that firm size is “not a significant factor” in the uptake of OI (p. 313). This hypothesis will be tested in relation to Welsh medium-sized businesses as part of this study. The focus on size and openness is also surveyed as part of Ahn et al. (2016) study, which indicates specifically that medium-sized firms are proportionally over 10% more open to innovation than larger firms. The opportunity to study in the diverse economic and social terrain in Wales is both novel and important for policy relating to innovation and medium-sized firms in Wales.

The ‘missing middle’? The Mittelstand to the Canol

The German economy has long been seen as a bastion of family owned, medium-sized, enterprise success, also referred to as the ‘mittelstand’. The success stories of companies such as Bosch (Schaefer, 2011) and Koenig & Meyer (Bayley, 2017) has led the European aspiration to emulate the German achievement (Pahnke and Welter, 2018). The so-called ‘Brittlestand’ (Thompson, 2014; Walker, 2014) describes the British variant on this growth model. The Chartered Business Institute (CBI) has long been advocating the development and investment in medium-sized business. The report, ‘Future champions: Unlocking growth in the UK’s medium-sized businesses’ (CBI, 2011, p. 4) illustrates that medium firms represent “22% of economic revenue and 16% of total employment” and they are “often neglected by policymakers”. In exploring the innovation-powered growth potential of medium-sized firms, or ‘Canol’ in Welsh, and gathering reflections on these results from policymakers

in Wales this study should ensure a clearer understanding of this neglect.

The Federation of Small Business (FSB) (2017) more recently looked at the issue of the under-development of medium-sized firms in Wales, leaving the responsibility firmly at the door of Welsh Government who expel energy and financial resources on attracting Foreign Direct Investment (FDI) while ignoring “domestic economic growth through the generation of sustainable middle-sized firms” (Federation of Small Businesses, 2017, p. 6). The report also indicated the lack of headquartered large organisations in Wales which leads to a deficit in private capital and research investment and the lack of publicly-funded innovation.

However, a recent report from the Economic Intelligence Wales (Kapitsinis et al., 2019) also highlights the deficit of larger enterprises in Wales, alongside a lack of growth from medium-sized enterprises. The report questions the notion of the missing middle as a particularly Welsh problem, citing parity with the UK picture while raising potentially Wales-specific issues (such as branch-plant operations and a lack of local strategic decision-making).

Research questions and methodology

In line with a wide variety of studies within economic and organisation studies, this study adopts the EU definition based on the number of employees being between 50 and 249. From the discussion above the following broad research questions were identified:

- 1) How do Welsh medium-sized firms innovate?
- 2) What are the factors influencing the take-up of OI in medium-sized enterprises?
- 3) What measures of success (or otherwise) are reported?

In order to respond to the research questions a large-scale survey was conducted. The survey sought to explore how medium-sized firms within Wales engage in innovative activity and what the motivations are for

innovating, whatever method is chosen (open, closed, or a combination of both).

The population of medium-sized firms in Wales was drawn from the FAME database (Bureau Van Dijk, 2019) which uses Companies House data of registered businesses that return accounts on an annual basis. In order to select this total population the following criteria was used:

- All active companies (not in receivership nor dormant) and companies with unknown situation
- Number of employees: >50, <250
- Year: 2017 (01/01/2017 – 31/12/2017)
- Registered address: Wales
- Registered email address and contact

At the time of the search, the total accessible population of medium-sized enterprises recorded on the FAME database in Wales was 971, and of this number 580 had a published email address enabling contact under GDPR legislation, which forms the accessible sample. The survey was then distributed via email with follow-ups sent over the course of a 3-month period in 2019. All data was anonymised before analysis. A total of 60 usable responses were ultimately received.¹

Survey results

As an initial finding, medium-sized firms in the NUTS2 West Wales & Valleys area are significantly more likely to be manufacturing

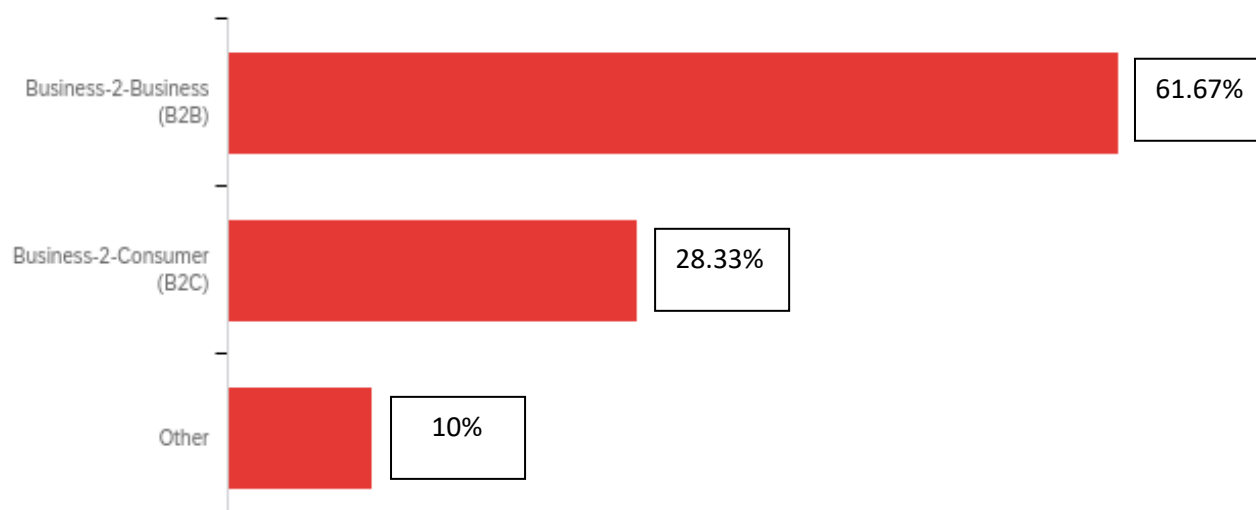
goods (defined as Industry) rather than selling goods and services (defined as Commerce) with the reverse true in the East Wales NUTS2.

The relationship between West Wales and the production of goods is long established due to the area being one of the old industrial heartlands of West Wales. So, while the results confirm a sectoral reality, they at least illustrate the need to invest in R&D regionally, through initiatives such as the Swansea Bay City deal and Swansea University's Bay Campus development, which have brought infrastructure investment and upskilling opportunities especially in the sectors of construction, engineering and manufacturing. It will be interesting to understand the regional enabling/inhibiting factors for innovation in these particular sectors in follow-up interviews with participants as part of planned further research.

The survey was designed to include information not presently captured by the Business Population Estimate and Community Innovation Survey. The first of these factors was the sales focus of the firms (Figure 1).

This analysis illustrates a majority of business-2-business (B2B) orientated medium-sized firms (62%) within the sample which potentially indicates a high-number of supplier-led businesses. The smaller

Figure 1: What is the main focus of your business sales activity?



percentage of business-2-consumer businesses in the sample is also in line with existing research on the Welsh economy which is perceived as product and construction driven economy (Kapitsinis et al., 2019).

The breakdown in terms of approach to innovation is also interesting with the majority of participants using OI or a combination of both forms of innovation (Figure 2). The relatively low use of just OI is broadly aligned with the approach to risk (Lichtenthaler and Ernst, 2008; Aquilani et al., 2017) of outsourcing technology and innovation. This in turn could be influenced by external factors such as funding for feasibility studies into OI from Welsh Government Smart Cymru's intervention. There is a clear picture from these results that Welsh medium-sized firms are innovating, and that cumulatively over 50% of companies are using OI or a combination of open and closed innovation to drive new products, services and processes.

The presence of an innovation strategy within the firms provides a picture of the approach to innovation within Wales. The majority of

responding organisations have an innovation strategy at various degrees of formation, but only 24% of this sample have a strategy that has been implemented (Figure 3). Several authors maintain the importance of an innovation strategy, and in particular a strategy towards OI; "the development of appropriate culture and skills to enable the operation of an OI strategy is an area of significant interest" (Mortara and Minshall, 2011, p. 588). This development of a culture to propagate innovation is due "a profit-maximizing strategy that targets both value creation and value appropriation." (Gambardella and Panico, 2014, p. 909).

The response to the question on how innovation success is measured (Figure 4) illustrates the importance of the economic impact of innovation (financial returns), alongside new products and processes. The number of patents achieved was only outlined by 3 participants as of importance, which challenges the assumption that new products lead to new patents. Potential reasoning for this includes expense of patent attorney work and the openness of the new shared digital economy to build on the work of others

Figure 2: Which methods of innovation do you predominantly use?

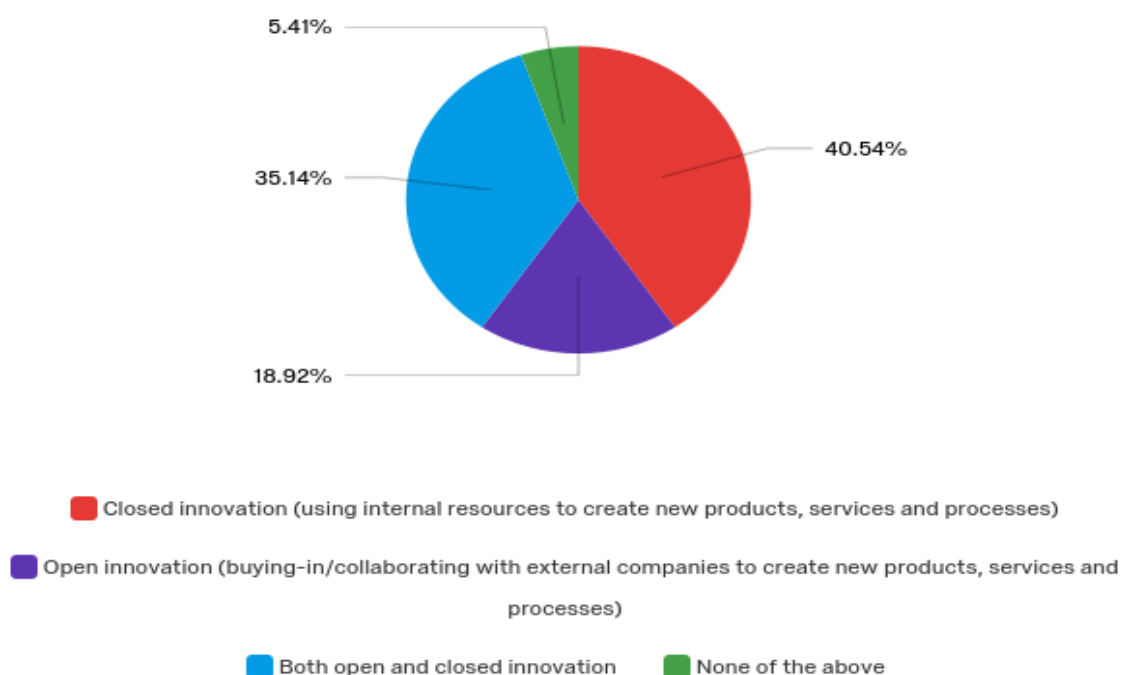


Figure 3: Do you have an organisational strategy for innovation?

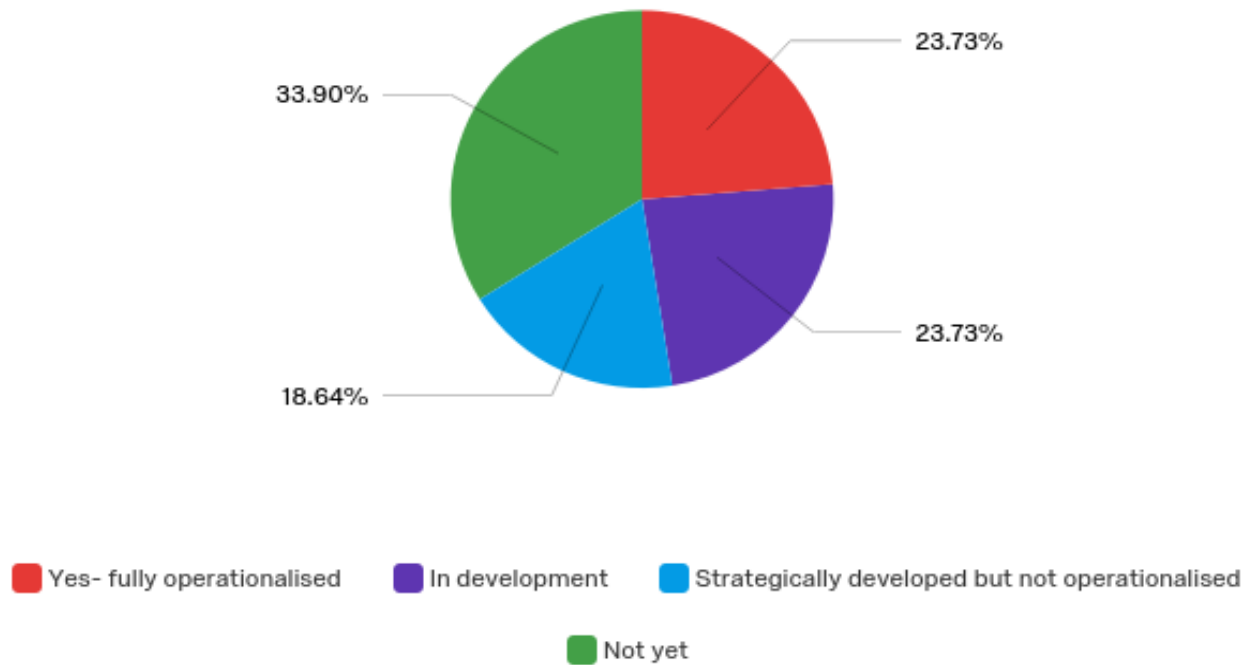


Figure 4: How is your innovation success measured in terms of outputs?

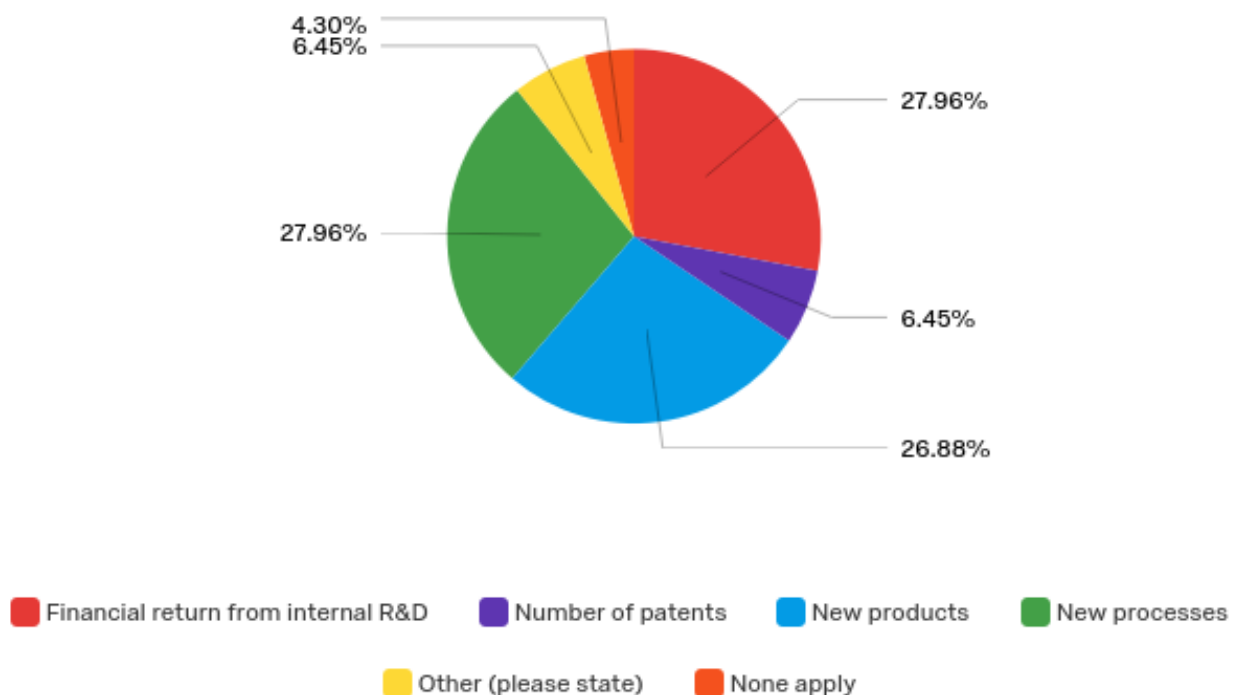
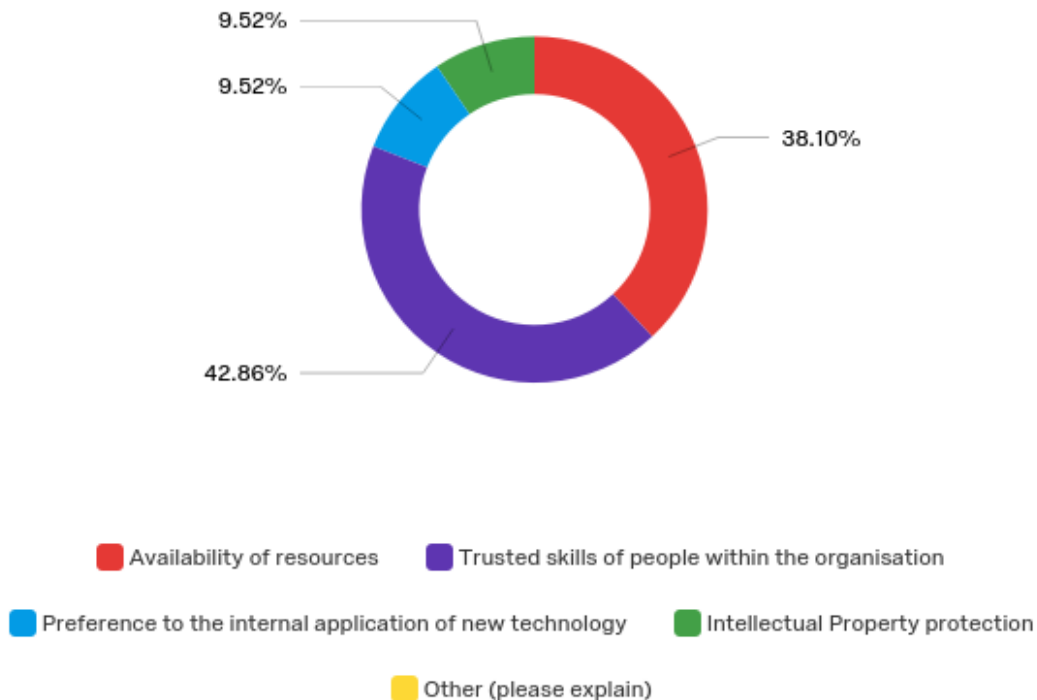


Figure 5. Why do use internal (closed) innovation only?



through code communities and open resources such as GitHub (Hsieh, 2014; Teece, 2018).

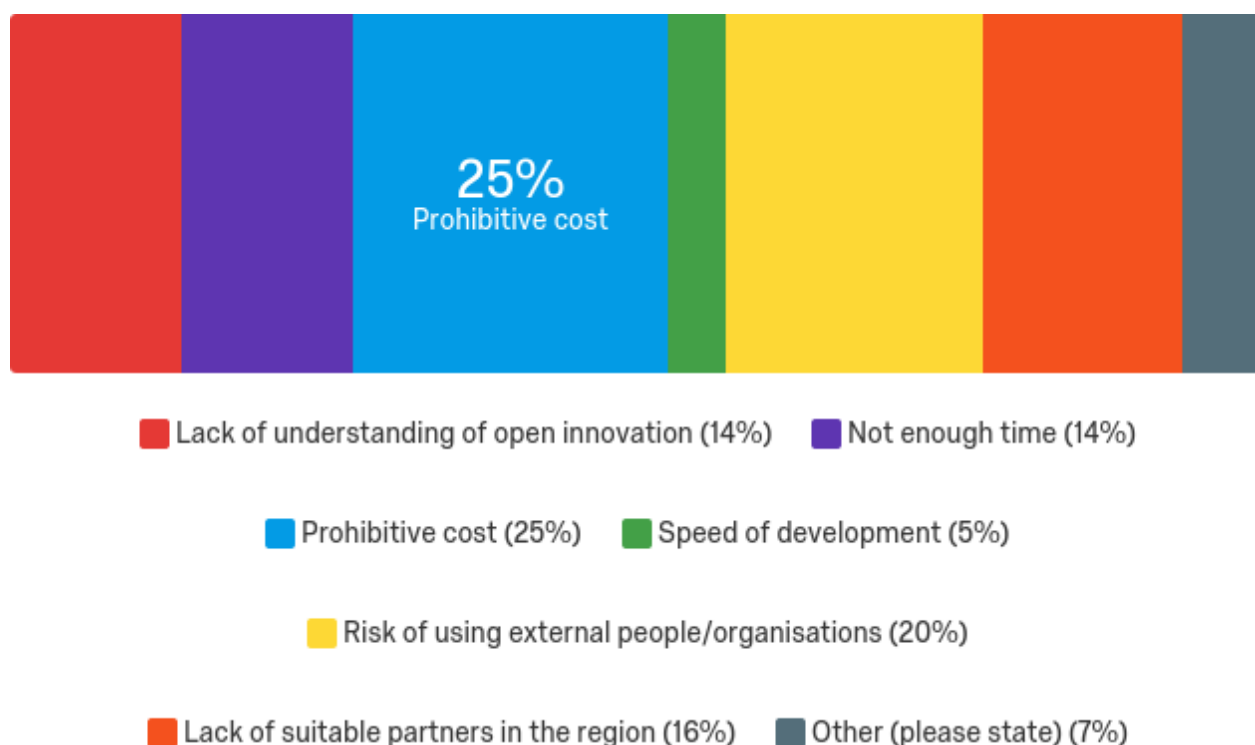
The majority of respondents using only OI indicate that building a culture of collaboration was the main reason for adoption which supports the perspective that “combining external knowledge with internal resources can boost the efficient use of firm resources” (Oltra et al., 2018, p. 817).

Figure 5 shows a focus on internal resource and skills as being the main reason for adopting closed innovation, making firms “self-reliant in terms of availability, capability, and quality of the new ideas” (Worsnop et al., 2016, p. 81). The scarcity of participants selecting the intellectual property response is surprising given Felin and Zenger (2014, p. 918) claim in their study of closed innovation that “the assignment of intellectual property rights to firms avoids the rather arbitrary and costly task of trying to impute the specific contributions of disparate actors.” This ability of a firm to own intellectual property (IP)

relating to innovation reduces the “very risky investment” of trade and negotiation with external partners around new products and services (Prokop and Stejskal, 2019, p. 387). Conversely, several authors (such as Hossain (2013) and Rhisiart *et al.* (2014)) identify the sharing of risk through OI as a benefit of the approach and this approach to risk around IP will require further exploration as part of future study.

The importance of asking respondents who only use closed innovation why they are not employing open approaches challenges some of the narrative around the spreading of risk, as 20% of responses to this question highlighted this as a barrier to OI. Cost is highlighted as the main prohibition on OI adoption, which could be viewed as another element of risk attached to this method of innovation. A quarter of responses to this question see OI as cost prohibitive, rather than leading to the “cost reduction” (Gassmann et al., 2010, p. 214) and “cost advantage” (Worsnop et al., 2016, p. 81) that is thought to drive this particular form of innovation. This

Figure 6: Your reasons for not engaging in open (external) innovation?



may be explained by studies such as Gassman et al. (2010) and Worsnop et al. (2016) specifically referencing large organisations such as Xerox, and the CrossRail project. This perspective would be enhanced with comparative surveying and analysis with start-up, micro, small and large enterprises, but provides useful insight aligned with this study's research questions around how and why medium-sized firms make innovation choices.

Conclusions

This study provides some important insights into how Welsh medium-sized firms are innovating, with a small majority of surveyed companies (54%) engaging some OI activities, albeit only 19% exclusively so. Over one third of sampled firms are operating an apparently pragmatic combination of both open and closed innovation activities. Further research will be important here to identify the nature of these choices – do they represent sub-optimal approaches, or an appropriately differentiated innovation strategy at the firm level? This is an important question for

research and innovation funding policy within Wales. The Innovation Wales policy needs to be updated to include specific interventions based on the size of business and the type of innovation to pursue, particularly in relation to the present and future iterations of the SmartCymru OI Feasibility scheme.

The identification of barriers to OI within Welsh medium-sized firms also provides an indication of the barriers that Welsh Government may need to overcome to increase engagement for future funding rounds of SmartCymru. The use of OI in a policy environment framed by the Well-Being of Future Generations Act (Welsh Government, 2015), and the Economic Action Plan (Welsh Government, 2017) which seeks to promote foundational activities and localised learning has interesting implications for OI. Companies and public sector bodies engaging in this form of innovation could find themselves in a nationally-bound system which is to some extent still open, but not globally so as in Chesbrough's (2003) vision. This combination, and some might say

contradiction, of policy and economic intervention will be interesting to review over time.

Finally, the issues of risk and cost associated with open innovation identified in this study need to be considered by policy makers to shape the needs and the next phase of the

SmartCymru OI Feasibility call. The current intervention is focused on feasibility which, while reducing upfront risk, does little to reduce the cost of engaging in OI in the longer term.

Endnote

1. In order to test the overall representativeness of the sample, a series of statistical tests were undertaken. No significant differences were found between the general population of medium sized firms and the respondents, hence the sample is considered to be representative.

References

- Ahn, J. M., Ju, Y., Moon, T. H., Minshall, T., Probert, D., Sohn, S. Y., and Mortara, L (2016). Beyond absorptive capacity in open innovation process: the relationships between openness, capacities and firm performance, *Technology Analysis and Strategic Management*. Taylor & Francis, 28(9), pp. 1009–1028. <https://doi.org/10.1080/09537325.2016.1181737>.
- Aquilani, B., Abbate, T. and Codini, A. (2017). Overcoming cultural barriers in open innovation processes through intermediaries: a theoretical framework, *Knowledge Management Research & Practice*. Palgrave Macmillan UK, 15(3), pp. 447–459. <https://doi.org/10.1057/s41275-017-0067-5>.
- Baughan, K. (2015). *Productivity and innovation - Innovate UK*. <https://innovateuk.blog.gov.uk/2015/08/06/productivity-and-innovation/>
- Bayley, C. (2017). *Germany's 'hidden champions' of the Mittelstand*, BBC News. <https://www.bbc.co.uk/news/business-40796571>
- Business Wales (2018). *Open Innovation Feasibility Support Call for Applications/Expertise Wales*. <https://businesswales.gov.wales/expertisewales/support-and-funding-businesses/open-innovation-feasibility-support-call-applications>
- CBI (2011). *Future champions Unlocking growth in the UK 's medium-sized businesses*, p. 40. http://www.cbi.org.uk/media/1125696/cbi_future_champions_report.pdf.
- Chesbrough, H. (2003). *Open innovation: the new imperative for creating and profiting from technology*. Boston, Mass.: Harvard Business School. Chesbrough, H. W. and Crowther, A. K. (2006). Beyond high-tech: early adopters of Open Innovation in other industries, *R&D Management*, 36(3), pp. 229–236. <https://doi.org/10.1111/j.1467-9310.2006.00428.x>.
- Cooke, P. and Clifton, N. (2005). Visionary, precautionary and constrained “varieties of devolution” in the economic governance of the devolved UK territories, *Regional Studies*, 39(4), pp. 437–451. <https://doi.org/10.1080/00343400500128457>.
- DTZ (2009). *Evaluation of the Technium Programme Stage 1: Scoping and review final report to the Welsh Assembly Government*. Cardiff. <https://gov.wales/sites/default/files/statistics-and-research/2018-12/101119techniumcasestudyen.pdf>.

- Federation of Small Businesses (2017). *Wales' missing middle*.
https://www.fsb.org.uk/docs/default-source/fsb-org-uk/fsb_missing_middle_eng.pdf?sfvrsn=0
- Felin, T. and Zenger, T. R. (2014). Closed or open innovation? Problem solving and the governance choice, *Research Policy*, 43(5), pp. 914–925.
<https://doi.org/10.1016/j.respol.2013.09.006>.
- Gambardella, A. and Panico, C. (2014). On the management of open innovation, *Research Policy*. Elsevier B.V., 43(5), pp. 903–913. <https://doi.org/10.1016/j.respol.2013.12.002>.
- Gassmann, O., Enkel, E. and Chesbrough, H. (2010). The future of open innovation, *R&D Management*, 40(3), pp. 213–221. <https://doi.org/10.1111/j.1467-9310.2010.00605.x>.
- Hanushek, E. A. (2010). Education and Economic Growth, in Peterson, P., Baker, E., and McGaw, B. (eds) *International Encyclopedia of Education*. Oxford: Elsevier, pp. 245–252.
<https://doi.org/10.1016/j.energy.2009.12.017>.
- Hossain, M. (2013). Open innovation: so far and a way forward, *World Journal of Science, Technology and Sustainable Development*, 10(1), pp. 30–41.
<https://doi.org/10.1108/20425941311313083>.
- Hsieh, D. (2014). Current issues with patenting software, *IEEE Potentials*. IEEE, 33(6), pp. 16–20. <https://doi.org/10.1109/MPOT.2014.2335238>.
- Huggins, R. and Williams, N. (2011). Entrepreneurship and regional competitiveness: The role and progression of policy, *Entrepreneurship & Regional Development*, 23(9–10), pp. 907–932.
<https://doi.org/10.1068/c3101ed>.
- Kapitsinis, N., Munday, M. and Roberts, A. (2019). *Medium-sized businesses and Welsh business structure*. Wrexham. https://developmentbank.wales/sites/default/files/2019-11/EIW_Quarterly_Bespoke_report_English.pdf
- Keupp, M. M. and Gassmann, O. (2009). Determinants and archetype users of open innovation, *R and D Management*, 39(4), pp. 331–341. <https://doi.org/10.1111/j.1467-9310.2009.00563.x>.
- de Laurentis, C. (2012). Renewable energy innovation and governance in Wales: A regional innovation system approach, *European Planning Studies*, 20(12), pp. 1975–1996.
<https://doi.org/10.1080/09654313.2012.665041>.
- Laursen, K. and Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms, *Strategic Management Journal*, 27(2), pp. 131–150. <https://doi.org/10.1002/smj.507>.
- Lichtenthaler, U. and Ernst, H. (2008). Intermediary services in the markets for technology: Organizational antecedents and performance consequences, *Organization Studies*, 29(7), pp. 1003–1035. <https://doi.org/10.1177/0170840608090531>.
- Mortara, L. and Minshall, T. (2011). How do large multinational companies implement open innovation?, *Technovation*, 31(10–11), pp. 586–597.
<https://doi.org/10.1016/j.technovation.2011.05.002>.
- Oltra, M. J., Luisa, F. M. and Alfaro, J. A. (2018). Open innovation and firm performance: the role of organizational mechanisms, *Business Process Management Journal*, 24(3), pp. 814–836. <https://doi.org/10.1108/bpmj-05-2016-0098>.

- Pahnke, A. and Welter, F. (2018). The German Mittelstand: antithesis to Silicon Valley entrepreneurship?, *Small Business Economics*, 52(2), pp. 345-358.
<https://doi.org/10.1007/s11187-018-0095-4>.
- Park, J. H. (2018). Open innovation of small and medium-sized enterprises and innovation efficiency, *Asian Journal of Technology Innovation*, 26(2), pp. 115–145.
<https://doi.org/10.1080/19761597.2018.1496796>.
- Podmetina, D., Vaatanen, J., Torkkeli, M. T., Smirnova, M. M. (2011). Open innovation in Russian firms: an empirical investigation of technology commercialisation and acquisition, *International Journal of Business Innovation and Research*, 5(3), p. 298.
<https://doi.org/10.1504/IJBIR.2011.040100>.
- Prokop, V. and Stejskal, J. (2019). Different influence of cooperation and public funding on innovation activities within German industries, *Journal of Business Economics and Management*, 20(2), pp. 384–397. <https://doi.org/10.3846/jbem.2019.9620>.
- Pugh, R., Mackenzie, N. G., Jones-Evans, D., and Mackenzie, N. G. (2018). From “Techniums” to “emptiums”: the failure of a flagship innovation policy in Wales, *Regional Studies*, 52(7), pp. 1009–1020. <https://doi.org/10.1080/00343404.2018.1444272>.
- Rhisiart, M., Djebarni, R., Thomas, A., Christie, C., and Rohrbeck, R. (2014). *Open innovation: the activities and views of companies in Wales*. Pontypridd: Centre for Research in Futures & Innovation. <https://doi.org/10.13140/2.1.2115.2961>.
- Rodríguez-Pose, A. (2013). Do Institutions Matter for Regional Development? *Regional Studies*, 47(7), pp. 1034–1047. <https://doi.org/10.1080/00343404.2012.748978>.
- Santoro, G., Ferraris, A., Giacosa, E., and Giovando, G. (2018). How SMEs Engage in Open Innovation: a Survey, *Journal of the Knowledge Economy*, 9(2), pp. 561–574.
<https://doi.org/10.1007/s13132-015-0350-8>.
- Schaefer, D. (2011). *The German drive to globalise*, Financial Times. I, 31 May.
<https://www.ft.com/content/7dbd5844-8b8d-11e0-8c09-00144feab49a>
- Teece, D. J. (2018). Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world, *Research Policy*, 47(8), pp. 1367–1387.
<https://doi.org/10.1016/j.respol.2017.01.015>.
- The World Bank (2008). Economic returns to investment in education, in *The road not travelled: Education reform in the Middle East and North Africa*, Chapter 2.
http://siteresources.worldbank.org/INTMENA/Resources/EDU_Flagship_Full_ENG.pdf
- Thomas, B. and Gornall, L. and Packham, G. (2009). The Individual Inventor and the Implications for Innovation and Entrepreneurship: A View from Wales, *Industry and Higher Education*, 23 (5), pp. 391-403. <https://doi.org/10.5367/000000009789711918>
- Thissen, M., Van Oort, F., Diodato, D. and Ruijs, A., (2013). *Regional competitiveness and smart specialization in Europe: Place-based development in international economic networks*. Edward Elgar Publishing.
- Thompson, B. (2014). *CBI urges backing for British “Mittelstand”*, Financial Times, 4 November.
<https://www.ft.com/content/4c1e95fc-7980-11e4-9e81-00144feabdc0>

van de Vrande, V., de Jong, J. P.J., Vanhaverbeke, W., de Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges, *Technovation*, 29(6–7), pp. 423–437. <https://doi.org/10.1016/j.technovation.2008.10.001>.

Walker, S. (2014). *The UK mid-market*, Director, April, pp. 48–53.
<http://proquest.umi.com/pqdweb?did=1571168391&Fmt=7&clientId=15443&RQT=309&VName=PQD>

Welsh Assembly Government (2002). *Wales for Innovation - The Welsh Assembly Government's Action Plan for Innovation*.
<https://www.webarchive.org.uk/wayback/archive/20060104120000/http://www.wda.co.uk/resources/action-e.pdf%20>

Welsh Government (2013). *Innovation Wales*, pp. 1–37.
<http://wales.gov.uk/docs/det/publications/140313innovationstrategyen.pdf>.

Welsh Government (2015). *Well-being of Future Generations (Wales) Act 2015*.
<https://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en>

Welsh Government (2017). *Securing Wales' future regional investment in Wales after Brexit*.
<https://gov.wales/sites/default/files/publications/2018-10/regional-investment-in-wales-after-brexit.pdf>

West, J., Salter, A., Vanhaverbeke, W., and Chesbrough, H. (2014). Open innovation: The next decade, *Research Policy*, 43(5), pp. 805–811. <https://doi.org/10.1016/j.respol.2014.03.001>.

Worsnop, T., Miraglia, S. and Davies, A. (2016). Balancing Open and Closed Innovation in Megaprojects: Insights from Crossrail, *Project Management Journal*, 47(4), pp. 79–94.
<https://doi.org/10.1177/875697281604700407>.