



Farm diversification, entrepreneurship and technology adoption: Analysis of upland farmers in Wales



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ABSTRACT

Farm businesses face increasing challenges in the face of policy reform which envisages multifunctional rural economies with objectives which span the environmental, the social as well as the production of food. This leads to uncertainties and ambiguities in the way in which farms respond to incentives and pressures to become entrepreneurial, to diversify, to become more efficient at food production and to adopt new technology. This paper examines these tensions in the context of upland agricultural business in rural Wales. Qualitative and quantitative results support a conclusion of significant heterogeneity in farm response, and highlight tensions between maintaining a focus towards current on-farm activity or pursuing entrepreneurial diversification, as well as differing levels of technology adoption in support of these income streams. Supported by a descriptive cluster analysis based on survey data, the paper proposes a new conceptual categorisation of entrepreneurial strategy, distinguished on the basis of attitudes towards on- and off-farm income generation and on stated stance towards current and future policy grant streams. The paper discusses some of the factors that may determine how particular farmers and farming businesses lie within this categorisation.

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1. Introduction

Although the paths of development of rural economies are the subject of growing debate (Marsden and Sonnino, 2008; Wilson, 2008; Winter and Lobley, 2009; Marsden, 2016), small-scale agricultural enterprises remain at the traditional core of the rural landscape. These face increasing social and financial challenges, as well as sustained pressure from policy reform to meet a range of objectives beyond food production extending into social and environmental goals (Bateman and Ray, 1994; Lobley and Potter, 2004; Horlings and Marsden, 2014). All of these impact business strategy and performance (McElwee, 2005; Evans, 2009; Maye et al., 2009; Morgan et al., 2010; Suess-Reyes and Fuetsch, 2016). Further future challenges will arise because of the result of the 2016 UK referendum on EU membership, and its implications for UK rural and farm development policy and for tariffs and trade in agriculture outputs. These pressures may stimulate, at varying levels of intensity, a range of responses including increased farm

household pluriactivity, as well as innovation in pursuit of both intensification as well as on-farm diversification activity. The latter might entail the development, transfer and use of new technologies, as well as the exploration of marketing and other process innovations in pursuit of value-adding opportunities. These might complement more traditional forms of business income diversification, such as the provision of hire and contract services.

In the next section the paper explores these themes in further detail, focused on the context of upland or predominantly pastoral farmers across Wales. Through qualitative and quantitative analysis, explained in Section 3 and presented in Sections 4 and 5, this article undertakes an investigation of diversification and innovation activity, and their interconnectedness (McFadden and Gorman, 2016). The analysis confirms significant heterogeneity in farm business development paths, as noted by previous researchers (Ilbery, 1991; Bateman and Ray, 1994; McNally, 2001; Maye et al., 2009; Evans, 2009; Morgan et al., 2010; Hansson et al., 2013). The contribution of the paper is to propose, arising from the data analysis, a more sophisticated four-fold clustering of farm businesses. This categorisation identifies variation in a number of distinguishing characteristics of Welsh farmers: pluriactivity (off-farm income-generating activity), entrepreneurial attitudes towards on-

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farm diversification and intensification, and business development intentions towards available European Union (EU)-funded grant support. In turn this facilitates an assessment of the level and focus of entrepreneurial activity, alongside revealed attitudes towards innovation and new technology as well as EU ('Pillar 2') rural development grant support, and the extent to which these are contextualised by the nature of the farm and the farming household. Informed by this analysis the paper then proposes, in Section 6, a fresh conceptualisation of farm business types, which highlights the ambiguities facing farm-based businesses in the changing and confusing policy context.

2. Background: pluriactivity, farm diversification and entrepreneurial behaviour in the Welsh context

The rural marketplace is a transitioning space where a key influence since 2003 has been the reform of the Common Agricultural Policy (CAP) (European Commission, 2013) and the sharp shift in funding ('decoupling') from direct subsidy or price support for agricultural production ('Pillar 1') towards wider use of discretionary grant support for rural development ('Pillar 2') through policy instruments to promote restructuring of both farm business and the wider rural community and to promote agri-environmental objectives (Richardson, 2005; Midmore, 2011). These changes imply a broader conception of the 'post-productivist' multifunctional rural economy, set in its particular spatial, social and farm household context (Blandford and Hill, 2005; Hodge and Midmore, 2008; Wilson, 2008; Marsden and Sonnino, 2008; Leck et al., 2014). However, one critic suggests that CAP reform has blunted incentives towards further improvements in farm efficiency and the adoption of productivity-improving innovation (Rickard, 2012).

2.1. The Welsh context for rural development support policy and CAP reform

The Welsh situation is distinct from the rest of the UK, in terms of both the particular territorial context and in terms of the manner of devolved responsibility for the management of EU funding and for rural policy since 1999. These have allowed distinct policy to be informed by that territorial context of fragmented, low population density and its social implications. Steep slopes, altitude and high rainfall has resulted in 80% of agricultural land in Wales being designated as Less Favoured Areas (LFA) under Community Regulation EC75/268 (Welsh Government, 2013) which lends itself to sheep production. The context of this study is therefore upland pastoral sheep farmers in Wales. Average farmer age is high at just over 60 years of age, and almost two-thirds of farmers over 55 years of age (Welsh Government, 2013). Skills levels are considered low, with the Welsh Farm Business Survey reporting that 43% of farmers have no post-compulsory educational attainment (Farm Business Unit, 2013). A weak demographic profile is compounded by financial precariousness. In 2010 38% of Welsh farms had annual turnover below £25,000 and almost a quarter stated that the EU Single Farm Payment was their principal income source (Wales Rural Observatory, 2011).

The CAP decoupling process was introduced to Wales from 2005 onwards and has been guided by 2007–2013 and 2014–2020 rural development programmes (Welsh Assembly Government, 2007; Welsh Government, 2014). As permitted by the Welsh devolution settlement, the shift towards Pillar 2 support was able to be distinct from that introduced elsewhere in the UK. Some commentators argue that despite a UK-wide absence of strong coherence in understanding multifunctionality, a stronger expression of the developing multifunctionality of the rural economy began to emerge in Wales (Marsden and Sonnino, 2008). Devolved

government may have allowed the attenuation of some potential tensions and policy ambiguities in England between rural affairs and industry and innovation. During 2007–2013 Pillar 2 support was provided through a range of interventions including the agri-environment *Tir Gofal* and *Tir Cynnal* schemes. Since 2014 these have been simplified into one grant scheme, *Glastir*, which prioritises mitigation of climate change, water management and biodiversity. Other elements support upskilling, knowledge transfer and innovation. However, the mix of support potentially leaves farmers with inherent tension in how they interpret their developing role and identity in the wider rural ecological, social and economic context, and how that is translated into farm business development and strategy.

2.2. Entrepreneurial activity in the context of agricultural enterprises

The process of social, political and environmental change expressed in the developing policy landscape of the past 15 years has highlighted for farmers the difficulties of persisting with traditional 'productivist' business models, and created an imperative for entrepreneurial opportunity-seeking behaviour. However, as already highlighted farming households face considerable ambiguity in direction of travel. The ability to adjust structurally to market signals and social preferences depends largely on the flexibility of the farming enterprise, (Happe, 2004). Structural change in the rural economy impacts on the resources available to the farm, both on the farm and in terms of employment and other off-farm opportunities which may take farm household labour resource away from the farm enterprise. Farming activity is also increasingly determined by the technology available and adopted. Therefore policy decisions on research and development may be as influential as the CAP itself (Angus et al., 2009). The situation is starker in the uplands where continued innovation is required to provide key ecosystem services and maintain viable upland communities (Reed et al., 2009).

Entrepreneurship in the wider rural context is attracting increasing research interest (McElwee and Smith, 2014; Pato and Teixeira, 2016). However, the practical application of entrepreneurial policy within agriculture itself has been largely ignored (Clark, 2009). In the past farmers have been typically characterised as price-takers, market followers and passive decision makers. A cursory analysis of recent trends (Wales Rural Observatory, 2011) as well as the developing stance of rural policy (Horlings and Marsden, 2014) suggests that this is now dated. Entrepreneurship, in the form of on-farm diversification activity, deploying resource either as a substitution for current farm enterprise or to increase the range of farm business activity, may be critical for the survival of contemporary family-managed farm businesses (Seuneke et al., 2013; Hansson et al., 2013; McFadden and Gorman, 2016). Studies which focus on farm diversification typically view the farmer as actors who respond as the objects of innovation diffusion, and therefore highlight the important role of farmer networking and farm extension services, as well as the broader development of infrastructure to support information and communication in the rural economy (Galloway, 2007; Galloway et al., 2011; McFadden and Gorman, 2016; Saleminck et al., 2015; Hill et al., 2017).

Just as within the specific context of farming activity usage of the term diversification is 'fuzzy' (CRR, 2002; Maye et al., 2009), so the concept of entrepreneurial activity remains 'slippery', more than half a century since Edith Penrose attached this adjective (Penrose, 1959). The shift towards thinking of farmers as entrepreneurs therefore raises questions such as how to define an entrepreneur and how to place the boundaries of the farm (Vesala

and Vesala, 2010). It could be argued, on the basis of narrow definition, that farmers are not entrepreneurs because the external market environment is subsidised and therefore not necessitating competitive responses (McElwee, 2006). However, adoption of technology in search of diversified farm business opportunities appears to be consistent with wider conceptions of entrepreneurship. Recent work, focusing on the farmer as an agent of rural innovation, has therefore paid attention to the entrepreneurial skills of farmers, but arrives at a similar conclusion that farmers face alternatives of seeking to add value to existing food production and diversifying into non-food on-farm business activity (Vesala and Pyysiäinen, 2008; Morgan et al., 2010).

2.3. Off-farm income generation and on-farm diversification

Reliance on off-farm income generating activity, or pluriactivity, has for some time been a strategy adopted by farm-based households to absorb economic shocks and protect rural society (Gasson, 1988; Shucksmith et al., 1989). Many farming households derive some proportion of total income by relying on off-farm sources (Farm Business Unit, 2013). In Wales, according to a 2010 survey, 41% of farming households were pluriactive (Wales Rural Observatory, 2011). However, definitions of on-farm diversification are more contested (Hansson et al., 2013), but the same survey reports that half of Welsh farms were diversified in some way. Opportunities for diversification vary significantly and may depend on individual circumstance, abilities and incentives. For example, farmers with greater assets (Ilbery, 1991; McNally, 2001), or larger farms (McInerney and Turner, 1991) may be better placed. Scope for pluriactivity also may be a function of both internal factors and geographic location and the interplay between these (Bateman and Ray, 1994). Improved off-farm employment opportunities may raise the opportunity cost of family labour for the farm, and encourage employment elsewhere.

More recent research, which focuses on the alternative income seeking motives of farmers (Alsos et al., 2003; Grande et al., 2011), tends to be concerned with on-farm technology options that can assist revenue enhancement and production efficiencies. One aspect here returns to the role of the diversified farmer as an entrepreneur (Carter, 1998; Alsos et al., 2003; McElwee, 2006; Hansson et al., 2013). Diversifying farmers may pursue resourced-based entrepreneurial strategies and/or portfolio entrepreneurial activity which seek to widen the range of farm-based opportunity-seeking activity (Alsos et al., 2003).

Although farmers need to be externally aware (Vesala et al., 2007), diversification need not depend solely on the external environment. Previous research has highlighted the critical role played by a range of internal factors (Gasson, 1988; McNally, 2001; Meert et al., 2005; McFadden and Gorman, 2016; Suess-Reyes and Fuetsch, 2016). One of the most significant is resource availability (labour and skills, land and fixed capital). Some 'productivist' conceptualisations of diversification explicitly embed resource utilisation, arising either from those spare from more intensified production activity or from those released from reducing production levels of food outputs in market surplus. Other drivers of diversification may be related to wider farming family and social context, and include those related to household/family structure and the need to provide gainful employment for other family members, or to the desire to contribute to wider social and environmental objectives such as providing employment opportunities for others in the specific rural area or contributing to care for natural amenity and landscape (Leck et al., 2014; Suess-Reyes and Fuetsch, 2016). The attachment that farmers and family members have to the farm itself, and the sense of identity provided by this in the face of economic and social change, could be a driving factor

propelling interest in entrepreneurial income-diversifying opportunities (Lobley and Potter, 2004; Evans, 2009; Brandth and Haugen, 2011; Cheshire et al., 2013). Thus diversification activities may be framed separately from core farming business, and may be particularly associated with other farming household members (Bock, 2004), pursued without significant disruption to main farming activities.

Previous characterisations of strategies towards pluriactivity and diversification tend to dichotomise around the importance of economic and financial motives. The literature for some time has discussed 'survivalist' as a common farming strategy, contextualised in the importance the social identity of farmers as food producers within the particular social and environmental context. So pluriactivity, as well as perhaps on-farm non-food diversification, becomes a necessary 'evil' to keep the core of the farming family in place on the land. This is contrasted with the alternative economic motive of 'accumulation' (Shucksmith et al., 1989). A similar dichotomisation is found in the contrast between 'economic' and 'lifestyle' strategies (Hansson et al., 2013), the former being concerned with farm business strategies to reduce risk and capitalise on spare resource, whereas the latter views strategy as supporting social motives and rural identity.

Whilst diversification might be a common income-seeking strategy, recent evidence for Wales contends that 'most farmers preferred to improve the quality and efficiency of their farming skills, instead of diversifying their business' (Wales Rural Observatory, 2011, p. 4). However, the existence of market opportunity, arising from location and (digital) connectedness, may continue to be one of the most important influences (Midmore, 2011; Galloway et al., 2011), leading on to the importance of innovation and technology adoption as a key enabling influence behind farm diversification and entrepreneurial strategies.

2.4. Innovation, technology adoption and farm management skills

As the previous discussion has highlighted, the relationship between off-farm and on-farm income generating activities may be complex. Thus, the switch from Pillar 1 to Pillar 2 support may not necessarily of itself pose a threat to agricultural incomes, but might be viewed as presenting potential new opportunities away from mainstream food production to be exploited in conjunction with technology adoption. Traditionally farming decisions are refined around externally developed innovations in mechanisation, in animal and plant breeding and in pasture management, as well as more recently in the use of biotechnology, of global positioning system (GPS) technology, and of management tools and decision support systems (DSS) (Galloway and Mochrie, 2005; Fernandez-Cornejo et al., 2007).

Information and communication technology (ICT) is a key enabling technology for many of these recent developments (Malecki, 2010). Technology adoption in agriculture is also driven by regulation and by changes to farming objectives (e.g. organics), as well as by wider socio-economic conditions (Warren, 2004; Reed et al., 2009). Innovation adoption remains critical for agricultural development (Feder and Umali, 1993; McFadden and Gorman, 2016), and is a key factor in understanding how farm households operate and remain viable or competitive. If Pillar 1 support disappears, post-EU membership, technology adoption might be even more important (Rickard, 2012).

Conceptual approaches such as the Technology Acceptance Model (Davis, 1989; Venkatesh and Davis, 2000; Flett et al., 2004) aim to address the limitations of production function-based 'black box' economic models. The latter approach does not address farmers' attitudes and behaviour. ICT adopters may be categorised by speed of adoption (Rogers, 2010), but evidence shows that rural

areas continue to lag due to gaps in infrastructure provision and quality (Galloway, 2007; Galloway et al., 2011; Salemink et al., 2015), as well as lower skill levels. This is creating a digital divide (Townsend et al., 2013) or rural penalty (Malecki, 2003). Connectivity is important; but so is adoption (Salemink et al., 2015).

This recent research on the role of ICT is set in the context of wider debates on the drivers of innovation and their relation to farm income stream choice. The capacity of farmers to capitalise on both farm diversification opportunities and grant-seeking activity may be supported or constrained by farmer attitudes, access, adoption costs, inertia and skills to use technology (Marra et al., 2003; Knowler and Bradshaw, 2007). Usually framed for the wider industrial context, the question arises of why some enterprises appear better able to identify and adopt technology-based opportunities. One explanation, which needs to be addressed in the specific agricultural context, is that successful enterprises have better management of technology (Morone, 1989). Further important considerations include the level and capacity of farmer managerial skills and the influence of networking processes for managing change (Clark, 2009; McFadden and Gorman, 2016; Suess-Reyes and Fuetsch, 2016).

With respect to the question of technology adoption, farm economic performance is significantly influenced by the ability and skills of key decision makers, usually farmers and/or their spouses (Bock, 2004; Fernandez-Cornejo et al., 2007). These skills apply not only to the effective management of resources but also ability to absorb new technologies. Farmers themselves may be a significant barrier to business development, with levels of education and readiness to cooperate being as influential as lack of physical resources (Lowe and Talbot, 2000; Morgan et al., 2010; Sutherland et al., 2016). Internal factors may be at least as important as external ones (McFadden and Gorman, 2016). Many farmers do not seek business advice and, due to limited social networking with others who have diversified, may not seize opportunities when they arise (McElwee, 2006). Farmers typically contact accountants and financial professionals first for advice, followed by farmers' organizations and then family and friends, all in preference to professional support groups (Lowe and Talbot, 2000). Poor and inconsistent advice may therefore restrict entrepreneurial activity. Farms without clear succession plans tend either to disinvest or to suffer from static management (Inwood and Sharp, 2012). Succession and its timing may also be important since analysis supports the view that younger farmers are more productive, as well as achieving higher profitability, investment and engagement in agri-environmental schemes (Hamilton et al., 2015; Sutherland et al., 2016).

2.5. Summary

The relationship between off-farm and on-farm income generating activities may be complex. Subsidy or grant-seeking on-farm activity may compete with or complement other income generating activity. However, 'decoupling' in EU farm support may not necessarily of itself pose a threat to agricultural incomes, but might present potential new opportunities to be exploited in conjunction with technology adoption. In addition to the application of new 'hard' technologies directed towards efficiency and intensification of food production, farm enterprises also face opportunities in respect of 'soft' technologies, notably those linked to information communication technology (ICT) and focused towards both on- and off-farm income generation. The capacity of farmers to capitalise on both farm diversification opportunities and grant-seeking activity may be supported or constrained by access to and skills to use technology. Their intentions to act are further conditioned by wider considerations of farming identify, social and territorial context,

and the circumstances of the farming household. In Wales, as in many other rural areas, farming businesses face a number of continuing choices in the face of the developing socio-economic and policy context. These are in terms of choices about off-farm pluriactivity, about on-farm entrepreneurial activity, and about engagement with technology and innovation to support productive intensification and diversification. None of these choices are necessarily 'either/ors' – however different farmers will choose to place differing levels of emphasis in each area of choice, conditioned by farm and farming household context. The research aim here is to identify particular strategic choice configurations in order to seek to identify a fuller categorisation of farming business types than has typically been addressed in previous work.

3. Methodology

The research exercise now presented is therefore predominantly a descriptive one with the objective of providing a new conceptualisation of farm types, and, as such, two methods were used. Firstly, qualitative interviews were undertaken. A semi-structured interview approach was used, with general questions aimed at stimulation of the topic (Patton, 1990). A purposive sampling method was used, to identify for survey farmers who were involved in both grant-seeking and entrepreneurial activities (Yin, 1989). The interviews had two main purposes. The first was to uncover issues related to income to gain a deeper understanding of barriers to adoption and attitudes towards technology and to grant-seeking. The second was to help develop a further quantitative phase of the research (Malhotra and Birks, 2007). The interviews ($n = 10$) ranged between 50 minutes and three hours, which is similar to previous studies in the subject area (for example see Joosse and Grubbström, 2017). The scope of the research, nature of the data sought, data quality and the mixed design (Mason, 2010) were all considered when considering the number of interviews. The number of interviews was similar to previous studies which have looked at farming (for example Downey et al., 2017). Further, and more importantly, the number of interviews reached data saturation, where no new themes, concepts or problems were emanating from the data (Francis et al., 2010). Data saturation was achieved with the interviews, with understanding as well as the development of the quantitative instrument complete. With the size of the data and number of interviews deemed suitable for the type of qualitative work proposed (Malterud et al., 2016) analysis was conducted. The first level of analysis was case-by-case, followed by the second level cross-case and eventually at the final level, thematic analysis (Patton, 1990; Yin, 1989).

Next a quantitative analysis was conducted on primary data gathered by questionnaire for the investigation of farmer entrepreneurial types. These data were obtained from a survey conducted across the population of agricultural businesses in Wales, which included items based on the qualitative interviews. The sample was a convenience sample which utilised a database of over 7500 farm operators provided by a membership-based farm support and marketing service for farmers in Wales producing beef and sheep meat. The primary purpose of the survey was to investigate attitudes towards and use of income diversification on and off the farm, along with detailed information on business type (farm size and activities) and farmer characteristics (demographics). The data are analysed using cluster analysis, a technique that characterises overall samples into smaller segments (Bacher et al., 2004; Mooi and Sarstedt, 2011). The results of the cluster analysis were analysed for validity using ANOVA and Chi-square analysis to ensure the segments developed were indeed distinct (Malhotra and Birks, 2007).

4. Qualitative data analysis

All farmers interviewed had a sheep enterprise within their business. They were geographically spread across Wales to avoid any regional bias. Two of the ten interviews were conducted with the farmer and spouse jointly. The others were conducted with the main farmer only. Farmer ages varied from late 30s to late 60s with a mix of owner occupier and tenant farmers. Farm acreage also varied along with enterprise turnover and off-farm income levels. Three key themes were investigated in the interviews: entrepreneurial activity (T1), off-farm diversification (T2) and technology adoption (T3).

4.1. Common themes analysis

4.1.1. Entrepreneurial activity (T1)

The first theme to emerge from the in-depth interviews was the presence of entrepreneurial activity or intent. For example: (Farmer 10) *'...I wanted a challenge, we needed to do something that would generate serious money, or generate much better money. I wanted not to be worrying about what (my son)... I didn't want my income stream to be dependent on what (the regional government) said or did, on anything they did, I wanted it to be dependent on something that I was in more in control of and it just really annoys me having to beg for, people begging for handouts, oh we deserve that, we deserve that. No, you get off your backside, work hard take the risks, do the work and then you get your reward.'* Apparent here is a view that is almost anti-subsidy reliance and indicative of a drive for financial independence, possibly resulting from differentiation.

There is also evidence in the data for farm-based innovative approaches, characterised by a desire to identify alternative production processes and markets: (Farmer 2) *'I'm selling lambs to a butcher in London. He is also in negotiations with other outlets.'* This example reveals further discussion in which the respondent describes looking to challenge business model norms and exploit new markets, in order to avoid being reliant on a single business model. A further example of this is: (Farmer 7) *'We've got a 60 kilowatt biomass system and that gives us about, well £6500 to £7000 a year, less we don't pay £2700 a year in oil and all we've got to do is feed it logs.'* This might typify an attempt not only to reduce on-farm costs but also to diversify income streams through exploiting alternative sources of energy and on-farm spare resource.

While much interview material centres on direct, agriculture-related entrepreneurial business activity, the data also reveal evidence for on-farm non-food related enterprise. One example of an on-farm entrepreneurial activity is: (Farmer 8) *'...our daughter is running the livery yard and she in time I think will, she doesn't have to farm, but she can still be involved and carry on a horse business alongside an agricultural business, if that's the way it's going to work.'* Here the physical and human capital resources of the farm are being used for non-food purposes, in search of a viable source of income to take advantage of a non-commodity market.

4.1.2. Diversification and off-farm income (T2)

This theme addresses evidence for farmers seeking to identify potential supplementary or replacement income streams away from their core on-farm agricultural business. Examples in the data included rental incomes from other property (residential or commercial), which may be related to tourism activity and may be more stable than agricultural incomes. They also included income from agriculture-related work to take advantage of spare farm resources such as contracting, which might also support the purchase of new equipment with direct benefit for the farm. These all entail some element of risk, and, although may use spare resources, might also entail additional management resource. For older farmers it is not

surprising that pension is another common income source, albeit a non-entrepreneurial one. Overall, from these data it is clear that any analysis needs to embrace information about the whole farm household, particularly if the full extent of structural change within the rural economy is to be captured.

The following narrative about diversification contextualises the debate in the minds of many farmers on food-based versus non-food diversification, and between on-farm diversification and pluriactivity: (Farmer 5) *'...I think diversification is for a minority. If your location just lends itself to other activities or other opportunities, it's good. But the majority of farms don't have that passing traffic, haven't perhaps got the prime location for bringing other foot..., getting a footfall on a farm.'*

The question of location plays a part in how opportunity interplays with farming policy and the availability of particular forms of grant support: (Farmer 5) *'If you don't go for alternative energy which the government is, it seems to be that the British government is moving away from wind turbines and solar panels so that's something that's going to diminish and probably disappear within the next 18 months. So core farming activity is, I think the majority of us will just have to make our money out of that.'* This narrative also highlights the drive to maintain on-farm activity and to redouble focus on core business. It implies a rejection of diversification as a strategy, based on both locational and policy-related considerations.

The qualitative data highlights the roles of tourism activity and farm property rental as important forms of income-generating enterprise on many farms. But set against this is a view that on-farm non-food diversification is perhaps not for all farmers. Previous studies have highlighted the importance of location and the clustering of businesses for such diversified activities to be successful (Lange et al., 2013; Lowe and Talbot, 2000).

4.1.3. Technology adoption (T3)

There was throughout the interview data a strong focus on technology. This divided into two areas. The first is the adoption of technology related to food and crop production: (Farmer 10) *'...I think technology is, it goes right through from grass to breeding to machinery and everything. Technology covers everything that we do. I think, it's funny how people take it up in some areas, they'll buy a tractor with a better gear box and all that sort of stuff and whatever.'* The second relates to adoption of technology in support of management activity: (Farmer 10) *'...they'll buy a mobile phone and stuff, but other areas they won't and I think in a way, as beef and sheep people we've actually lost focus on what we do';* (Farmer 5) *'Well, weighing animals used to be it would be half a day's work for two people to run through, sort out by eye and weigh a load of lamb. This machine works so fast, you just run them down and you can know. We did a condition scoring project weighing, ... and we were doing 288 an hour. That's ewes condition scored, lambs weighed, everything and all the data's captured.'* Technology adoption here has assisted the production system directly by reducing labour time and indirectly by capturing data which can be used to improve future productive efficiency.

Although in general the data reveal a positive attitude towards technology adoption, there is a lack of awareness of the technology available on the part of some businesses. Some of this may be a consequence of poor communication and information dissemination. For other respondents the wide range of available options and strategies makes for difficulties in choosing the most appropriate adoptions. Connectivity remains a key barrier in remoter rural areas. Perceived risks in the use of online tools and the costs associated with technology adoption are also barriers. Finally, the data strongly support previous research in pointing to age and low education as significant constraints on adoption.

4.2. Strategic stance

Thus far, the findings indicate tensions which the farming business must address. The farmer has the option to become entrepreneurial or to remain reactive. But they must settle the tension between on and off farm sources of revenue pursuit (diversification), making best use of the range of available resources, and the quest towards technology-driven approaches to improved productive efficiency on the farm. These areas need to be assimilated into a broader farming strategy, which will be more reliant on the farmer's strategic drive. Four behavioural themes from the interviews relating to strategy are as identified and labelled as follows: resource-maximisation (S1), farm-focused (S2), lifestyle (S3) and passive (S4).

4.2.1. Resource maximization strategies (S1)

Two of the interviewees typify a resource-maximisation approach. Their data related to their needs for multiple income streams and the use of on-farm natural assets. Both have multiple incomes from tourism-focused enterprises as well as some off-farm activity. Farmer 1 had invested heavily in renewable energy. Farmer 2 is a leader in customer engagement through social media and had adopted differentiation strategies for new market avenues. Both farmers have a broad portfolio of enterprise activity. Both farmers have focused their farming activities around Single (now Basic) Farm Payments and uptake of agri-environmental grants. Thus, grant-seeking activity tends to focus business development on the farm, with correspondingly lower focus on pluriactivity.

A specific example is as follows: (Farmer 1) *'The hydro (-electric generation facility) has been a major investment, major investment. It's set up as a company, but it's funded immensely by the farm. And then down at (farm location) the old farm buildings have been turned into the short term lets with, there's probably about 15 people living down there in all just in 2 person, 1 person units so that again is an income to the farm.'* This illustrates grant use for business development and revenue generation through fixed and natural resources. However, this does not represent productive improvement. In a similar vein: (Farmer 2) *'What we try to do always is to make sure that we cover all the bases that nothing on the farm is kept at a loss, that there's always something coming in. The income from the caravan park and the farm comes together but the income from the caravan park makes us very strong as a business and gives us the power to buy land. This is why we can move on. And as everybody knows, you need to be bigger than what you did 20 years ago to make exactly the amount, the same amount of money or lifestyle you want to keep.'* Available resource on the farm is used to generate income in a non-agricultural manner. These two farmers have different non-agricultural investments, but both still based on the farm. The objective is to exploit alternative uses of farm resources to support plans for further on-farm investment. In both cases Pillar 2 grant-seeking behaviour is around development of alternative income streams.

4.2.2. Farm-focused strategies (S2)

A farm-focused stance is characterised by on-farm management which has developed for the pre-reform CAP environment. Such farmers would appear happy if decoupling was reversed and payments reverted to production support rather than being tied to rural and agri-environmental development. Such grant-seeking behaviour is exemplified as follows: (Farmer 3) *'...we did try and get, join up with Glastir but there was such a, to get the points it was is, yeah, probably a bit easier today, I don't know. But it's, you had to do so much before you gained anything over the years like, so we thought it wasn't beneficial to us anyway.'* This farmer is motivated mostly by production subsidy, rather than support for the *Glastir* agri-

environmental aims. Indeed, the farmer later stated they had not realised benefits from the programme, finding it a hindrance to better income management, and had thus withdrawn.

Despite a sceptical focus on grant-seeking, there also emerged a sub-theme here around farm development: (Farmer 3) *'...we could switch over to more arable but we don't want to be, put all our eggs in the one basket sort of thing, it, what we intend to do is improve our grass really, improve the grass.'* Another interviewee characterises the same theme: (Farmer 5) *'More sheep essentially to go forward. I've looked. I've got involved with the development of the costing group for the sheep ... with natural business. It hasn't got off the ground yet but essentially I'm looking at my cost of production, my cost per kilogram and I'm just trying to do, to change my business and develop my business which will give me a lower cost of production but I anticipate the dead weight price will drop too and so and try and do more kilograms so that I have sufficient income off the sheep.'* Here is seen the clear admission that efficiency-seeking behaviour is motivated by growing food output as a response to future price expectations. Scepticism is again apparent, in that the farmer is looking for opportunity in the existing market, rather than diversify away from it.

Perhaps the most compelling Pillar 1 or farm-focused perspective is encapsulated in the following: (Farmer 7) *'The farm's got to stand on its own two legs rather than having these hand-outs, we've got to become more efficient. So there's an immediate problem with, we've got to find money to buy more fertiliser, I think once that comes into the system we'll be hopefully away.'* This shows a general scepticism about policy, exemplified in the use of the label 'hand-outs'. And a state of denial about CAP reform is present here in a sense that the farmer envisions a long-term viability for core agricultural activity, and one that is not based on a grant-supported business model. The articulated plan is improvement in core farming business, rather than agri-environmental scheme participation or allocation of land resource to alternative activity. The theme of on-farm efficiency, supported by appropriate operational metrics and a recognition of position in the supply-chain, is further illustrated in the following narrative: (Farmer 8) *'We're predominantly, sheep is what leads the way a bit, is to produce lambs, as many lambs as efficiently as possible, and we supply (supermarket chain), so we're looking at a good R3L (classification) and better, produced at a reasonable cost.'*¹

Farmers adopting this stance typically have multiple food enterprises, involving significant scale, and this sharpens focus on improving business efficiency and productivity. They display no major desire to invest heavily in new capital equipment but seek to make better use of existing resources. Stimulated by regular participation in information gathering activity such as the Welsh Farm Business Survey, they tend to display high levels of awareness of unit costs and profit margins. Their produce enters the main supply chain with no value-adding elements. Insofar as technology is embraced to improve the productivity and efficiency, they have a positive attitude towards innovation. This approach supports other evidence that some farmers focus on improving operational managerial ability to enhance farm business performance (Veidal and Flaten, 2014).

4.2.3. Lifestyle strategies (S3)

Aside from urgent search for on-farm efficiency gains and opportunity-seeking activity to use the farm's resources in a non-agricultural manner, a lifestyle-focused strategy is apparent. This stance typically avoids complicated agri-environmental schemes,

¹ This is a classification system used throughout Europe, and rewards producers for supplying lambs with more marketable carcase classifications.

or seeking resources to support non-agricultural enterprise. The objective appears to be one of farming in pursuit of quality of life, or to maintain identity and tradition. The farm household may be pluriactive. The following narrative illustrates this: (Farmer 6) ‘...my wife earns, she’s a teaching assistant at a local school so that’s quite a large part of our income. We fortunately enough I suppose have two properties which are rented out so that provides an income although against that there’s a mortgage on one of them. But that does, so we’ve got income from properties. I’m still doing the non-farming ones first’. Here there is no mention of the farm itself; the stated sources of income are off-farm. The lifestyle strategy is built around pluriactivity and off-farm property assets. This farmer went on to discuss other land-based enterprise such as felling timber. Yet there was no mention of technology, and the farmer admitted that achievement of leisure time was a key driver. This is also illustrated in another case looking to return to a different, previous way of life: (Farmer 1) ‘You’ve got to have a balance. Yeah, I’ve gone, I’ve adopted more contractors to do the fertiliser and to plough, to silage. Just it takes the pressure off a little bit. And also the last four years doing the hydroelectric schemes have been a massive, it’s been massively intensive, and long hours have gone into that. So it’s quite nice now to just take a step back and just return to normality’. Lifestyle plays a key part in choices and influences the decision to adopt technology and make use of support services. Finding work/life balance is important in future investment decisions on the farm.

Traditional farming methods are not necessarily outdated, as these have been formed by processes of inter-generational information sharing and trial and error. Localised expert knowledge can form a vital source of information, especially in challenging upland areas: (Farmer 2) ‘I’ve seen people bringing in crossbreeds onto the mountain and things, they don’t do. Welsh mountain sheep have been brought and bred on these mountains for a reason, because they suit the area, and this is why we keep to the traditional ways of farming’

Lower altitude locations allow for greater flexibility and experimentation but, in this example, this is supported by utilising previous research and highlights the importance of education: (Farmer 5) ‘Well I suppose the farming system has just come from my background of university and what I’m trying to do is maximise use of forage because in west Wales we can grow grass and we’re, this is a grass growing farm. So I’ve done a lot of reseeding, lime, and so I tend to, I try to pay attention to the detail insofar as to get things, lime, pH right and to create good swards and the whole system is geared to, well ideally I’m making a profit. Everything is about making a profit at the end of the day...’

4.2.4. Passive farming (S4)

Farmers of this type are largely passive in their approach to their business, and conform to the earlier characterisation of farmers who are reactive to market changes. This form of farming might be characterised by an absence of strategic intent or direction. It is typified by one farmer who, despite income from agri-environmental grant schemes, appears to be adopting a ‘satisficing’ approach rather than seeking higher or alternative income streams: (Farmer 7) ‘...we run about 862 acres. But run it very extensively, we could most probably double our stock rate most probably if we wanted to but there’s only me and (name of other family member) now really farming now.’

In addition to absence of business succession, location and planning restrictions can be constraints: (Farmer 4) ‘we are in a national park here, so a lot of them things are out anyway. You know, there are no wind turbines or any of that.’ This means that the farming style lends itself to agri-environmental scheme participation. Little technology investment is made as over many years a comfortable style of farming has been found. The farmer is over 65 years of age and is likely to retire and disinvest soon. Lifestyle

factors may be at work: (Farmer 8) ‘Because I’m the wrong side of 60 I’m wanting to do less full time hours and we do do other things now a little bit at certain times of the year, recreational, and the farm is geared to be run as efficiently as possible with (name of employee) doing most of the work.’

Absence of clear succession strategy is also a key aspect of this stance: (Farmer 8) ‘Yeah, well we’ve got a daughter and a son, neither have gone into agriculture full time in any way, but our daughter is running the livery yard and she in time I think will, she doesn’t have to farm, but she can still be involved and carry on a horse business alongside an agricultural business, if that’s the way it’s going to work. And our son at the meantime is doing other things away, whether he comes back and shows an interest enough to want to farm we’ll have to see.’ This undermines any motive for continued investment in business development: (Farmer 8) ‘We’re not spending huge amounts of money in new streams of investment or ideas if there’s going to be no interest to carry it on. We’re quite happy to run the farm as a profitable business now and produce what we produce...’ The cultural and emotional attachment to the farm and land could be the rationale for maintaining business activity rather than closure (Cheshire et al., 2013).

5. Quantitative analysis

The qualitative analysis was supplemented by a questionnaire instrument designed to understand the characteristics of a larger sample of farmers and their businesses. The qualitative research indicates that there are a series of farmer types; the quantitative analysis allows the further exploration of this and addresses the issue of generalizability of findings. Therefore, the data obtained are analysed specifically to address whether a classification is extant which supports qualitative analysis. A postal survey was sent to the membership of a Welsh farmers’ cooperative with a membership of 7,500, representing 70% of all lamb and beef produced in Wales. The membership list represents well the geographical and demographic spread of this farmer population. A total of 738 usable questionnaire responses were obtained (a response rate of 9.84%). 35 responses were subsequently dropped from the analysis as they failed to provide full information. Comparatively, the sample size is much larger than similar studies in the area (for example Beedell and Rehman, 2000; Bowler et al., 1996; Damianos and Skuras, 1996).

A non-hierarchical two-step cluster analysis was conducted, with the two vectors comprising binary indicators for the (1) presence of off-farm income and (2) agri-environmental (*Glastir*) grant-seeking intentions. These two items were selected because they demonstrate external income-seeking behaviour. Technology adoption is too broad and is measured in various items, so was not used directly to discern the clusters, but as a series of ‘profile’ items to understand the segment strategies. The two-step cluster approach was selected based on the nature of the data (binary) (Bacher et al., 2004), in addition to the other known properties of this type of cluster analysis (Mooi and Sarstedt, 2011). Two-step cluster analysis has been previously used to analyse farm systems (see Kuivanen et al., 2016). Cluster analysis allows partitioning of participants into groups with underlying similarities, to clusters of homogeneous groups (segments) based on attitudes and behaviours (Mooi and Sarstedt, 2011). Once the sample has been partitioned, in this case using off-farm income and grant seeking, the resultant segments can be profiled, by not only demographics, but also technology.

The data support the hypothesis of four different clusters as established in the qualitative data analysis. The overall model fit was high, and no group was more than twice the size of any other, with a ratio of 1.12, indicating that each of the clusters was

Table 1
Cluster analysis – descriptive findings.

Variable	Cluster				Total
	1	3	3	4	
Number of members	184	173	165	181	703
Percentage of sample	24.9	23.4	22.4	24.5	–
Future Pillar 2 grant intention (yes/no)***	N	Y	Y	N	–
Off farm Income (yes/no)***	N	Y	N	Y	–
Use DSS (%)**	15.8	19.7	21.8	9.4	16.5
Previous agri-environmental scheme participation (%)***	14.1	37.6	43.0	15.5	27.0
Previous other Pillar 2 scheme participation (%)***	12.0	39.3	29.7	17.7	24.3
Biotechnology data adoption (rams) (%)***	16.3	34.7	32.1	28.2	27.5
Biotechnology data adoption (bulls) (%) n/s	21.7	22.5	24.2	14.9	20.8
Renewable energy on-farm generation (%)***	21.2	40.5	27.9	23.2	28.0
ICT adoption (%)***	15.8	19.7	21.8	9.4	16.5
Has broadband access (%)***	71.2	88.4	85.5	78.5	80.7
Uses computerised accounts (%) n/s	31.5	39.9	41.2	37	37.3
Has business website (%)*	4.9	11.6	8.5	11.6	9.1
Higher education qualification (%)***	19.2	35.5	27.4	24.6	26.5
Age <30 years %***	1.1	5.2	4.3	1.7	3.0
Age 31–50 years %***	25.8	42.4	42.9	28.7	34.7
Age 51–64 years %***	47.8	34.9	35.6	45.3	41.1
Age >65 years %***	25.3	17.4	17.2	24.3	21.2
Farm acreage***	234.8	330.0	452.2	186.6	297.0
Permanent Pasture acreage n/s	197.3	196.2	283.8	152.4	205.7
Animal stock (head) n/s	446.7	580.4	820.5	355.9	544.0

***p < 0.001, **p < 0.01, *p < 0.10, n/s not significant; acreage, pasture, stock tested using ANOVA, all others Chi-square tests.

reasonably similar in size. With regard to normal practice a number of segment outcomes were proposed and tested, the other solutions (two, three, five and six) had lower levels of cohesion, with the goodness-of-fit measures closer to fair than good, which is inferior to the good fit achieved with a four-cluster solution. In short, support for a four cluster approach is apparent.² This is further supported through the Chi-square analysis and ANOVA, which indicate significant differences between the four segments. Moreover, a discriminant analysis, using the same set of independent variables also indicated that the best solution was four clusters.

Table 1 reports results from cross-tabulation and ANOVA analysis, describing each of these clusters in terms of a range of characteristics which develop the profile of each group. These profile variables relate to awareness and adoption of a particular on-line decision support (DSS) tool developed to allow systematic monitoring of production factors, adoption of other technologies including use of biotechnology data (use of performance-recorded breeding sheep rams and bull cattle) and renewable energy generation, take-up of the various previous Welsh agri-environmental grant schemes (*Tir Gofal* and *Tir Cynnal*) and other Pillar 2 schemes, ICT availability and usage (broadband access, computerised accounting, website use), presence of off-farm income, and farm and farmer characteristics (farmer age and education level, farm acreage).

5.1. Cluster 1

This cluster contains enterprises with the second smallest average sized farms (mean = 234.8 acres, mean = 197.3 acres of permanent pasture). They have no off-farm income streams and engagement with subsidy opportunities is low. They have the lowest level of previous engagement with Pillar 2 grants and

indicate that they will not seek future grants. They do have some engagement with technologies that might engage potential business efficiency. However, these are at low levels when compared to the other clusters. Low levels of broadband and farm website use also suggest the farmers are not looking to enhance their marketing efforts (and consequently margins). Some however may be seeking to intensify existing production activity, for example by renting additional land to increase sheep numbers. In terms of farmer characteristics, this cluster has the lowest level of higher education qualification (only 19.2%), and the largest proportion of people over the age of 65 years. Given the profile, it seems this group may be preparing to hand over management of the farm or dispose of it if there is no clear succession in place.

5.2. Cluster 2

This cluster has the second highest level of decision support system uptake and reports off-farm incomes. They have the second highest acreage (mean = 330.0 acres, mean = 196.2 acres of permanent pasture). They appear active in exploring off-farm income opportunities, and have high levels of uptake of previous agri-environmental and the highest level of uptake of other grant schemes. In addition to these past behaviours, they also intend to seek future grant opportunities. They are also exploiting opportunities presented by renewable energy generation (highest level of uptake across the clusters (p < 0.001)).³ On the farm they have engagement with efficiency and management improvement technologies (highest levels of biotechnology (ram performance breeding) uptake at 34.7%). Over three quarters of this cluster is between 30 and 64 years of age, and they have the highest level of higher education attainment (35.5%).

5.3. Cluster 3

Cluster 3 intends to seek future grant income and does not have off-farm income sources. This cluster has the highest average mean

² In principle the data might have supported a larger number of clusters with two or more clusters characterised by the same off-farm income and grant-seeking configuration but differing configurations of technology adoption. However, the statistical analysis does not find this.

³ ANOVA is used to make this distinction.

farm size (452.2 acres). The cluster has the largest area of permanent pasture and stock levels, and also the highest proportion using IT and decision support systems. These businesses focus solely on the farm itself and its resources as sources of income. They appear managed to make full use of available Pillar 2 grants and explore new income streams from within the farm. As such, they have the highest level of previous agri-environmental grant take up (43%), and high levels of biotechnology (ram performance breeding) adoption. They appear to display a positive attitude towards technology-embracing innovations, and have high levels of broadband connectivity (85.5%) and IT adoption (21.8%). The group has the second highest levels of educational attainment and has a similar age profile to cluster 2.

5.4. Cluster 4

This cluster contains those enterprises with the smallest farms (mean = 186.6 acres, mean = 152.4 acres of permanent pasture). The group also has the lowest level of animal stock on hand (mean = 355.9). They do have off-farm income streams to support and assist the core farming business. They have not previously fully engaged with others sources of income such as agri-environmental grants and their future intentions to do so are low. Information technology adoption is at the lowest level across the clusters and contains the second least educated group. The cluster is demographically similar to the first in that its two biggest age categories are 31–50 and over 65 years. This cluster, however, contains the second largest number of 51–64 year-old farmers. This is indicative of not only older traditional farmers but also the presence of a sizeable proportion of younger farmers who have more recently become the primary decision-maker on the farm, with limited opportunity to date to develop in a more entrepreneurial direction.

6. Discussion and conceptual classification

Agricultural businesses may segment according to a range of characteristics and business management styles (van der Ploeg, 1994; McElwee, 2004). One survey of farming households, also in Wales, proposed the emergence of three overlapping groupings, identified in terms of farming household income structure and level (Wales Rural Observatory, 2011). The clusters identified by that research were 'strugglers', 'policy-dependent' and 'pro-active'. It is the last of these that tended to be the most engaged in terms of diversification and technology adoption, while the first represents lagging non-entrepreneurial farm businesses. The middle group are in essence reactive businesses, albeit ones which may have some significant degree of technology adoption in response to Pillar 2 policies.

However, this cluster characterisation conflates a number of policy and innovation related issues. A different approach combines three perspectives (Alsos et al., 2003); the rural society perspective, the opportunity perspective and the resource based perspective and from these identified three entrepreneurial types – the 'pluriactive' farmer, the 'resource exploiting entrepreneur' and the 'portfolio entrepreneur'. These entrepreneurial types contribute to the wider rural society differently in economic terms. They are also likely to respond to entrepreneurial policies differently. What is clear that a simple dichotomisation of farmers into survival/accumulation or lifestyle/economic (Hansson et al., 2013) fails to distinguish between the range of accumulation strategies open to farmers in the contemporary 'decoupled' policy environment.

The qualitative research presented here indicates a number of areas in which farm businesses diverge. The quantitative analysis confirms extensive heterogeneity amongst farmers. The four-cluster solution identified from the present survey data, by

segmenting on off-farm income and grant-seeking intentions, points to the grouping of farm businesses on the basis of differences in on- and off-farm strategies and opportunity-seeking activity. Two clusters are seeking to diversify through achieving future access to agri-environmental grants, yet differ in terms of pluriactivity (Cluster 2 and Cluster 3). The other two clusters are not as interested in future Pillar 2 grants, of which one (Cluster 1) has no off-farm income, while the other (Cluster 4) is pluriactive. Both of these exhibit currently lower levels of technology adoption, ICT adoption and the use of breeding technology found in Clusters 2 and 3. These cluster characterisations appear to fit well with the themes and farm business strategies identified from the earlier qualitative analysis.

Cluster 1 contains smaller farms that contribute to producing food while maintaining some element of concern for environmental protection, albeit low in terms of past scheme participation. Technology adoption is relatively low. This cluster has a larger percentage of older farmers than the others. Further research might seek to establish if these farmers have a settled way of farming which implies reluctance to change, or have a level of risk aversion to new technology which makes them unable to change. This cluster appears to conform the most closely to the characterisation of some farmers as passive, and may require particular policy attention for promoting knowledge transfer and raising awareness of the changing nature of agriculture. These are mainstream food producers with little, if any, further value-adding activity. They may also be hindered from investment activity by a lack of succession strategy.

Clusters 2 and 3 are more likely to utilise technology to raise efficiency and improve product quality. They jointly comprise the larger farms, but the key difference between these two technology-engaged groups is off-farm income. Further research might seek to uncover further the reasons for this difference, and on the purposes to which technology is being put (cost reduction, increased scale, or on-farm diversification), which may be linked to location and family structure. They are also better-connected and are embracing technology for managerial improvement. Because of their size these clusters are potentially the largest contributors to the food supply chain. This points to their importance for the attention of policy and extension service support.

Cluster 4's main focus appears to be on promoting the lifestyle opportunities of the farmer and family, pursuing an approach to farming with which they are comfortable, and therefore conform most closely to the lifestyle farmers identified by other researchers (Hansson et al., 2013). These farms are supported by off-farm income, with therefore potentially less emphasis on productivity. The group are uninterested in seeking on-farm grant funded opportunities in the future. Technology adoption is the lowest amongst all four groups, and, where adopted, this may be more concerned with the freeing-up of managerial time to support pluriactivity or non-food diversification rather than seeking productive improvement.

The quantitative analysis presented here, in particular, presents a potentially static "snapshot" of farmer heterogeneity, but points strongly towards heterogeneous farm business development paths which are dynamic and influenced by a range of economic, social and political processes which do not remain fixed. Informed by this discussion, the entrepreneurial choices faced by agricultural enterprises, in the face of these changing external circumstances, can be distilled into two decision types. The first decision is one that researchers have previously explored in some detail, namely whether to focus solely on on-farm business activity, or to be pluriactive. The second is whether to improve the income-generating capacity of farming activities through Pillar 2 grant seeking. However, this second decision leads on to a third key issue, that of whether to adopt technology to enhance effectiveness and

Table 2
Characterisation of agricultural entrepreneurial choices.

		Diversification strategy:	
		Focus on off-farm income streams and on-farm diversification	Focus on supporting and achieving on-farm efficiencies
Future and current grant-seeking stance:	High	<p><i>Resource Maximisers</i></p> <ul style="list-style-type: none"> • seeking a range of income streams • utilisation of all available resources (human, natural and fixed capital) • actively identifying and embracing technologies • actively pursuing sources of productive efficiency • seeking awareness of and connection to the needs of customers/consumers • demonstrating of personal entrepreneurial attributes 	<p><i>Farm Focused</i></p> <ul style="list-style-type: none"> • business focus largely on the farm • utilising farm resources (land, agricultural by-products etc.) for sources of income, including renewable energy generation • embracing information and bioscience technologies • actively pursue the use of tools to enhance management decision-making • seeking awareness of and connection to the needs of customers/consumers for sectors of interest • actively pursuing efficiency and product quality improvements • demonstrating personal entrepreneurial attributes
	Low	<p><i>Lifestyle Farmers</i></p> <ul style="list-style-type: none"> • developing off-farm income streams, but principally to supplement and de-risk core farm income • adopting a farming style adapted to lifestyle/values choices and not strongly shaped by subsidies/grants • demonstrating low levels of technology adoption across all business activities 	<p><i>Passive farmers</i></p> <ul style="list-style-type: none"> • displaying limited engagement with grant-focused opportunities • displaying low levels of engagement with technology • persisting with mainstream farming systems/methods with no business differentiation

diversification or not. In a simplified example these might be viewed sequentially (although there is no *a priori* reason to believe that all agricultural businesses adopt a sequential approach): a farming household may look to off-farm activity to maintain household income levels, or look to improve the income potential of the farm, with available strategic resources and competencies. Once this decision is made, the farm can think about the attractiveness of pursuing Pillar 2 grants for funding diversification activity. The farmer may then identify whether or not to adopt technological innovation, for example to support internet-based marketing strategies, to support off-farm income streams, or look to technological investments either as diversifications such as renewable energy generation or as productivity-engaging tools such as decision support systems or the use of biotechnology. These combinations of choices can be represented by a conceptual characterisation of farm business as shown in Table 2 which translates the four clusters found in the data into a two by two structure.

The development of skills to assist diversification activity is a significant issue and particularly so for older farmers with greater resistance to change and self-confidence to upskill. Allied to these interventions to support improved succession of younger age group farmers (35–54) into positions of decision making is also critical for rural development policy. The importance of skills cannot be ignored if future models of rural development are to be shaped as much by the effective deployment of managerial time and entrepreneurial skills, as by resource availability and productive efficiency (Veidal and Flaten, 2014).

Precise characterisations of particular agricultural enterprises into each of these types will be conditioned further by individual farmer characteristics (age, education etc.) and the nature of the farm and farming household (size, family structure etc.), and might be explored in future research.

7. Conclusions

The research presented in this paper provides insights for the debate which surrounds the ambiguity of rural economy development, with farm strategy as the central focus. It is contextualised by an economic, social and policy environment⁴ in which the

prevailing view of the farm continues to diverge away from seeing the farm as providing economic livelihood for the farming household, based on traditional food production. Thus, the research firstly provides further evidence that the 'productivist' conception of the farmer as master of input-grow-output is flawed. Farmers, as revealed here, are reactive dynamic business operators, not only facing the physical constraints of weather and land, but also influenced and constrained by social and policy expectations. The farmer might increasingly be seen as an entrepreneur, albeit not necessarily for-profit, who contributes to the rural economy in many ways. Specifically, this research categorises farmers into four broad operator types, distinguished across domains of diversification, pluriactivity and attitudes towards technology, the policy environment and the 'productivist' imperative.

Firstly, the farmer must decide if on-farm opportunities are the way forward, or if off-farm opportunities are a better path. Off-farm income-seeking in turn raises a number of rural socio-economic issues, concerning the sectoral make-up of the rural economy and the changing centrality of agriculture within it. Pillar 2 grant focus is a second question that the farmer must seek to answer. Decoupling shapes the direction of where the investment and strategic impetus will be focused on the farm. Unknown changes which will follow from British exit from the EU will further affect this, but seem unlikely at this stage in Wales to reverse the current emphasis towards the 'green economy'. By identifying two responsive groups of farmers to future grant opportunities, insight is provided into the potential future shape of the rural economy, as well as identification of who needs to be a target of policy to meet future environmental imperatives. A third question addresses how farmers must consider technology adoption in conjunction with the implications of policy and farm business models. Technology can support different business models in different ways, since it may support improved production scale, improved cost management at given scale, as well as support entrepreneurial diversification activity. Policy intervention designed to support the last of these may encourage some farmers in the opposite direction. The uptake of technology is immersed in farming household situation and demographics and is linked to stance in respect to the first two questions. ICT and broadband inclusion remains a facilitator and, in Wales at least, remains dependent on infrastructure roll-out and skills development policy.

These issues coalesce with farmer strategy here. The farmer is not independent of policy, but can choose to engage or not, being

⁴ This research was conducted before the United Kingdom vote to exit the European Union, in 2016.

active or passive in a developing multifunctional rural economy. Yet, these decisions need to be taken with an understanding of options and form part of a general farm strategy. Here again demographics, notably age and education level, as well as business succession come into play. The ambiguity of the rural economy sees some farmers strategizing based on policy, resource and knowledge availability and entrepreneurial opportunity recognition. In short, many farmers can be viewed as active or latent entrepreneurs in a ‘fuzzy’ decision space, with internal and external factors to consider, but some remain passive. The divergence of farmers in this study highlights the need for clarity, both for farmers themselves and wider stakeholders in the rural economy.

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References

- Alsos, G.A., Ljunggren, E., Pettersen, T.L., 2003. Farm-based entrepreneurs: what triggers the start-up of new business activities? *J. Small Bus. Enterp. Dev.* 10, 435–443.
- Angus, A., Burgess, P.J., Morris, J., Lingard, J., 2009. Agriculture and land use: demand for and supply of agricultural commodities, characteristics of the farming and food industries, and implications for land use in the UK. *Land Use Policy* 26, S230–S242.
- Bacher, J., Wenzig, K., Vogler, M., 2004. SPSS TwoStep Cluster - a First Evaluation. *Lehrstuhl für Soziologie, Berlin, DE*, pp. 578–588.
- Bateman, D., Ray, C., 1994. Farm pluriactivity and rural policy: some evidence from Wales. *J. Rural Stud.* 10, 1–13.
- Beedell, J., Rehman, T., 2000. Using social-psychology models to understand farmers' conservation behaviour. *J. Rural Stud.* 16, 117–127.
- Blandford, D., Hill, B., 2005. Structural change and public policies in EU agriculture: an overview. In: *Proceedings of XIth congress of the EAAE, Copenhagen, Denmark*.
- Bock, B.B., 2004. Fitting in and multi-tasking: Dutch farm women's strategies in rural entrepreneurship. *Sociol. Rural.* 44, 245–260.
- Bowler, I., Clark, G., Crockett, A., Ilbery, B., Shaw, A., 1996. The development of alternative farm enterprises: a study of family labour farms in the Northern Pennines of England. *J. Rural Stud.* 12, 285–295.
- Brandth, B., Haugen, M.S., 2011. Farm diversification into tourism - implications for social identity? *J. Rural Stud.* 27, 35–44.
- Carter, S., 1998. Portfolio entrepreneurship in the farm sector: indigenous growth in rural areas? *Entrepreneursh. Regional Dev.* 10, 17–32.
- Cheshire, L., Meurk, C., Woods, M., 2013. Decoupling farm, farming and place: re-combinant attachments of globally engaged family farmers. *J. Rural Stud.* 30, 64–74.
- Clark, J., 2009. Entrepreneurship and diversification on English farms: identifying business enterprise characteristics and change processes. *Entrepreneursh. Regional Dev.* 21, 213–236.
- CRR, 2002. *Farm Diversification Activities: Benchmarking Study 2002*. Centre for Rural Research, University of Exeter (Final report to Department of Food and Rural Affairs, UK Government).
- Damianos, D., Skuras, D., 1996. Farm business and the development of alternative farm enterprises: an empirical analysis in Greece. *J. Rural Stud.* 12, 273–284.
- Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* 13, 319–340.
- Downey, H., Threlkeld, G., Warburton, J., 2017. What is the role of place identity in older farming couples' retirement considerations? *J. Rural Stud.* 50, 1–11.
- European Commission, 2013. *Overview of CAP Reform 2014–2020*. Agricultural Policy Perspectives Brief No 5, Brussels.
- Evans, N., 2009. Adjustment strategies revisited: agricultural change in the Welsh marches. *J. Rural Stud.* 25, 217–230.
- Farm Business Unit, 2013. *Farm Business Survey in Wales: Statistical Results for 2012/13*. ISSN: 0961-9321. Aberystwyth University, UK, Institute of Biological, Environmental and Rural Sciences.
- Feder, G., Umali, D.L., 1993. The adoption of agricultural innovations: a review. *Technol. Forecast. Soc. Change* 43, 215–239.
- Fernandez-Cornejo, J., Nehring, R., Hendricks, C., Southern, M., Gregory, A., 2007. Off-farm Income, Technology Adoption and Farm Economic Performance. US Department of Agriculture. *Economic Research Report No. 7234*.
- Flett, R., Alpass, F., Humphries, S., Massey, C., Morriss, S., Long, N., 2004. The technology acceptance model and use of technology in New Zealand dairy farming. *Agric. Syst.* 80, 199–211.
- Francis, J.J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M.P., Grimshaw, J.M., 2010. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychol. Health* 25, 1229–1245.
- Galloway, L., 2007. Can broadband access rescue the rural economy? *J. Small Bus. Enterp. Dev.* 14, 641–653.
- Galloway, L., Mochrie, R., 2005. The use of ICT in rural firms: a policy-orientated literature review. *info* 7 (3), 33–46.
- Galloway, L., Sanders, J., Deakins, D., 2011. Rural small firms' use of the internet: from global to local. *J. Rural Stud.* 27, 254–262.
- Gasson, R.M., 1988. *The Economics of Part-time Farming*. Longman, London.
- Grande, J., Madsen, E.L., Borch, O.J., 2011. The relationship between resources, entrepreneurial orientation and performance in farm-based ventures. *Entrepreneursh. Regional Dev.* 23 (3–4), 89–111.
- Hamilton, W., Bosworth, G., Ruto, E., 2015. Entrepreneurial younger farmers and the “young farmer problem” in England. *Agric. For.* 62, 61–69.
- Hansson, H., Ferguson, R., Olofsson, C., Rantamäki-Lahtinen, L., 2013. Farmers' motives for diversifying their farm business – the influence of family. *J. Rural Stud.* 32, 240–250.
- Happe, K., 2004. Agricultural policies and farm structured: agent-based modelling and application to EU policy reform. In: *Studies on the Agricultural and Food Sector in Central and Eastern Europe*, vol. 30. Institute of Agricultural Development in Central and Eastern Europe, Halle.
- Hill, B., Bradley, D., Williams, E., 2017. Evaluation of knowledge transfer; conceptual and practical problems of impact assessment of farming connect in Wales. *J. Rural Stud.* 49, 41–49.
- Hodge, I., Midmore, P., 2008. Models of Rural Development and Approaches to Analysis Evaluation and Decision-making. *Économie rurale* 5/2008(307), pp. 23–38.
- Horlings, L.G., Marsden, T.K., 2014. Exploring the ‘new rural paradigm’ in Europe: eco-economic strategies as a counterforce to the global competitiveness agenda. *Eur. Urban Regional Stud.* 21, 4–20.
- Ilbery, B.W., 1991. Farm diversification as an adjustment strategy on the urban fringe of the West Midlands. *J. Rural Stud.* 7, 207–218.
- Inwood, S.M., Sharp, J.S., 2012. Farm persistence and adaptation at the rural–urban interface: succession and farm adjustment. *J. Rural Stud.* 28, 107–117.
- Joose, S., Grubbström, A., 2017. Continuity in farming – not just family business. *J. Rural Stud.* 50, 198–208.
- Knower, D., Bradshaw, B., 2007. Farmers' adoption of conservation agriculture: a review and synthesis of recent research. *Food policy* 32, 25–48.
- Kuivanen, K.S., Michalscheck, M., Descheemaeker, K., Alvarez, S., 2016. A comparison of statistical and participatory clustering of smallholder farming systems – a case study in Northern Ghana. *J. Rural Stud.* 45, 184–198.
- Lange, A., Piore, A., Siebert, R., Zasada, I., 2013. Spatial differentiation of farm diversification: how rural attractiveness and vicinity to cities determine farm households' response to the CAP. *Land Use Policy* 31, 136–144.
- Leck, C., Evans, N., Upton, D., 2014. Agriculture - who cares? An investigation of ‘care farming’ in the UK. *J. Rural Stud.* 34, 313–325.
- Lobley, M., Potter, C., 2004. Agricultural change and restructuring: recent evidence from a survey of agricultural households in England. *J. Rural Stud.* 20 (4), 499–510.
- Lowe, P., Talbot, H., 2000. *Providing Advice and Information in Support of Rural Microbusinesses*. Centre for Rural Economy Research Report, University of Newcastle, Newcastle upon Tyne.
- Malecki, E.J., 2003. Digital development in rural areas: potentials and pitfalls. *J. Rural Stud.* 19, 201–214.
- Malecki, E.J., 2010. Everywhere? The geography of knowledge. *J. Regional Sci.* 50, 493–513.
- Malhotra, N., Birks, D., 2007. *Marketing Research: an Applied Approach*, 3rd European Edition. Pearson Education.
- Malterud, K., Siersma, V.D., Guassora, A.D., 2016. Sample size in qualitative interview studies: guided by information power. *Qual. Health Res.* 26, 1753–1760.
- Marra, M., Pannell, D.J., Abadi Ghadim, A., 2003. The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: where are we on the learning curve? *Agric. Syst.* 75, 215–234.
- Marsden, T., 2016. Exploring the rural eco-economy: beyond neoliberalism. *Sociol. Rural.* 56, 597–615.
- Marsden, T., Sonnino, R., 2008. Rural development and the regional state: denying multifunctional agriculture in the UK. *J. Rural Stud.* 24, 422–431.
- Mason, M., 2010. Sample size and saturation in PhD studies using qualitative interviews. *Forum Qual. Sozialforschung/Forum Qual. Soc. Res.* 11 (3). Retrieved from: <http://www.qualitative-research.net/index.php/fqs/article/view/1428>.
- Maye, D., Ilbery, B., Watts, D., 2009. Farm diversification, tenancy and CAP reform: results from a survey of tenant farmers in England. *J. Rural Stud.* 25, 333–342.
- McElwee, G., 2004. A segmentation framework for the farm sector. In: *The 3rd Rural Entrepreneurship Conference*. University of Paisley, Scotland, October 2004.
- McElwee, G., 2005. *A Literature Review of Entrepreneurship in Agriculture*. Report, European Union Framework Programme 6: ESof Developing Entrepreneurial Skills of Farmers. University of Lincoln.
- McElwee, G., 2006. Farmers as entrepreneurs: developing competitive skills. *J. Dev. Entrepreneursh.* 11, 187–206.
- McElwee, G., Smith, R., 2014. Rural entrepreneurship. In: *Fayolle, A. (Ed.), Handbook of Research on Entrepreneurship*. Edward Elgar, Cheltenham.
- McFadden, T., Gorman, M., 2016. Exploring the concept of farm household innovation capacity in relation to farm diversification in policy context. *J. Rural Stud.* 46, 60–70.
- McInerney, J., Turner, M.M., 1991. *Patterns, Performance and Prospects in Farm*

- Diversification. Report-Agricultural Economics Unit. University of Exeter.
- McNally, S., 2001. Farm diversification in England and Wales — what can we learn from the farm business survey? *J. Rural Stud.* 17, 247–257.
- Meert, H., Van Huylenbroeck, G., Vernimmen, T., Bourgeois, M., Van Hecke, E., 2005. Farm household survival strategies and diversification on marginal farms. *J. Rural Stud.* 21, 81–97.
- Midmore, P., 2011. Food and the economy in Wales. *Welsh Econ. Rev.* 22, 29–31.
- Morgan, S.L., Marsden, T., Miele, M., Morley, A., 2010. Agricultural multifunctionality and farmers' entrepreneurial skills: a study of Tuscan and Welsh farmers. *J. Rural Stud.* 26, 116–129.
- Mooi, E., Sarstedt, M., 2011. *Cluster Analysis*. Springer, Berlin.
- Morone, J., 1989. Strategic use of technology. *Calif. Manag. Rev.* 31 (4), 91–110.
- Pato, M.L., Teixeira, A.A.C., 2016. Twenty years of rural entrepreneurship. *Sociol. Rural.* 56, 3–18.
- Patton, M.Q., 1990. *Qualitative Evaluation and Research Methods*. Sage Publications, New York.
- Penrose, E., 1959. *The Theory of the Growth of the Firm*. Oxford University Press, Oxford.
- Reed, M.S., Bonn, A., Slee, W., Beharry-Borg, N., Birch, J., Brown, I., Burt, T.P., Chapman, D., Chapman, P.J., Clay, G.D., Cornell, S.J., 2009. The future of the uplands. *Land Use Policy* 26, S204–S216.
- Richardson, D., 2005. How can agricultural extension best harness ICTs to improve rural livelihoods in developing countries. *ICT Agric. Perspect. Technol. Innovation* 14.
- Rickard, S., 2012. *Liberating Farming from the CAP*. IEA Discussion Paper, No. 37. Institute of Economic Affairs, London.
- Rogers, E.M., 2010. *Diffusion of Innovations*. Simon and Schuster, New York.
- Salemink, K., Strijker, D., Bosworth, G., 2015. Rural development in the digital age: a systematic literature review on unequal ICT availability, adoption, and use in rural areas. *J. Rural Stud.* (published online 25-9-2015) <http://dx.doi.org/10.1016/j.jrurstud.2015.09.001>.
- Shucksmith, D.M., Brydon, J., Rosenthal, P., Short, C., Winter, D.M., 1989. Pluri-activity, farm structures and rural change. *J. Agric. Econ.* 40, 345–360.
- Seuneke, P., Lans, T., Wiskerke, J.S., 2013. Moving beyond entrepreneurial skills: key factors driving entrepreneurial learning in multifunctional agriculture. *J. Rural Stud.* 32, 208–219.
- Suess-Reyes, J., Fuetsch, E., 2016. The future of family farming: a literature review on innovative, sustainable and succession-oriented strategies. *J. Rural Stud.* 47, 117–140.
- Sutherland, L.A., Toma, L., Barnes, A.P., Matthews, K.B., Hopkins, J., 2016. *Agri-environmental diversification: linking environmental, forestry and renewable energy engagement on Scottish farms*. *J. Rural Stud.* 47, 10–20.
- Townsend, L., Sathiseelan, A., Fairhurst, G., Wallace, C., 2013. Enhanced broadband access as a solution to the social and economic problems of the rural digital divide. *Local Econ.* 28, 580–595.
- van der Ploeg, J.D., 1994. Styles of farming: an introductory note on concepts and methodology. In: de Haan, H.J., van der Ploeg, J.D. (Eds.), 1991. *Endogenous Regional Development in Europe*. Vila Real, Portugal. And in: Born from within., J.D. van der Ploeg, J.D. and Long, A., Editors, 1994. *Practice and perspectives of endogenous rural development*, Van Gorcum, Assen.
- Veidal, A., Flaten, O., 2014. Entrepreneurial orientation and farm business performance: the moderating role of on-farm diversification and location. *Int. J. Entrepreneursh. Innovation* 15, 101–112.
- Venkatesh, V., Davis, F.D., 2000. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Manag. Sci.* 46, 186–204.
- Vesala, K.M., Peura, J., McElwee, G., 2007. The split entrepreneurial identity of the farmer. *J. Small Bus. Enterp. Dev.* 14, 48–63.
- Vesala, K.M., Pyysiäinen, J., 2008. *Understanding Entrepreneurial Skills in the Farm Context*. Final Report, European Union Framework Programme 6: ESoF Developing Entrepreneurial Skills of Farmers. Research Institute of Organic Agriculture, Frick, Switzerland.
- Vesala, H.T., Vesala, K.M., 2010. Entrepreneurs and producers: identities of Finnish farmers in 2001 and 2006. *J. Rural Stud.* 26, 21–30.
- Wales Rural Observatory, 2011. *Report on Farmers' Decision Making*. <http://www.walesruralobservatory.org.uk/sites/default/files/Farmers%27%20Decision%20Making%20Final%20Report.pdf> (Accessed 1 September 2016).
- Warren, M., 2004. Farmers online: drivers and impediments in adoption of internet in UK agricultural businesses. *J. Small Bus. Enterp. Dev.* 11, 371–381.
- Welsh Assembly Government, 2007. *Rural Development Plan for Wales: 2007–2013*. Welsh Assembly Government, Cardiff.
- Welsh Government, 2013. *Welsh Agricultural Statistics 2012 and 2013*. Welsh Government, Cardiff.
- Welsh Government, 2014. *Rural Development Programme: 2014–2020*. Welsh Government, Cardiff.
- Wilson, G.A., 2008. From 'weak' to 'strong' multifunctionality: conceptualising farm-level multifunctional transitional pathways. *J. Rural Stud.* 24, 367–383.
- Winter, M., Lobley, M. (Eds.), 2009. *What Is Land for? The Food, Fuel and Climate Change Debate*. Earthscan, London.
- Yin, R.K., 1989. *Case Study Research: Design and Methods*, revised edition. Sage Publications, Newbury Park, CA.