REFEREED ARTICLE

The future contribution of bioenergy enterprises to rural business viability in the United Kingdom

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ABSTRACT

Bioenergy enterprises have been granted an official role in the UK in order to make a significant contribution to sustainability targets and yet our understanding of attitudes amongst farmers and rural entrepreneurs to these enterprises is yet to be fully understood. Financial support, electricity tariffs, the availability of advice and the profit foregone from other enterprises have all fluctuated. The level of adoption of the new technology is not as advanced as in other EU countries. This study seeks to discover why this could be by exploring the entrepreneurial, financial and motivational environments that bioenergy adopters are working in. The following hypotheses have been developed:

1. The entrepreneurial environment for bioenergy development in the UK is sympathetic to the needs of this emerging industry;
2. Adopters of bioenergy are positively motivated towards the venture; and
3. Farm based bioenergy enterprises make a positive contribution to overall farm business viability.

The UK government is looking to rural entrepreneurs to play a role in this through the adoption of bioenergy technologies which can contribute towards achieving the country's energy and climate change targets and at the same time offer potential farm enterprises that could be viable long-term contributors to farm enterprise sustainability (NFU, 2008). This study extends and applies the concepts of entrepreneurship environment and country institutional profiles to a specific domain of entrepreneurship in the land based bioenergy sector in the UK.

KEYWORDS: Bioenergy; entrepreneurship; entrepreneurial environment; viability; renewable energy

1. Introduction and literature review

Recent research outputs from the field of bioenergy have been many and this literature review contains a number of the most important papers that have been published of relevance to the UK. The institutional profile for entrepreneurship in the renewable energy sector is also considered and an examination of both themes leads to the formation of research objectives and hypotheses. The overall research objective is to identify variables that explain the behaviour of UK farmers and to construct a theoretical or conceptual framework to support research that explains the adoptive or non adoptive nature of the behaviour of UK farmers with respect to renewable energy (RE) enterprises. This paper is structured in four sections commencing with a detailed introduction and review of literature, followed by the conceptual framework and methodology where the findings from the literature review are summarised and the hypotheses formed, the knowledge gap is determined and the plan for the fieldwork is made in order to test the hypotheses. The pilot survey results are shown and discussed in the third section of the paper and this is followed by the conclusion.

The UK Government has formally recognised the need for a reduction in the climate changing impact of energy consumption. A number of environmental targets have been defined: to reduce the emissions of CO_2 by 80% by 2050 with a 26% reduction in CO_2 by 2020 together with the production of 10% of transport fuel; 12% of heat; and 30% of electricity from renewable sources (CCA, 2008, DECC, 2010). The Government is looking to the rural sector to play a substantial role in these developments (DEFRA, 2007; NFU, 2008) and RE is potentially an important opportunity that might become a viable long-term contributor to farm business sustainability. However it should also be noted that some RE technologies such as biomass and Miscanthus potentially involve an increased risk to the farmer. Typically there is the fixed capital expenditure on plant to handle the crop, combust it and on the rhizomes themselves, plus the potential prospect of committing land to a 15–20 year single enterprise use. There is also the inconsistent nature of the value of bioenergy outputs and government support payments. Thus it can be seen that although there is potential to increase farm business sustainability this might not be realised for all adopters.

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In the face of a decline in traditional agricultural support with pending CAP reform, production and income alternatives for farmers appear attractive. Plieninger (2006) has argued that bioenergy represents the most outstanding alternative for traditional agricultural production. Through bioenergy production, farm businesses may then be stabilised; production diversified and farmers remain in the business of farming, acknowledging that along the same timeline of bioenergy adoption it is likely that farmers will also have to adjust to climate change (Tate et al, 2010).

There are increasing concerns about the low level of adoption of bioenergy in the farm sector in the UK suggesting that government objectives might not be met (Sherrington et al., 2008). The UK Biomass Strategy suggests that to reach the technical potential of perennial energy crops such as short rotation coppice (SRC) willow and Miscanthus by 2020 will require 350,000 hectares of land. This represents a more than 20-fold increase on the current 15,546 hectares currently devoted to biomass in the UK (Sherrington and Moran, 2010 In Press). There is little agreement amongst scholars on the reasons for this limited deployment in the farm sector (Perry and Rosillo-Calle, 2008, Pollitt, 2010, Thornley and Cooper, 2008) and the need to more fully understand and model the processes and consequences of farmers' decisions remains (Willock et al., 1999). Researchers have argued that adoption is not merely a question of relative profitability of different systems, but also reflects the lifestyle decisions of producers and so any analysis which confines itself to farm level financial measurements will be missing important factors (Burton et al., 1999; Willock, 1999; Wallace and Moss, 2002; Greenbank, 2001).

One objective of farm diversification from the farmers' perspective is to enhance farm incomes and ensure the sustainability of the business (Plieninger, 2006; Ilbery et al., 2009). Policy makers are advocating a more entrepreneurial approach to farm business management because of its likely positive effects on business profitability and sustainability. What is known is that farmers, for whatever reason often find it difficult to be entrepreneurial (Tate, 2010) Unfortunately, there has been little research based upon entrepreneurs who own bioenergy enterprises, what motivates them to engage and what contribution to business viability and sustainability bioenergy might be making given that farmers have rarely been an empirical setting for entrepreneurship research (Carter, 1998, Carter, 2001, Sara and Rosa, 1998).

Vesala et al. (2007) studied the entrepreneurial identity of non farming and farming entrepreneurs. They concluded that portfolio farmers showed strong entrepreneurial traits including personal control, risk taking, innovativeness and a positive orientation towards the growth of their businesses. This was quite similar to non farming entrepreneurs. Carter (Carter, 2001) differentiated between monoactive, diversified and portfolio farmers. Alsos et al. (2003) categorised farmers as being pluriactive when they or their family members carried out non farming income earning activities. Thus it might be argued that farmers' interaction with the institutional environment will differ, in terms of their motivations and objectives, their appraisal of the business environment and the type of bioenergy investments and strategies that they will engage in. It has been suggested from a number of research projects that the targeting of Government policies towards RE would be enhanced if policy makers were more aware of these characteristics in farmers (Rosenqvist et al., 2000; Sara and Rosa, 1998; Alsos et al., 2003).

Researchers have often found that farmers are aware of and respond to internal and external factors in the operation of their businesses (Bowler et al., 1996; Barlas et al., 2001; Maye et al., 2009). This suggests that attention to these factors could reward Government and policymakers.

According to these authors, these factors permit farmers to adopt capital accumulation (expansion or profit maximisation) or economic survival strategies. Farmer's decisions to exploit their lands for bioenergy were dependent on economic factors (input and output prices), expected yields, timeliness of operations, availability of investment capital, subsidies and other socio cultural characteristics of farmers (Bokusheva et al. 2007, Rounsevell and Reay, 2009).

Gnyawali and Fogel (1994), Fogel (2001) and Zapalska et al. (2003) conceptualised five issues which affected entrepreneurial behaviour including: (i) government policies and procedures; (ii) socioeconomic conditions; (iii) entrepreneurial and business skills; (iv) financial assistance and (v) non-financial assistance.

Institutions and the policies that shape them appear to determine the allocation of farmers' entrepreneurial decisions. If entrepreneurial decisions are to be applied to productive investments, policy strategies need to be tailored to the institutional context of each economic region (Minniti, 2008). An assumption that is made in this study is that institutional dimensions affect the attitudes and intensions of entrepreneurs in the venture creation process (Fogel, 2001; Wallace and Moss, 2002; Willock et al, 1999; Burton et al., 1999).

Table 1: Internal and external factors affecting farm business operation

Internal factors	External factors
1. changing farm profitability	1. regulation by the state
2. employment status	2. market trends and opportunities
3. family size and family life course	3. availability of new technologies
4. pressures on farm incomes	4. physical environment
5. characteristics of those who run the farms	5. social trends
6. farm management experience	6. behaviour of agricultural support organisations
	7. location

Source: adapted from (Bowler et al., 1996; Barlas et al., 2001; Maye et al., 2009).

The **regulatory** pillar of the institutional theory of entrepreneurship is primarily driven by the provisions of government legislation, industrial agreements and standards; (Bruton et al., 2010). Busenitz et al. (2000) define this as consisting of laws, regulations and government policies which provide opportunities, support for businesses, reduces risks and assists the entrepreneurial effort to acquire productive resources.

The UK Biomass Strategy published in May 2007 (DEFRA, 2007) was presented as meeting the need for a coherent strategy for bioenergy deployment in the UK (Slade et al., 2009).The Renewables Obligations (RO) has been the main UK government policy instrument to support the development of RE since 2002. This is a system of tradeable permits or renewable obligations certificates (ROCs) that yield a revenue stream for RE producers. After years of its operation, it has been acknowledged (DECC, 2010) that the RO was not designed with small projects in mind. The RO favours mainly electricity based technologies while non-electricity technologies are disfavoured (Mitchell and Connor, 2004). Pollitt (2010) concluded that the real failure of the UK policy has been to gain practical support from investors while other instruments like the renewable transport fuel obligation, the climate change levy and the EU trading schemes have achieved very little impact.

Non financial assistance refers to any form of sponsorship provided to create an environment that is favourable to the creation and survival of businesses (Flynn, 1993). At creation, non financial assistance may help facilitate access to other types of resources needed by the nascent entrepreneur. Many organisations have emerged with the objective of providing non financial assistance to farmers interested in renewable energy in the UK. These include public and private sector organisations. The most prominent are government departments: Department for Environment, Food and Rural Affairs, Department of Energy and Climate Change; non departmental public bodies: Environment Agency, Research Councils and quasi autonomous government agencies: Carbon Trust, Energy Saving Trust and Ofgem (Slade et al., 2009). It might be expected that the more assistance farmers have, the more they will engage in renewable projects. Non financial assistance enhances the human, social and financial capital of entrepreneurs (Jenssen and Havnes, 2002). This has stopped short of widely available free business specific consultancy which has not been available to farmers and other rural entrepreneurs for some time.

Table 2: A timeline of key policy instruments in the UK

Year	Policy initiative
1989	Deregulation and Non Fossil Fuel Obligation (NFFO) set
1997	Government encouragement for biofuels
1998	Investment subsidies
2001	Carbon tax
2002	Renewables Obligation
2002	Capital grants
2010	Feed in tariffs

Source: adapted from Thornley and Cooper (2008 p. 908) and DECC (2010)

Table 3: Reasons for public opposition to a renewable energy project in Devon, UK

Major concern	Response
Haulage lorry traffic congestion	93%
Haulage lorry air pollution	86%
Credibility of the developer	85%
Air pollution	85%
Visual appearance of the community	84%
Odour	82%
Wastes	82%
Technological reliability	79%

Source: Upham and Shackley (2007)

The ability of the entrepreneur to put together financial resources is very important for the commencement, growth and subsequent survival of any business (Alsos et al., 2006). Financial incentives are particularly relevant for renewable energy deployment because they offer the possibility for farmers to carry out farm investments which might not be justified by purely potential economic returns. Incentives are also valid considering that the initial investment for Renewable Energy Technologies (RETs) is usually costly and of a capital nature. In effect, most countries involved in the promotion of this type of energy employ some form of financial support. This includes capital grant schemes and subsidies (DECC, 2009a), feed in tariffs (Campoccia et al., 2009), tax credits (Dautzenberg and Hanf, 2008), low rate loans (German Federal Ministry for the Environment Nature Conservation and Nuclear Safety, 2009); net pricing and net metering (Talavera et al., 2010). Most of the financial support is derived via government agencies (Pollitt, 2010).

Access to resources enhances the ability and willingness of entrepreneurs to invest (Fogel, 2001). It is estimated that between 2005 and 2008, the UK government support for RETs was estimated at about £8.5bn[2]. This covered subsidies and grant schemes, research and development and other support services (Pollitt, 2010). These investments are thought to have had limited impact (Thornley and Cooper, 2008) but this has not discouraged the provision of other grant schemes aimed at promoting RETs uptake (DECC, 2009a; DECC, 2009b, DECC, 2010). Additionally, energy generators receive support when they meet their renewable energy quotas in the form of ROC recycled funds (Ofgem, 2009) as well as guaranteed feed in tariffs for units of heat and electricity generated and used or sold to the national grid (DECC, 2010). Increasing oil prices and low prices for conventional agricultural commodities have made the production of biomass for electricity, heat and fuel production very interesting for farmers compared to the production of conventional agricultural products (Tharakan et al., 2005). However, recent increases in world commodity prices and most notably wheat and other grains have altered the perception of attractive financial returns to energy crop farmers. In mitigation it has been found that the security and stability of income from bioenergy contracts has been a positive feature of renewable energy production (Sherrington and Moran, 2010 In Press). Development

[2] At mid-October 2011 £1 sterling was equivalent to about $US 1.6 and €1.16.

of bioenergy projects is almost always accomplished at the level of the individual farm business, often run by a sole trader or partnership. Although this has the merit of organisational simplicity, seldom is the business risk or borrowing spread over more than one or two individuals. As a result, the type of cooperative fuel processing and burning plants and district heating systems seen in some European countries are not commonly available in the UK. This clearly is an issue that increases business risk for bioenergy participants and tends to add to the capital required for UK bioenergy ventures.

There are increasing concerns amongst land owners that red tape and regulation could make microgeneration unaffordable (Country Land and Business Association, 2010). It has been argued that entrepreneurs can be discouraged from investing if they have to comply with too many rules and procedural requirements, are expected to report to a wide range of institutions and have to spend a substantial amount of money and time on what is seen as 'red tape' (Soto, 2000 cited by Bruton et al. 2010). Any lack of familiarity with the different support mechanisms and an increased perception of risk is likely to make RE a less attractive proposition for investors (Connor, 2003). Knowledge of the views of entrepreneurs with regards to their experiences of public support and their need for such support has been very limited (Normann and Klofsten, 2009).

The **cognitive** pillar of the institutional theory has been defined as the knowledge and skills possessed by people in a country pertaining to the creation and operation of a new business (Manolova et al., 2008). This dimension can therefore operate at the individual level and influences the ability of the entrepreneur to invest. Recent trends in the agricultural landscape in Europe (globalisation, increasing energy prices, the CAP reform, recession, etc) have increased demands on the skills required by farmers to succeed in their activities. It is desirable that farmers acquire skills additional to those needed for primary production, in areas such as marketing, personnel management, communications and to realise new business opportunities (Rudman, 2008). Skills are defined as the "competencies required to accomplish tasks and activities related to the farm business which can be acquired by learning and experience" (De Wolf and Schoorlemmer, 2008). These skills are categorised into professional, management, opportunity, strategic, and cooperation/networking skills. These are the intangible resources embedded in the enterprise (Mc Elwee, 2008).

De Wolf and Schoorlemmer (2008) suggested that skills are required to follow cost reduction, value adding and diversification strategies as a response to the environmental context in which farms operate. In this sense, entrepreneurial skills are needed to enhance farm survival and at the same time, take advantage of opportunities that are created by the changing farm context (Vesala and Pysysiainen, 2008). The personal experience, knowledge, education, and training are the human resources which business founders bring to the enterprise (Rotefoss and Kolvereid, 2005). Firms are also able to improve on their human resource or social capital through capacity building and advice (Mole and Keogh, 2009).

Renewable energy technologies are new and demand new skills from farmers who are interested in investing in them or those that adopt them (Sherrington and Moran, 2010 In Press). Investments can be increased by improving the capacities of managers to handle these new activities (Bokusheva et al., 2007). Ernst (1999) showed that new energy technologies required managerial skills and farmers needed to stay updated to keep their projects in operation.

Domac et al. (2004) and Domac et al. (2005) found that a common constraint for bioenergy development in the EU was inadequate information and awareness among stakeholders in the economy, society and politics. A lack of awareness of the numerous advantages of biomass and bioenergy and their consequent poor acceptance has often been highlighted as an important disincentive for their use and adoption (NFU, 2005). One major challenge for the agricultural sector is to enable farmers to have access to information and develop entrepreneurial skills (Vesala et al., 2007). Skills and knowledge are also needed on: (i) how to legally protect a new business; (ii) how to deal and manage risk as well as (iii) where to find information about markets for their products (Busenitz et al., 2000). Farmers need trusted, clearly independent, practical and specific information at an individual farm level to help them make investment decisions and take on new ventures. Research can provide an understanding of the information and skills needs of entrepreneurs (Sherrington et al., 2008).

The **normative** pillar of the administrative theory of entrepreneurship refers to the degree to which residents of a country admire entrepreneurial activity and appreciate creative and innovative thinking (Kostova, 1997). The normative pillar also exerts influence because of the social obligation to comply, rooted in social necessity, in what an organisation should be doing. They are typically made up of values and norms, what is preferred and how things are to be done in line with the accepted values (Bruton et al., 2010). The normative pillar represents actions that organizations and individuals ought to take – behaviors that may not be rational in the economic sense but which individuals' think of as good nonetheless (Bruton et al., 2009).

With literature on institutional environments largely focused on the regulatory dimension, there is relatively little written on the normative dimension (Manolova et al., 2008). It is argued that a supportive normative environment is one in which: (a) entrepreneurship is admired; (b) society appreciates innovative and creative thinking as a route to success and (c) turning ideas into business is admired as a career path by society (Busenitz et al., 2000). Estay (2004) asserted that rapid entrepreneurial development in countries like the United States was partly explained by the fact that people who started and ran their enterprises were highly admired and entrepreneurship was considered as a career path and a route to success.

Micro-businesses generally pursue a number of economic and non-economic objectives relating to factors such as income levels, job satisfaction, working hours, control and flexibility. These objectives are derived from the individual's social and economic contexts (Greenbank, 2001). Sutherland (2010) noted that farm viability as a personal goal directly reflected

farm community norms: that there is a social stigma attached to failure to maintain a successful farm. Estay (2004) noted that networks and family as well as the existence of strong links with those in the same sector gave confidence to the entrepreneur with his progress towards business creation. Zhang and Wong (2008) proposed that networks are particularly important in areas of weak institutions. These social and market networks may be formal or informal in nature improving access of the entrepreneur to valuable resources needed for the venture – connections, finance, counselling and advice, and legitimacy. Otherwise stated, networks help to reduce market failures facilitating the activities of actors.

According to Roos et al (1999), there is a social dimension of bioenergy choice and social structures such as status, solidarity and conflicts influence the development of a bioenergy market. Social criteria have been consistently identified as being decisive in making bioenergy projects viable (Buchholz et al., 2009). Also, many farmers think that the production of bioenergy is fundamentally a "good" thing and it was widely thought that it could be a strong incentive for energy production in the future (Sherrington et al., 2008).

There appears to be a need for research concerning the experiences of UK farmers who have adopted or are considering the adoption of RE enterprises. With some of the research reported in this paper a period of time has elapsed which has coincided with a change in the business environment within which potential RE adopters are operating. There is no published research that applies the administrative theory of entrepreneurship to UK farmers which the authors of this paper are aware of. This paper seeks to apply the principles of the regulatory, cognitive and normative pillars of the administrative theory of entrepreneurship to a sample of farmers in the West Midlands with the assistance of the regional office of the NFU. As a result of this literature review and following the identification of the knowledge gap with respect specifically to RE enterprises and UK farmers the following hypotheses have been developed:

H1: The entrepreneurial environment for bioenergy development in the UK is sympathetic to the needs of this emerging industry;
H2: Adopters of bioenergy are positively motivated towards the venture; and
H3: Farm based bioenergy enterprises make a positive contribution to overall farm business viability.

2. Proposed conceptual framework for the study and methodology

Upreti and van der Horst (2004) studied the causes and consequences of public opposition to the development of the North Wiltshire Biomass Energy plant. The authors suggested that when an external development process posed threats on the values and expectations of people, they developed mistrust - mistrust increased if the benefits of the proposed project were not clear to the local people. Upham and Shackley (2007) assessed local opinion to a proposed biomass gasifier in Devon

In another study of conflicts over biomass energy development in England and Wales, the Arable Biomass Renewable Energy project (ARBRE), the North Wiltshire Biomass Power Plant (NWBPP) and the Newbridge Integrated Wood Processing Plant were studied (Upreti, 2004). Two contrasting attitudes from the community and developers were observed: the 'Not In My Back Yard (NIMBY)' attitude by the locals and the 'There is No Alternative (TINA)' attitude of developers. Negative public opinion is a strong disincentive for renewable energy deployment especially when enterprises create negative externalities. This is very likely to affect the willingness of any investor interested in such a venture.

Rural entrepreneurship researchers have advised on the need to clearly determine the unit of analysis in studies of the agricultural sector (McElwee, 2005; 2006 and Carter, 2001). This is because farmers are considered to be entrepreneurially active individuals and directing the strategy of the businesses that they are responsible for (McElwee, 2008). McElwee and Smith (2010) suggested that there is a need to determine whether the unit of analysis is the farmer or the farm. In this study, we are interested in the farmer and the farm.

Kostova, Busenitz et al. and Manolova et al. measured constructs of the institutional environment as they affected the domain of entrepreneurship as a whole at the macro level. In this study, we seek to apply the dimensions to the farm sector. This micro institutional view differs from the macro-institutional perspective.

The conceptual framework is a model that combines the three pillars of the institutional theory of entrepreneurship with the elements for the determination of the new venture creation process, giving rise to the entrepreneur's decision to either adopt or not to adopt a new enterprise. In this case it is being applied to RE enterprises, although it could be applied to any new enterprise or business venture.

The conceptual framework proposed to be employed is shown in Figure 1 below:

The conceptual framework has been produced from the findings of the review of literature and these are combined and provide the basis for testing the hypotheses as follows:

Hypothesis 1 will be tested by the questions in sections 1, 2 and 3 of the questionnaire. The questions in these sections focus on the regulatory, cognitive and normative dimensions respectively of the institutional environment of the conceptual framework.
Hypothesis 2 will be tested by the questions in sections 4, 5 and 6 of the questionnaire and the focus of this part of the research is on the sections of the conceptual framework that deal with the venture creation process and the farmers' decision for or against the adoption of RE.
Hypothesis 3 will be tested in the qualitative or case study phase of the research which will be forthcoming in 2013.

The study area is the West Midlands Region of the UK. This is because the region is quite accessible to the researcher. Also, this region is a possible lead region for bioenergy (DEFRA, 2010). By considering areas of potential bioenergy production the study could be more relevant than a nationwide study (Sherrington and Moran, 2008).

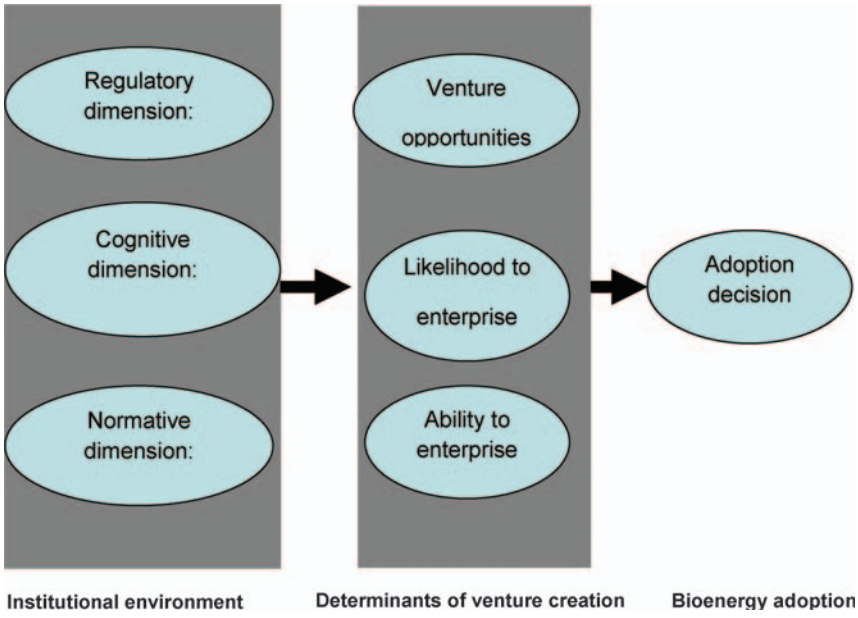

Figure 1: Proposed conceptual framework
Source: adapted from Kostova, 1997; Busenitz et al., 2000; Lim et al., 2010; Gnyawali and Fogel,1994.

The study will be undertaken in three stages, these being:

Pilot study

The original intention of the pilot survey was to interview a sample of nine farmers; three RE adopters, three who have weighed up the options and decided not to adopt and three others who were yet to consider RE. It was felt that farmers in these categories would be best placed to participate in the pilot. A draft questionnaire was used and the results from this pilot survey are reported below.

Quantitative phase

The survey of a statistically significant stratified sample of farmers was carried out after the pilot survey. The National Farmers' Union West Midlands Regional Office were happy to cooperate with this project and consequently a sample of 2000 members of the West Midlands Region, including the counties of Staffordshire, Shropshire, Herefordshire, Worcestershire and Warwickshire were surveyed in February 2011. The response from the sample was 402 completed questionnaires, of which 395 were useable, representing a response rate of 20.1%. The results from this sample are currently being examined using a variety of approaches including factor analysis.

Qualitative Phase

The intention is to sample examples of a selection of RE enterprises, including solar, biomass, anaerobic digestion, wind and hydro and to undertake a set of detailed financial case studies that assess both the capital investment and annual transactions that go to make up overall enterprise financial viability. The qualitative research phase will deal with case studies sampled from the quantitative phase. This phase of the research will employ DCF/IRR techniques to assess potential investment viability. The unit of analysis here is the RE enterprise.

Based on these results and the key explanatory variable of the quantitative research, a predictive capital decision making model for the bioenergy sector is foreseen comprising of both qualitative and quantitative business drivers which will explain the financial viability of farm based enterprises. This model should provide a basis for policy formulation as well as serve as an investment decision tool for rural entrepreneurs as potential adopters. There are well established financial assessment methods for evaluating the viability of energy technologies (Ericsson et al., 2009). These methods consider profit maximisation as the main objective behind farmers decisions to adopt (Sherrington and Moran, 2010 In Press) even though there is strong evidence that farmers often pursued a multitude of objectives and not only profit maximisation (Greenbank, 2001, Wallace and Moss, 2002 and Willock et al., 1999).

3. Pilot survey results

The pilot survey was carried out in order to develop a valid and reliable postal survey instrument for the quantitative phase of the study. Originally it was hoped that nine farmers would participate and these were randomly sampled from the category 'farmers' in the West Midlands from the website Yell.com, however two found that they could not in the end participate and seven farmers were finally interviewed. The pilot sample included some who had adopted RE, some who had considered RE and decided not to adopt the technology and others who were yet to consider it. Results of the pilot survey suggested that key issues could be grouped into six main headings: (1) Regulatory and government, (2) Normative and social acceptability, (3) Information, knowledge and cognitive skills development, (4)

Farmers attitudes towards RE, (5) Motivations conducive to RE investment, and (6) Barriers to RE investment, resources and self efficacy. The draft questionnaire contained questions on these main areas and this was followed by a section designed to elicit demographic information. The questionnaire consisted of questions that sought to elicit two main types of responses. There were those that required a scale response from the interviewee and these responses were coded by way of the use of Likert scales. There were also open ended and semi-open ended questions that were used to collect information that required the interviewee either to compose a short sentence or to select a category within which the appropriate response was contained such as the question on farm type which was in Section 7 on Farm Business Characteristics. The pilot was administered by visiting the seven pilot survey participants and requesting that they complete the proforma under the supervision of the researcher, voicing any concerns they might have about what appeared to be confusing or ambiguous terminology. These observations were recorded and taken back for consideration and reflection with the project supervisor. Slight amendments were made, including a shortening of the survey from seven pages to six with the final survey instrument being dispatched by Royal Mail in February 2011 with a deadline for completion as March 14 2011 if participation in a draw was to be guaranteed. The final questionnaire is at Appendix 1.

4. Conclusion

This paper has developed a conceptual framework to progress the study of the potential contributions of bioenergy to farm business sustainability in the West Midlands of the UK and proposed a methodology to realise the study. The research is likely to show that the low level of adoption of RE enterprises and especially bioenergy on land based enterprises in the UK will be explained by variables in the regulatory, cognitive and normative dimensions of the country institutional profiles of entrepreneurship (Busenitz et al 2000). These variables affect the venture creation process and the farmers' decision to adopt bioenergy technology rests on his assessment of the opportunities offered by the institutional fabric, the willingness to enterprise and the ability for enterprise.

The qualitative phase of the research will investigate the financial viability (Turner and Taylor 1998) of a wide range of potential farm enterprises in the renewable energy sector and to construct web-based computer software that farmers can use to forecast enterprise viability. In this paper both a framework and a methodology are proposed to investigate the interaction between farmers and the institutional environment. Mitchell et al. (2000) suggested that such a combination of concepts from entrepreneurship cognition research and institutional theory provided finer grained explanations for entrepreneur's venture creation decisions. This paper has argued that this novel, selective approach is more comprehensive than other established approaches used to study adoption of bioenergy on farms in the UK (Sherrington et al., 2008, Sherrington and Moran, 2008).

Bioenergy technologies and their adoption is claimed to be of increasing importance (DEFRA 2007, NFU, 2008) by the UK government and as a result has become worthy of detailed study. Nevertheless UK farmers and rural entrepreneurs are not in the strongest competitive position, faced with irregular policy changes that impact upon adopters and most importantly potential adopters, the lack of a developed cooperative infrastructure which might spread risk and an underdeveloped bioenergy engineering industry. On top of these constraints there is the current difficulty in sourcing funds for capital investment generally due to the ongoing effects of the 2008 banking crisis and widespread and complex planning controls, which might be expected on the relatively densely populated mainland of the UK. We must also be mindful that there is the UK government's new found enthusiasm for nuclear energy that will come on stream from 2017 onwards, possibly in the long term raising questions in the future about the viability and acceptability of alternative sources of energy production.

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Appendix 1: Final Quantitative Phase Questionnaire

UNIVERSITY OF WOLVERHAMPTON BUSINESS SCHOOL

With the assistance of

NFU The Voice of British Farming

RESEARCH TITLE:
RENEWABLE ENERGY AND THE FARMER: A VIABLE BUSINESS PROPOSITION?

Introduction:

Faced with the challenge of climate change, renewable energy could be an important option to mitigate climate change and it may also prove to be a profitable farm business diversification. We'd like to learn more about the reasons why farmers find adoption of these technologies challenging.

Only a small proportion of the NFU membership has been randomly selected to participate, so your experiences and thoughts on the subject are very important. Please help us by answering the questions to the best of your ability. As an incentive, we will offer Marks and Spenser (M&S) **vouchers worth fifty (£50) pounds** each to three farmers returning their completed questionnaires by **March 14, 2011**.

The results of the study will document the factors which help or hinder uptake of renewable technologies by farmers in the West Midlands. It will also help us to understand the motivations behind the decision to invest (or not) in renewables.

The questionnaire should take about 25 minutes to complete. We are aware that Spring is fast approaching and you should be getting very busy. We hope you could find time within your very busy schedule to help complete it. Please kindly return the completed questionnaire to me by March 14, 2011 in the enclosed freepost envelope.

If you have any questions or would like further information, please do not hesitate to telephone me on 01902323863 or email me at a.mbzibain@wlv.ac.uk. **I am grateful for your kindness, and thank you for your generous help in completing this questionnaire to help me with my postgraduate research.**

(1) Please tick here to indicate that you have understood the purpose of this study ☐

(2) Please tick here to indicate that your participation in this study is completely voluntary ☐

(3) If you would love to take part in the draw to win a £50 M&S voucher, please tick here ☐

(4) If you would like to receive a summary of the research findings please provide me an email address:

_____

SECTION 1: RENEWABLE ENERGY (RE) REGULATIONS AND POLICIES

For each of the following statements, **please tick ✓ the box** that matches your view most closely.

1.1 Government and council support	Strongly disagree ⇨		Unsure	⇨	Strongly agree
Government organisations assist farmers to start RE enterprises	❑1	❑2	❑3	❑4	❑5
Government sponsors organisations that help farmers invest in RE	❑1	❑2	❑3	❑4	❑5
Current policies encourage farmers to adopt RE on their farms	❑1	❑2	❑3	❑4	❑5
Councils provide support for farmers who want to set up RE on farms	❑1	❑2	❑3	❑4	❑5
Government grants are accessible for farmers starting RE enterprises	❑1	❑2	❑3	❑4	❑5
Banks have funds available for farmers for starting RE enterprises	❑1	❑2	❑3	❑4	❑5
1.2 Procedures to set up renewable energy enterprises					
Farmers have to comply with too many procedure requirements	❑1	❑2	❑3	❑4	❑5
Procedures for grid connection **discourage** farmers from generating RE	❑1	❑2	❑3	❑4	❑5
Local council planning procedures **discourage** farmers to invest in RE	❑1	❑2	❑3	❑4	❑5

SECTION 2: STANDING OF ENTREPRENEURS, PUBLIC PERCEPTION AND SOCIAL NORMS

For each of the following statements, **please tick ✓ the box** that matches your view most closely.

2.1 Standing of entrepreneurs/ public perception	Strongly disagree ⇨		Unsure	⇨	Strongly agree
People in the UK tend to admire those who start their own businesses	❑1	❑2	❑3	❑4	❑5
Farmers with successful businesses are admired	❑1	❑2	❑3	❑4	❑5
People **do not** have a favourable attitude towards renewable energy	❑1	❑2	❑3	❑4	❑5
People in the UK care a great deal about climate change	❑1	❑2	❑3	❑4	❑5
2.2 Social norms					
Because of climate change, investing in RE is a moral obligation	❑1	❑2	❑3	❑4	❑5
Most people that I look up to for advice think it is good to invest in RE	❑1	❑2	❑3	❑4	❑5

SECTION 3: PUBLIC AWARENESS, INFORMATION AND TRAINING PROGRAMMES

For each of the following statements, **please tick ✓ the box** that matches your view most closely.

3.1 Public awareness, information and training	Strongly disagree ⇨		Unsure	⇨	Strongly Agree
Most farmers know where to find relevant information about RE	❑1	❑2	❑3	❑4	❑5
Farmers are familiar with the government financial support mechanisms/packages available to them	❑1	❑2	❑3	❑4	❑5
There many training programmes for farmers on RE topics	❑1	❑2	❑3	❑4	❑5

SECTION 4: PERCEPTIONS ON RENEWABLE ENERGY BUSINESS OPPORTUNITIES

For each of the following statements, **please tick ✓ the box** that matches your view most closely.

4.1 Your perceptions on RE business opportunities	Strongly disagree	⇨	Unsure	⇨	Strongly agree
a) There are new market opportunities in RE if I want to exploit them.....	❑1	❑2	❑3	❑4	❑5
b) RE can help improve the economic success of my business.....	❑1	❑2	❑3	❑4	❑5
c) Renewable energy production is not a viable option compared to my existing farm business activities	❑1	❑2	❑3	❑4	❑5
d) If I start a RE enterprise it will help me achieve other important non economic goals in my life	❑1	❑2	❑3	❑4	❑5

SECTION 5: INTENTION AND DECISION-MAKING

For each of the following questions, please **tick** ✓the box that matches your view most closely.

5.1 (a) Have you already adopted any form of renewable energy enterprise on your farm?

Yes..... ❑1 No..... ❑2 **➔IF NO, PLEASE SKIP TO QUESTION 5.2 ON THE NEXT PAGE**

b) If yes, when did you set it up? (*Please write the year*) _____

c) What was the source of funding for this project? Please **tick ✓all** the appropriate boxes.

Bank ❑1 Government grant/subsidy ❑2 Personal Savings ❑3 Business ❑4 Other_____

d) Kindly indicate which type (s) of renewable energy enterprise (s) you have adopted? *(You can tick more than one)*

Miscanthus..... ❑1 Short rotation coppice.. ❑2 Combine heat power..... ❑3
Wind turbine.....❑4 Anaerobic digesters..... ❑5 Woodchip/biomass pellet production.... ❑6
Biomass boiler..❑7 Solar.....❑8 Other ..... ❑9

e) To what extent has the adoption of the enterprise contributed to your farm business performance?

Highly deteriorated	Deteriorated	Remained the same	Slightly Improved	Significantly improved
❑1	❑2	❑3	❑4	❑5

f) In comparison to your conventional farming activities, what proportion of your total farm income was derived from the renewable energy enterprise (s) in 2009 (IF AT ALL)? _____ %

g) Can you kindly indicate the level of contribution of the RE enterprise to your total farm income in 2009?

Not sure.. ❑1 £ 0 ❑2 £1- £10 000...❑3 £10000 - £25000...❑4 > £25 000...❑5

h) How likely is it that you will expand the renewable energy enterprise (s) on your farm in the next 5 years?

Very unlikely ❑1 Unlikely ❑2 Undecided ❑3 Likely ❑4 Very likely ❑5

➔ **PLEASE NOW SKIP TO QUESTION 5.3 ON THE NEXT PAGE**

5.2(a) How interested are you in setting up some form of renewable energy enterprise on your farm?

Very uninterested ❑1 Uninterested ❑2 Undecided ❑3 Interested ❑4 Very interested ❑5

b) How much consideration have you given to establishing a renewable energy enterprise on your farm?

None whatsoever ❑1 Have thought about it ❑2 Considered but undecided ❑3

Considered and interested ❑4 Considering implementation ❑5

c) How likely is it that you will set up some form of RE enterprise on your farm within the **next five (5) years?**

Very unlikely ❑1 Unlikely ❑2 Undecided ❑3 Likely ❑4 Very likely ❑5

d) Which enterprise are you most likely to adopt **first**? IF AT ALL *(Please kindly tick **only one** box)*

Miscanthus..... ❑1 Short rotation coppice ❑2 Combine heat power..... ❑3

Wind turbine.... ❑4 Anaerobic digesters..... ❑5 Woodchip/biomass pellet production.... ❑6

Biomass boiler ❑7 Solar.....❑8 Other ..... ❑9

➔PLEASE GO TO 5.4 IF YOU DO NOT INTEND TO ADOPT ANY RE ENTERPRISE IN THE FUTURE

5.3 Please kindly **rank 4 items** in order of importance to you as regards why you would adopt (or why you adopted) the RE enterprise mentioned on your farm. Number the most important 1, the next important 2 and so on.

To take advantage of grants/subsidies..... ❑ To dispose of farm waste.....❑

To diversify farm income..... ❑ To cut farm business costs.....❑

To help meet government energy targets..... ❑ To provide environmental benefits.....❑

To take advantage of market opportunities..... ❑ Other (please specify)_____

5.4 If you do not intend to invest in any form of RE enterprise in the near future, please **kindly write** in order of importance, **3 most** important reasons for not doing so. Where 1 = most important, the next important 2, ...

1) _____

2) _____

3 _____

SECTION 6: YOUR ABILITIES, RESOURCES and FARM BUSINESS MOTIVATIONS

For each of the following statements, **please tick** ✓ the box that matches your view most closely.

6.1 How much confidence do you have in your ability to...?

Abilities	Very little ⇨		Unsure	⇨	Very High
a) Identify new business opportunities and act on them.....	❑1	❑2	❑3	❑4	❑5
b) Find the right technology that is needed for the farm.....	❑1	❑2	❑3	❑4	❑5
c) Estimate financial viability of a renewable energy enterprise.....	❑1	❑2	❑3	❑4	❑5
d) Raise enough funds to start a renewable energy enterprise.....	❑1	❑2	❑3	❑4	❑5
e) Lead the planning permission process at local council level.....	❑1	❑2	❑3	❑4	❑5
f) Organise and maintain financial records of your farm business.....	❑1	❑2	❑3	❑4	❑5

6.2 To what extent do you agree or disagree with the following statements about your business networks?

Support of friends and business networks	Strongly disagree ⇨		Unsure ⇨		Strongly agree
My family has social relationships that can help my business	❑1	❑2	❑3	❑4	❑5
I have friends and family that can assist my business development	❑1	❑2	❑3	❑4	❑5
I have business networks that I can rely on in case of difficulties	❑1	❑2	❑3	❑4	❑5
The knowledge that is necessary to exploit potential opportunities in RE is very similar to the knowledge that you already possess	❑1	❑2	❑3	❑4	❑5

6.3 To what extent do you agree or disagree with the following statements about your goals?

Business goals	Strongly disagree ⇨		Unsure ⇨		Strongly agree
a) My goal is to grow my farm business as much as I can	❑1	❑2	❑3	❑4	❑5
b) I prefer to have a farm size that I can manage myself without help	❑1	❑2	❑3	❑4	❑5
c) My goal is to maximise farm profit	❑1	❑2	❑3	❑4	❑5
d) I am an entrepreneur and will start a business given opportunities	❑1	❑2	❑3	❑4	❑5
e) I enjoy being independent	❑1	❑2	❑3	❑4	❑5
f) I am ready to take significant risks if the possible rewards are high	❑1	❑2	❑3	❑4	❑5
g) My highest goal is to pass on the farm business to the next generation	❑1	❑2	❑3	❑4	❑5

SECTION 7: FARM BUSINESS CHARACTERISTICS

Please kindly **tick** ✓ the boxes that apply in the following questions.

7.1 Predominant farm type

Cereals ❑1
General cropping ❑2
Horticulture ❑3
Speciality Pigs ❑4
Speciality poultry ❑5
Grazing livestock (LFA) ❑6
Grazing livestock (lowland) ❑7
Dairy ❑8
Mixed ❑9
Other (please specify) _____

7.2 Total farm area (ha)

Under 5 ha ❑1
5 – 20 ha ❑2
20 – 50 ha ❑3
50 - 100 ha ❑4
100 and above ❑5

7.3 Structure of the farm business

Sole proprietorship ❑1
Family partnership (e.g. father & son) ❑2
Partnership with non family ❑3
Limited Company ❑4
Co-operative ❑5
Other (specify) ❑6

7.4 Tenure

Wholly tenanted ❑1
Mainly tenanted ❑2
Mainly owned ❑3
Wholly owned ❑4

7.5 Annual value of total sales of agricultural products in 2009

Under £50 000 ❑1
£50 000 - £99 999 ❑2
£100 000 - £499 999 ❑3
£500 000 and over ❑4

7.6 Share of family income from agriculture in 2009

Under 25% ❑1
25 – 49% ❑2
50 – 74% ❑3
75% and over ❑4

7.7 Farm made a loss or a profit over past 5 years?

Significant profit..... ❑1
Moderate profit..... ❑2
Break even ..... ❑3
Moderate loss..... ❑4
Significant loss ..... ❑5

7.8 New activities within the farm in the past five years

Please **tick ✓ each (a - f)** of the following statements

	Yes	*No*
(a) Energy crops/ Renewable energy.....	❑1	❑2
(b) Accommodation or catering	❑1	❑2
(c) Agricultural contracting.....	❑1	❑2
(d) Non-agricultural contracting	❑1	❑2
(e) Food preparation and packaging	❑1	❑2

(f) Others (please specify) _____

7.9 In comparison to your conventional farming activities, what proportion of your total income was derived from these other activities within the farm in 2009? _____ %

7.10 Do you have/manage any other additional businesses out of agriculture? (Please write number)_____

7.11 In comparison to your conventional farming activities, what proportion of your total income was derived from these other business activities out of agriculture in 2009? _____ %

SECTION 8: FARMER CHARACTERISTICS

Please **tick ✓** the appropriate boxes in the following questions.

8.1 Are you male or female? Male ❑1 Female ❑2

8.2 Please indicate your age

Less than 35..... ❑1
35 – 44 years .....❑2
45 – 54 years ..... ❑3
55 – 64 years ..... ❑4
65 years and over.....❑5

8.3 Years of experience in agriculture

Under 5 years.....❑1
5 – 14 years.....❑2
15 – 24 years.....❑3
25 years and over.....❑4

8.4 Education attainment

Below secondary.....❑1
Secondary.....❑2
University degree.....❑3
Post University degree.....❑4
Not undertaken formal study❑5

8.5 Have you undergone training in any of these areas?

Agriculture..... ❑1
Management..... ❑2
Finance..... ❑3
Marketing..... ❑4
Other subject _____

Thank you very much for your time and help.

Now please kindly return the completed questionnaire to me by March 14, 2011 in the enclosed envelope to:

Aurelian Mbzibain
University of Wolverhampton Business School
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Wolverhampton. WV1 1AD