Exploring the economic contribution and visibility of women in UK agriculture

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Abstract

While the overall number of people occupied within the agriculture sector falls, the UK and other developed countries has witnessed a rise in the proportion of women occupied within the industry. Insights from cross-disciplinary research suggests that differences between the roles and performance of men and women are found to occur; with women substantially underrepresented as farm holders and often associated with lower visibility roles and contributions than their male counterparts. Yet, research from the field of economics lags and the area has received little attention from policy and public bodies.

This thesis' objective is thus to undertake an economic analysis of the roles and experiences of women in the UK agriculture sector. As such, it aims to further the existing literature and help bridge the gap between social science and economic studies to become a stepping-stone on which further research could be based.

Given the limited economic data available, it combines insights from cross-disciplinary works with secondary data from UK Government sources and primary data collection to investigate the following areas: comparison of the economic performance of farm men and women; differences in performance between farm women; and the barriers and opportunities influencing women's economic performance and participation.

The methodologies used in pursuing these investigations included: systematic review, survey and thematic analysis, as well as advanced econometric models such as the Multiple Regression Model, Ordered Logit Model.

The investigation yielded: a theoretical economic framework to characterise the economic profiles of UK farm women; empirical assessment of drivers affecting farm output, including an assessment upon gender; and evidence characterising the relationships between roles, responsibilities, visibility levels, and the barriers and opportunities presented to women in the UK agriculture sector. The investigation also yielded published works.

This study is the first in the UK literature to provide an investigation on the economic contribution of farm women that is supported by empirical evidence. The outcomes derived

could be viewed as an initial examination of the economic contribution and characteristics of UK women in agriculture on which further research could be based.

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Part A: Introduction

Background

The total contribution of agricultural output from high-income countries represents about one-fifth of the world's total output (World Bank, 2019a). In the United Kingdom (UK), agricultural production contributes approximately 0.5% to Gross Value Added (GVA); with Gross Output estimated to total £26.7bn and total UK income from farming (TIFF) estimated to have totalled £4.1billion in the year 2020 (Defra, 2020 [1]). The UK agricultural workforce is comprised of around 467,000 people, including farmers, business partners, directors and spouses (Defra, 2020 [1]). As with other developed countries, despite a fall in the overall number of people occupied within the sector, the UK has been experiencing a growth in the percentage of women's representation (Brandth et al., 2011; Hoppe and Korb, 2013; Ball, 2020).

The Farm Structure Survey (Defra, 2016) shows that women represent 52% of UK family farm workers, 19% of non-family workers and just 15% of both farm holders and managers. Furthermore, using Standard Output (SO) as a measure of the economic size and value of the holding, the Farm Structure Survey shows women are consistently most highly represented within the smallest sized economic holdings, and least within the largest sized economic holdings (Defra, 2016). For example, women farmers represent 23% of smallest holdings and just 4% of largest holdings (Defra, 2016). As such, it is widely acknowledged throughout existing literature from social science disciplines such as rural and gender studies, that there are a variety of structural constraints which may influence women's participation, visibility and leadership in agriculture. These include succession, access to training and education, organisations and policy; and appear to be largely specific to the agricultural industry (Gasson 1981; Whatmore; 1991; O'Hara 1994; Byrant, 2002; Silvasti, 2003; Seuneke and Bock, 2015; Contzen and Forney, 2017; Shortall, 2019).

Nevertheless, women are shown to exhibit agency and play an important role in the economic strengthening and sustainability of the agricultural sector. Women farmers are

highly represented in fast-growing, innovative agricultural markets such as organic, local, direct-to-market, and farm diversification (Gasson and Winter, 1992; Evans and Ilbery, 1993, 1996; Zelezny et al., 2000; Trauger, 2004; Bock 2004; Trauger, 2004; Iakovidou et al, 2009; Haugen and Brandth 2010, 2011; Sumner and Llewelyn, 2011; Läpple, 2012; Ball, 2014). Meanwhile, as increasing pressure is placed upon farm income, farm women have also proved to play a vital role in farm survival strategies including unpaid farm labour and off-farm work and diversification (Whatmore, 1991; Kalbacher, 1985; Haugen et al., 1993; Ball, 2014; Heggem, 2014). Furthermore, research beyond the agricultural sector indicates the benefits of gender integrated workforces which include improved financial performance, social and ethical compliance, and an indirect positive effect upon firm value (Adams and Ferreira, 2009; Isidro and Sobral, 2014)

Despite this, research from the field of economics lags and the area has received little attention from policy and public bodies (Ball, 2020). Following the UK's exit from the European Union (EU) and associated development of domestic agricultural policy, the agriculture industry is on the cusp of significant political, economic, and social changes to rural and agricultural life. Indeed, upcoming EU Agricultural policy reforms refer specifically to promoting the role of women in agriculture, and, since 2016, Scottish and Northern Irish Governments have begun to investigate and enact specific measures to promote gender equality and women's participation in agriculture (Shortall, 2017, 2019; Northern Ireland Assembly, 2022). As of yet, English policy has not addressed this topic, nor is it mentioned in upcoming policy documents. As the UK formulates and enacts its own domestic agricultural policies, it bears too the autonomy and responsibility to develop inclusive policy which intersects the relationship between structure and agency to influence and support the role of women in UK agriculture.

Aims and objectives

The present thesis sets out to empirically assess the roles and experiences of women in the UK agriculture sector. It aims to help bridge the gap between social science and economic studies in this area and to become a stepping-stone on which further research could be based. More specifically it has attempted to intersect the relationship between structure and agency to provide an initial investigation on the economic contribution and visibility of women in UK agriculture. Hence, its main objective is to provide an elaborate descriptive and analytical assessment of the economic characteristics of women in UK agriculture and to assess: (1) comparison of the economic performance of farm men and women; (2) comparison of differences between farm women; (3) influences upon women's economic performance; and finally to provide (4) evidence-based industry and policy recommendations.

Structure

In order to accommodate the aforementioned objectives, this thesis has been structured into Parts within which chapters address a specific element of these objectives. More specifically, this thesis is structured as follows:

Part B provides the descriptive and analytical review of UK Agriculture. Within this Part, two chapters are included. Chapter 1 provides a description of UK agricultural structure, discussing the socio-economic trends and impacts of agricultural development at a global level and its influence upon the economic landscape of UK farming. Chapter 2 assesses the roles of structure and agency as it investigates the economic visibility and contribution of UK women in agriculture through a systematic review of international literature which includes; empirically assessing differences between men and women farmers; differences within farm women as a group; and the barriers and potential incentives to women's participation to develop a theoretical economic model.

Part C undertakes the empirical investigation of the UK farm business performance data and industry feedback. Within this Part, two chapters are included. Chapter 3 investigates the

economic contribution and visibility of women in UK agriculture through an analysis of UK Farm Business Survey data. The investigation is carried out using a multiple linear regression model to conduct an empirical assessment of the role of gender pertaining to statistically significant drivers of farm output. Chapter 4 collects data from UK industry stakeholders via a mixed methodology to empirically – using an ordered logit regression model – and qualitatively – using thematic analysis – assess the relationships between activities on farm, visibility levels, and the barriers and opportunities presented to women in the sector.

Part D constitutes the thesis' final part which draws together the descriptive and analytical review of the UK agriculture structure presented in Part B and the empirical evidence presented throughout investigations undertaken in Part C to assess women's economic contribution to UK agriculture and how it can be supported. It includes two Chapters: Chapter 5 provides an overall discussion on the findings, and industry and policy recommendations; and Chapter 6 discusses the limitations of the thesis and briefly suggests areas for further research. Finally, Part E provides the appendices.

Contribution to knowledge

This thesis constitutes the first study in the UK literature to provide an investigation on the economic contribution of farm women that is supported by recent empirical evidence.

Chapter 2 contributes to knowledge by providing a systematic and replicable methodology whereby women's contribution and visibility with UK agriculture has been assessed through the lens of trans-disciplinary research. This methodology attempts to bridge the gap between economic and other social-science disciplines and represents the first of its kind to be used and applied recently in the UK literature; building upon the initial methodology employed by Ball (2020) in the United States, it presents findings which may be utilised in further economic and empirical research. Furthermore, this chapter contributes to knowledge as the process yielded a hypothetical framework, consistent with cross-disciplinary findings, which may be used within both subsequent research and industry to better understand the needs of groups of farm women within in the UK setting and generate more effective outcomes. Discussion around these findings draws together both

structural and individual factors influencing the roles of women in agriculture, and, alongside published works, provides a bedrock for further investigation.

Chapter 3 utilises data collected from 2,300 UK business units to provide the first recent UK-wide empirical evidence to further the limited existing literature. Utilising the only available gender-disaggregated UK-wide data collected annually by UK farm organisations, Chapter 3 reveals statistically significant drivers of farm output relating to gender which contributes a new perspective within existing research, builds upon the findings of Chapter 2, and provides the impetus for further UK-specific primary data collection and analysis. Notably, the findings present no statistically significant difference in farm economic performance which can be attributed solely to gender. This suggests causality may be associated with other structural factors which in turn helps to inform further research, industry initiatives, and dispel damaging narratives that gender is an independent driver of farm performance.

Additionally, Chapter 3 provides the first empirical evidence to give visibility to the role of women's unpaid labour on farm. Within the analysis of existing literature undertaken in Chapter's 1 and 2, women's unpaid labour is found to represent an important and often overlooked negative externality whereby women receive very little recognition for the vital role they play in UK farming systems. Chapter 3's empirical investigation provides evidence that women's unpaid labour is indeed a statistically significant driver of UK farm output. Furthermore, substantial differences between the roles and responsibilities associated with men's and women's unpaid labour are also indicated. These findings contribute the first empirical basis to existing knowledge, identify areas for further investigation and help provide visibility of such roles.

Chapter 4 collects primary data from UK industry to empirically and qualitatively assess the roles, responsibilities and experiences of UK farm women which underpin their economic participation, contribution, and visibility. This chapter contributes to knowledge by providing the first UK-wide primary data collection and analysis pertaining to women's own perceived roles, contribution and visibility in UK agriculture via a national survey. Findings support the proposition of the hypothetical profile framework proposed in Chapter 2 and provide empirical evidence that the roles and responsibilities of UK farm women differ

significantly in relation to visibility level. Yet, barriers and opportunities facing women in the sector are also found to be consistent across all groups of women and attributed almost solely to structural factors. As such, Chapter 4 contributes depth to the empirical findings of the investigation, and furthers existing international, dated, or small sample size data on the topic.

In conclusion, this study is the first in recent UK literature to provide an investigation on the economic contribution of farm women that is supported by recent empirical evidence. The outcomes derived contribute to knowledge in several areas and could be viewed as an initial examination of the economic contribution and characteristics of UK women in agriculture providing preliminary findings, and identifying areas upon which further research could be based. Overall, the thesis concludes that the hampered visibility and participation of women in UK agriculture presents a negative social and economic externality restricting the resilience and sustainability of future UK farming systems. Alongside recommendations for policy, industry and further research, the findings aim to help bridge the gap between social science and economic studies, providing new perspectives within the intersection of structure and agency, and presenting a stepping-stone for further cross-disciplinary research and industry actions.

Part B: A descriptive and analytical review of the UK Agriculture sector

Chapter 1: A description of UK Agriculture Structure

1.1 The Socio-Economic Impacts of Agricultural Development

Agriculture is an important sector of the global economy; providing employment to 874 million people, equating to 27% of the global workforce (FAO, 2023). In 2021 the global value added (GVA) generated by agriculture, forestry and fishing totalled $3.7 trillion, an increase of 84% since the turn of the millennium (FAO, 2023). Yet, as the world population continues to grow – more than doubling between 1961 and 2016, and expected to reach almost 10 billion by 2050 – global demand for food and pressure on agricultural systems continues to increase, bringing with it a host of socio-economic impacts (FAO, 2023).

Since 1960, agricultural production has more than tripled owing to both a significant expansion in the use of land, water, and other limited natural resources for agricultural purposes, alongside productivity-enhancing Green Revolution technologies such as selective breeding, fertiliser and pesticides (Knudsen et al., 2006). At the same time, cropland area per capita has decreased continuously from 0.45 ha per capita in 1961 to 0.21 ha per capita in 2016 (FAO, 2020). Indeed, the need to produce more food from relatively fewer resources is both a cause and effect of the industrialisation and globalisation of world food production systems (Knudsen et al., 2006) and therefore integral to any understanding of the current socio-economic trends and drivers moulding agriculture both at a global and UK level.

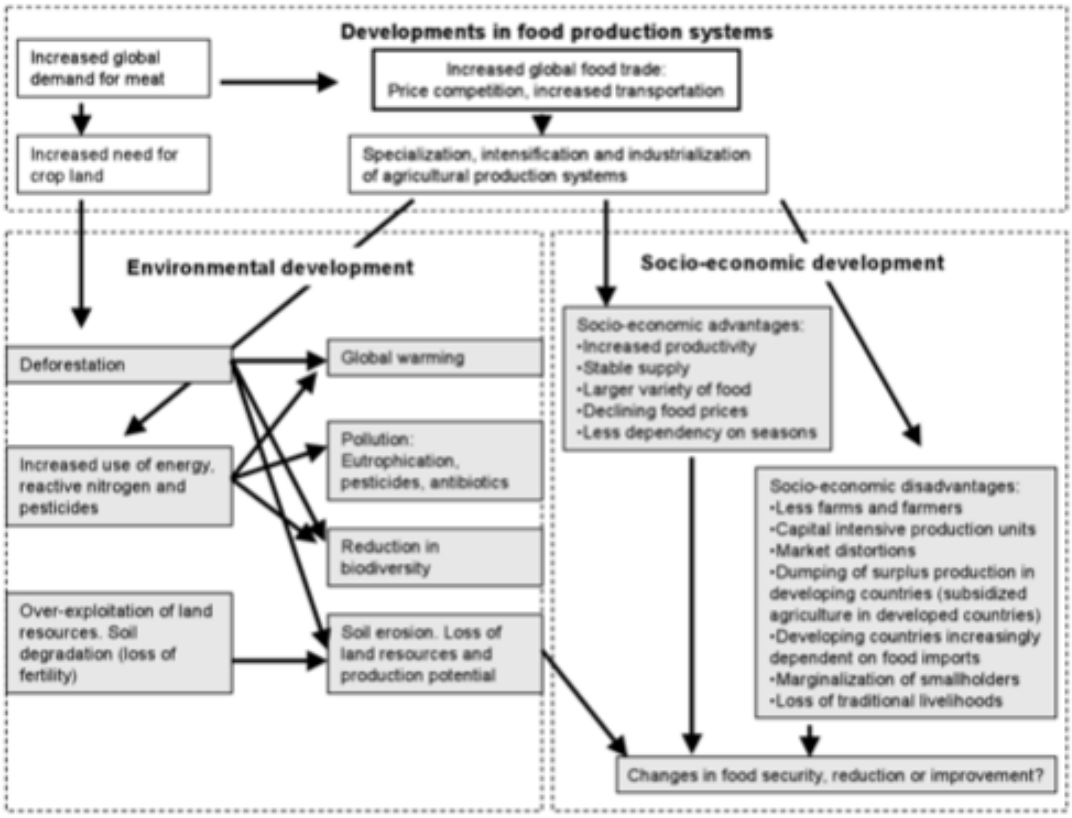


Figure 1: Developments in Food Production Systems. Knudsen et al. (2006)

Illustrated in Figure 1, Knudsen et al. (2006) developed a framework illustrating how a variety of structural factors may interact and influence the sustainability of global food systems to elicit a range of socio-economic impacts. As shown in Figure 1, hand-in-hand with improved transport, communication, and mechanisation, growing global demand for meat and cropland has spurred the specialisation, intensification, and industrialisation of agricultural production systems. The shift towards system specialisation and mass production has been accompanied by a range of socio-economic benefits including increased productivity, stability of supply and declining consumer food prices. Yet, the specialisation of production systems also presents a host of socio-economic impacts. A global abundance of 'cheap' food accompanies falling commodity prices and places further pressures on producers to consolidate into ever larger operations in order to remain economically viable (Mies and Bennholdt-Thomsen, 1999). With this, the risk and capital expenditure associated with farming operations increases and as a result farmers may choose to exit the industry or enact farm survival strategies such as unpaid family labour, off-farm work, or farm diversification. As such, the percentage of the population engaged in

agricultural activities also declines (FAO, 2020). For instance, over the past 20 years, the total agricultural workforce in developed economies has declined by 50% and now holds a share of less than 5% of total employment (ILOSTAT, 2024).

Indeed, amidst the backdrop of structural change, so too changes the role of actors who remain within the sector. Knudsen et al. (2006) suggests that the impacts of factors such as consolidation and specialisation are accompanied by a loss of traditional livelihoods which in turn are accompanied by cultural shifts which may enable new identities to emerge. Moreover, the findings of Byrant (2002) and Giddens (1991) are discussed in Chapter 2 whereby, amidst everchanging global influences, individuals may exhibit agency, and actively create and choose between diverging options to construct their own new economic identities, independent of traditional local contexts. Furthermore, the intensification of agriculture systems both contributes to, and is directly affected by, the degradation of natural resources and the loss of biodiversity including soil erosion, water pollution, deforestation, hedgerow removal, and genetic uniformity in crops (Knudsen et al., 2006). Changing climatic conditions as a result of global warming are also a major concern, raising further threats to traditional production practices, increased incidence of extreme weather events and associated rising market price volatility. As such, the need for resilience and innovation grows ever more imperative to the future of the sector and survival of farm businesses.

1.2 Structure of UK Agriculture

Two main surveys, the Farm Business Survey (FBS) and Farm Structure Survey (FSS), collect data pertaining to agricultural business performance and structure in the UK. The FBS is an annual survey commissioned by the UK government which collects a range of management accounting information on all aspects of farmer's and grower's businesses. The survey uses a sample of farms that is representative of the national population in terms of farm type, farm size and regional location. Engaging with over 2,300 farm businesses in England and Wales, and with similar surveys in Scotland and Northern Ireland, the FBS provides information on the physical and economic performance of farm businesses to inform policy

decisions on matters affecting farm businesses. It also collects data on gender pertaining to 'farmer' and 'unpaid labour'. As such, FBS contains sensitive business data and is not freely available in the public domain. Chapter 3 deals with extraction of FBS data via Special Licence request and subsequent assessment of gendered differences in farm performance.

Meanwhile, the FSS is carried out by all European Union (EU) Member States every three or four years as a sample survey, and once in ten years as a census. The information collected in the FSS covers land use, livestock numbers, farm type, rural development, management, and farm labour input - including the age, gender and relationship to the holder of the agricultural holding. Data from the FSS (Defra, 2016) is published freely in the public domain.

According to the FSS, agricultural production contributes approximately 0.5% to Gross Value Added (GVA); with Gross Output estimated to a total of £26.7bn and total UK income from farming (TIFF) is estimated to have reached £4.1billion in the year 2020 (Defra, 2020 [1]). The UK agricultural workforce is comprised of around 467,000 people, with farmers, business partners, directors and spouses accounting for the majority (64%) of the total labour force. The FSS (Defra, 2016) shows that women represent 52% of UK family farm workers, 19% of non-family workers and 15% of both farm holders and managers (see Figure 2).

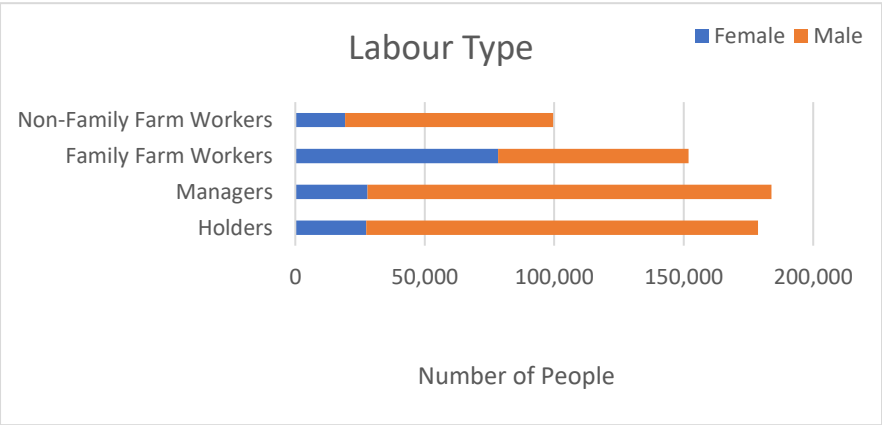


Figure 2: UK Agriculture Workforce: Gender and Labour Type (Defra, 2016)

The FSS (Defra, 2016) states that the Utilised Agricultural Area (UAA) of UK land area equals 17.3m ha and covers 71% of the total UK land area. The FSS classifies UK farming systems based upon their mix of land use and farm enterprises and categorises them within nine main farm types. These are: general cropping, cereals, mixed, horticulture, poultry, pigs, dairy, grazing livestock (lowland) and grazing livestock (less favoured area). According to FSS, permanent grassland accounts for the largest UAA (58%), followed by cereals (18%). The most numerous farm type is grazing livestock - lowlands (30%), followed by general cropping (19%) and cereals (17%) (Defra, 2016).

The varied topography and climate of the UK means that some sectors and farm types are more concentrated in some regions than others. Overall, FSS (Defra, 2016) reports that land use in the UK has changed little in the last 30 years, with annual variation between specific crops due to factors such as the weather and prices rather than long-term or systematic variation. Hot air brings warm dry summers to the flat land of East of England making it the most suitable area in the UK for cropping; producing 62% of England's sugar beet and 27% of wheat (Defra, 2016). Pig and poultry farming is often concentrated close to where the feed is produced: 37% of England's 5.1 million pigs are reared in Yorkshire and The Humber (Defra, 2016). Meanwhile, moist air brings wet weather to the west of the UK (Defra, 2016). The warm, wet climate and gentle hills of the west make it highly suitable for dairy farming (Defra, 2016). Indeed, 39% of England's 1.9 million head dairy herd is farmed in the South West (Defra, 2016). Yet, hillier upland regions, which are typically colder and wetter see livestock dominate. A such, 21% of England's 33 million sheep are in the South West and 19% in the North West (Defra, 2016). Tables 1 and 2 demonstrates the relationships between sector types, farm populous, and land area.

Table 1: Sector Size and Land Area (Defra, 2016)

Sector Type	Number of Farms	Proportion of Total Farms	Land Area	Proportion of land area used
Cereals	17,600	17%	32 million ha	32%
General Cropping	21,100	19%	1.6 million ha	17%
Mixed	8,500	8%	0.9 million ha	10%
Dairy	5,900	6%	0.8 million ha	9%
Grazing Livestock (lowland)	32,200	30%	1.4 million ha	15%
Grazing Livestock (LFA)	12,400	12%	1.3 million ha	14%
Horticulture	3,500	3%	150,000	2%
Pigs	1,900	2%	80,000	1%
Poultry	2,800	3%	90,000	1%
Unclassified	1,200	1%	6,000	<1%

Table 2: Number of UK Livestock (Defra, 2016)

Type of livestock	Number of Head
Dairy herd	1.9 million head
Cattle	9.6 million head
Sheep	33 million head
Pigs	5.1 million head
Poultry	182 million head

In 2019, there were 219,000 agricultural holdings, with an average size of 80.7ha (Defra, 2020 [1]). According to Defra (2020 [1]) the majority of farms in the UK are owner occupied (52%), followed by mixed tenure (34%) and wholly tenanted (14%). Of the 219,000

agricultural holdings in the UK, 97% are run as 'sole holders' and 3% by limited companies or institutions. In 2023, employment in agriculture declined 2.9% on the previous year (Defra, 2023), as the number of farms has also fallen. Throughout developed countries, agriculture typically has an aging workforce (Defra, 2022). Data from Defra (2016) states that in 2016, the average (mean) age of UK farm holders was 60 years old, an increase of one year from 2013. Furthermore, over 35% of all holders were over the typical retirement age of 65 years while the proportion of people aged under 35 years was 3%. The proportions of holders in the central age bands, 45-54 years and 55-64 years, have remained relatively unchanged over the previous decade. Since 2005 the proportion in the 35-44 years old band has decreased by 5% while the proportion of 65 years and over has increased by 5% (Defra, 2016).

Alongside falling employment, the number of farms has also fallen, however this decline has been accompanied by an increase in Total Factor Productivity (TFP). TFP is measured as the ratio of aggregate output, such as GDP, to aggregate inputs, such as labour and capital, indicating productivity (Sickles & Zelenyuk, 2019). According to Defra (2020) UK TFP has increased by nearly 50%, driven by a 32% increase in the volume of outputs and a 12% fall in the volume of inputs. For example, between 1996 and 2020 the number of dairy producers in the UK fell from 35,700 to 11,900; a reduction of 67% (House of Commons, 2021). At the same time, the number of UK dairy cows fell from 2.6 million to 1.9 million; a 28% reduction, yet, the average herd size and yield per cow have each risen by almost 100% (House of Commons, 2021). This said, in 2021 the agriculture sector had an average labour productivity of £16 output per hour, the second lowest figure of all sectors and £22 less per hour than the average for the whole economy (£38) (Defra, 2022). Again, this illustrates agriculture's declining contribution to UK Gross Domestic Product (GDP) – currently 4.3%, versus 7.5% in 1981 (World Bank, 2022) - and places increased pressure on farming income and profitability.

Indeed, Farm Business Income (FBI) varies greatly across farms within the UK. FBI is a measure of net profit, calculated as Farm Business Output (revenue) minus Farm Business inputs (costs). According to Defra (2020 [1]) the average FBI for UK farmers is £48,800. Accounting for Direct Payments (£28,000), agri-environment payments (£5,500) and

diversification (£23,800), on average, the agricultural part of UK farm businesses made a profit of £6,000. As such, around 21% of farms in the UK failed to make a positive FBI in 2019/20 with around half of farms falling into the lower income brackets (less than £20,000). At the top end of the scale, just 26% of farms in the UK had an FBI of more than £50,000. Furthermore, using Net Farm Income as a narrower measure of income (imputing rent on owned land and a cost for unpaid labour, not including farmer and spouse labour) 36% of farms in the UK would fail to make a profit. As such, the key drivers of agricultural income include the volume of production, commodity prices and the cost of inputs. These are themselves driven by a range of volatile and external factors such as the weather, exchange rates, oil price and global supply and stocks of commodities, all of which are out of a farmers immediate control. As a result, UK agricultural income tends to fluctuate from year to year placing increased pressure upon farming income. Again, this fits into the picture of increasingly globalised and industrialised food production systems requiring higher economies of scale and capital requirements to manage risk and price volatility.

1.2.1 Gender Trends

Defra (2016) demonstrates that gendered trends can be found across farm types. Figures 3 – 6 detail the number and gender of UK agricultural workforce by farm and labour type. The term ‘farm holder’ refers to the individual/s of whom the farm belongs to in their name e.g. owner or tenant; ‘farm manager’ to whom is responsible for the normal daily financial and production routines of the farm, if not the farm holder; ‘family worker’ to whom work on the farm and are relatives; and ‘non-family worker’ to whom work on the farm and are not relatives. Data from Defra (2016) shows that women farm holders and managers are most highly classified within mixed livestock (23% and 24%, respectively) and non-classified (24% and 20%) farm types. In terms of family workers, women are most highly represented in non-classified (65%) and horticulture (59%) farm types. As non-family farm workers, women are most highly represented in horticulture (38%) and mixed livestock (31%) production.

Table 3: Number and Gender of Agricultural Workforce by Farm and Labour Type (Defra, 2016)

Farm Type	**Holder**		**Manager**		**Family Workers**		**Non-family workers**	
	Female	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*
Field crops	7,398	42,025	7,168	45,330	17,164	15,984	4,864	30,929
Horticulture	222	1,435	231	1,538	1,168	814	3,496	5,713
Permanent crops	338	1,514	361	1,588	910	731	1,447	3,407
Grazing livestock	17,362	91,848	17,831	92,700	50,010	47,558	6,106	25,299
Pigs and poultry	499	4,211	566	4,339	2,885	2,655	1,717	7,572
Mixed cropping	148	785	136	859	467	387	380	1,052
Mixed livestock	506	1,698	539	1,727	1,151	1,036	367	825
Mixed crops and livestock	764	7,101	818	7,215	4,398	4,234	745	4,959
Non-classified	173	620	175	710	182	99	130	540

1.2.1.a Farm Type: Farm Holders and Managers

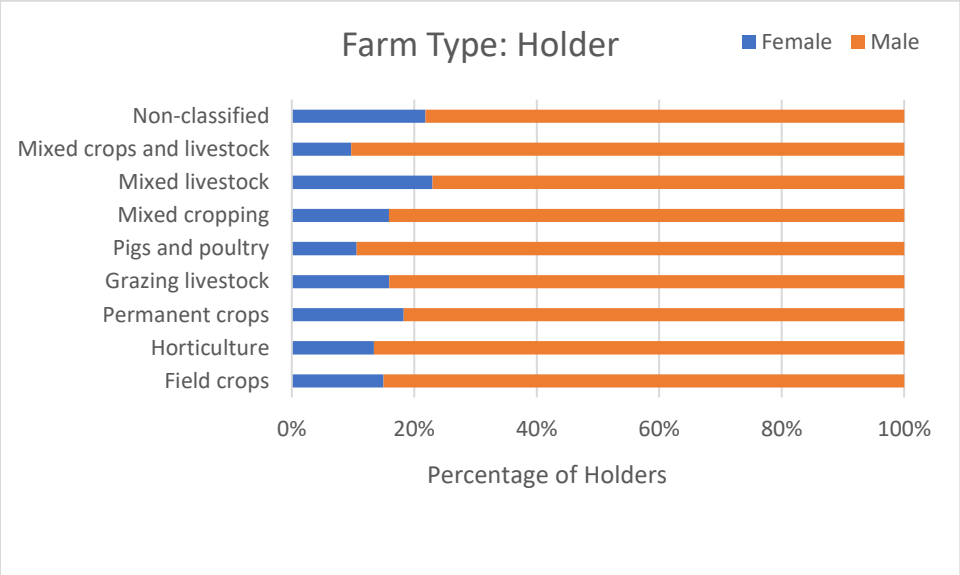


Figure 3: Farm Type by Labour Type (Holder) (Defra, 2016)

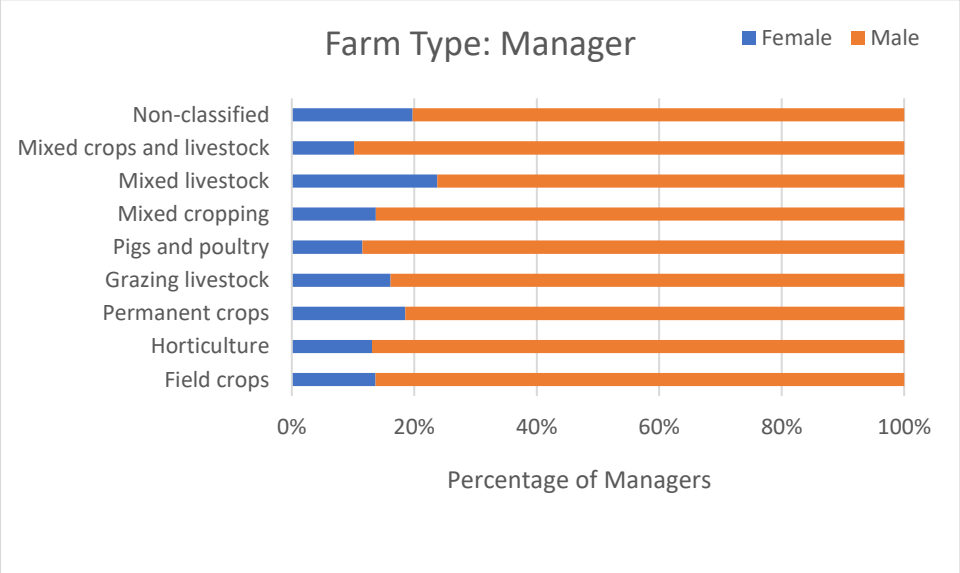


Figure 4: Farm Type by Labour Type (Manager) (Defra, 2016)

1.2.1.b Farm Type: Family and Non-Family Workers

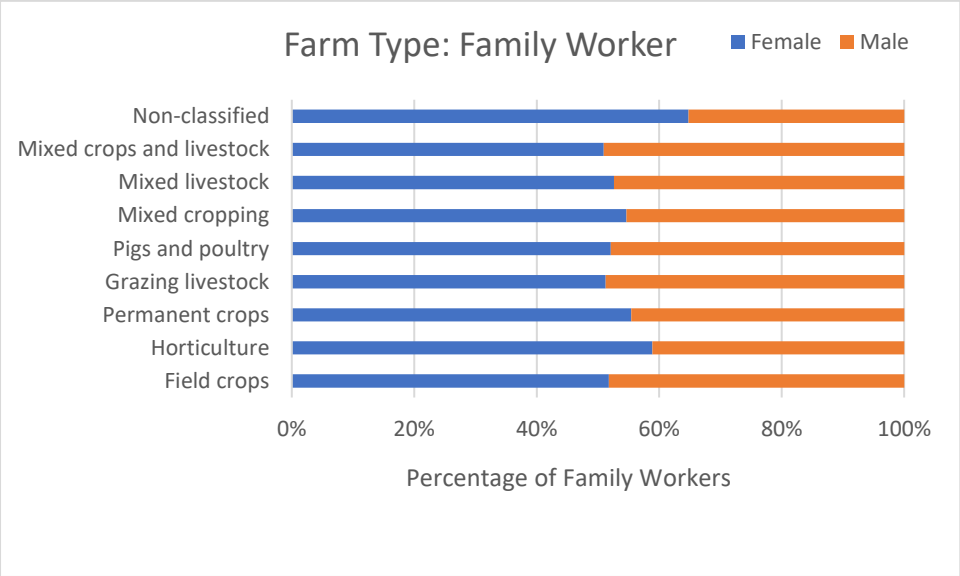


Figure 5: Farm Type by Labour Type (Family Worker) (Defra, 2016)

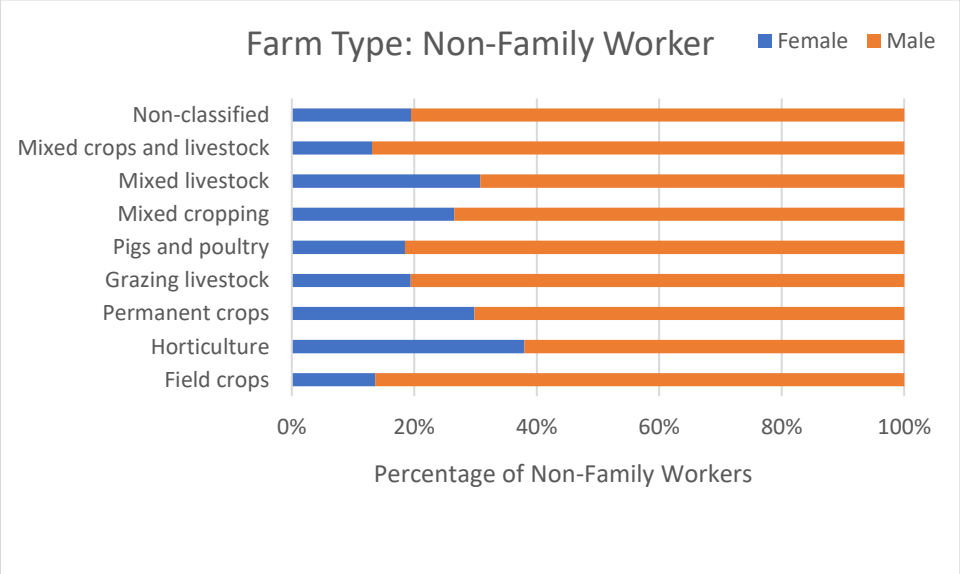


Figure 6: Farm Type by Labour Type (Non-Family Worker) (Defra, 2016)

Furthermore, gendered trends can also be demonstrated within the economic performance of a holding. Using Standard Output (SO) as a measure of the economic size of the holding (see Appendix A), the FSS (2016) shows women gain highest representation within lowest SO band, and lowest representation with the highest SO bands across all labour types. For example, women farm holders and managers represent 23% of smallest SO band holdings and just 4% and 5% of largest SO band holdings (Defra, 2016), respectively. As family farm workers, women retain highest representation within the smallest SO band (54%) and lowest percentage representation within the largest SO band (35%). Meanwhile, women who are non-family workers represent 26% of workers within the smallest SO holdings and 18% in the largest SO holdings. See Table 4, and Figures 1 – 10.

Table 4: UK Standard Output by Labour Type and Gender (Defra, 2016)

SO Band	**Holder**		**Manager**		**Family workers**		**Non-family worker**	
	Female	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*
<€25,000 euros	19,603	65,356	19,904	67,615	27,929	22,756	4,800	13,673
€25,000 - €49,999	2,860	19,938	2,929	20,249	9,903	8,717	1,442	4,259
€50,000 - €99,999	2,083	19,349	2,098	19,774	9,998	8,835	1,513	5,143
€100,000 - €249,999	1,624	22,817	1,615	23,418	13,496	13,426	2,070	10,282
€250,000 - €499,999	758	13,377	727	13,839	9,110	10,389	1,918	11,897
>€500,000	484	10,401	551	11,110	7,900	9,376	7,508	35,043

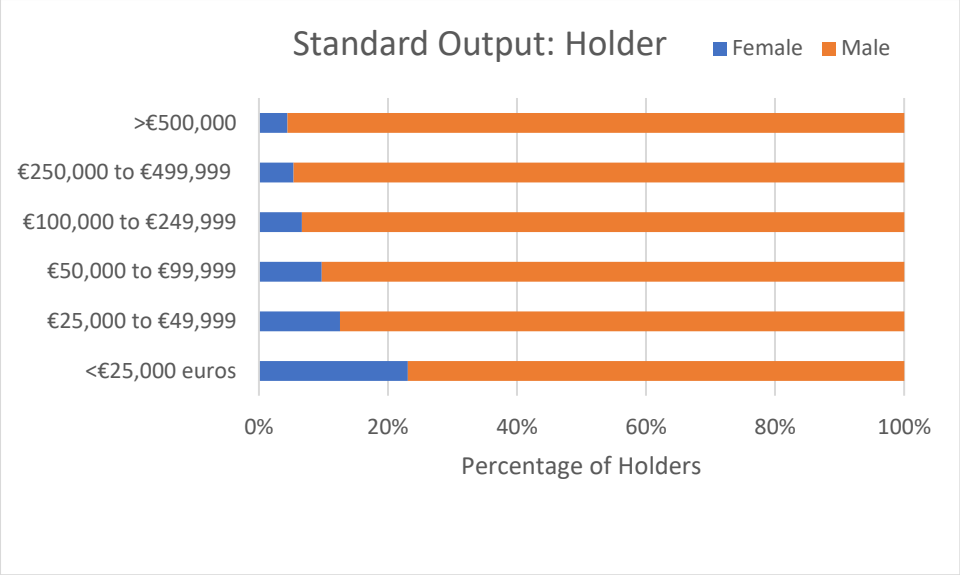


Figure 7: Standard Output by Labour Type (Holder) (Defra, 2016)

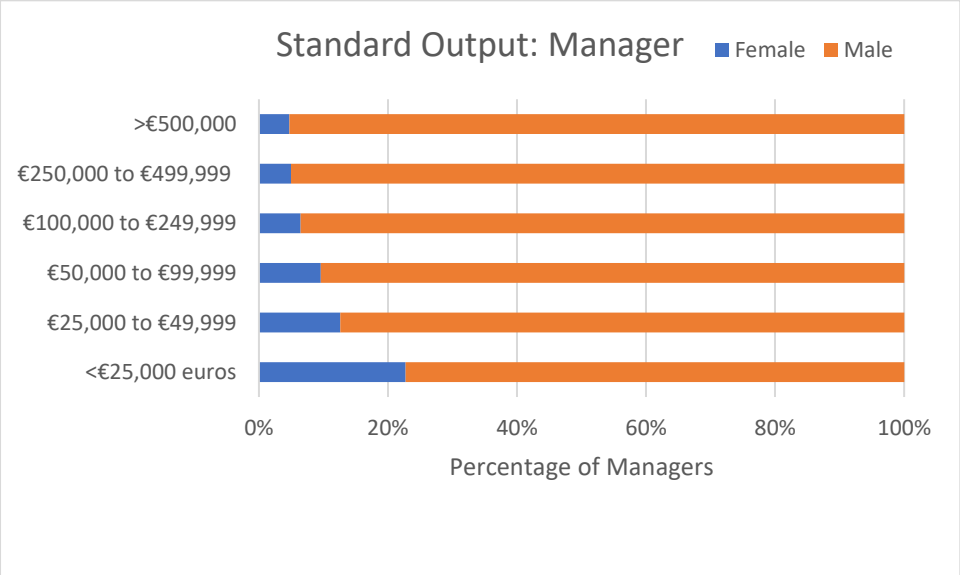


Figure 8: Standard Output by Labour Type (Manager) (Defra, 2016)

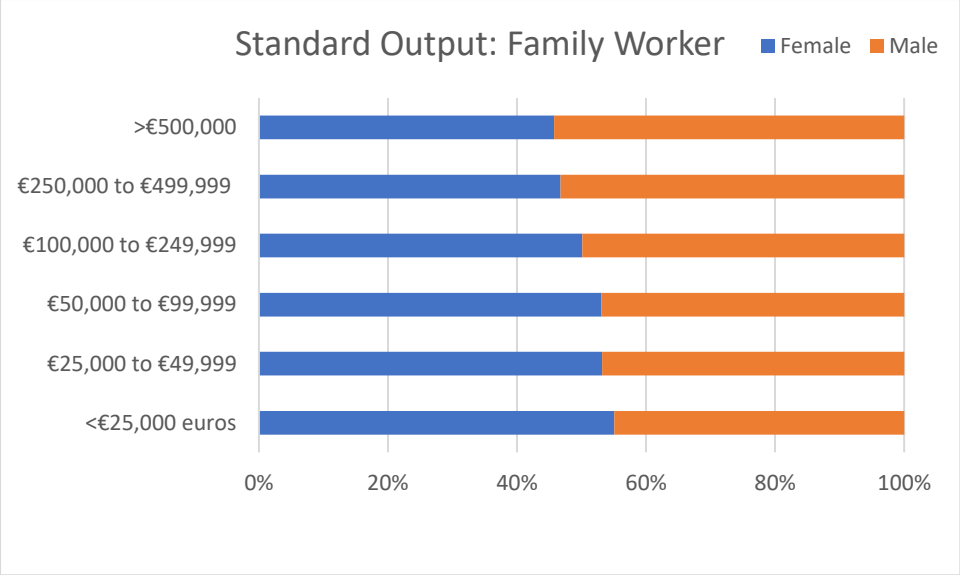


Figure 9: Standard Output by Labour Type (Family Workers) (Defra, 2016)

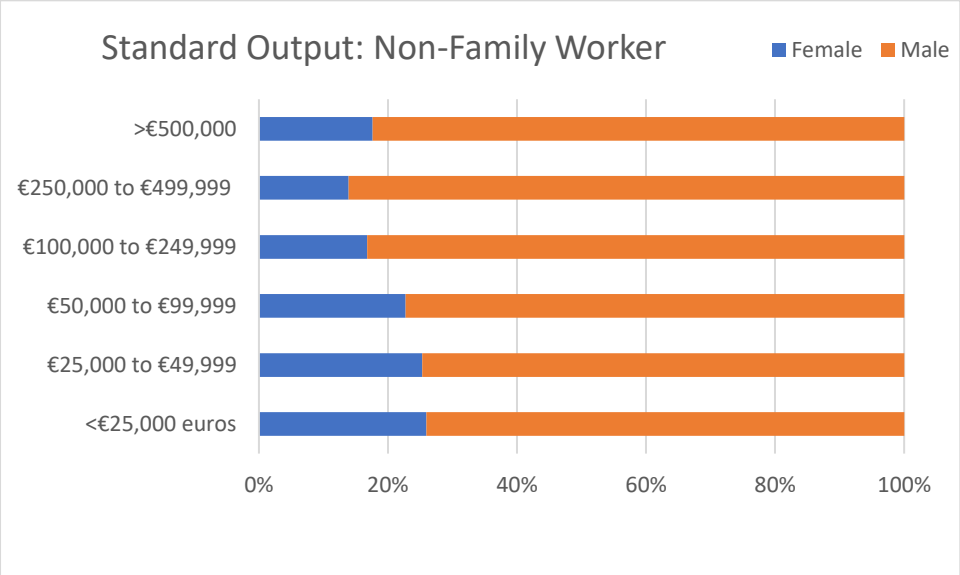


Figure 10: Standard Output by Labour Type (Non-Family Workers) (Defra, 2016)

1.3 UK Policy Structure

1.3.1 European Influence: The CAP

As discussed within sections 1.1 and 1.2, the structural development of UK agriculture sits within a complex arrangement of international socio-economic drivers. Nevertheless, via its membership of the EU, European Common Agricultural Policy (CAP) policy has been integral in shaping how UK agriculture structure has developed at both individual farm and industry levels. Indeed, the UK voted to leave the EU in 2016 and officially separated from its nearest and largest trading partner (Goldsworthy, 2020) on January 31, 2020, following 27 years of membership. However, any understanding of UK agricultural policy cannot be complete without an appreciation of EU CAP.

In 2014, the Department for Environment, Food and Rural Affairs (Defra) estimated that CAP payments represented 55% of farm incomes (House of Commons, 2020). Furthermore, in 2020 over one-fifth of UK farms failed to generate a positive return while 26% of UK farms earnt an FBI of over £50,000 (Defra, 2020 [1]). The same year, UK farmers gained £3.5bn in support, 80% of which was through direct payments (House of Commons, 2020).

Within the EU, the CAP policy provides financial support to farmers in its 27 member states. Created in 1962 by the six founding countries of the European Communities, it is the longest-serving EU policy and brings national intervention programmes together into one scheme to allow farmers to compete on a level playing field while protecting against volatility in agricultural prices (and hence incomes) and to provide food security (European Commission, 2019). As such, The European Council of the European Union (2022), defines CAP's aims as: to provide affordable, safe and high-quality food for EU citizens; to ensure a fair standard of living for farmers; to preserve natural resources and respect the environment.

As a substantial project accounting for over 38.9% of EU budget between 2014-2020 (European Parliament, accessed 2022), CAP's commitment to gender mainstreaming was

significant. According to the Council of Europe, gender mainstreaming is defined as: “an approach to policy-making that takes into account both women’s and men’s interests and concerns, aimed at designing better policies” (Council of Europe, accessed 2022). In European legislation, gender mainstreaming was enshrined in Articles 2 and 3 of the Amsterdam Treaty and ‘places an obligation on the Community to eliminate inequalities and promote equality between men and women in all its activities’ (European Commission, 2000). However, studies exploring the extent to which gender mainstreaming had been successful at both an EU-level (Bock, 2015; Shortall, 2015), and within specific EU countries (Prugl, 2009; Oedl-Wieser, 2015; Istenic, 2015), agree that gender mainstreaming has not been sufficiently implemented in EU agricultural policy to promote the transformation of gender relations.

Throughout its history, CAP has been through successive reforms reflecting the ever-changing structure of European agriculture, however its most recent 2023 reform focuses upon creating a ‘fairer, greener and more result-oriented policy’ (European Council of the European Union, 2021). Key features of the proposed new policy include greater focus on environmental and climate goals and supporting smaller farms. It will also be the first CAP to include a social dimension aimed at guaranteeing adequate employment conditions for farm workers. Indeed, text in the forthcoming reform which obligates EU states to “promote employment, growth, gender equality, including the participation of women in farming” and outlines that:

“Equality between women and men is a core principle….and gender mainstreaming is an important tool in the integration of that principle into to the CAP. There should therefore be a particular focus on promoting the participation of women in the socio-economic development of rural areas, with special attention to farming…. Member States should be required to assess the situation of women in farming and address challenges in their strategic plans. Gender equality should be an integral part of the preparation, implementation and evaluation of CAP interventions.”

1.3.2 The Future of UK Agricultural Policy

The UK exited the EU on January 31, 2020, marking a seven-year agricultural transition period (2021–2027 inclusive) (Defra, 2020 [2]) away from CAP-like support towards the development of new domestic Agriculture Acts for England and each of the devolved nations. The future direction of UK policy is mapped out in 'Farming for the Future Policy and Progress Update' (Defra, February 2020); and 'The Path to Sustainable Farming: An Agricultural Transition Plan 2021 to 2024' (Defra, November 2020). Between 2021 and 2027, UK government is gradually reducing and then stopping untargeted Direct Payments, investing public money in support for agriculture in different ways. According to 'Farming for the Future Policy and Progress Update' (Defra, 2020), farmers will be paid to improve the environment, animal health and welfare, and to reduce carbon emissions. There will also be significant grants made available to support farmers to reduce their costs and improve profitability, to help those who want to retire or leave the industry, and to create new opportunities and support for new entrants (Defra, November 2020). The redirection of direct support towards payment for public goods through environmental land management initiatives, and efforts to support the introduction of new technological and social assets within the industry heralds a step-change in traditional agricultural policy. Yet, despite clear intentions for comparable EU 2023-2027 CAP reform to address gender equality (see section 1.3.1), neither of Defra's policy documents which set the future strategic framework for farming in England include any of the terms "woman", "women", "gender", "female" or "equality".

Nevertheless, jurisdictions across the UK have, to varying degrees, enacted their own policy frameworks, research and initiatives to investigate and address some of the challenges facing women in the agriculture sector. According to the 2022 'Breaking The Grass Ceiling' paper on Women in Agriculture published by Northern Ireland Assembly Committee for Agriculture, Environment and Rural Affairs (AERA), a variety of policy levers within devolved nations have been enacted independently. The Committee undertook a review of policy provision in respect of the challenges facing women in the local agriculture sector between November 2021 – March 2022. The investigation utilised a mixed methodology which included engaging with the Department for Agriculture, Environment and Rural Affairs

(DAERA) to understand what current, and potential future, policies are in place to support women within the sphere. This was created by contacting relevant Departments in England, Scotland, Wales and the Republic of Ireland to assess their policy provision.

The AERA paper reported the following policy provisions across UK jurisdictions:

1.3.2.a Scotland

In 2017, Scottish First Minister, Nicola Sturgeon, commissioned a "Women in Agriculture Taskforce" to establish a baseline position on women in farming and the agriculture sector. The taskforce reported on its findings in November 2019. Its recommendations were taken forward with £400,000 annual funding pledged by the Scottish Government until 2024-25, and included: diversity and unconscious bias training for key agricultural organisations; development programmes to facilitate training and mentoring to build women's confidence, business and leadership skills (including 200 training places funded for 2021-22); increasing training opportunities for women including women-only programmes (including £215,000 for the "Women in Agriculture Practical Training Fund" which enables applicants to claim up to £500 per course); scoping how provision of childcare services in rural areas can be improved; succession planning campaigns including the consideration of all children as potential successors; encouraging inclusive language in schemes designed to support new entrants and promotion of opportunities for women where possible; and specific Health and Safety training geared towards women.

1.3.2.b Wales

The Welsh government has supported initiatives for women in agriculture via its "Farming Connect Programme" which was part funded by the EU until 2020 and extended by Welsh government until March 2023 with long-term commitment to resourcing of further initiatives in this area. This included a focus on developing women's skills and expertise via: Annual Women in Agriculture Conferences, and Discussion and Action Learning Groups (regional women-only forums).

1.3.2.c England

While Defra currently does not have any active policies in place, it has undertaken research and identified priorities for future policy development including: targeting communication to ensure women are aware of schemes, support and funding; giving specific consideration to the Health and Safety needs of women farmers e.g. provision of additional safety equipment and better education; ensuring schemes for land access and entry are fair and inclusive; encouraging opportunities for earlier family discussions on succession planning.

1.3.2.d Northern Ireland

The AERA Committee undertook a review of policy provision in respect of the challenges facing women in the local agriculture sector and reported its findings in March 2022. It made a series of recommendations to DAERA including: a Motion debate recognising the role of women within the agricultural sector should be tabled at the Assembly; the commission of further academically-led research; the provision of equality, diversity and unconscious bias training for its staff; the facilitation awareness training for key agri-food organisations; and exploration of options for providing support for women farmers during and after pregnancy. As part of its Knowledge Transfer Workstream of its Future Agricultural Policy the Committee also recommended DAERA should take specific actions to facilitate enhanced training and education for women in the sector to including: programmes which are targeted at women farmers and new entrants; flexible and online course access; training subsidy for women farmers; and the facilitation of “women-only” training forums. Additionally, as part of the Generational Renewal Workstream, the Committee recommended DAERA should ensure that provision is made to educate farm owners about the benefits women can bring to farm businesses and the importance of considering the suitability of all potential successors, regardless of sex.

In addition, the Committee also made recommendations to industry, including: organisations should embrace affirmative action and seek to promote and encourage women where possible; leaders across the industry should seek to “set an example” of expected behaviours and gender equality; and when promoting a new initiative, policy or

project, agri-food organisations should consider how women can be promoted in communication strategies.

DAERA also has a range of current local policies which aim to enhance support for women working within the sector, including: childcare grant for students enrolled at the College of Agriculture, Food and Rural Enterprise (CAFRE); strategy and targets improve gender representation in CAFRE courses. Furthermore, its Future Agricultural Policy proposals – Generational Renewal Workstream will provide “an opportunity to encourage more females into the industry”, and notes that “DAERA is cognisant of the need to encourage females in farming and to eliminating any perceived barriers to accessing the industry as a viable career path.”

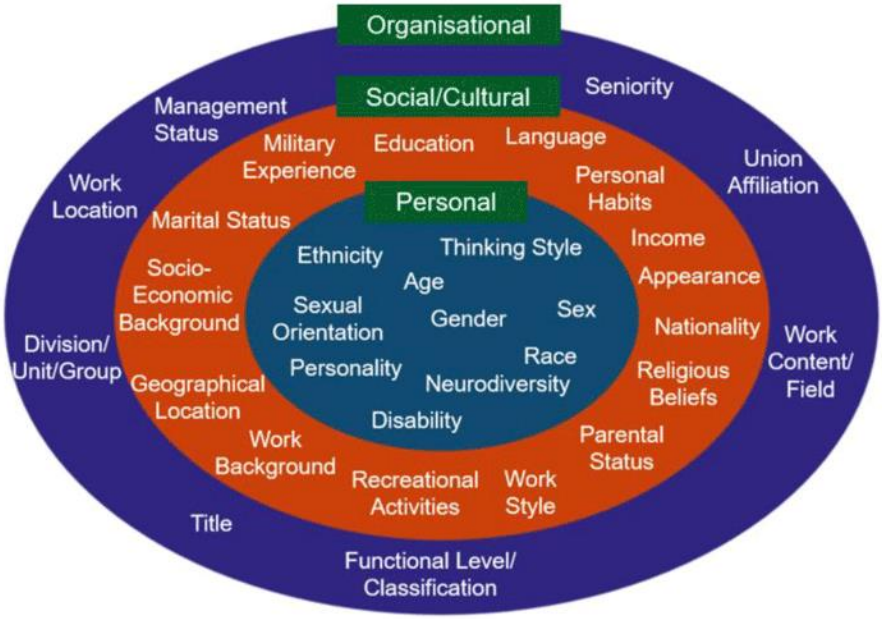
1.4 Comment on intersectionality

The term intersectionality was first officially coined in research by Crenshaw (1989), who defined it as:

"a metaphor for understanding the ways that multiple forms of inequality or disadvantage sometimes compound themselves and create obstacles that often are not understood among conventional ways of thinking."

Loudon and Rosener (1990) developed a framework depicting different dimensions of characteristics within individuals and institutions, known as the diversity wheel (figure 13), which is foundational in thinking about how different characteristics intersect with systems and structures to shape a person's lived experience. The centre of the wheel houses primary dimensions of diversity, including personal characteristics such as age, ethnicity and gender. Environmental, social and cultural factors and experiences extend from here, including factors such as learnings from family, friendships and community. The periphery of the wheel includes organisational factors such as influences from work groups or areas, structures or processes, and may include systemic barriers and bias.

Figure 13: Diversity Wheel demonstrating how personal characteristics intersect with systems and structures to shape a person's experience (Loudon and Rosener, 1990).



According to Crenshaw (1991), the focus of an intersectional approach to research and policy making is to highlight and enact accounting for these multiple grounds of identity when considering how the social world is constructed. This helps decision makers to understand how peoples lived experiences may differ as a result of their identity and unequal power relations, and thus develop more effective strategies to overcome inequality. Key to this approach, is that higher status is not attributed to any single inequality or experience of discrimination above another (Scottish Government, 2020; 2022). As such, Hankivsky et al (2014) argue that "intersectionality encourages critical reflection that allows researchers and decision makers to move beyond the singular categories that are typically favoured in equity driven analyses (e.g., sex and gender in sex and gender-based analysis) … to consider the complex relationships and interactions between social locations."

With regards to considerations of intersectionality within agricultural research, Tavernner et al's (2022) investigation of applied research design suggests that although there is growing

interest in intersectionality within agricultural research (McKune et al., 2021; Mungai et al., 2017; Ngum & Bastiaensen, 2021), its concepts and methodologies are yet to be operationalised in a "widespread or systematic way," with most intersectional analyses only investigating single identity intersections or 'snippet' approaches to intersectionality (Adaptation Fund, 2022).

The present thesis endeavours to explore differences between women as a group. In undertaking this investigation, it focuses upon key intersections (such as age, roles and responsibilities, education and organisations), while other intersections receive less coverage (such as entry to farming), and some regrettably receive no coverage (such as race and sexuality). This section aims to acknowledge and provide an overview upon intersections which are not well-integrated within the appraisal herein, while recommendations for further extension of the present research with regards to greater intersectionality are discussed within section 5.5.

Sexuality

With regards to existing literature, while there is a diverse and expanding body of research surrounding the role of gender in agriculture (Campbell et al. 2006; Ferrell 2012; Hall and Mogyorody 2007; Peter et al. 2000; Sachs et al. 2016; Trauger 2004), yet, the role of sexuality and heteronormativity is largely absent. As discussed within section 2.1, foundational to the organisation and understanding of both agriculture structure and gender, is the premise of the 'family farm' with following perpetuations including nucleated "farmer and farmer's wife" model that featured rigid divisions of gendered labour (Rosenberg, 2015). As such, the roles of women on farms has traditionally been viewed and assessed via their relationship to men (Shortall, 2010); men continue to control the greatest share of farming resources (land) (sources); and thus (heterosexual) marriage remains the primary route of entry for women in the sector (sources). Furthermore, while data availability pertaining to gender lags considerably for the sector, data pertaining to sexuality can be considered virtually non-existent (Leslie, 2017). Indeed, are no existing quantitative studies on queer and transgender farmers (Leslie et al, 2019), and the UK government does not collect information on sexuality and gender identity. Leslie (2017) and Leslie et al. (2019) suggest that although research into rural sexuality has expanded in recent years and

documents unique experiences through these sexuality, this has been largely viewed through the lens of ‘rurality’ or ‘sustainable agriculture’ with opportunity to now expand studies specifically focusing upon the sphere of commercial agriculture. Furthermore, as research from other male-dominated industries such as construction suggests (Wright, 2012), both heterosexual and non-heterosexual womens’ sexuality within male-dominated industries presents an additional intersect beyond that of gender alone which can affect lived experiences.

Race

Farming is the least ethnically diverse (whitest) profession in Britain, alongside horticultural, environmental and craft-based professions (Policy Exchange, 2017). Estimates of the numbers of Black and People of Colour (BPOC) in UK agriculture sit at around 1%, while BPOC are estimated to make up 17% of the general population and 33% of all children (Office for National Statistics, 2023).

There is a small and growing body of UK research focusing on the experiences of BPOC in UK agriculture, which highlights significant challenges relating to racial equity and inclusion. For example, The Jumping Fences project (Terry et al., 2023) explores barriers including systemic economic inequalities, education and skills gaps, and unearths pervasive societal narratives that farming is "not for them”, microaggressions, overt racism, and disconnection within communities. Theeb Partheeban's Nuffield Scholarship (2023) also investigates barriers and advocates for creating equity and inclusion through better representation of BPOC in agricultural spaces, targeting organisational practices, and challenging the false narratives farming is not for BPOC. Nye and Lobley (2023) review how to encourage and maintain diversity within future industry leaders, identifying race-related barriers to include racial microaggressions or racial violence, unconscious bias in recruitment or campaign targeting, intersectionality (such as growing up poor), encountering ignorance and harmful stereotypes, urban upbringings, and experiences of isolation and disconnection. Nye and Lobley state that failure to urgently address these issues risks ‘sabotaging the industry’.

Indeed, as highlighted by Terry et al. (2023) and Nye and Lobley (2023) reports, some of the challenges faced by BPOC in UK agriculture share similarities with those faced by women in the sector, such as underrepresentation, social exclusion and access to resources. However, while women's challenges are more centred around gender roles, patriarchy, and sexism within the industry, the experiences of BPOC in agriculture are shaped by intersectional factors, including race, immigration status, socioeconomic class – and sometimes gender. As such, intersectionality plays a key role in how these experiences overlap, especially for BPOC women, who navigate both racial and gender-based barriers.

Jumping Fences (Terry et al., 2023) report participant summarised the intersectional nature of challenges faced by BPOC in UK agriculture:

"There are things that are the same across the board, men are above women - that's across the board. The colourism thing - that's across the board. So all those levels are there to be fixed. Because it's like having four or five wounds on your body. You fix the big one, which is racism, then you've still got three or four here that need healing. And the doctor that can fix the racism one is not the doctor that's going to fix these others. We've gotta do these ourselves."

Addressing these barriers requires systemic changes, such as improving access to land, financing, and education, promoting diversity and inclusion within agricultural institutions, and fostering stronger support networks for BPOC in agriculture (Terry et al., 2023). Even within targeted recommendations to support women, specific consideration to BPOC must be given. Recommendations for further extension of the present research with regards to greater intersectionality are discussed within section 5.5.

Chapter 2: Investigating the economic visibility and contribution of UK women in agriculture through existing literature

2.1 Introduction

According to Ball (2020), academic interest in the role and contribution of women in agriculture from social science disciplines such as gender studies, rural studies and sociology has increased since 1980's, yet academic attention from the field of economics still lags. Despite a shortfall in economic studies, however, Ball suggests that insights into the economic contribution of women farmers can be found in other disciplines' literature and has important insights for agricultural economists. As such, this Chapter replicates Ball's methodology and broadens its focus upon 'farm women'. This Chapter comprises works published in the Journal of Rural Studies (Dunne et al., 2021).

2.1.1 Structure and Visibility

During the 1970s and 80s research began to emerge which revealed that women's integral role in agriculture had, until then, been "overlooked and unrecognised" (Boserup, 1970) within the traditional structure of 'male' agriculture across developed countries. Researchers such as Sachs (1983), Gasson (1980, 1992), Loeffen (1984) and Stratigaki (1988) began by inventorying and comparing women and men's farm roles and working patterns. They found that despite technological advances, most so-called 'one-man farms' of the era in fact relied heavily upon the unpaid daily farm labour of women. Some scholars argued that the traditionally physically demanding nature of farming itself initiated and perpetuated the gendered division of labour on farm, with heavy lifting, working with large animals and operating machinery commonly viewed as 'male' and 'productive' jobs. Meanwhile, 'female' and 'reproductive' roles included domestic work, child nursing/rearing, office work and assistance roles on farm. Yet, despite both types of work being essential to the survival of the farm, it was revealed that many of the tasks women undertook were overlooked due to narrow definitions and separation of productive and reproductive work (Bouquest, 1982; Whatmore, 1990; Brandth, 2002; Little and Panelli, 2003). As such, it is

argued that it is therefore not the nature of women's work which led to a lack of recognition, but rather unequal gender relations and status within patriarchal households (Oakley, 1974; Walby, 1990; Whatmore, 1991) which resulted in a lack of recognition of this work.

Indeed, wider structural constructs are therefore central to the understanding of such concepts. For example, it was not until 1918 that the majority of women gained the right to vote in the UK (UK Parliament [1], n.d); 1926 that women were allowed to hold and dispose of property on the same legal terms as men (UK Parliament [2], n.d); and 1970 that the Equal Pay Act was passed to prohibit any less favourable treatment between men and women in terms of pay and conditions of employment (The House of Commons Library, 2020). Indeed, the traditional practice of patriarchal succession has also dominated patterns of UK property ownership. With regards to agriculture, the practice of passing the ownership of farms and property to a son(s) or male relative(s) has perpetuated the existence of a male-dominated industry while ownership of resources and their associated social and economic capital has resulted in further male primacy in terms of ownership and leadership both at a farm-level but also within wider agricultural industry, organisations and policy. As such, most women entered and engaged with farming primarily through kinship relations, as wives, daughters, mothers and widows and gendered socialisation prepared men and women to fulfil different roles, societal norms, values and expectations (Little and Panelli, 2003). During the 1980s, rural research continued to evolve alongside the rise of Marxist and socialist ideology which challenged existing political concepts (Little and Panelli, 2003). Research focusing upon the roles and contributions of rural women outside farming began to appear and the concept of 'gender' was introduced and used to re-conceptualise the unequal relations between the sexes and structural norms which reinforced them. As such, agency emerged as a key force enabling women resist and remodel structural norms to redefine their position, and thus visibility, both on-farm and in society.

According to traditional political economy models, when the cost of business operation exceeds the opportunity cost, the business will cease to operate and exit the market. Yet, the rate at which actors exit the agriculture industry does not match the rate or proportion of farm businesses who fail to generate a profit or generate a low profit despite the sectors

characteristically high capital inputs and demanding working hours and conditions (Friedman, 1986). This contrasts with the principles of traditional political economy models and suggests that there may be extraneous variables, unaccounted for within traditional models, which producers prioritise more highly than the pursuit of profit.

Unlike other businesses and industries, agriculture is an industry still typified by family units. Gasson and Errington (1993) argue that the farm family business consists of six elements:

- Business ownership is combined with managerial control in the hands of business principals.
- These principals are related by kinship or marriage.
- Family members (including these business principals) provide capital to the business.
- Family members including business principals do farm work.
- Business ownership and managerial control are transferred between the generations with the passage of time, and
- The family lives on the farm.

Reflective of these trends, researchers identified a dominant 'traditional' discourse shaping the roles and identities of actors within the farming industry, and accounts for family and family labour interwoven within farming community and business structures. 'Agrarian ideology' can be defined as a belief system which ultimately prioritises the continuation of the family farm and its associated way of life at all costs (Price, 2012) and it is often used to explain how the family farm persists within capitalism when Marxist theories would predict its demise. Indeed, despite market volatility resulting in variable peaks and troughs throughout production cycles, UK farm incomes have seen a sustained and steady decline over recent years (Defra, 2016). In fact, in 2019/20 over one-fifth of UK farms failed to generate a positive return and around half of farms generated an income of less than £20,000 (Defra, 2020 [1]). Yet, again, the rate of exit from the industry does not match the rate or proportion of farm businesses who fail to generate a profit or generate a low profit (Defra, 2020 [1]).

Subsequently, modified versions of the domestic political economy model endeavour to encompass agrarian ideology and explain how and why many farming businesses continue to function when other factors, such as way of life and family succession, replace the

primacy of profit as a motivator of business function. As such, common family farm survival strategies enabling the substitution of profit include unpaid family labour and off-farm work. Indeed, using Net Farm Income as a narrower measure of income (imputing rent on owned land and a cost for unpaid labour, not including farmer and spouse labour) 36% of farms in the UK would fail to make a profit, versus 21% of farms using Farm Income as an indicator alone (Defra, 2020 [1]). Even more, this measure still fails to recognise farmer and spouse labour - who will likely provide highest units of labour - meaning even this figure is highly likely to largely underestimate the actual number of farms failing to make a profit when the true cost of labour is accounted for. Indeed, some 97% of UK farms are classified as 'sole holders' (Defra, 2016), despite their high reliance upon unpaid labour from spouses and other family members, thus voiding the visibility of other actors within the business. Furthermore, subsidy payments through the CAP - issued to a sole holder - composed 55% of UK farm incomes in the year 2019/20 (House of Commons, 2020) suggesting that policy and traditional accounting methods may well support the enactment of family farm survival strategies and sustain the masking of unpaid labour.

According to Friedman (1986) the success of agriculture within a capitalist society was based upon the self-exploitation of farm families, who kept on working more hours for less payment in order to survive modernisation and scale-enlargement. As such, farm survival strategies are underpinned by a range of social and cultural practices such as division of labour and patrilineal succession (Shortall, 1992; Little & Austin, 1996; Whatmore, 1991; Alston, 1995; Liepins, 1998; Lankester, 2012), and as such require the participation of all family members, thus, the family must be unified in their adoption of this agrarian ideology. Endogamy, the custom of marrying within the constraints of a local community, is recognised as a global phenomenon within farming communities and can be influenced by spatial isolation and social control (Pélissier et al., 2005; Van Leeuwen et al., 2005). Because farms are traditionally passed down to first born sons from generation to generation, later sons of farming families are encouraged to marry within the farming community because women from farming backgrounds have been socialised into the role and demands of the job more than non-farming women (Bomel, 2006). This understanding offers explanation to cultural hegemony; how prevalent ideologies remain intact across successive generations, and how they influence the roles and responsibilities of actors within its arena (Whatmore,

1991a, 1991b; Saugeres, 2002a, 2002b; Charatsari, 2014). Indeed, Whatmore (1990) explained how the political economy concepts of productive and reproductive labour justified ideologies of wifehood and motherhood and further perpetuated women's subordinated position on farm in modern capitalist farming. Shortall (1992, 1996) analysed farm women's exclusion from agricultural property as a result of patriarchal inheritance laws and practices that promote male dominance in agricultural production and politics. Researchers also revealed how modernisation, instead of improving women's position through liberation from heavy farm work, resulted in a de-skilling of their labour and devaluation of their position (Rooij, 1994). As such, women oft became unpaid assistants who 'gave a hand' when necessary but failed to gain any official recognition of their contribution.

During this time, research focusing upon the roles and contributions of rural women outside farming also began to appear (Little, 1991). At the same time, wider studies investigating women's participation in rural development, farm diversification and community engagement began to occur (Gasson and Winter, 1992; Benjamin, 1994; Clemenz et al, 1995; Overbeek et al, 1998; Eikland, 1999; Bock, 2004a; Chapman, 1996; Little, 1997a) and reveal how masculine definitions of participation, development and innovation not only restrict women's benefits from development policies and tools, but also define women's activities as irrelevant and therefore invisible (Little and Jones, 2000; Shortall, 2002; Bock, 2002, 2004b).

2.1.2. Agency

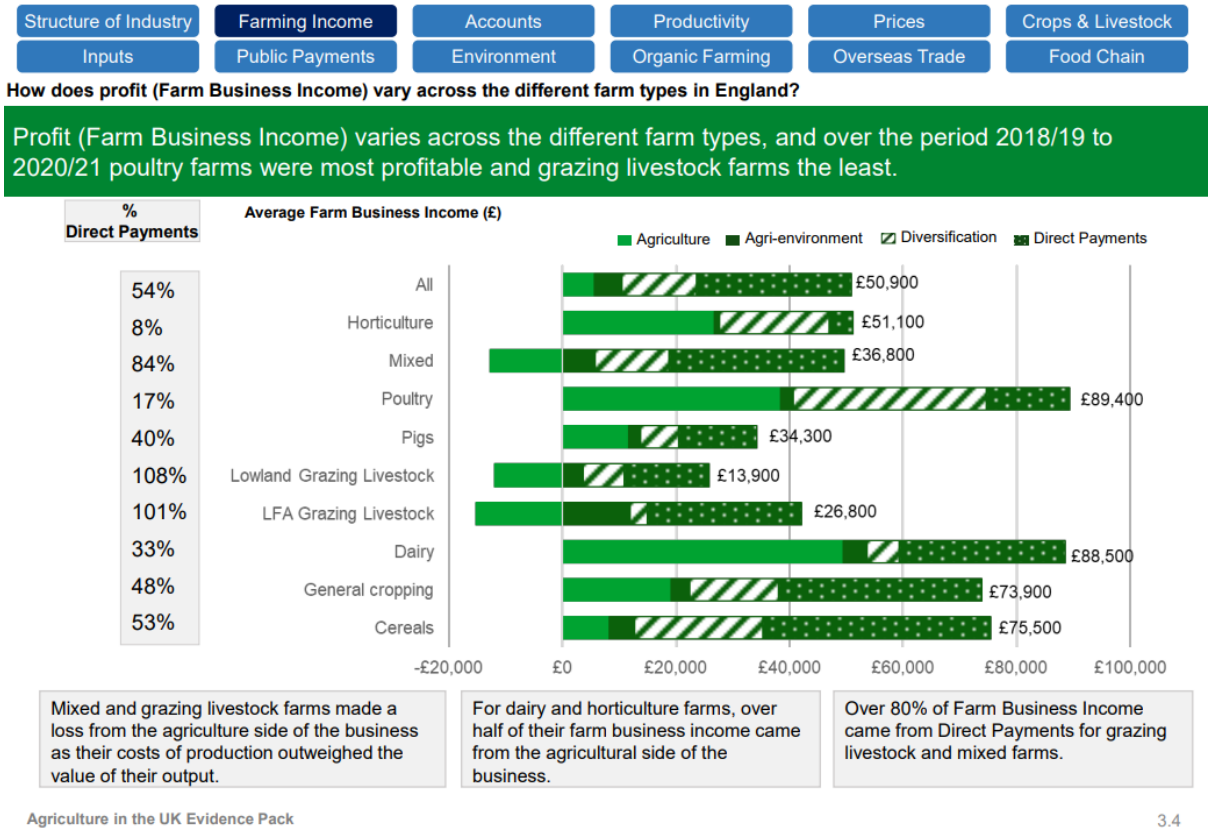
Until mid-1980's, much research had regarded men and women as fixed relations according to sex role theories which were socially constructed through gendered learning and practices within prescribed structural conditions (Brandth, 2002). However, during late 1980's into 1990's, the concept of 'gender' was introduced and used to re-frame the unequal relations between the sexes. The concept of gender used a three-layered approach comprising of 'identities', 'institutions', and 'norms and values' and studied how these structural components interact to produce and reproduce unequal gender relations (Scott,

1988). Ridgeway (2009) argued that gender identities and roles are not just individual, they are 'culturally hegemonic'; being embedded in social structures such as the media, the law, educational and organisational practices. As such, both women and men take part in the creation and perpetuation of gender relations, and as such are also able to exhibit agency to resist and initiate change. During this period, researchers developed several classifications of farm women that illustrate their diversity in position and power (Haugen, 1990; Bock, 1994) ranging from farm heads or partners to farm-wives or home-makers; underlining the possibility of change and women's agency in redefining their position within the farm and society (Berlan-Darque, 1988; O'Hara, 1998).

Alongside the concept of agency and the ability for new and discursive identities to be produced, the notion of differences between individual women gains importance. Structural characteristics such as class, ethnicity, race, age, education, religion and sexuality are acknowledged as contributing to the production of new identities and of social inequality (Kanij, 2003; McIlwaine and Datta, 2004). In this vein, the increased employment of farm women has meant a considerable change in their work status and identities. This has garnered interest throughout more recent research including their roles in both on-farm diversification activities (Bock, 2004; Trauger, 2004; Iakovidou et al, 2009; Haugen and Brandth 2010, 2011; Ball, 2014; Heggem, 2014; Wright and Annes, 2014), off-farm work (Haugen et al., 1993; Kalbacher, 1985) and as autonomous farmers (Ball, 202; Trauger, 2004). Shortall (2010) surmises that women's role on the farm and within research has changed over time from being understood as one of an unpaid assisting labourer, to one where women's varied contributions to the economic survival of the farm are recognised e.g. through their farm labour, managerial input, ownership of (usually very small) holdings, off-farm work and diversification activities. As external pressures elicit structural changes at both a farm and industry level, so too changes the role of actors within such systems. Indeed, off-farm work moves women's occupations into the public sphere and elevates their economic status, thus, how this interacts with farm/household dynamics and identities is an area of present and ongoing research (Budge and Shortall, 2022 [1]; [2]). Furthermore, many farms, particularly in Europe (thanks to the EU Rural Development Programme) have observed the rapid adoption of farm diversification activities (Shortall, 2010). As such,

income from diversification activities is shown to play a substantial role in UK farm incomes, as shown in Figure 14.

Figure 14: UK Farm Business Income (Defra, 2019)



Research also shows women play important roles in diversification and the characteristics of their diversifications may differ in comparison to their male counterparts activities (Bock, 2004; Trauger, 2004; Iakovidou et al, 2009; Haugen and Brandth 2010, 2011; Ball, 2014; Heggem, 2014; Wright and Annes, 2014). Simultaneously, the effect of policy instruments upon industry structure cannot be separated from its effects upon gender relations (Shortall, 2012; Shortall, 2022; Shortall, 2024), making this a particularly pertinent issue given UK's exit from European Union, and formulation of its own domestic agriculture policies. Indeed, UK agriculture is going through significant readjustments in terms of its political, economic and environmental operating landscape. As such, factors regarding the position of women on farms continues to attract further attention from both industry and policy makers, yet, Shortall (2010) also states that we do not have coherent data to understand these changes.

As such, researchers begin to recognise and attempt to account for the existence of multiple identities and understand how they are formed, maintained, and interact within the context of local structures, time and space. Indeed, as suggested by Shortall (2016) much research within this realm is based upon small, qualitative studies which rely upon in-depth interviews, participant observation and focus groups. Combining this research with quantitative analysis may provide potential benefits (Henderson and Hoggart, 2003; Brasier et al., 2014). Adjacent to the concept of multiple identities, dimensions and research methods; the fusion of research from multiple disciplines also comes to the fore. According to Ball (2020), academic interest in the role and contribution of women in agriculture from social science disciplines such as gender studies, rural studies and sociology has increased, yet academic attention from the field of economics still lags. Indeed, there is exciting scope to further develop quantitative analyses in this area.

2.1.3 Implications for Economists

As argued by Ball (2020), despite a shortfall in economic studies, insights into the economic contribution of women can be found in other disciplines' literature. Furthermore, Shortall (2016) recommendations for future research within the realms of gender in agriculture highlighted scope to further develop quantitative analyses. Hence, following Ball's (2020) footsteps, the present chapter set out to investigate the economic contribution of women working in the UK agricultural sector through the exploration and systematic review of other disciplines' outputs.

The difference between the present chapter and Ball (2020) is twofold; firstly, the definition of farm women is used as opposed to Ball's (2020) women farmers; and secondly, there are different research objectives. Within Ball (2020), the definition of women farmers was taken from Gasson (1980), where the categories suggested by Pearson (1979) of independent producers and agricultural partners were combined. According to Pearson (1979), the definition of farm women includes the following categories: Independent producers, where women hold both decision making and primary labour positions; agricultural partners,

where women are partners in both the decision making and labour positions; agricultural helpers, where women hold labour positions only; and finally, farm homemakers, where women rarely if ever hold labour positions on the farm and have no decision making power but may support the farm through off-farm employment or other activities. The present study has broadened Gasson's (1980) definition and included all categories suggested by Pearson (1979) alongside additional literature such as Haugen and Blekesaune (1996), Bryant (2002) and Contzen and Forney (2017).

Ball's (2020) research objective was to assess whether women farmers have become more economically equal to men farmers than they were in 1995. Ball (2020) concluded that the evidence of progress towards women farmers' equality with men farmers is mixed, highlighting the need for further research. The research objectives of the present chapter are threefold: firstly, it aims to identify women's economic contribution and visibility; secondly, it aims to document the key differences suggested in the literature between women and men's farming practices and outcomes; finally, it aims to explore the barriers to women's participation and visibility. As such, the outcomes of the present systematic review build upon Ball (2020) and allow the creation of an initial 'bigger picture' of women's contribution and provide an additional resource that can underpin further economic studies. It was the aim of the study in addressing a lack of economic research in this area to contribute towards the multi-dimensional consideration of all aspects of the farm business, including existing cultural, social, political and environmental research.

This systematic review is organised as follows: Section 2 details the methodology used; Section 3 provides the systematic review results; Section 4 discusses the results concerning the UK policy context and provides recommendations for further economic research. The chapter concludes with Section 5.

2.2 Methodology

The methodology employed for this study is a systematic review of international peer-reviewed, English-language literature between January 1970 and January 2020, using the

PRISMA statement as guidance (Moher et al., 2009). The British Medical Journal (BMJ, 2009) suggests systematic reviews provide a useful way to summarise evidence accurately and reliably. As such, a systematic review attempts to collate all evidence that fits pre-specified eligibility criteria to answer a specific research question. It uses explicit, systematic methods that are selected to minimise bias, thus providing reliable findings from which conclusions can be drawn and decisions made (BMJ, 2009). Key limitations of this methodology are discussed in more detail in Chapter 6.2.

First, to capture the multidisciplinary evidence using the terms "women or gender" and "agriculture or agricultural or farm or farmer" via the University of Nottingham online library 'NU-search' which uses 27 databases for agriculture, 34 for economics and 45 for sociology (see Appendix B for database list). Second, to search citations within the first round of records to identify additional relevant literature. From a total of 14,470 search results, 1340 records were identified for abstract screening, 480 full-texts were assessed for eligibility, and 184 peer-review papers were selected which focus on the role of women in agriculture within developed countries.

2.2.1 Search strategy

2.2.1.a Identification and search terms

Searches were performed in 'NU-search' for literature published since 1970 on women farmers in Organization for Economic Cooperation and Development (OECD) high-income countries using the terms "women or gender" and "agriculture or agricultural or farm or farmer" in addition to the name of each of the OECD high-income countries. This initial search strategy yielded 14,470 records.

2.2.1.b Initial screening

A complication of using the 'NU-search' database was that despite the specific search terms employed, results generated from 105 databases still included vast quantities of research

which was not relevant to this study, the majority of which documented women's roles in agriculture in developing countries. Preserving the richness of relevant research was not found to be possible in combination with narrower search terms. As a result, an immediate screening was employed by reviewing the titles of only the first three hundred records for each search (ranked in order of relevance to search terms) to efficiently collect only the relevant titles for this study. For example, where the title of literature clearly did not indicate links to our search terms, e.g. named a developing country, it was excluded from further screening. Only titles that were clearly irrelevant to the search terms were excluded. Where this was unclear, the literature was retained for further screening. This generated 1040 records for further review.

2.2.1.c Abstract screening

A second screening was employed to afford a greater focus on the research terms within a more manageable record set. In this stage, the abstracts of 1040 records were assessed for relevance to search terms and applicability to study criteria. This included records that specifically focused on the role of gender in agriculture within developed countries. Duplications across multiple searches were also removed. In this stage, the abstracts of 350 pieces of literature were identified as relevant.

2.2.1.d Full text assessment and citation identification

An in-depth review of the 350 full-text records was then conducted. This included the assessment of original content and identification of relevance to our three research objectives. Records without available full-text were excluded. Throughout the review of the full text records selected for assessment, 300 relevant citations from the literature reference lists were also identified. Once screened, this generated an additional 130 records for full-text assessment. Following this, the final collection for synthesis in this review comprised of 184 records. PRISMA search strategy and outcomes are presented in Figure 11.

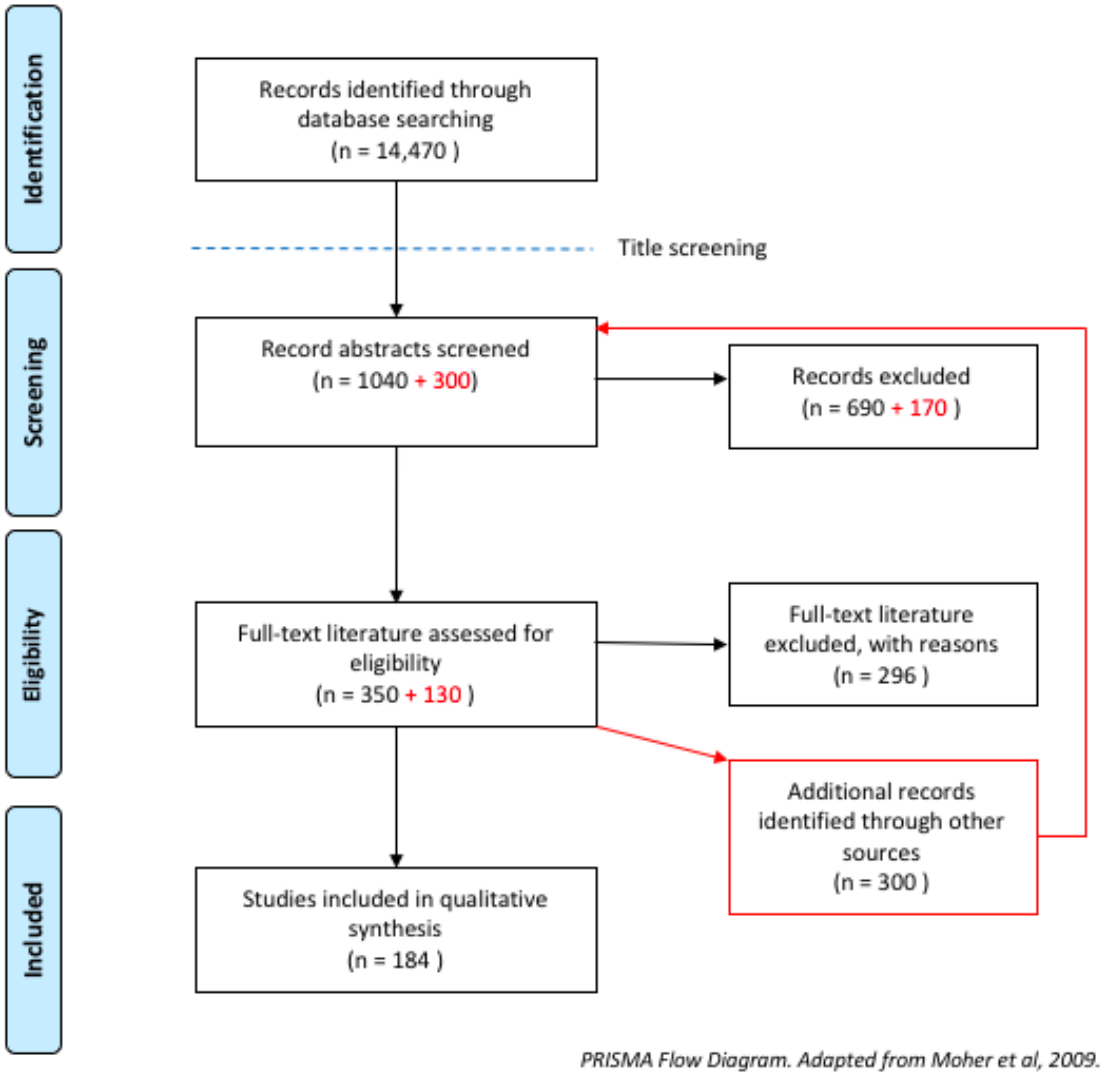


Figure 11: PRISMA Flow Diagram

2.3 Systematic Review Results

The findings of the systematic review allow firstly to identify the economic contribution and classification of farm women. Differences within farm women as a group are explored and used to develop a conceptual framework characterising the different economic identity types of farm women across a spectrum of economic contribution and visibility. Secondly, these findings allow a comparison of the economic contribution of farm men and women, revealing key differences between farming practices and outcomes. Thirdly, this chapter reveals that key barriers and potential incentives to women's participation and visibility in agriculture are associated with access to land, education and organisations.

2.3.1 Economic contribution and classification

Informed by the work of Pearson (1979) and extended by the work of Gasson (1981, 1992); Haugen (1990); O'Hara (1994); Haugen and Brandth (1994); Bryant (2002); Brazier et al. (2014); Contzen and Forney (2017) cross-disciplinary research was drawn together to create three on-farm economic identity classifications: traditional farm housewife; working farm member; and women farmer. The creation of two additional off-farm economic identity classifications, namely 'dual occupation' (pluriactive) and 'off-farm occupation', allows us to distinguish those who combine farming with another economic identity which may be located in waged work or a second enterprise. Building upon these categories, the organisation of labour, economic visibility and decision making power associated with each economic farm identity classification was expanded upon. In the formulation of these roles, it is accepted that individuals may exhibit fluidity between classifications. All criterion may not explicitly nor indefinitely apply, and individuals may fulfil different roles, or aspects of different roles, at different times (Riley, 2009).

2.3.1a On-farm economic identity classifications

A. Traditional Farm Housewife

Traditional farm housewives encounter clear gender division of labour. They may be primarily responsible for domestic tasks but help around the farm during busy periods or emergencies (Whatmore; 1991; Gasson, 1981; O'Hara, 1994; Byrant, 2002; Silvasti, 2003; Seuneke and Bock, 2015; Contzen and Forney, 2017). They may have entered farming through marriage rather than occupational choice (Haugen and Brandth, 1994) and their domestic work often gains limited economic visibility despite making a valuable contribution to the farm (O'Hara, 1994; Haugen and Brandth, 1994; Riley, 2009). Traditional farm housewives may work off-farm to support income, but personal income is commonly undifferentiated and contributes towards 'farming income' (Gasson, 1981; Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017). They contribute little to daily farm decisions but may be consulted over strategic farm decisions (Contzen and Forney, 2017). Structure is highly traditional and agency is assumed to be limited.

B. Working Farm Member

Within this economic identity, the literature suggests women are assistants to men farmers. They are either classified as farm assistants or subordinate managers, indicating that structural constructs and agency varies with economic power relations.

B.1. Farm Assistant

Farm assistants encounter clear gender division of labour and are primarily responsible for domestic tasks in addition to suitable farm tasks e.g. labour for youngstock/livestock and farm administration (Whatmore; 1991; Gasson, 1981; O'Hara, 1994; Byrant, 2002; Silvasti, 2003; Contzen and Forney, 2017). Farm assistants provide limited input into daily farm decisions but may be consulted over strategic farm decisions (Contzen and Forney, 2017). In addition, they may receive limited acknowledgement of their economic contribution

(Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017). Farm assistants may work off-farm to support income, but personal income is commonly undifferentiated and contributes towards 'farming income' (Gasson, 1981; Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017).

B.2. Subordinate Manager

Subordinate farm managers are associated with increasing agency, flexible division of labour and may be responsible for minor farm enterprise or diversification (Whatmore, 1991; Gasson, 1981; O'Hara, 1994; Byrant, 2002; Silvasti, 2003; Contzen and Forney, 2017). They may also be responsible for farm administration duties. Their work receives increased acknowledgement of their economic contribution (Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017) while they provide valued input into daily farm decisions and strategic farm decisions (Contzen and Forney, 2017). Subordinate farm managers may work off-farm to support income, with limited but increasing differentiation of personal income and 'farming income' (Gasson, 1981; Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017).

C. Women Farmer

Within this economic identity, women hold clearly defined responsibility and autonomy for farm or major enterprises. They exhibit agency and may farm independently or in partnership with family, spouse or an employer. Within this category, women can be further grouped into traditional women farmers or professional women farmers.

C.1. Traditional women farmer

Traditional women farmers may be older and farm independently (Haugen, 1990; Byrant, 2002; Contzen and Forney, 2017). Division of labour is not gendered, but they may maintain traditional views and workstyles, for example avoiding heavy machinery (Haugen, 1990; Byrant, 2002; Contzen and Forney, 2017). Traditional women farmers may be widowed and

previously fulfilled a 'working farm member' role (Haugen, 1990; Haugen and Brandth, 1994; Byrant, 2002; Contzen and Forney, 2017). There is a clear acknowledgement of their economic contribution and autonomy over daily farm decisions, where they have the authority within strategic farm decisions (Contzen and Forney, 2017). They may also work off-farm to support income and maintain limited but increasing differentiation of personal income and 'farming income' (Gasson, 1981; Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017). Although they exhibit agency, this may be exercised within the bounds of some traditional structural forms.

C.2. Professional women farmer

Professional women farmers may be younger and entered farming through occupational choice, holding managerial positions or being entrepreneurs (Haugen, 1990; Byrant, 2002; Haugen and Brandth, 1994; Contzen and Forney, 2017). Within this category, the division of labour is not gendered, and it appears that progressive views and work styles are more prominent (Byrant, 2002; Contzen and Forney, 2017). Professional women farmers exhibit high levels of agency and receive clear acknowledgement of their economic contribution, possess autonomy over daily farm decisions and have authority within strategic farm decisions (Contzen and Forney, 2017). They may work off the farm to support income, and there is greater differentiation of personal income and 'farming income' (Gasson, 1981; Bryant, 2002; Shortall, 2002; Contzen and Forney, 2017).

2.3.1b Off-farm economic identity classifications

A. Dual Occupation

Dual occupation can be associated with any economic identity classification and used to describe pluriactive women who engage and identify with economic endeavours both on- and off-farm. For example, a 'working farm member' may identify both as a farm worker, and as an off-farm professional e.g. marketeer (Bryant, 2002). The organisation of labour,

economic visibility and decision making power associated with dual occupation identities is associated with each economic identity classification, as described above (Bryant, 2002; Contzen and Forney, 2017).

B. Off-Farm Occupation

An off-farm economic identity classification can be associated with a limited on-farm presence and disengagement with farming activities (Bryant, 2002). They may include those without an autonomous association to farming e.g. entry through marriage rather than occupational choice (Haugen and Brandth, 1994). As farm work is not undertaken, division of labour does not occur and the economic contribution of off-farm income is clearly acknowledged (Bryant, 2002; Contzen and Forney, 2017). No input into daily farm decisions is sought or received, although off-farm economic identities may be consulted over strategic farm decisions which affect the household (Contzen and Forney, 2017).

2.3.2 Economic contribution and economic visibility conceptual framework

Figure 12 builds upon these economic identity classifications to map a conceptual framework which may be applied in the UK setting. This follows the findings of Byrant (2002), who used a similar model to demonstrate categories of farm occupational identity in an Australian setting. Figure 12 uses this structure to visually represent the economic identity classifications presented within this chapter alongside additional economic indicators, including the economic contribution and visibility of farm women.

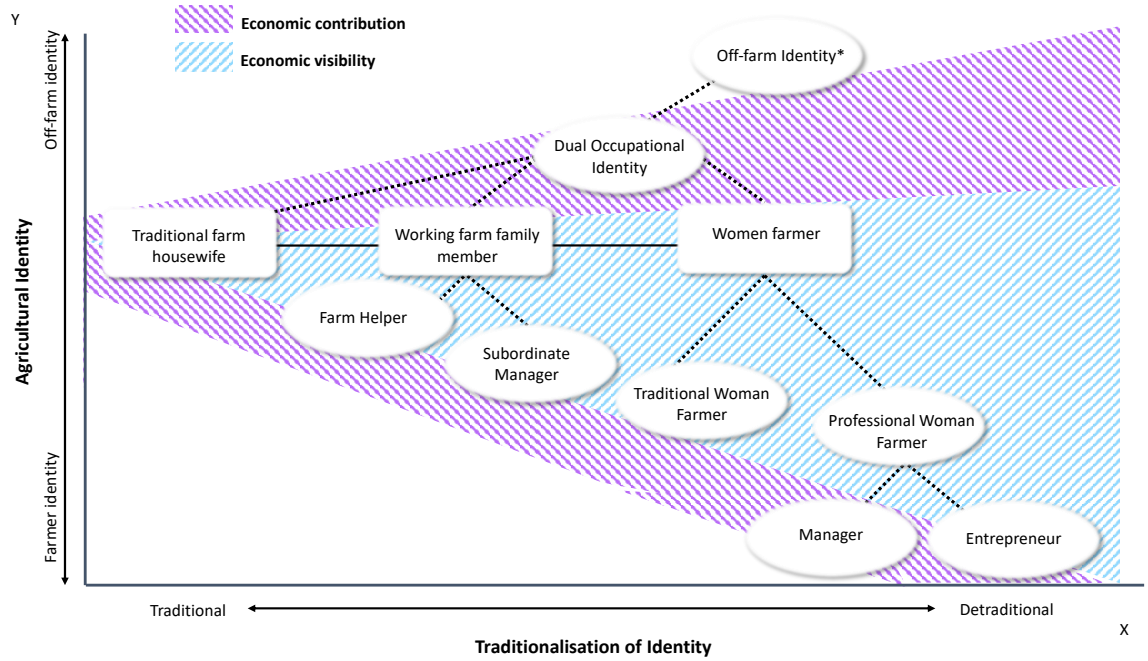


Figure 12: Farm women identity conceptual framework

**Placement of 'off-farm identity' classification relative to the y-axis prevents its accurate representation within the (dash coded) economic visibility intersect. Rationale for this positioning is explained in more detail below.*

Figure 12 illustrates the three on-farm economic identity classifications: traditional farm housewife; working farm member; and women farmer, which sit across a central trajectory. Differences of agency within 'working farm member' and 'women farmer' groups are represented via the creation of additional categories which sit within these broader economic identity classifications. Dual occupation and off-farm economic identity classifications are also accounted for.

The relationship between 'on-farm' and 'off-farm' identity is mapped via the y-axis to reflect agricultural identity and participation in farm activities. As in Byrant (2002), the x-axis of this graph represents a continuum from 'traditional' to 'detraditional' whereby each economic identity is plotted. The term detraditional is used, rather than non-traditional, to indicate the active process whereby, amidst increasingly global structural influences, individuals may exhibit agency to choose between diverging options and construct their own economic identities (Beck 1992a; Giddens, 1991; Beck, Giddens and Lash 1994). Giddens (1991) described detraditionalisation as the 'evacuation' or emptying out of traditional local contexts of action which are in some sense rooted in origin or place.

The economic contribution is represented within the dotted coded intersect. The symmetrical widening of the intersect along the x-axis demonstrates increasing economic contributions associated with higher input and autonomy over farm tasks in association with detraditionalised economic classifications. Its symmetrical representation accounts for the economic contribution of women spanning across both farm and off-farm identity classifications, and the contribution this makes to both farm and household income.

Economic visibility is represented within the dashed coded intersect. The widening of the intersect along the x-axis demonstrates the increasing recognition of economic contributions associated with both greater on-farm economic contributions and detraditionalised economic identity classifications. Its asymmetrical representation accounts for a lack of differentiation between income streams and the widely documented failure for many 'farm incomes' to recognise the contribution of off-farm or non-farming incomes e.g. diversification (Gasson, 1992; Shortall, 2002; Bryant, 2002). An exception to this is the 'off-farm identity' classification, where no overlap between farm and waged work occurs. This income stream is clearly differentiated and high economic visibility is received. Its classification positioning relative to the y-axis prevents inclusion within the dotted intersect and is noted (*) in Figure 12.

The relative positioning of both the dashed and dotted coded intersects illustrates that the economic contribution of most farm women far exceeds the recognition they gain. Findings throughout the literature reviewed suggest that despite providing vital support to the farm and household, the value of women's contribution to the farm is often not fully recognised. This may occur through a combination of off-farm employment; unpaid farm or household work; undifferentiated income streams; gendered division of labour; and subordination (O'Hara, 1994; Gasson, 1992; Bryant, 2002; Riley, 2009).

In terms of women's economic visibility, this is associated with clear decision making power and autonomy over enterprise decisions (Gasson, 1992; Bryant, 2002). This work gains visibility and acceptance both within the household and the wider farming community. When women hold detraditionalised economic identities, a more economical liberal

discourse is identified (Ní Laoire, 2002; Coldwell, 2007), whereby traditional social structures are replaced by market forces which in turn influence the construction of work identities (Bryant, 2002; Lankester, 2012).

To apply these findings to a UK lens, pairing the Farm Structure Survey (Defra, 2016) statistics and the economic identity classification framework proposed within this review, an initial classification of UK farm women's economic contribution and visibility can be achieved. The 52% of UK family farm workers which are women could be included within the economic identities of 'traditional farm housewives' and 'working farm members'. The 19% of non-family workers which are women could be included within the economic identity of 'working farm members'. Finally, the 15% of farm holders and managers which are women could be included within the 'women farmer' economic identity classification.

2.3.2 Comparison of the economic contribution of farm men and women

The literature also documented differences in economic contributions between farming men and women. In this section, cross-disciplinary research is drawn together to compare the economic contribution of both farming men and women across a variety of categories. A total of 56 studies were identified to document economic differences across 10 distinct categories including: farm size; type of production; farm income; off-farm work; age; education; land; labour; machinery and technology. Corresponding sub-categories were also formed. The categories/sub-categories comprising the largest number of supporting studies include 'diversification' (16), 'agricultural education and training' (13) and 'farm size' (11). The category including the smallest number of supporting studies is labour (1). These findings revealed key differences between farming practices and outcomes of farming men and women. An overview of the scope of this research is provided in Table 5.

Table 5: Overview of literature for the economic comparison of farm men and women

Category	Subcategory	Number of studies	Timeframe of literature	What the literature suggests
Farm size		11	1985 - 2014	Women are associated with smaller farm size
Type of production	Farm type	10	1985 - 2016	Women are associated with livestock and speciality production as well as organic production.
	Diversification	16	1992 - 2014	Women are positively associated with farm diversification
	Sustainable and environmental objectives	6	1999 - 2016	Women are associated with sustainable and environmental objectives
Farm income	Farm income and profitability	8	1985 – 2016	Women are associated with lower farm income, profit, return on equity and sales value
	Business goals	3	2010 - 2014	Women are associated with goals other than profit maximisation
Off-farm work	Frequency	3	1985 - 2013	Women associated with higher engagement in part-time work than male farmers.
	Income	5	1985 - 1998	Women are associated with lower off-farm income
Age		5	1985 - 2013	Mixed evidence with three studies supporting that women are associated with a higher age; one study supporting that women are associated with a lower age, and one study supporting that there is no significant difference.
Education	Agricultural training and education	13	1996 - 2019	Women are associated with lower access and participation in agricultural training and education
	General education	3	1998 - 2013	Women are associated with higher levels of general education
	Age	3	1990 - 2011	Younger women are associated with higher educational qualifications

Land	Succession	5	1994 - 2017	The majority of literature suggests that women are associated with a lower likelihood to inherit farmland. However, one study did suggest that younger women are more likely to inherit than older women.
	Tenure	3	1985 - 2013	Women are associated with a lower likelihood to rent farmland
Labour		1	2016	Women are associated with a higher labour input and higher reliance on family help
Machinery		4	1990 - 2014	Two papers suggest that women are associated with a lower attraction to farm machinery and an additional two papers suggest that the difference between men and women machinery use is lower in younger women than older women.
Technology		7	1997 - 2014	The majority of the literature suggests that women are drivers and users of technology, with only one study documenting no difference or less use.

Eleven studies conducted throughout the US and Europe between 1985 and 2014 found significant differences in farm size between men and women farmers. The majority of these studies found that women were associated with a smaller farm size compared to men farmers (Kalbacher, 1985; Haugen, 1990; Leckie, 1993; Haugen and Brandth, 1994; Perry et al., 1995; Rosenfeld and Tigges, 1998; Gidarakou, 1999; Shortall, 2010; Hoppe and Korbe, 2013; Ball, 2014). Only one US paper, Zeuli and King (1998), found women farmers to be associated with larger farm sizes, in contrast to the results of previous and subsequent studies. The findings of Zeuli and King (1998) infer that although their results may buck the trend of existing research, these differences may well be less substantial than other contributory factors. They suggest that where farm size is held constant, there do not appear to be substantial differences in farm income or profitability that can be attributed to gender.

Farm type is another area Zeuli and King (1998) offer to explain differences between male- and female-operated farms that have traditionally been attributed to gender. The findings of their 1998 study concur with prior research in the area to suggest that women are more highly represented in livestock and speciality production farm types (Kalbacher, 1985; Leckie, 1993; Perry et al., 1995; Rosenfeld and Tigges, 1998; Zeuli and King, 1998; Trauger, 2004; Elias and Lundqvist, 2016). An additional two studies from Canada (Sumner and Llewelyn, 2011), and Ireland (Läpple, 2012), suggest that women are more highly represented in organic production. Furthermore, sixteen studies conducted across the UK and Europe between 1992 – 2014 suggest that women are positively associated with farm diversification (Gasson and Winter, 1992; Evans and Ilbery, 1993, 1996; Benjamin, 1994; Cawley, 1995; Ilbery et al., 1998; Caballe, 1999; Carter, 1999; Gorman, 2004; Bock, 2004; Trauger, 2004; Iakovidou et al, 2009; Haugen and Brandth 2010, 2011; Ball, 2014; Heggem, 2014; Wright and Annes, 2014), and six studies between 1999 and 2016 indicate that women are associated with sustainable and environmental objectives (Gidarakou, 1999; Zelezny et al., 2000; Trauger, 2004; Goldsmith et al., 2013; Xiao and McCright, 2015; Sachs et al., 2016).

In terms of business goals, recent US studies including Trauger (2010), Hoppe and Korb (2013) and Ball (2014) suggest that women are associated with business goals other than profit maximisation. Examples include an emphasis on work/life balance and the requirement to work businesses around other commitments such as family and childcare. This, combined with factors such as farm size and type, may offer insight into the findings of eight studies included in this review which associate women with lower farm income, including profit, return on equity and sales value (Kalbacher, 1985; Haugen and Brandth, 1994; Perry, 1995; Rosenfeld and Tigges, 1998; Zeuli and King, 1998; Hoppe and Korb, 2013; Zeuli and King, 1998; Elias and Lundqvist, 2016).

Another area linked to this is participation in off-farm work. Kalbacher (1985) and Haugen et al. (1993) found women in the US and Norway engaged more highly in part-time off-farm work. Furthermore, five additional studies indicate that where women do engage in off-farm work their work is found to yield a lower income than men (Kalbacher, 1985; Leckie,

1993; Perry et al., 1995; Rosenfeld and Tigges, 1998; Zeuli and King, 1998). On the contrary, Hoppe and Korb (2013), a US study, suggest that women are less likely to engage in part-time work than men. Yet, UK government statistics (Defra, 2016) suggest that women farmers are associated with a lower time worked annually on their holdings than male farmers; with over three-quarters of female farmers (77%) working on their holding part-time, versus just over half of male farmers (53%).

A component indicated to be linked to many of the aforementioned factors is education. Thirteen studies from across Europe, Australia and the US, conducted between 1996 and 2019 suggest that women are associated with lower access to, and participation within, agricultural training and education (Haugen and Brandth, 1994; Shortall, 1996; Alston, 1998; Liepins and Schick, 1998; Pini, 2002; Brandth, 2002; Safilios-Rothschild, 2006; Trauger et al., 2008, 2010; Brasier et al., 2009; Istenic, 2015; Shortall 2017, 2019). Yet, three further studies suggest that women are associated with higher levels of general education (Rosenfeld and Tigges, 1998; Zeuli and King, 1998; Hoppe and Korbe, 2013).

In terms of access to resources, the existing literature suggests that this is intrinsically linked to land succession and resource ownership. This systematic review found five studies conducted throughout Europe between 1994 – 2017 which indicated that women are associated with a lower likelihood to inherit farmland (Haugen and Brandth, 1994; Leckie, 1994; Mann, 2007; Cavicchioli et al., 2015; Shortall, 2017). A further three studies from the US found that women farmers are associated with a lower likelihood to rent farmland (Kalbacher, 1985; Zeuli and King, 1998; Hoppe and Korbe, 2013), and a study by Elias and Lundqvist (2016) suggests that Norwegian women are associated with a higher labour input and higher reliance on family help.

Regarding the use of machinery and technology, two US studies, Trauger (2004) and Ball (2014), found that women are associated with a lower attraction to farm machinery. Yet the same two studies, in addition to four more from across Europe, Australia and the US (Zepeda and Castillo, 1997; Burton et al., 2003; Trauger et al., 2010; Hay and Pearce, 2014), suggest women are the drivers and users of technology. Indeed, a more overt example of women's crucial role within the mechanisation process was observed on 40 UK farms where

women were central to, and commonly took control of, farm finances steering the adoption of farm technology and mechanisation (Riley, 2009). Haugen (1990) suggests that the difference between men and women machinery use is lower in younger women than older women. Despite this, a US study by Zeuli and King (1998) suggests no difference in computer use between genders but found men to be higher users of information services.

An important aspect highlighted within this systematic review is age and the result of generational differences across farmer populations. Existing research documenting the age structure of women farmers is unclear. North American studies by Kalbacher (1985), Leckie (1993), and Hoppe and Korb (2013), suggest that women are generally older than their male counterparts, however, Gidarakou (1999) found that in Greece, women were generally younger, while Zeuli and King (1998) found no significant difference between the age structure of men and women farmers in the US.

Furthermore, a small number of studies have identified differences between farm women, based solely on their age. Three studies suggest that younger women are associated with higher educational qualifications than older women and compared to their male counterparts (Haugen, 1990; Bock and Shortall, 2006; Hocevar and Cernic Istenic, 2011). Furthermore, Haugen and Brandth (1994) found that younger Norwegian women were more likely to inherit land than older women and, as mentioned previously, Haugen (1990) suggests that the difference between men and women's machinery use is lower in younger women than older women.

2.3.3 Identified barriers and potential incentives

The understanding of key challenges and opportunities is essential in any attempt to bridge the gap between farm men and women. The literature identifies three prominent structural factors affecting farm women across a spectrum of economic contribution and visibility. These are access to land, education and training, and organisations.

2.3.3.a Access to land

Shortall et al. (2019) suggests that access to land represents the single largest barrier to women's entry and participation within agriculture. Structurally, across most of the developed world, it is the norm for men to own land and for men to pass land from father to son (Gasson, 1980; Sachs, 1983; Whatmore, 1991; Alston, 1995; Shortall 1999, 2010, 2016; Bock and Shortall, 2006; Brandth and Haugen, 2011). Studies including Alston (1998); Mann (2007); Voyce (2007); Rossier and Wyss (2008); Cavicchioli et al. (2015, 2018) and Shortall et al. (2017) illustrate that men and first-born potential successors are more likely to succeed the family farm. This knowledge is well established within the international literature reviewed, which suggest that patrilineal succession presents a major structural barrier to women's participation within agriculture (Gidarakou et al., 2000; Rossier and Wyss, 2008; Cassidy and McGrath, 2014, 2015; Shortall et al., 2017).

Rather than being of legal origins - for example, during and after the Spanish Civil War under General Francisco Franco (1939-1975) where Spanish women were prohibited from almost all economic activities including employment and ownership of property without a husband's approval - women's access to land throughout developed countries is suggested to be largely governed by cultural practices. Knowledge established within the literature reviewed reflects the persistence of traditional normative beliefs (Silvasti, 2003; Price and Evans, 2006; Rossier and Wyss, 2008; Shortall et al., 2017). This aligns with studies by Mann (2007), Cassidy and McGrath (2014, 2015) and Luhrs (2016) who suggest that gendered socialisation and education of male and female offspring can often be linked to the inheritance patterns of land, and is shown to reduce agricultural socialisation of females from an early age. Furthermore, an industry survey by Farmers Weekly (2014) reveals that 61% of female respondents considered themselves "rarely" or "never" treated equally when it comes to succession. This is a factor that may also be further exasperated by a lack of future business planning practices. Succession planning is identified as a key issue through the agricultural sector, where it is estimated that less than 50% farms have a succession plan in place (Cassidy and McGrath, 2014; Farmers Weekly, 2015).

Furthermore, access and ownership of land correlates with considerable economic resources and facilitates access to other resources including capital, infrastructure, training and networks (Rico and Fuller, 2016; Williams, 2006; Ingram and Kirwan, 2011; Miler and Butler, 2014; Ilbery et al., 2010). Pertinently, recent studies have revealed that land ownership, and its associated economic benefits, are associated with the recognition of women's economic position within farming both internally and externally to the farm (Brandth, 2002; Safilios-Rothschild, 2003; Cush et al., 2018). The findings of such studies support the notion that patrilineal succession, therefore, aids to mask the economic participation and visibility of women in the sector through restricted access to land and other resources. Furthermore, a Farmers Weekly industry survey (2014) revealed that the route of entry to farming for both men and women differs significantly as a result of successional practices. While only 2% of male respondents married into farming, the survey revealed that marriage remains the main route into farming for 25% of women respondents. As marriage is the most common route of entry into farming for women, their marrying into the sector is said to present a range of structural challenges from both cultural norms and restricted ownership and access to economic resources, as patrilineal succession remains dominant (Shortall, 2002; Shortall et al., 2017).

Two studies by Brandth and Overrein (2013) and Wheeler et al. (2012) suggest that traditional patterns of succession may be weakening, and with this, greater economic opportunities for women within agriculture are presented. Such opportunities may be found in a range of economic structures including joint farming ventures, share farming and land matching schemes which have been demonstrated to increase women's access to land and resources (Williams, 2006; Almas, 2010; Ingram and Kirwan, 2011; Macken-Walsh and Roche, 2012; Shortall et al., 2017; Rico and Fuller, 2016; Cush et al., 2018). Furthermore, Safilios-Rothschild (2003), Gidarakou et al. (2008) and Cush et al. (2018) also suggest that where women achieve land ownership status this appears to encourage participation in economic activities such as farm decision making, production and investments.

2.3.3.b Education

Education is another key theme identified throughout this systematic review. Access to education facilitates the sharing of knowledge and networks are a key structural component which affects women's economic contribution, performance and visibility within agriculture (Slagsvold and Sørensen, 2008). The provision of training and education is also often supported by policy, therefore, it is an important area for economic understanding.

Studies have demonstrated that there are key structural differences in education between farm men and women, notably that women are associated with lower access and participation in agricultural training and education (Haugen and Brandth, 1994; Shortall, 1996; Alston, 1998; Liepins and Schick, 1998; Pini, 2002; Brandth, 2002; Safilios-Rothschild, 2006; Trauger et al., 2008, 2010; Brasier et al., 2009; Istenic, 2015; Shortall 2017, 2019). Yet, women farmers are also associated with higher levels of general education (Rosenfeld and Tigges, 1998; Zeuli and King, 1998; Hoppe and Korbe, 2013). Women's access and participation in educational activities are shown to be primarily attained through traditional education and off-farm work, rather than specific agricultural education and training (Brandth et al., 2011). Shortall et al. (2017) observe that women rarely attend continuing education provisions for people on farms.

Sociological studies suggest these findings may be embedded in cultural norms, whereby, despite growing up on a farm, women may not experience the same exposure to on-the-job training as men (Shortall, 1996; Cassidy and McGrath, 2015; Shortall et al., 2017). This can be linked to successional practices and offer an insight into the gendered division of labour to explain differences in educational requirements (Shortall, 1996; Cassidy and McGrath, 2015; Shortall et al., 2017) and economic contribution and visibility.

Shortall (2010, 2015) and Istenič (2015) suggest that, structurally, women do not benefit and are not targeted, for agricultural training as much as men because they are not the landowner. Particularly, women who enter the sector through marriage also have less access to training and networks (Shortall, 2002; Williams, 2006; Shortall et al., 2017). Furthermore, research argues that agricultural education services continue to offer only

specific programmes which are not consistent with women's demands or requirements (Shortall, 1996; Liepins and Schick, 1998; Albright, 2006; Trauger et al., 2008; Brasier et al., 2009; Trauger, 2010; Charatsari et al., 2013), and content adheres to the traditional division of labour which may no longer represent women's evolving economic roles within modern farming systems (Shortall, 1996; Schmitt, 1998; Charatsari et al., 2013; Trauger, 2010). In addition to this, other barriers may include that women hold competing commitments, such as family and work responsibilities in which training would interfere (Shortall, 2002; Little and Panelli, 2003; Brasier et al., 2009; Charatsari et al., 2013; Shortall et al., 2017).

A key component of discussion within the literature reviewed is whether women may feel uncomfortable at current training events because the events are primarily attended by men (Shortall, 1996; Trauger, 2010; Charatsari et al., 2013; Shortall et al., 2017). Several studies also reveal that women feel they are not 'taken as seriously' as men at training events (Shortall, 1996; Trauger, 2008; Brasier et al., 2009; Trauger, 2010). Economic obstacles to the provision of women-only events are suggested to include that providers are not aware of the demand, or differences in educational preferences, and are therefore reluctant to run courses focusing upon the specific educational requirements of women (Trauger, 2010; Shortall et al., 2017).

Economic incentives for the integration of women within agricultural education are clearly represented throughout the literature reviewed. Bower (2010) and Charatsari et al. (2013) suggest that women have a positive perception of education and training that exclusively addresses women and can encourage their economic participation on-farm (Sachs, 1983; Shortall, 1996; Albright, 2006; Safilios-Rothschild, 2006; Shortall, 2010; Schultz et al., 2017). The literature suggests that women recognise the areas they require training in (Trauger et al., 2008; Barbercheck et al., 2009; Bock and Shortall et al., 2017; Shortall et al., 2017), and what kind of educational styles they prefer. Trauger (2008) and Shortall et al. (2017) suggest that women prefer personable experiences, and prefer workshops, demonstrations and discussions as methods of information transfer. Furthermore, studies show that successful women's groups are said to be based upon education and networking to increase knowledge and social capital (Bell & Kilpatrick, 2000; Heins et al., 2010; Kiernan et al., 2012; Schultz et al., 2017). Studies by Trauger et al. (2008); Barbercheck et al. (2009); Brasier et al.

(2009) and Shortall et al. (2017) suggest there is a demand for more women-only courses in the agricultural industry. Shortall et al. (2017) also suggest that short courses for women who are new to farming, particularly those who have married into farming, should be developed.

2.3.3.c Organisations

The final key theme associated with barriers to economic contribution and visibility is agricultural organisations. Here, the economic visibility and contribution of females within agricultural organisations is taken as a measure of female participation. Indeed, it is suggested that the participation of both men and women contributes different skills and attributes to rural leadership and that gender-integrated workforces utilise complementary skill sets to improve overall performance (Gillard et al, 1990; Grace, 1994; Roberts, 1994; Claridge and Chamala, 1995; Buchy, 2001; Pini, 2003; Sheriden and Mckenzie, 2011). Despite this, Shortall (2001) states that there is no country where women are well represented in farming organisations. Indeed, according to existing research, women are under-represented in farming organisations throughout the developed world (Shortall, 2001; Pini, 2002; Alston, 2003; Shortall et al., 2017) and represent both a higher proportion of lower economic status workers and hold minimal representation at the highest economic managerial and executive positions (Liepins, 1998; Alston, 1998).

Grace (1997), Alston (1998) and Pini (2002) suggest that these structural trends may be underpinned by women's lack of confidence and experience, associated with gendered experiences including poorer access to social networks. However, studies also suggest that specific structural organisational factors may affect women's participation in farming groups (Grace, 1997; Pini, 2002). Alston (2000) and Brandth (2002) suggest that the traditional limiting of votes to one per farm may impact female representation due to household power relations (Alston, 2000; Brandth, 2002). Furthermore, a body of research suggests that masculinist cultures, for example, language used, gender segregation and 'the pervasive operation of old boys' network' is off-putting to women (Grace, 1997; Alston, 1998; Elix and Lambert, 1998; Alston, 2000; Pini, 2002; Shortall, 2020). Additionally, the time

and location of meetings (for example, evening time at public houses) is cited as a common barrier preventing women from attending local groups who may often have to balance childcare and household commitments (Grace, 1997; Elix and Lambert, 1998; Shortall, 2002; Pini, 2002; Little and Panelli, 2003).

Other research suggests that women are deterred by hierarchical structures and prefer more open and collaborative organisational structures (Gillard et al., 1990; Grace, 1997; Elix and Lambert, 1998; Pini, 2002). The informal practices governing the nomination and election of representatives in hierarchical farmers' organisations may also disadvantage women as 'unarticulated merit' around personal characteristics leading to progression tend to privilege 'masculine identities' over softer, more 'feminine' approaches (Grace, 1997; Alston, 1998, 2000; Alston and Wilkinson, 1998; Pini, 2002).

Further cross-disciplinary research focuses upon the experience of women as individuals within organisations and shares useful insights into the broader experience of women to provide learnings for future economic applications. Alston (1998), and Brandth and Bjørkhaug (2015) suggest that as a minority within organisations, women can struggle to have their views perceived as by their own merit and not as 'women's views', and further studies suggest that even 'confident women' may feel 'uncomfortable, intimidated and not taken seriously' when attending meetings primarily attended by men (Trauger et al., 2010; Strong et al., 2013; Petrzelka et al., 2018; Fairchild, 2019). This is also suggested to be an issue for young people (Alston, 1998; Pini, 2002; Shortall et al., 2017). Examples of this are illustrated by Morris and Evans (2001) regarding how reports in the farming press may serve to reinforce prejudices in the farming community. Morris and Evans (2001) suggest 'appropriate' female gender roles within groups and organisations are assumed according to traditional females' roles of nurturer and carer and contrast markedly with the typical representation and activities of men.

Some studies suggest a lack of female participation is commonly perceived by organisations to be an individual rather than a structural constraint (Still, 1993; Sinclair, 1994; Gherardi, 1995; Elix and Lambert, 1998; Alston and Wilkinson, 1998; Shortall, 2002; Shortall, 2020). It is suggested that in some cases, agricultural power holders may deny there are any

structural constraints for women in achieving positions of leadership and 'women's silence is taken to justify their exclusion and lack of interest' (Shortall, 1992; Alston and Wilkinson, 1998; Shortall, 2002; Pini, 2002). In such cases, barriers to women's participation have been described as implicit rather than explicitly defined, and the term 'gender blind' was coined to describe where such incidences may occur (Sinclair, 1994; Gherardi, 1995; Alston and Wilkinson, 1998). In the first study of its kind, Shortall (2020) suggests that implicit social barriers can endure through a culture of informal processes of social interaction which are not only difficult to prove and challenge but result in normative claims which are, in turn, accepted by both men and women. It is suggested that the implicit nature of such challenges may contribute to a slow rate of change and stubbornness of gendered cultural norms. To overcome some of these barriers, women-only organisations have been suggested to encourage women's participation and address issues pertinent to them (Alston, 1998; Shortall et al., 2017). This is discussed in further detail in Chapter 5.

2.4 Reflection on additional literature

The decision to undertake a systematic review of international literature published between January 1970 and January 2020 was taken to produce a replicable methodology, based on economic principles, which encompassed both the foundation of early work throughout 1970-80s, and accommodates the cross-disciplinary nature of the existing research. This methodology was based upon Ball (2020), a respected researcher in the field. However, it is acknowledged that matters and publications of significant importance will also have occurred beyond the limits the imposed by the methodology. Just as the lens of research on women from unpaid farm assistants to autonomous actors has evolved over the last 50 years (Shortall, 2010), during the time between this review being undertaken (2020) and the thesis being submitted (2024), new research and perspectives will have emerged. Indeed, as this investigation has progressed, papers of significant importance will have come to light which may not have fallen within the scope of this methodology. As such, the section herein aims to provide an extension to the findings discussed and highlight important new research and perspectives beyond the scope of the original methodology.

Until this point, the Chapter has systematically reviewed literature from countries both throughout and beyond the EU, without distinction, and considers the UK largely as a whole without regional distinction. As discussed, this decision was made primarily due to the generally small amount of research in this area, thus benefitting from drawing upon literature from a wider pool. This methodology was also undertaken to progress the economic principles of this thesis. Shortall (2016) suggests that much research within this realm is based upon small, qualitative studies which rely upon in-depth interviews, participant observation and focus groups. Although this research is helpful in attempting to account for the existence of multiple identities and understand how they are formed, maintained, and interact within the context of local structures, time and space, combining this ongoing research with quantitative analysis may also provide potential benefits (Shortall, 2010). For example, Henderson and Hoggart (2003) suggest a strength of their revealing study into rural women's labour market participation may be attributed to the use of census data, while Brasier et al. (2014) utilise quantitative methods to efficiently survey and document identity shifts in over 800 woman farmers across nine North American states.

Still, according to Shortall (2010), while it is possible to speak generally about agriculture in Europe, UK and developed countries, we must always be mindful of the vast differences in the structure and culture of agriculture on a country-by-country and region-by-region basis. While the globalisation of agriculture produces many similarities across developed countries (section 1.1), it is important to consider research in the context of local structures, time and space (Riley, 2009). Indeed, some factors appear constant across developed countries and the literature reviewed e.g. women are consistently found to be less likely to own farmland in their own right (Haugen and Brandth, 1994; Leckie, 1994; Mann, 2007; Cavicchioli et al., 2015; Shortall, 2017), have a smaller share of farmland (Kalbacher, 1985; Haugen and Brandth, 1994; Leckie, 1994; Zeuli and King, 1998; Mann, 2007; Hoppe and Korbe, 2013; Cavicchioli et al., 2015; Shortall, 2017), and own smaller holdings (Kalbacher, 1985; Haugen, 1990; Leckie, 1993; Haugen and Brandth, 1994; Perry et al., 1995; Rosenfeld and Tigges, 1998; Gidarakou, 1999; Shortall, 2010; Hoppe and Korbe, 2013; Ball, 2014). These differences are illustrated both within and beyond the farm gate, as Shortall (2001) also states that "there is no country where women are well-represented within farm organisations." However, despite these similarities, the findings from one developed

country may not be wholly applicable to another. For example Byrne et al. (2014) found that in Western Europe one in four agricultural holders is a woman. This figure rises to one in three in the Baltic countries (Eurostat, 2009); however these holdings are generally much smaller (Shortall, 2010). Indeed, the nature of farming is largely determined by regional variations in factors such as climate, soils, resources and markets which often influences farm type and farming practices. Some studies demonstrate differences in women's participation across farm types (Trauger, 2004; Elias and Lundqvist, 2016), thus, Bomel (2006) suggests that regional variations may thus in turn influence stereotypes of the roles of women within farm systems on a geographical basis e.g. different representation in areas suited to dairy farming, than cropping. It follows that this variation may also be reflected on a country-by-country and region-by-region basis.

Furthermore, although part of the globalised production economy (section 1.1), as discussed within sections 1.2 and 1.3, agriculture in the European Union is inseparable from the Common Agriculture Policy (CAP). CAP payments to farmers accounted for over 38.9% of EU budget between 2014-2020 (European Parliament, accessed 2022), and has been integral in shaping how EU agriculture operates developed at both individual farm and industry level. Indeed, in 2014, the Defra estimated that CAP payments represented 55% of farm incomes (House of Commons, 2020), while in 2020 over one-fifth of UK farms failed to generate a positive return (Defra, 2020 [1]). Further to this, since the implementation of EU Rural Development Programme, which in some cases provides grants of up to 40-50% of eligible costs for farm diversification activities, EU countries have seen rapid adoption of diverse enterprises, and thus incomes, which may differ to other developed countries without this financial support (Defra, 2018; Scottish Government, 2020; Welsh Government, 2020). Indeed, Figure 14 illustrates that income from diversification activities may represent a substantial portion of total farm business income (Defra, 2019). Shortall (2010) states there are considerable gaps in the data we have available to examine the situation of women in farming across Europe; existing statistics provide partial information; a lot of available evidence is qualitative, and; is only provided for individual Member States. As such, although research from other developed countries can be used to help inform UK perspectives, there is a pertinent need for quality UK-specific quantitative study and data to inform UK-specific recommendations.

The need for UK-specific research is particularly important in light of its exit from the EU, and as significant readjustments in terms of its political, economic and environmental operating landscape subsequently evolve. Recent studies within the UK include Smith et al., (2021) who undertake a literature review characterising the changing roles of women in UK farms; Kempster et al., (2023) who conduct a further case study (n=8) documenting the variance and multiplicity of tasks women provide to their farming business and the farm household structure; Budge and Shortall (2022 [1]), who investigate the differing impacts of COVID-19 pandemic on men and women on Scottish farms; Budge and Shortall (2022 [2]) who also examine women's exclusion from a traditional annual festival held in a small rural Scottish community, and; Wheeler and Lobley (2023) who suggest farm women may experience anxiety at a higher rate than farm men. From a regression in gender equality associated with COVID-19 pandemic (Budge and Shortall, 2022 [1]; Wheeler and Lobley, 2023), to extensive and often under-recognised contributions to the farm business/household (Kempster et al., 2023; Wheeler and Lobley, 2023), the stark polarisation of community members surrounding traditionally gendered gatherings (Budge and Shortall, 2022 [2]) and gendered impacts upon stress and well-being (Wheeler and Lobley, 2023); such studies highlight the role and influence of factors ranging from household and community dynamics to international crises in the wider governance and future sustainability of UK rural communities.

Although, as demonstrated, some UK-specific research is indeed ongoing, research and policy attention within the UK continues to progress at a much slower rate than the EU and thus raises questions surrounding what will happen when the UK is no longer subject to EU gender equality legislation (Shortall, 2010; Budge and Shortall, 2022). As discussed with section 1.3.2. despite clear intentions for comparable EU 2023-2027 CAP reform to address gender equality (section 1.3.1), none of Defra's policy documents which set the future strategic framework for farming in England include any reference to women, gender, or equality. As section 1.3.2 details, this is despite well-established research and ongoing policies yielding continual advancement from Scotland and Northern Ireland. As such, policy action within England still lags drastically and concerningly behind.

Indeed, agriculture at both UK and global level is subject significant readjustments in terms of its political, economic and environmental operating landscape (Chapter 1), and such ongoing changes have contributed to a change in women's roles and visibility since research in this area first began in 1970s. As reflected within present research streams, Shortall (2010) surmises that women's role on the farm and within research has changed over time from being understood as one of an unpaid assisting labourer, to one where women's varied contributions to the economic survival of the farm are recognised e.g. through their farm labour, managerial input, ownership of holdings, off-farm work and diversification activities. Yet, we still do not have coherent data to understand these changes (Shortall, 2010). As mentioned, Shortall (2016) suggests that much research within this realm is based upon small, qualitative studies which rely upon in-depth interviews, participant observation and focus groups. Although this research has been vital attempting to account for the existence of multiple identities and understand how they are formed, maintained, and interact within the context of local structures, time and space, the research reviewed (Ball, 2020) clearly demonstrates that this is scope to combine ongoing research with quantitative analysis, which may also provide potential benefits (Hoggart, 2003; Shortall, 2010; Brasier et al. 2014).

Adjacent to the concept of multiple identities, dimensions and research methods; the fusion of research from multiple disciplines also comes to the fore. While academic interest in the role and contribution of women in agriculture from social science disciplines such as gender studies, rural studies and sociology has indeed increased, a lag in academic attention from the field of economics presents exciting scope to further develop quantitative analyses in this area.

Thus, the collection and analysis of aggregate data is a starting point for UK-specific economic investigation. While this may differ from the aims and outputs of small, qualitative or region-specific studies, this can still provide a useful starting point for further studies in the area and promote the inclusion of economic perspectives within ongoing research. The thesis herein endeavours to address some of these challenges, collect data in the wider UK setting, and test hypothesis drawn from international research in the UK

setting. As such, the thesis herein aims to contribute a UK economic perspective to ongoing transdisciplinary investigations.

2.5 Chapter Limitations

With regards to limitations, the largest hurdle in undertaking both the current Chapter and wider thesis was the lack of accurate and sufficient data. As identified by Ball (2020) and discussed throughout this Chapter, although academic interest in the role and contribution of women in agriculture from social science disciplines such as gender studies, rural studies and sociology has increased since the 1980s, academic attention from the field of economics still lags. As such, data pertaining to the economic roles and performance of farm women is low; failing to collect information on gender even where it would be relevant, or, masked by traditional accounting methods which ignore the contribution of unpaid and/or domestic labour in the survival of the family farm represents a major limitation. To bridge this shortfall, Ball (2020) suggests that insights into the economic contribution of women can be found in other disciplines' literature. As such, this systematic review of international cross-disciplinary literature was undertaken, broadening the categorisation of Ball's (2020) women farmers, to include farm women, as proposed by Pearson (1979) to offer economic insights in this field.

However, a primary limitation of this review is publication bias. The decision to use literature between January 1970 and January 2020 was taken to preserve research richness and include the foundation of work produced throughout 1970-80s. However, despite acknowledgement that significant changes within gender relations and women's position in the labour market over that time have been shown to occur (UK Parliament, 2020), matters and publications of significant importance will also have occurred beyond the limits of timeframe imposed by the methodology. Furthermore, it is also acknowledged that the full scope of research which relates to themes identified throughout the systematic review may not have been fully recognised by the methodology employed and may again be associated

publication bias. To help overcome these factors, commentary pertaining to the topic is offered around the Chapter. Indeed, section 2.1 discusses the evolution of research from 1970s to present day, 2.5 provides gives space to consider factors pertaining to intersectionality, and 2.6 offers additional commentary to more recent literature outside the scope of the systematic review.

As is true for all research, systematic review methodology should be reported fully and transparently to allow readers to assess the strengths and weaknesses of the investigation (see section 2.2 for full details). The primary aim of this review chapter and methodology employed is to provide a broad assessment of women's economic position in agriculture and identify areas for subsequent economic research via a replicable methodology.

A further limitation of this Chapter, and indeed discussion throughout subsequent Chapters, is the review and inclusion of international, rather than purely UK-specific material. The decision to review data from throughout developed countries was taken to address the paucity of research in the UK. As such, although the UK agriculture sector has been assessed to show similar trends to that of other developed countries, the conclusions and output from this Chapter – including economic classification framework – may not be wholly representative of UK agriculture. Furthermore, as England and each of the devolved nations refine their own Agriculture Acts, the difficulty of a UK analysis given the different structure of agriculture in each of the four UK regions must not be overlooked.

Indeed, a result of utilising the economic identity classification framework proposed within this Chapter to assess and validate findings of subsequent Chapters using UK data acknowledged that the generalisation of insights presented within the methodology may not be feasible to all individuals and thus may be attributed to selective reporting, while ignoring factors of intersectionality (section 1.4). To overcome this, statistical testing of results within Chapter 3 and 4 is subsequently undertaken. However, it is acknowledged that the generalisations made within the economic identity classification framework presented may still not be applied to all women within farming. For example, suggestions that organisational structures can present barriers to women in agriculture could be deemed at odds with the fact that two high profile agricultural leaders recently exist as the

first female heads of National Farmers Union (Minette Batters) and Linking Environment and Farming (LEAF) (Late Caroline Drummond); two leading agricultural organisations in the UK. Additionally, important factors regarding aspects such as race, sexuality are not considered (section 2.4). However, it is noted that the thesis aims to identify and report upon the prominent trends at an industry level and make recommendations for further economic research in light of this, rather than assessing individual cases. Additionally, it is noted that while the economic identity classifications discussed may not explicitly nor indefinitely apply to all individuals, they may not remain fixed across time and space either. As such, the output of this work acknowledges that individuals may exhibit fluidity between classifications as a result of spatial and temporal dynamicity (Riley, 2009).

2.7. Conclusion and Contribution to Knowledge

The research objectives of this chapter were to gain a trans-disciplinary perspective of women's economic contribution and visibility in UK agriculture; document the key differences between women and men's farming practices; and explore the barriers to women's economic participation. The outcomes of the investigation carried out within this chapter yielded published works in the Journal of Rural Studies (Dunne et al, 2021).

This chapter contributes to knowledge by providing a systematic and replicable methodology whereby women's contribution and visibility with UK agriculture has been assessed through the lens of trans-disciplinary research. This methodology, attempting to bridge the gap between economic and other social-science disciplines, is the first of its kind to be used and applied recently in the UK literature; building upon the initial methodology employed by Ball (2020) in the United States, and presents findings which may be utilised in further economic research.

Furthermore, this chapter contributes to knowledge as the process yielded a hypothetical framework, consistent with cross-disciplinary findings, which may be used within both subsequent research and industry. The framework helps to segment and better understand

the needs of groups of farm women which may be applied in the UK setting, while discussion around these findings draws together both structural and individual factors, providing a bedrock for further investigation.

As such, the chapter found that key differences between men and women farmers are consistently found to occur. Women farmers were found to be associated by smaller farms, incomes and different farm types. Women were also illustrated to participate more highly in diversification activities, hold different business interests, be more likely to engage in lower-paid off-farm work, and associated with lower time worked. Yet, solid conclusions upon these findings were hard to draw with concerns surrounding data quantity, quality, accuracy and access (Rosenberg, 2017; Ball, 2020) alongside global disparities. As such, robust economic insights remain to be sought in the UK setting and present a pressing need for further research.

Key differences between women's economic contribution and visibility are also illustrated between economic identity classifications of farm women. Segmenting and understanding the different factors which may influence the creation and perpetuation of these identity types presents an important topic for further economic research, with tangible implications. Furthermore, with structural components - governed mostly by cultural and social factors - identified to play the leading role in influencing women's access and participation within agriculture, the importance of integrating further economical and empirical perspectives into future research is underlined.

Part C: Empirical investigation of the UK Agriculture Sector

Chapter 3: Exploring the economic contribution and visibility of women in UK agriculture through an analysis of Farm Business Survey data

3.1 Introduction

Chapter 2 systematic review of cross-disciplinary literature aimed to build upon the findings of Ball (2020) and identify the differences in men and women's farm performance across a range of farm characteristics and economic indicators. The findings suggested differences across 10 distinct categories including: farm size; type of production; farm income; off-farm work; age; education; land; labour; machinery and technology. Furthermore, accounting for women's low visibility as principal farmers yet high representation as family farm workers, Chapter 2 broadened Ball's (2020) classification of 'women farmers' to account for all 'farm women' involved in agricultural production. As such, it proposed that the economic contribution and visibility of farm women may be mapped across a conceptual framework characterising the different economic identity types of farm women. Figure 12 depicts the relationship between the economic identity classifications and illustrates their interaction with economic indicators, including economic contribution and visibility.

Differences between farm women's economic contribution and visibility are illustrated between economic identity classifications as proposed in Chapter 2. Bringing this together with findings that suggest women are highly represented across fast-growing 'environmentally conscious' agricultural markets - such as organic, local, direct-to-market and farm tourism (Trauger, 2004; Gidarakou, 1999; Zelezny et al., 2000; Goldsmith et al., 2013; Xiao and McCright, 2015; Sachs et al., 2016) indicates that researching and supporting the role of women in UK agriculture may have important economic implications. As the UK looks to refine its own Agriculture Acts, the need for economic research becomes increasingly prominent. Yet, to date, there is comparatively little research focused precisely upon farm women, and concerns exist surrounding data quality, accuracy and access in relation to farm women's contribution within the agricultural economy (Rosenberg, 2017).

Furthermore, imbalance remains across the globe as to where research investigating farm women's contribution to agriculture is undertaken, and much research in this area maintains to ignore gender considerations even when they might be enlightening to policy makers and industry alike (Ball, 2020).

Two main surveys, the Farm Structure Survey (FSS) and Farm Business Survey (FBS), collect data pertaining to agricultural business performance and structure in the UK. The FSS is carried out by all European Union (EU) Member States every three or four years as a sample survey, and once in ten years as a census. The information collected in the FSS covers land use, livestock numbers, farm type, rural development, management, and farm labour input - including the age, gender and relationship to the holder of the agricultural holding. The FSS (Defra, 2016) shows that women represent 52% of UK family farm workers, 19% of non-family workers and 15% of both farm holders and managers. Women farm holders and managers are most highly classified within mixed livestock (23% and 24%, respectively) and non-classified[1] (24% and 20%) farm types; while women family farm workers are most highly represented in non-classified (65%) and horticulture (59%) farm types; and women non-family farm workers are most highly represented in horticulture (38%) and mixed livestock (31%) production. Using Standard Output (SO)[2] as a measure of the economic size and value of the holding, the women farmers in the FSS represent 23% of smallest SO band holdings and 4% of largest SO band holdings.

The FBS is an annual survey commissioned by the UK government which collects a range of management accounting information on all aspects of farmer's and grower's businesses.

[1] A farm is allocated to a particular type when the contribution of a crop or livestock type (or set of crop and livestock types) comprises more than two-thirds of its total standard outputs. The term 'non-classified' is allocated to farms below this threshold.

[2] According to the Farm Structure Survey 2016, the economic size of a holding is measured using Standard Output (SO): "The standard output is the average monetary value of the agricultural output at farm-gate price in euro per hectare or per head of livestock and by region and represents the level of output that could be expected on the average farm under "normal" conditions. The smallest farms are those with standard output of less than 25,000 euros and the largest farms were those with a standard output of 500,000 euros or more."

The survey uses a sample of farms that is representative of the national population in terms of farm type, farm size and regional location. Engaging with over 2,300 farm businesses in England and Wales, and with similar surveys in Scotland and Northern Ireland, the FBS provides information on the physical and economic performance of farm businesses to inform policy decisions on matters affecting farm businesses. It also collects data on gender pertaining to 'farmer' and 'unpaid labour'. As such, this chapter aims to use FBS data to assess gendered differences in farm performance.

This chapter aims to conduct the first recent empirical analysis of UK-wide data pertaining to gender within the UK agriculture setting. The objectives of this chapter are three-fold: Firstly, it aims to investigate the extent to which FBS data indicates that women have economic contribution and visibility within UK agriculture; secondly, it aims to explore whether these findings correlate with the economic contribution and visibility classifications of farm women as proposed in Chapter 2; thirdly, as a result of its investigation it aims to identify areas for further primary data collection. As such, the outcomes of the present chapter build upon the recent findings of Ball (2020) and provide an additional resource that can underpin further and future economic studies.

This chapter is organised as follows: Section 2 details the methodology used; Section 3 provides the presentation of FBS data and findings; Section 4 discusses whether farm business survey data demonstrates differences in women's economic contribution and visibility, and whether these findings are explained by the economic classification framework presented in Chapter 2. Finally, Section 5 provides the chapter's conclusions and recommendations.

3.2 Materials and methods

3.2.1 Materials

Access to Farm Business Survey (FBS) data was achieved through a Special Licence granted by Department for Environment, Food and Rural Affairs (Defra) via the UK Data Service. Records were extracted for the year 2017-2018 as this represented the most recent dataset available at the time of writing. In total, 15 variables were extracted (Table 6) pertaining to 2317 data sets (farm holdings), thus creating a total of 34,755 data entries.

Table 6: Definition of variables

Variable	**Definition / Unit**
Farm Output	Total farm financial output (£)
Farm Size	Measured in hectares (ha)
Farmer Gender	Men / Women's
Farmer Time Worked Annually	Total time spent on farming activities annually by farmer. Measured in hours (hrs)
Farmer Management Hours	Total time spent on management activities annually by farmer. Measured in hours (hrs)
Farmer Time Spent on Diversification Activities	Total time spent on diversification activities annually by farmer. Measured in hours (hrs)
Farmer Age	Farmer age in years
Men's / Women's Unpaid Labour Time Worked Annually	Total time spent on farming activities annually by men's/women's unpaid labour. Measured in hours (hrs)
Farm Type	Type of farm production and activities – categorised (see results for breakdown)
Farmer Education	Education level of farmer – categorised (see results for breakdown)
Diversified Income	Total income from agricultural diversification activities (£)
Farm Business Income	Total income from farming activities (£)

Non-Farm Income	Total income from non-agricultural activities (£)
Region	UK geographical location of farm holding

3.2.2. Methods

3.2.2.a Descriptive Analysis

Following the initial screening, records pertaining to a range of business performance indicators were taken forward for descriptive analysis - segmented by both gender and labour type (farmer or unpaid labour) - including count of entries, percentage representation of sub-sample and breakdown of representation throughout categories. Microsoft Excel was used for this analysis as well as for the graphical representation.

3.2.2.b Statistical Analysis

Results of the descriptive analysis were used to identify metrics for further statistical investigation. t-test and Chi-square tests were used within continuous and categorial datasets, respectively, and significance within these tests was used to qualify inclusion within subsequent regression analysis.

A multiple linear regression model was then used to investigate and model the relationship between variables whereby multiple independent variables, X, have a relationship with a response variable, y, that is a straight line.

A multiple linear regression model can be represented by:

$$y = B_0 + B_1 + B_2 + ... + B_n + \varepsilon$$

where the intercept B_0 and the slope $B_1 \ldots B_n$ are unknown and ε is a random error. The errors are assumed to have mean zero and unknown variance. The parameters B_0 and $B_1 \ldots B_n$ are unknown and must be estimated using sample data.

The analysis was undertaken using Stata SE 16 utilising a backward stepwise selection model. The model begun with all variables included and at each step gradually eliminated variables to find a reduced model that best explains the data. At each step the variable with the largest p-value (above 0.10) was eliminated and the model re-ran. While some variables demonstrated significance, other variables did not. Yet, the decision to retain some of these non-significant (p-value above 0.10) variables within the statistical modelling was made based upon existing economic methodologies. Studies such as Edelsbrunner and Thurn (2023) and Greenland (1989) approve the retention of statistically non-significant variables within models where strong evidence, for example existing literature or previous statistical testing, suggests such variables may indeed play an integral part in understanding the complete model. As such, based upon insights from existing literature and previous testing using t-test and chi-square tests, the presence of some non-significant (p-value above 0.10) were retained within this model, with limitations of this approach discussed within Section 3.5). When all remaining variables met the criterion to stay in the model (p-value <0.10 or identified as important throughout existing literature), the backward elimination process stopped. Each proposed model also underwent testing for collinearity using variance inflation factor (vif) command to detect and eliminate highly correlated explanatory variables. Here, a vif value under 10 (tolerance value, 0.10) was the threshold.

As a result, we estimated the following multiple regression to explore the influence of several independent variables on farm financial output. The decision to investigate farm output as the response variable was two-fold. First; due the completeness of the available data-set, and second; being a recognised and established unit of measurement within both domestic and international agricultural policy and statistics (Defra 2016; World Bank, 2019a). Further appraisal on this measurement is conducted in Section 3.5, Chapter Limitations.

As a result, we estimated the following multiple regression to explore the influence of several independent variables on farm financial output:

$$\textit{Farm Output} = B_0 + B_1 \textit{farm size} + B_2 \textit{farmer gender} + B_3 \textit{farmer time worked annually} + B_4 \textit{farmer management hours} + B_5 \textit{farmer time spent on diversification activities} + B_6 \textit{farmer age} + B_7 \textit{men's unpaid labour time worked annually} + B_8 \textit{women's unpaid labour time worked annually} + B_9 \textit{farm type} + B_{10} \textit{farmer education} + \varepsilon$$

3.3 Results

3.3.1 Descriptive Overview

This section presents visual representation and descriptive overviews of FBS data pertaining to key variables including gender; farm size; farm type; age; education and training; time spent on activities; and farm output.

3.1.1a Gender

As shown in Figure C1 (see Appendix C) and Table 7, from a total of 2317 entries, women farmers represented 107 data entries and men farmers represented 2210 data entries: constituting 5% and 95% of farmer sample, respectively. From a total of 1056 entries, women's unpaid labour represented 174 data entries and men's unpaid labour represented 1056 data entries: constituting 16% and 84% of unpaid labour sample, respectively.

Table 7: FBS gender data

Labour Type	Count of all	Men's	Women's

Farmer	2317	2210	107
Manager	52	52	0
Unpaid	1056	882	174

3.1.1b Farm Size

Figure C2 (see Appendix C) illustrates the average total farm size associated with women farmers is 166ha, and the average utilised agricultural area (UAA) is 157ha. Respectively, these figures are 11% and 14% lower than men farmers whose average total farm size area was 188ha and average UAA was 183ha. Women farmers utilise on average 95% of total farm area for agricultural practices, this is 2% lower than their male counterparts. Overall, women farmers within this sample are associated with a smaller farm size than men farmers.

As shown in Figure C2, the average farm size associated with women's unpaid labour is 228ha, and the average UAA is 219ha. Respectively, these figures are 2% and 3% lower than farms associated with men's unpaid labour whose average total area was 232ha and average UAA was 225ha. Women's unpaid labour was associated with 96% utilisation of area for agricultural practices, this is 1% lower than their male counterparts. Overall, women's unpaid labour within this sample is associated with a smaller farm size than men's unpaid labour. Yet, there is a smaller difference in total farm size between men's and women's unpaid labour, than between men and women farmers; 2% difference vs 11% difference. Furthermore, across both genders, unpaid labour is associated with a larger farm size than paid labour (Women's: 166ha vs 228ha. Men's: 188ha vs 232ha).

3.1.1c Farm Type

Figure C3 (see Appendix C) shows women farmers were most frequently observed in less favourable area (LFA) grazing livestock farms (19%) and lowland grazing livestock farms (19%); followed by horticulture (16%); cereals (16%); dairy (8%); general cropping (5%); poultry (4%), and finally, pig farms (3%). Meanwhile, men farmers were most frequently observed in LFA grazing livestock farms (24%) and cereals (16%), followed by; lowland grazing livestock farms (15%); dairy (15%); horticulture (7%); general cropping (7%); poultry (4%), and finally, pig farms (3%). Key differences between men's and women's representation include horticulture - 16% of women farmers occupied within horticulture vs 7% of men farmers - and dairy; 8% of women farmers occupied within dairy vs 15% of men farmers. In terms of sub-sample populations, women represented 10% of both horticulture and pig farmers, falling to 4% of general cropping, mixed, LFA grazing livestock farmers and gained lowest representation within dairy farmer sub-sample, with just 3% of dairy farmers being women.

Women's unpaid labour is most frequently counted in LFA grazing livestock farms (26%); and least frequently within pig farms (3%). In terms of sub-sample populations, women's unpaid labour represented the highest proportion of unpaid poultry (26%) and horticulture (24%) workers, and lowest representation within general cropping and dairy enterprises, 11% and 9% of unpaid workers, respectively.

3.1.1d Age

The modal age category for women farmers is 50-60 years old (33%), meanwhile, the modal age category for men farmers is 60-70 years old (32%). As shown in Figure C4 (see Appendix C), the average trend lines of men and women farmer age demonstrate similar bell-shaped curves across both genders. These findings suggest that men and women farmers demonstrate similar age distribution.

The modal age category for women's unpaid labour 70-80 years old (25%), meanwhile, the modal age category for men's farmers is 30-40 years old (19%). As illustrated by Figure C4's steadier incline and later peak in the average trends line for women's unpaid labour suggests an older age profile in comparison to men participating in unpaid labour.

3.1.1e Education and training

Figure C5 (see Appendix C) illustrates that women farmers were most frequently counted as having achieved a 'college-level' education (29%); followed by 'degree-level' (28%); GCSE or equivalent (20%). 'School only', 'A-level or equivalent', and 'postgraduate qualification' each represented 7% each, while 'Other' represented 1%. No women farmers were recorded within the apprenticeship category. In comparison to men farmers, women farmers reported lower levels of 'college level education' (45% men, vs 29% women), and higher 'degree-level' (17% men, vs 28% women) and 'postgraduate-level' education (3% men vs 7% women). Other results were similar across men's and women's farmers and the average trend lines demonstrate similar, bell-shaped curves across both genders. Yet, a slightly higher end point suggests women farmers are associated with higher levels of higher education (degree and postgraduate level) than men farmers. Indeed, despite representing just 5% of the total farmer sample, women made up 11% of postgraduates, and 8% of degree holders).

As shown in Figure C5, unpaid women's labour was most frequently counted as having achieved a 'GCSE-level' education (28%); followed by 'college-level' (22%); 'postgraduate-level' (16%); 'school only' (17%); 'degree' (10%); 'A-level or equivalent' (8%). No women unpaid labourers were recorded within the apprenticeship category. Women respondents reported lower levels of 'college level education' (37% men, vs 22% women), and higher 'postgraduate qualification' (1% men, 17% women). Men's unpaid labour demonstrates a similar bell-shaped average trend line to that of men's and women's farmers. This suggests similar levels of education. Yet, greater fluctuation is observed within the women's unpaid labour sample. Peaks at either end of the average trend line suggest polarisation within the women farmer sample, who are both highly represented within lower and higher levels of education. Across the board, women's unpaid labour and women farmers appear to be associated with higher levels of education than men. Indeed, despite representing just 15% of total unpaid labour sample, women represented 81% of postgraduates within the sample.

Figure C6 (see Appendix C) illustrates that with regards to training, women farmers were most frequently counted as having 'practical experience' (42%), 'fully trained' (39%), and finally 'partly-trained' (19%). Men farmers were represented: 42%; 26%; and 33% across each section, respectively. The average trend line for men farmers shows a linear tail-off in training level across respondents. However, with women farmers, a central dip suggests polarisation within women farmer sample who are both highly represented within lowest and highest levels of training, and least represented with partial training.

Women's unpaid labour was most frequently counted as having practical experience (78%), partly trained (12%), and least frequently fully trained (10%) (Figure C6). Conversely, men's unpaid labourers demonstrated higher levels of partial and full training (41%; 29%; and 29% across each section, respectively). The average trend line for men's unpaid labour shows a linear tail-off in training level across respondents, similar to that of men farmers. Yet, the average trend line for women's unpaid labour demonstrates its peak at practical experience, with low representation across partial and full training. This suggests that women's unpaid labour gains lower exposure to practical on farm training than men's unpaid labour. Furthermore, unpaid labourers (regardless of gender) gain lower exposure to practical on farm training than paid labourers.

3.1.1f Time Spent on Activities

Total management hours (annual) for women farmers averaged 145 hours, 25 hours lower than men's 170 hours, or a difference of 17% (Figure C7, see Appendix C). Time spent on diversification activities (annual) for women farmers averaged 179 hours, 57 hours lower than men's 236 hours, or a difference of 32%. Furthermore, total time worked annually for women farmers averaged 1520 hours, 584 hours lower than men's 236 hours or a difference of 38%. These findings suggest that women farmers spend less time participating in a range of farming activities in comparison to men farmers in this sample.

Figure C7 illustrates that total management hours (annual) for unpaid women's labour averaged 102 hours, 30 hours lower than men's 132 hours, or a difference of 29%. Time spent on diversification activities (annual) for unpaid women's labour averaged 945 hours, 675 hours lower than men's 1620 hours, or a difference of 71%. Furthermore, total time worked annually for women's unpaid labour averaged 811 hours, 908 hours lower than men's 16021 hours, or a difference of 53%. These findings suggest that women's unpaid labour spend less time participating in a range of farming activities in comparison to men's unpaid labour.

3.1.1g Farm Output

Farm output for women farmers averaged £365,860, 20% lower than men farmers £445,806 (Figure C8). Farm business income for women farmers averaged £66,191, 24% lower than men farmers £86,984. This suggests women farmers are associated with a lower farm output than men.

3.3.2 Statistical Analysis Results

3.3.2a t-Test

By conducting t-Tests, salary and time worked annually were found to represent statistically significant differences between men and women farmers, both at the 0.001 level.

Table 8: t-Test results

Variable	Mean (men)	Mean (women)	Difference in mean	t_value	p_value
Age	58.38	58.12	0.26	0.250	0.816
Farm Size	187.58	166.14	21.44	0.900	0.379
Salary	21261.10	15993.63	5267.47	6.350	0.000***

Management hours	170.79	145.40	25.38	1.150	0.246
Section I activities	236.62	179.19	57.43	1.150	0.242
Time worked annually	2103.78	1520.21	583.58	7.800	0.000***
Diversified income	23466.09	14775.58	8690.51	1.300	0.192
Farm business income	64522.89	42020.69	22502.20	1.600	0.112
NFI	50915.43	29951.60	20963.83	1.550	0.119
Significance level: *** = 0.01, 1% ** = 0.05, 5% *0.1, 10%					

3.3.2a Chi-squareTest

By conducting Chi-square tests, region and education were found to represent statistically significant differences between men and women farmers at the 0.01 level, while farm type was significant at 0.05 level.

Table 9: Chi-square Test Results

Variable	**Chi-square value**	**pr**
Region	18.540	0.000***
Education	22.9427	0.001***
Farm Type	16.9409	0.031*
Significance level: *** = 0.01, 1% ** = 0.05, 5% *0.1, 10%		

3.2.3 Multiple Linear Regression

Findings from t-test, chi-square test and existing research were taken forward and incorporated within subsequent multiple linear regression statistical modelling. Farm size, total management hours, men's unpaid labour time worked annually, and women's unpaid labour time worked annually were found to be statistically significant drivers of farm output at 1% level. Meanwhile, 1% level of significance was also demonstrated within farm type, with dairy, poultry, pigs, horticulture, and general cropping, and 10% level for LFA grazing livestock, against the baseline of lowland grazing livestock.

Other variables included for analysis such as farmer age, gender and education were not identified to be significant drivers of farm output within this model. Yet, the decision to retain some of these non-significant (p-value above 0.10) variables within the statistical modelling was made based upon existing economic methodologies. Region was not selected due a small category size limiting subsequent analysis and existing research (Henderson and Hoggart, 2003; Brasier et al., 2014) which illustrated the benefits of an aggregate sample size in line with the economic aims of this thesis. Limitations of this approach are discussed within Section 3.5.

Table 10: Multiple Linear Regression with Farm Output (£/farm) as Dependent Variable

Variables	**Base**	**Coef.**	**Standard Error**	**95% Conf. Interval**
Farm Size		1,315***	74.63	1169.055 1461.751
Farmer Gender	Men	-70137	79585	-226202.9 85929.41
Farmer Time Worked Annually		-21.81	24.71	-70.26467 26.63746
Farmer Total Management Hours		1,260***	83.90	1095.147 1424.185
Farmer Time Spent Diversification Activities		11.06	56.97	-100.6566 122.7759

Farmer Age		665.0	1623	-2518.156 3848.222
MU Sum Time Worked Annually		42.47***	14.280	14.4566 70.47538
FU Sum Time Worked Annually		144.2***	48.580	48.9599 239.4717
Farm Type				
LFA Grazing Livestock	Lowland Grazing Livestock	-96,441*	54508	-203330.6 10449.03
Cereals		-58252	60505	-176902.2 60398.04
Dairy		245,688***	61516	125054.5 366320.6
Mixed		38529	71315	-101320.5 178378.1
Poultry		733,516***	90804	555450.7 911582.3
Pigs		754,545***	100163	558124.9 950964.5
Horticulture		603,360***	76118	454092.9 752627.4
General Cropping		252,066***	78164	98787.07 405345.1
Education				
GCSE or equivalent	School Only	59668	70708	-78991.43 198326.7
A level or equivalent		20894	88730	-153105.6 194892.6
College / National Diploma / Certificate		58622	65473	-69770.03 187014.8
Degree		9183	74807	-137514.1 155879.5
Postgraduate qualification		116375	112946	-105112.8 337862.6
Apprenticeship		52151	136419	-215366.6 319668.3
Other		-8394	175208	-351977 335188.2
Constant	-141129	-141129	174340	-483010.2 200752.3
Observations	2317.00			
R-squared	0.322			
Significance level: *** = 0.01, 1% ** = 0.05, 5% *0.1, 10%				

3.4 Discussion

3.4.1 FBS Descriptive and Statistical Findings

3.4.1a Farm size

Firstly, farm size was found to be a significant driver of farm performance, with a positive effect upon farm output of £1,315/ha. This suggests that larger farm size is associated with higher farm output. This concurs with existing research suggesting that operated farm size rises with economic development (Eastwood et al., 2010), and that a larger farm size is often associated with higher total output profit (Woodhouse, 2010). This argument functions based upon economies of scale, yet Ellis (1998) argues that taking farm size as a measure of productivity may therefore be confounded by other extraneous variables, such as farm scale and farm type, and ignores measures pertaining to productivity per ha. Measures such as total factor productivity (Griffith et al., 2002) may offer greater insights into farm productivity, however this information is not available directly within FBS, therefore farm size was taken as an influence of farm performance in this scenario.

Farmer gender was not found to be a statistically significant driver of farm performance within this regression model. However, the importance and significance of farm size on farm performance noted is important in the context of numerous studies across the UK and other developed countries, including Kalbacher (1985), Haugen (1990), Leckie (1993), Haugen and Brandth (1994), Perry et al. (1995), Rosenfeld and Tigges (1998), Gidarakou (1999), Shortall (2010), Hoppe and Korbe (2013) and Ball (2014), that suggest that women are associated with a smaller farm size compared to men. Indeed, the summary data results presented herein demonstrates that women farmers averaged an 11% smaller total farm size (166ha) and 14% lower UAA (157ha) than men farmers. As such our initial results concur with the findings of Zeuli and King (1998) who suggest that although differences in farm size may be demonstrated between genders, these differences may well be less substantial than other contributory factors and suggest that where farm size is held

constant there do not appear to be significant differences in farm performance that can be attributed solely to gender. As discussed by Shortall (2017), Ball (2020), and Chapter 2 of the present thesis, there may be a variety of factors affecting women's farmers access to land and other resources which may indirectly affect farm size.

3.4.1b Farm type

Farm type was also found to be a significant driver of farm output, both within the chi-square test and the multiple linear regression model. Using 'lowland grazing livestock' as a base comparison, 'LFA grazing livestock' performed comparatively lower (negative effect), while 'dairy', 'general cropping', 'horticulture', 'poultry' and 'pigs' each performed successively higher (positive effect) than 'lowland grazing livestock', with significance demonstrated at 1% level. This concurs with existing research suggesting that farm type can be linked to farm output (Hadley, 2006; Defra, 2016; Ball, 2020).

Furthermore, gendered differences in farm type may be demonstrated. According to Defra (2016), women farm holders are approximately twice as highly classified within mixed livestock (23%) and permanent crops (19%) farm types; than mixed crops & livestock (10%) production. Meanwhile, Kalbacher (1985), Leckie (1993), Perry et al. (1995), Rosenfeld and Tigges (1998), Zeuli and King (1998), Trauger (2004), Andersson and Lundqvist (2016) suggest that women are more highly represented in livestock and speciality production farm types. Similarly, within this study, women farmers were most frequently observed in LFA grazing livestock farms and lowland grazing livestock farms (19% of women's farmer sample) each; followed by horticulture and cereals (16% each); dairy (8%); general cropping (5%); poultry (4%), and pig (3%) farms. This concurs with existing research and suggests that women farmers may be more highly represented within livestock and speciality farm types. However, as discussed in Chapter 2, gender cannot be attributed as a significant driver of farm output on its own, again, there may be a variety of factors affecting women's farmers access to land and other resources which may indirectly affect farm type (Shortall, 2017; Ball, 2020).

3.4.1c Management hours

Management hours was also found to be a significant driver of farm output, with a positive effect of £1,257 per unit. This suggests that if all other factors remain constant, if total recorded management hours were to increase by one unit (one hour), then output increases by £1,257. This indicates that management hours are a significant and profitable driver of farm output, and suggests that farms and farmers associated with a lower input of management hours may in turn also be associated with lower farm output and profitability. This concurs with research by Austin et al. (2001), Hasson (2008) and O-Leary et al. (2017) who suggest that several farmer managerial characteristics were found to influence farm performance, while Stanford-Billington and Cannon (2010) suggest that time spent on strategic planning plays a major role in farm performance and generates higher profitability than any other exercise. However, the high value attributed to this finding may not be realistic and is discussed within chapter limitations section.

Although farmer gender did not have statistical significance within the regression model (Table 10), differences in time allocation relating to gender may still be explored by examining the descriptive data and statistical tests. Across all metrics, time spent on farming related activities was lower for women farmers, and the t-test indicated significant difference at 0.001 level between men and women farmer's time worked annually. Total management hours for women were 17% lower than men, time spent on diversification activities was 32% lower, and time worked annually was 38% lower (Table 8). These findings suggest that women farmers may participate less frequently across a range of farming activities in comparison to their male counterparts. Indeed, studies exploring gendered differences in management activities across US farms include Trauger et al. (2010), Hoppe and Korb (2013) and Ball (2014) who suggest that women tend to be associated with business goals other than profit maximisation; examples include time spent on family and childcare commitments and desire for a greater work/life balance. Another factor which could influence time spent on farming activities is participation in off-farm work (Kalbacher,

1985; Blekesaune et al., 2010). The t-test utilised within this chapter found significance at 0.01 level between the gross salary of men and women farmers, with women farmers taking home £5,276, or 28%, lower salary per annum. This may corroborate studies which associate women with lower farm income, including profit, return on equity and sales value (Kalbacher, 1985; Haugen and Brandth, 1994; Perry, 1995; Rosenfeld and Tigges, 1998; Zeuli and King, 1998; Hoppe and Korb, 2013; Andersson and Lundqvist, 2016).

3.4.1d Unpaid labour time worked annually

Both men's and women's unpaid labour time worked annually were found to be a significant driver of farm performance, with an effect upon farm output of £42.36 and £147.10/hour respectively. Unpaid women's labour time worked annually was on average 53% lower than men. Furthermore, although not recognised as statistically significant in this model, total management hours for unpaid women's labour was 29% lower; and time spent on diversification activities was 71% lower than men's unpaid labour (Table 9). Such findings reflect those of studies pertaining to women farmers time spent on activities and suggest that women may participate less frequently across a range of farming activities when compared to men (Trauger et al, 2010; Hoppe and Korb, 2013; Ball, 2014) and participate more frequently in off-farm work (Kalbacher, 1985; Blekesaune et al, 2010). Despite appearing to engage in lower hours of farm activities, our statistical modelling reveals women's unpaid labour time worked annually to be a 111% higher driver of farm output than men's unpaid labour. As discussed in Chapter 2, this suggests there may be key differences between the roles and responsibilities of men's and women's unpaid labour and has important implications regarding how the economic roles, contribution and visibility of farm men and women may differ.

With regards to age, the modal age category for women's unpaid labour is 70-80 years old (25%), meanwhile, the modal age category for men's unpaid labour is 30-40 years old (19%). A steadier incline and later peak in the average trends line for women's unpaid labour suggests an older age profile in comparison to men participating in unpaid labour. This may be indicative of differences between men's and women's routes into agriculture, access to

resources and economic power relations (Gasson, 1981; Bryant, 2002; Shortall, 2002; Riley, 2009; Contzen and Forney, 2017). Indeed, research by Friedmann (1978); Bouquet (1986), Gasson et al. (1989) and Whatmore (1991) suggest farm women's roles may evolve throughout the lifecycle of the farm and family. Despite some studies suggesting that traditional patterns of succession may be weakening (Brandth and Overrein, 2013; Wheeler et al., 2012), a majority of existing research suggests that access to land represents the single largest barrier to women's entry and participation within agriculture (Shortall et al., 2019) with men and first-born potential successors remaining most likely to succeed the family farm (Alston, 1998; Mann, 2007; Voyce, 2007; Rossier and Wyss, 2008; Cavicchioli et al., 2015, 2018; Shortall, 2017). As such, marriage remains the most common route of entry into farming for women (Farmers Weekly, 2014) which in turn feeds back into challenges regarding ownership and access to economic resources (Shortall, 2002; Shortall, 2017 et al.). The average age at marriage for women in the UK is 35.7 years old (ONS, 2020), as such, these findings may offer explanation of the lower representation of women's unpaid labour within younger age categories in comparison to that of men. Following entry to farming through marriage, 'family life cycle' theorists propose 'farm wives' may remain in unpaid labour roles, transitioning towards becoming 'mothers' of male farming heirs, as such the activities and contribution they make within the family farm economy may also evolve (Friedmann, 1978; Bouquet, 1986; Gasson et al.,1988).

Information on the level of formal education and practical training received by participants is also recorded by the FBS. With regards to formal education, men's and women's unpaid labour demonstrates a linear decline in education level, in comparison to men's and women's farmers bell-shaped curves, suggesting lower formal education levels across unpaid labourers. Greater fluctuation is also observed within the women's unpaid labour sample which may suggest polarisation of education levels recorded within the sample. With regards to practical training, women's unpaid labour demonstrates its peak at practical experience, with low representation across partial- and full- training. This suggests that women unpaid labourers may gain lower exposure to practical on farm training than their male and/or paid counterparts. These findings regarding both formal education and practical training concur with studies suggesting that although women participate highly in traditional and further education, their representation within practical and agricultural

education and training is lower than men (Brandth et al., 2011). Indeed, the chi-test demonstrated statistically significant differences between men and women farmers' education level at the 0.001 level. Furthermore, Shortall et al. (2017) observed that women rarely attend continuing education provisions for people on farms, and women may not experience the same exposure to on-the-job training as men (Shortall, 1996; Cassidy and McGrath, 2015; Shortall et al., 2017).

3.4.1e The impact of gender upon farm performance and output

Overall, the statistical modelling utilised herein indicates that farmer gender, on its own, is not a significant driver of farm business performance. Despite key differences between the economic characteristics of men and women farmers across 10 distinct categories being demonstrated in Chapter 2, the findings of this model suggest that the individual contribution of women farmers within UK agriculture may not be significantly different to the individual contribution of men farmers, when accounting for other impacts.

Furthermore, an R-Squared value of 0.322 suggests that the model explains only around one-third of the variation in the response variable (farm output) around its mean. This suggests that all factors which may influence farm performance were not included within this model, and thus this model cannot be taken to represent a definitive statement upon farm output. While this figure may be considered low by some disciplines, studies that try to explain human behaviour are well documented to report R-Squared values around this level (Peterson, 2023). This is discussed further in Section 3.5; while Chapter 4's industry survey endeavours to investigate and present further information surrounding this topic; and recommendations for changes in industry data collection subsequently discussed within Chapter 5.

Indeed, the overall representation, 5%, and economic contribution to total farm output, 4%, of women farmers within this dataset is substantially lower than that of men. Despite statistical modelling indicating that farmer gender on its own is not a significant driver of farm business performance; and that only around one-third of variation in farm output may

be explained within the regression model; it has still been possible to explore descriptive differences in farm output relating to gender. Indeed, FBS data used within this study demonstrates that women farmers averaged a total farm output of £365,860, 20% lower than men's farmers. Although these differences are not statistically significant, such insights concur with the findings of Kalbacher (1985), Haugen and Brandth (1994), Perry (19950, Rosenfeld and Tigges (1998), Zeuli and King (1998), Hoppe and Korb (2013), Andersson and Lundqvist (2016) and Ball (2020) whose studies have associated women farmers with lower farm income, including profit, return on equity and sales value.

Furthermore, while farmer gender was not found to be a statistically significant driver of farm output in this model, both men's and women's unpaid labour time worked annually was found to be statistically significant. The higher value attributed to women's unpaid labour suggests key differences exist between the roles, responsibilities, visibility and contribution of men and women. The conceptual framework of farm womens' economic identities proposed in Chapter 2 may be useful to explore these findings further as discussed below.

3.4.2 Economic Identity Classifications

On-farm economic identity classifications

Pairing the FBS data and the economic identity classification framework from Chapter 2, an initial classification of UK farm women's economic contribution and visibility can be achieved.

3.4.2a Farmers

The 5% of farm holders which are women could be included within the 'women farmer' economic identity classification (Figure 12). Recognised as the farm holder, and principal farmer, these women hold clearly defined responsibility and autonomy for farm- or major-enterprises. The economic contribution they make within the farm therefore gains visibility. This supports the findings of statistical modelling within this chapter which indicates that farmer gender, on its own, is not a significant driver of farm business performance. As such,

differences in farm performance demonstrated between genders may well be explained by other contributory factors.

Within the ‘woman farmer’ category, women can be further grouped into ‘traditional women farmers’ or ‘professional women farmers’. Professional women farmers may be younger and have entered farming through occupational choice, whereas traditional women farmers may be older, maintain more traditional views and workstyles and entered the sector though marriage or widowing. Both types of farmer may have previously fulfilled ‘working farm member roles’, however professional women farmers may have been associated with greater autonomy and acknowledgement of economic contribution. Figure C6 shows that the majority of women farmers can be categorised as either receiving the highest or lowest levels of practical training, in comparison to a more even distribution demonstrated by men farmers. Such polarisation suggests two distinct segments of women farmers may exist and complements the characteristics outlined within the identity classification framework. Furthermore, with regards to education, the FBS data suggests that women farmers may generally be associated with higher levels of degree and postgraduate education than men farmers (Figure C5) which may be indicative of characteristics pertaining to both classification types including higher enrolment in agricultural university courses (professional woman farmer) and higher engagement in education relating to off-farm work (traditional woman farmer) (Riley, 2009). Indeed, evidence that women represent more students studying agriculture within further and higher education (Riley, 2006) offers support to the hypothesis that an increasing number of younger women are choosing to enter and pursue professional careers within the sector through choice. However, whether these activities will result in higher visibility as principal farmers, and classification within ‘professional woman farmer category’, plays out against a backdrop of external influences including access to land, resources, training and societal norms (Gasson, 1981; Bryant, 2002; Shortall, 2002; Riley, 2009; Contzen and Forney, 2017). Indeed, the 2016 Scottish Government's Rural and Environment Science and Analytical Services Division (RESAS) research on 'Women in Farming and the Agriculture Sector' (Shortall et al., 2017) states: ‘farming, and the agricultural sector as a whole, is an area in which women's contributions are often not recognised and at a leadership level women are significantly under-represented’ and refers to a ‘leaky pipeline' between training/education

and labour market participation (Goulden et al., 2011) resulting in a loss of skills and participation within the sector. Further research on women's economic contribution and visibility within agriculture following higher education is therefore required.

3.4.2b Unpaid Labour

The 15% of unpaid farm labour which is provided by women could be included within the economic identities of 'traditional farm housewives' and 'working farm members'. As this labour is unpaid, it is assumed to be undertaken by family members and therefore intertwined with household politics and economic power relations (Whatmore, 1991; Riley, 2009). In the majority of cases, unpaid labourers will contribute to a farm business where the principal farmer is a man (95% of FBS sample) and who may possess the ultimate decision-making power and control of resources. 'Working farm members' may be either classified as 'farm assistants' or 'subordinate managers', indicating that autonomy varies with economic power relations. As mentioned previously, within a farming life cycle, working farm members may also transition to become principal farmers. Whether they are classified as professional or traditional women farmers may be determined by factors including occupational choice and economic power relations within the household.

As illustrated in Figure C4 women's unpaid labour may be associated with a higher age profile in comparison to men's unpaid labour. This may be indicative of differences between men's and women's routes into agriculture which in turn affects access to resources and decision-making power. As 95% of farm holders in the FBS dataset are men, unpaid labour is provided by family members and marriage remains the main route of access for women in agriculture, it follows that a large proportion of labour in the family farm economy may be provided by the spouse of farmers. The persistence of patrilineal succession (Shortall, 2017), lower levels of practical training associated with women's unpaid labour, and the younger age profile of men's unpaid labour within the FBS dataset may support 'family life cycle' hypothesis's that women's roles as unpaid labourers may be more likely to be those of wives and mothers meanwhile men's roles as unpaid labourers may be more likely to be those of succeeding principal farmers. Indeed, FBS data shows women represent a higher

proportion of unpaid farm labour (15%) than principal farmers (5%), whereas men represent a higher proportion of principal farmers (95%) than unpaid labour (85%). As such, it can be inferred that the economic visibility of unpaid women's labour remains lower than that of their men's counterparts.

The concept of 'unpaid-' or 'family- labour' may also be deemed problematic and further exasperate this problem. As described by Whatmore (1991), such terminology may be characterised by three main constraints. Firstly, a narrow concept of labour is adopted, which only accounts for labour contributing to commercial agricultural production and neglects a range of activities necessary to the function of family labour on a daily and generational basis. Secondly, the family is poorly theorized, with nuclear family configuration largely being taken as the 'norm' and obscuring the different positions of individual members (Lem, 1988). Thirdly, both these problems are underpinned by a general failure to incorporate a theory of gender relations into explanations of how the family is structured and labour is processed. As such, it is argued that the economic visibility of unpaid family labour is poor. For example, FBS data shows that farms associated with unpaid labour appear to hold £679,883, or 34%, higher average net worth than paid labour. Furthermore, the valuation of farms associated with women's unpaid labour is £475,047, or 18%, higher than that of men's unpaid labour. In part, these differences may be attributed to a larger farm size, which also represents statistical significance within our regression model. As such, the availability of unpaid labour can be illustrated to make a significant contribution towards the output and profitability of farming systems, however, the very nature of being unpaid may mean it lacks visibility. For example, the Farm Structure Survey (Defra, 2016) shows that women represent 52% of UK family farm workers. Yet, no data is collected pertaining to the roles or number of hours worked by such individuals, therefore their economic contribution cannot be identified. On the other hand, the FBS does collect data on unpaid labour, however, the proportion of women said to represent unpaid workers within this data set is 15%; substantially lower than from the FSS's 52%, suggesting the full extent of women's unpaid labour may not be recorded, even when it is possible to do so. Furthermore, as 'farm life-cycle' theories suggest women unpaid labourers may be less likely to transition into principal farmer roles than men - or may do this under different circumstances, or at an older age - a lack of visibility for women family farm workers may

therefore be perpetuated. Yet, such theories fail to explain the diversity and variation of gender divisions of labour nor address the central issue of why it is women as opposed to men who undertake subsistence or reproductive work over a wide range of contexts, and gain such low representation as principle farmers. As these discrepancies demonstrate, there continues to be concerns about the quality, accuracy, and access to economic data pertaining to gender (Rosenberg, 2017), while a lack of data and visibility of farm women presents a major challenge to the sector (Shortall, 2010).

3.5 Chapter Limitations

In terms of limitations, as introduced within Chapter 2, a key limitation present throughout the thesis was a lack of accurate and sufficient data. With regards to Chapter 3, a dearth of UK secondary data affected the Chapter's ability to assess a breadth of data, and to cross-check its own findings against other sources. As highlighted earlier within this Chapter, only two main surveys, the Farm Business Survey and Farm Structure Survey, collect data pertaining to agricultural business performance and structure in the UK alongside demographic characteristics such as age and gender. Records were extracted for the year 2017-2018 as this represented the most recent dataset available at the time of writing. Aggregate data from the FSS (Defra, 2016) is published freely in the public domain and provides a useful overview of agricultural structure and trends, however, closer analysis of any individual data sets thus is not possible. Only the FBS provides information on the physical and economic performance of individual farm businesses – but contains sensitive business data and as such is not freely available in the public domain, but anonymised data sets may be requested for research purposes. Although in many ways this information provides a rich and useful resource which was utilised within this Chapter under special licence request, only being able to draw data from one source limits the Chapter's ability to assess and cross-check its own validity. Additionally, gendered information is not collected consistently across some farm metrics, limiting its applicability beyond the number of measure analyses undertaken within Chapter 3 – for example, there are many cases where farmer and spouse labour are not differentiated, thus gendered analysis cannot always take place. Furthermore, as women farmers (5%) and women managers (0%) represent only a

comparatively small proportion of the sample data set, conclusions drawn on comparatively smaller numbers are more exposed to the influence distortion. Comparatively, the FSS (Defra, 2016) shows that women represent 15% of both farm holders and managers and 52% of UK family farm workers (Defra 2016). Indeed, both data sets suggest that women represent a low proportion of farmers and farm managers and are more highly represented within the unpaid labour force than as farm holders or managers. However, the proportions demonstrated within the FBS sample are much lower than that of other official statistics provided by Defra. Indeed, FBS has a minimum business size threshold of €25,000 Standard Output value. FSS has a minimum business size threshold ranging from 0.1ha for intensive horticultural production to 5ha utilised agricultural area for arable, grassland and permanent crops. To help overcome this, statistical testing of results using appropriately selected economic frameworks was undertaken.

Statistical testing was undertaken to investigate the effect of variable upon farm output. Farm output is a commonly employed metric within official national and international agricultural data collection and analysis (Defra, 2016; World Bank, 2019a). However, as discussed by Shortall et al (2014), the use of farm output as a measure of farm performance may in fact mask the true productivity and hamper the visibility of all actors within farm operations. In this circumstance, the decision to utilise this metric was three-fold. First; concerns surrounding data accuracy. The FBS data source utilised represented the sole source of UK specific economic data available to this investigation. Within this, the FBS defines Farm Output as:

"total crop enterprise output plus adjustment for output from previous year's crops plus total livestock enterprise output plus output from home grown fodder crops plus output from tillages and forage plus output from non- agricultural diversified activities plus miscellaneous revenue plus single payment."

Endeavouring to overcome some of the challenges associated with using farm output, the use of Net Farm Income (NFI) was explored, however, the definition and calculation of this metric had since been deemed 'untenable' by its data owners, FBS:

"recent research has revealed that many of the more varied non-agricultural activities which have been increasing on farms over the years have been inadvertently included in the calculation of NFI, with the result that about three-quarters of non-agricultural activities on farm by value are currently included and one-quarter excluded, without any clear basis for this division… this means that the definition of NFI has become untenable on the current basis"

Second; other 'income-centric' measures within FBS dataset lacked completeness to facilitate further analysis. Third; given that no other sources of detailed economic and gender disaggregated data exist within the UK, the decision was made to proceed using FBS data pertaining to farm output. While not ideal, this measure still sits in-line with existing industry practices and aims to make the best use of the available data.

As described within Section 3.2.2.b, the analysis of the effects upon farm output was undertaken using Stata SE 16 utilising a backward stepwise selection model. While some variables presented within the final model demonstrated significance, other variables did not. Yet, the decision to retain some of these non-significant (p-value above 0.10) variables within the statistical modelling was made based upon existing economic methodologies. Studies such as Edelsbrunner and Thurn (2023) and Greenland (1989) approve the retention of statistically non-significant variables within models where strong evidence, for example existing literature or previous statistical testing, suggests such variables do indeed play an integral part in understanding the complete model and not include them may not offer a true representation of the model sought to explain. As such, based upon insights from existing literature and previous testing using t-test and chi-square tests, the presence of some non-significant (p-value above 0.10) were retained within this model. Each proposed model also underwent testing for collinearity using variance inflation factor (vif) command to detect and eliminate highly correlated explanatory variables. Here, a vif value under 10 (tolerance value, 0.10) was the threshold. Notably, while non-significant (p-value above 0.10) variables were retained within the statistical modelling, region was not selected due to not selected due to a small category size limiting subsequent analysis alongside existing research (Henderson and Hoggart, 2003; Brasier et al., 2014) which illustrated the benefits of an aggregate sample size in line with the economic aims of this thesis.

A further limitation includes an R-Squared value of 0.322 obtained within the multiple linear regression modelling; which suggests that the model explains only around one-third of the variation in the response variable (farm output) around its mean. This suggests that all factors which may influence farm performance were not included within this model, and thus this model cannot be taken to represent a definitive statement upon farm output. While this figure may be considered low by pure science disciplines, studies that try to explain human behaviour are well documented to report R-Squared values of less than 50% (0.5) (Peterson, 2023); with people being harder to predict than things like physical processes. Furthermore, due to limitations such as those discussed pertaining to data quality, availability and accuracy, there is limited possibility to cross-check these findings against other or additional sources to improve model representation in this circumstance.

A prime example is management hours was found to be a significant driver of farm output, with a positive effect of £1,257 per unit. This suggests that if all other factors remain constant, if total recorded management hours were to increase by one unit (one hour), then output increases by £1,257. While Stanford-Billington and Cannon (2010) suggest that time spent on strategic planning plays a major role in farm performance and generates higher profitability than any other exercise, the high value attributed to this finding may not be realistic and may be attributed to methodological limitations as discussed. As such, the value associated with this finding should not be overemphasised.

As discussed throughout this thesis, and these chapter limitations illustrate, there continues to be challenges pertaining to the quality, accuracy, and access to gender-segregated economic data. Given the restriction of accurate and sufficient data, primary data collection was deemed necessary in order to undertake further investigation, and is detailed within Chapter 4 while recommendations to industry are made within Chapter 5.

3.6 Conclusion and Contribution to Knowledge

The research objective of this chapter was to conduct the first recent empirical analysis of UK-wide data pertaining to gender within the UK agriculture setting. Utilising the only available gender-disaggregated UK-wide data collected annually by UK farm organisations, this chapter set out to investigate whether FBS data indicates that women have economic contribution and visibility within UK agriculture; explore whether these findings correlate with the economic contribution and visibility classifications of farm women as proposed in Chapter 2; and identify areas for further primary data collection.

Chapter 3 contributed to knowledge in three main areas. First, providing the first recent UK-wide empirical evidence to further the limited existing literature, and second, by revealing statistically significant drivers of farm output relating to gender. As such, both of these factors go on to address two key areas previously identified for further investigation; lack of data availability, accuracy and applicability; and, substantiating the causality of women farmers apparent lower economic performance in comparison to men. Third, UK-specific empirical evidence is provided for the first time highlighting the statistically significant effect of women's unpaid labour upon farm output.

Based upon Chapter 3's multiple linear regression model, farmer gender, on its own, was not found to represent a significant driver of farm performance within the dataset. This suggests that the economic contribution individual women farmers make within UK agriculture gains visibility in comparison to their male counterparts. Yet, the overall representation, 5%, and economic contribution to total farm output, 4%, of women farmers within this dataset remains substantially lower than that of men, and, while farmer gender was not found to be statistically significant driver of farm output in our regression model, statistical testing demonstrated significant differences between men and women farmers pertaining to salary, time worked annually, education, region and farm type. Chapter 2 systematic review of international literature suggested that there may be a variety of structural factors affecting women's farmers access to land, education, organisations, and other resources which explains women's farmers lower performance across a range of descriptive measures and existing research. As such, to substantiate and build upon these

initial findings, further UK-specific primary data collection and analysis is required – to be undertaken in Chapter 4.

Furthermore, both men's and women's unpaid labour time worked annually was identified within Chapter 3 to be a significant driver of farm output. This suggests unpaid labourers make a significant economic contribution to UK agriculture, and the higher value attributed to women's unpaid labour suggests key differences exist between the unpaid roles and responsibilities of men and women. Yet, the poor definition and visibility of unpaid labour presents problems in accounting for the true economic contribution it yields within UK agriculture. As such, this finding contributes to knowledge in providing the first empirical evidence highlighting the statistically significant effect of women's unpaid labour upon farm output. These findings support ongoing inter-disciplinary research in the field which state that current definitions and accounting of the contribution UK unpaid family farm labour are poor, and better understanding and visibility of the diversity and variation of unpaid (gender) roles within UK farms is needed. This provides impetus for Chapter 4 primary data collection, and Chapter 5 industry and policy recommendations which advocate for improvements to official data collection methods for more informed policy design.

Chapter 4: Exploring the economic contribution and visibility of women in UK agriculture through an industry-wide survey

4.1 Introduction

Chapter 2 provided a systematic trans-disciplinary review of literature exploring structural and individual influences upon women's economic contribution, visibility and farm performance. This methodology attempted to help bridge the gap between economic and other social-science disciplines and represented the first of its kind to be used and applied recently within the UK literature, while presenting findings which may be utilised in further economic and empirical research. Within Chapter 2, four main themes including work and occupations, access to resources, training/education, and social processes were identified as important factors interacting with women's participation and visibility within the agriculture sector. In addition to this, Chapter 2 presented a conceptual framework typifying different economic roles and identity types of women within the industry. The identified themes and proposed framework shone a light on current knowledge within the area and together highlighted useful hypothesises for further investigation within the present UK setting. Next, utilising data from UK Farm Business Survey (the only available gender-disaggregated UK-wide data collected annually by UK farm organisations), Chapter 3 examined farm business performance data in relation to the categorisations proposed within Chapter 2 and concluded that while some differences between men and women economic characteristics were found to exist, better knowledge and understanding of the detail and variation of women's roles and responsibilities within UK farms is needed via primary data collection.

Building upon the findings of Chapter 2 and Chapter 3, the objectives of Chapter 4 are firstly to undertake the first UK-wide primary data collection pertaining to women's own perceived roles, contribution and visibility in UK agriculture via a national survey. Secondly, Chapter 4 aims to use mixed methods research to empirically and qualitatively assess this data. As such, Chapter 4 aims to provide a baseline assessment, alongside both empirical and qualitative assessment to provide preliminary findings and inform future research in the area.

Based upon women's own first-hand accounts, this survey represents the first recent UK-wide research survey which was open to all members of the industry and specifically focused upon women in agriculture. In particular, the survey focused upon the four main themes identified within Chapter 2, including specific sections investigating: 'Farm work and occupations'; 'Diversifications and off-farm work'; 'Training and organisations'; and 'Industry outlook and experiences'. Insights pertaining to sociodemographic and farm characteristics were also collected to enable investigation and segmentation of responses relating the proposed identity framework. As such, the survey and chapter herein aims to progress the provision of both UK-specific, large group, and quantitative data as discussed within section 2.6. Thus, the outcomes of the present chapter build upon the theoretical findings of previous chapters offering a practical, UK perspective upon the intersection between structure and agency. Collecting the first recent UK-specific dataset with an economic focus and substantial sample size aims to help bridge the gap between economic and other social-science disciplines and can provide an additional resource to help test proposed hypotheses and present findings which may be utilised in further economic, empirical and trans-disciplinary research.

This chapter is organised as follows: Section 2 details the methods and methodology used; Section 3 presents the results of both empirical and qualitative analysis; Section 4 discusses findings of the survey; and finally, Section 5 provides the chapter's conclusions and recommendations.

4.2 Methods and Methodology

4.2.1 Survey: design and methodology

To collect data pertaining to the research questions, an online questionnaire using Jisc Online Survey platform (onlinesurveys.ac.uk) was launched on 13 July 2022 and remained open until 24 July 2022. All design and recruitment procedures were evaluated and approved by University of Nottingham School of Biosciences Research Ethics Committee [approval code: SBREC202122027FEO].

The survey was structured into five sections, totalling 33 questions, and collected a mixture of quantitative and qualitative responses: Section 1 provided participants with an overview of the study and ethics notice. Section 2 collected participants' socio-demographic characteristics. Section 3 investigated the characteristics of participants farms, farm work, and off-farm occupations. Section 4 explored participants experience of agricultural education and organisations. Finally, Section 5 investigated participants experiences and outlook for the sector and included an open ended free-text question inviting participants to discuss any points they thought relevant to the topic. Survey instrument is presented in Appendix D.

A mixed model methodology was chosen because of its ability to synthesise new perspectives and explore these ideas at greater depths than quantitative or qualitative analysis alone (Creswell et al., 2015). According to Driscoll et al. (2007), mixed methods research can provide pragmatic advantages when exploring complex research questions; with the qualitative data providing a deep understanding of survey responses, and statistical analysis providing detailed assessment of patterns of responses. As discussed within section 2.6, Shortall (2016) suggests that much existing research on this topic is based upon small, qualitative studies which rely upon in-depth interviews, participant observation and focus groups. Although this research is helpful, combining this ongoing research with quantitative analysis and larger sample sizes may also provide potential benefits (Shortall, 2010). Thus, a concurrent model of mixed methods data collection was chosen as it was deemed an efficient and easy approach for a large number of participants to complete and understand

using an online hosting platform (Harrison, 2013). Overtly linked open-ended response fields succeeded structured response sections, facilitating linkage during both data collection and analysis. However, limitations of this methodology include lack of opportunity to follow-up on interesting or confusing responses and the will of respondents to expand upon their answers.

Before the final survey was distributed, a small pilot survey (n=5) was conducted with a sample of industry actors. A description of the sample and its outcomes can be found in Appendix D. Feedback incorporated into the final model included: a reduction in survey length and the revision of some statements for clarity. This helped to improve the final survey and make it more user-friendly.

The link to the online questionnaire was distributed widely via social media and through direct communication by industry groups and individuals (for further detail on distribution methods please see Appendix D). The survey received 647 responses. These responses were then filtered and two responses which did not meet our survey criteria were removed. In total, 645 responses were used within the analysis which met the following four criteria: were resident within UK; gave consent to participate in the study; and work or reside on a farm/within agri-industry; and were female.

From here, participants were asked to define their role on farm which allowed the segmentation of the sample by labour type as a proxy of visibility level. Participants were categorised into one of three cohorts: Cohort A – 'Farmer/Manager' (full and part-time); Cohort B - 'Employee' (full and part-time); Cohort C – 'Other/casual labour' (including farm wives, mothers, and other farm residents). Segmentation by labour type classification was undertaken to provide continuity and allow comparison against both existing industry data sets and collection methods (Defra, 2016, 2020; Shortall et al., 2017, 2019), as well as the economic framework proposed in Chapter 2.

Furthermore, labour type classification was taken as a proxy of visibility level. As discussed by Smith et al. (2021) and presented in Chapter 3, the farmer/manager of a holding is a position associated with high visibility and decision-making power, and where women hold this position, their economic contribution matches that of their male counterparts and

visibility is gained. The position and visibility level of farmers can be likened to extensive research undertaken within the realm of business management studies. As such, the position of 'farmer / manager' as a business leader is associated with a high level of responsibility and decision-making power and is situated at the top of its leadership hierarchy (Binns, 2010; Nevicka et al., 2018). Following this, are employees. Employees may be involved with the daily and/or strategic activities of the business, however they are associated with lower visibility and decision-making power than the business leader (Binns, 2010; Nevicka et al., 2018). As such, researchers demonstrate that employees gain a lower visibility level than business owners.

Employee's aside, as previously discussed, much labour in UK agriculture relies upon unpaid family labour and as presented in Chapter 3, unpaid family labour time worked annually is a significant driver of farm output (Defra, 2016; 2019). Yet, as discussed in Chapter 2, its contribution is often masked by traditional accounting methods. Indeed, many data collection methods identify a single individual as the sole proprietor, or owner/farmer; in fact, 97% of UK farms are classified as 'sole holder', despite heavy reliance upon family and unpaid labour (Defra, 2016). Furthermore, separation between work, family and duties within agriculture sector are often vague (Gasson and Errington, 1993; Melberg, 2003) and the contribution of unpaid labour is often underestimated even when attempts are made to record it (Whatmore, 1991; O'Hara, 1994; Riley, 2009). As such, despite representing a substantial and statistically significant impact upon farm output, unlike farmers and employees, unpaid labour is rarely accounted in official data collection methods and as such demonstrates the lowest visibility level. Consequently, visibility level can be taken to be inherently ordered as it possible to be promoted through the ranks of unpaid labourer, to employee, to farmer/manager.

As any singular respondent could select multiple identity types to describe their position within the farm - i.e. a 'full-time farmer' (Cohort A) could also select 'farmer's wife' (Cohort C) – a process of hierarchical selection was employed to eliminate duplication between groups. All respondents enlisted as 'Farmer/Manager' were placed in Cohort A. From here, any respondents enlisted as 'Employees' were subsequently placed in Cohort B. The remaining respondents constituted Cohort C. Cohort A comprised of 260 individuals (40% of

sample); Cohort B was made up of 85 individuals (13% of sample); and Cohort C contained 300 individuals (47% of sample).

As such, the total number of responses represents a database on which a number of statistically significant analyses could be made. However, as an online survey, respondents were self-selecting, and participation was dependent upon both internet access and engagement with industry networks. The total dataset is therefore not necessarily representative of the total population of women living and working within UK agriculture. Furthermore, it only collects the views of women within the industry, rather than those of male peers, partners, and families.

4.2.2 Data analysis and methodology

4.2.2a Descriptive and statistical analysis

First, extraction and coding of data from JISC platform was undertaken using Microsoft Excel. The data was segmented by visibility level (see section 4.2.1) and formatted for descriptive analysis. As such, responses across the Cohorts were examined, totalled, and presented alongside each other in tabular and graphical format to facilitate comparison and subsequent discussion of similarities, differences and trends across the three Cohorts.

Following this, data was taken forward for initial statistical testing using Chi-square test. Predictors of visibility levels were entered into a univariate analysis using Chi Square tests (see Table 10).

Subsequently, variables with a univariate P-value < 0.1 were selected for inclusion in a stepwise ordered logistic regression model to determine those factors with independent predictive value. Given a labour type variable, visibility, which is inherently ordered, we argue that it is appropriate to employ an ordered logit modelling framework within which to

analyse visibility level of individual economic agents. As presented in Sawkins et al. (1997), following the work of Zavoina and McElvey (1975) and Greene (1997), the ordered logit regression model represents a latent variable model of the following form, where y* is the unobserved dependent variable, x a vector of explanatory variables, β parameter vector and ε the error term:

$y^* = \beta' x + \varepsilon$

Instead of y^* the following is observed:

$y = 0$ if $y^* \leq 0$

$y = 1$ if $0 < y^* \leq \mu_1$

$y = 2$ if $\mu_1 < y^* \leq \mu_2$

.

.

$y = J$ if $\mu_{j-1} < y^*$

where y is the level of visibility and μ the vector of the unknown threshold parameters that is estimated with the β vector. ε is assumed to have a standard logistic distribution. Consequently:

$\Pr[y_i = J] = \Pr[y^* \text{ is in the Jth range}]$

Hence the probability of observing an outcome may be written:

$\Pr[y_i = J] = F[\mu_j - \beta' x_i] - F[\mu_{j-1} - \beta' x_i]$

where $F(.) = \exp(.)/[1 + \exp(.)]$. This implies:

$$\Pr[y_i = J] = \frac{1}{1 + e^{-\mu_j + \beta' x_i}} - \frac{1}{1 + e^{-\mu_{j-1} + \beta' x_i}}$$

which can be used to derive a likelihood function and, subsequently, maximum likelihood estimates of μ and β.

The analysis was undertaken using Stata SE 17. Specifically, the following ordered regression was estimated to explore the influence of several independent variables on Cohort classification.

4.2.3 Qualitative analysis

Data was first extracted from JISC platform and segmented by visibility level (see 4.2.1) using Microsoft Excel. Then, thematic coding of the final, open-ended survey response was undertaken using Braun and Clarke's (2006) six-step process of thematic analysis using NVivo12 software.

Step	Procedure
1. Familiarisation	Collating data: reading and re-reading; noting down initial codes
2. Generating initial codes	Coding interesting features in the data in a systematic fashion across the data set, collating data relevant to each code
3. Searching for themes	Collating codes into potential themes, gathering all data relevant to each theme
4. Reviewing themes	Checking if the themes work in relation to the coded extracts and the entire data set; generate a thematic map
5. Defining and naming the themes	Ongoing analysis to refine the specifics for each theme; generation of clear names for each theme
6. Producing the report	Final opportunity for analysis: selecting appropriate extracts and including in discussion or analysis; relate back to the research question or literature; incorporate result into final report

Table 11: Six-Step process of Thematic Analysis, from Braun and Clarke (2006)

This technique was chosen because it offers a flexible method to gain a detailed account of many individuals broad and diverse experiences. Furthermore, NVivo12 software was selected due to its ability to assist in systematically organising and presenting data throughout this process. For example: automatically collating data as it was manually coded; allowing colour coding as a visual aid; and updating lists when codes were changed e.g. merging two codes, renaming etc.

During the familiarisation stage, initial concepts and ideas were noted down and responses were repeatedly read and re-read to ensure accuracy and 'data immersion' (Braun &Clarke, 2006). Next, interesting or recurring features and patterns were coded in across the data set using the NVivo12 computer programme. Following this, potential themes were explored, with common codes grouped together to form over-arching categories. The next stage of analysis involved reviewing both the proposed themes and the coded data housed within each category to ensure compatibility and applicability. This included the generation of a thematic map. Penultimately, a list of major- and sub-themes were identified alongside a name, definition, and complete list of data. These were then discussed with my supervisors to ensure the rigour of analysis, and any differences were resolved through discussion. As a result, six major themes were finally identified: traditional division of labour responsibilities; structure and sexism; positive structural change; positive individual; challenges for education/organisations; negativity towards topic. Each of these key themes was further divided into a total of 38 sub-themes, each with their own individual code (see Table 14). A final version of the thematic map and a thematic illustration are presented in the following sections.

4.4 Results

This section presents descriptive and statistical differences between cohorts. Statistical differences according to chi-square models is divided into five categories; demographics; farm characteristics; roles and responsibilities; and training and organisations. Following this, statistical differences according to the logit model are then presented, followed by

descriptive trends detailing respondents perception of their own experiences and outlook for the sector. A full survey instrument accompanied by response data is detailed in appendix D.

4.4.1 Survey responses

The 645 survey respondents hailed from a variety of locations across the UK, with highest representation in the South West region (19%) and lowest in Northern Ireland (3%). Respondents were involved with a range of farm types, of which sheep and beef gained the highest representation (28% and 26%, respectively) while horticulture, other, and woodland gained the lowest (3%, 2% and 2% respectively). Small and mid-sized farms gained highest representation within the sample, with 100-199ha representing the most numerous farm size (21%). Perhaps most notably, contrasting somewhat to the age of the general farming population at 60 years, with 40% of holders over the age of 65 (Defra, 2016); the age profile of this sample was relatively young; 33% were 25-34 years old while a further 27% were 35-44 years old. A total of 57% of participants possessed a farming background, while the remainder reflected new entrants to agriculture through familial connection e.g. marriage (27%) and occupational choice (17%).

4.4.2 Statistical analysis results

4.4.2a Chi-square test

By conducting chi-square tests, 21 factors were found to represent statistically significant differences between Cohorts at the 0.01 level (***), 5 factors at 0.05 level (**), and one factor at 0.1 level (*). Statistically significant factors at 0.01 level were: Full-time vs Part-time work; entry to agriculture; age; farm size; farm income; final decision maker: gender; agricultural education; training frequency; training confidence; farm type (sheep); farm type (dairy); and roles and responsibilities for: farm management, farm work, farm admin,

environment, technology, diversification and domestic activities. Statistically significant factors at 0.05 level were: diversification income; general education; organisation confidence; and farm types (arable) and (other). Results of chi-square tests are presented in Table 12.

Table 12: Chi-square Values

Variable	Definition/ Measurement	Chi-square Value	Pr Value
Full-time vs part-time work	Whether individuals consider themselves to work full-time or part-time on farm	(2) 231.1955	0.000***
Entry to agriculture	Route of entry to agriculture e.g. farming background or new entrant	(4) 53.2934	0.000***
Age	years	(12) 46.8553	0.000***
Farm size	ha	(16) 52.1957	0.000***
Farm type: dairy		(2) 11.5354	0.003***
Farm type: sheep		(2) 26.3747	0.000***
Farm type: beef		(2) 5.2527	0.072**
Farm type: arable		(2) 6.5655	0.038**
Farm type: other		(2) = 7.2493	0.027**
Farm income	Income of farm £/annum	(16) 68.3571	0.000***
Diversification income	Income of diversification activities £/annum	(16) 30.2222	0.017**
Salary	Personal remuneration £/annum	(14) 70.7137	0.000***
RR: Farm management	Roles and responsibilities for farm management activities	(4) 85.1640	0.000***
RR: farm work	Roles and responsibilities for farm work	(4) 120.4485	0.000***
RR: farm admin	Roles and responsibilities for farm admin	(4) 56.8777	0.000***

RR: environment	Roles and responsibilities for environment	(4) 53.5199	0.000***
RR: technology adoption	Roles and responsibilities for technology use and adoption	(4) 58.0244	0.000***
RR: diversification	Roles and responsibilities for diversification activities	(4) 47.3477	0.000***
RR: domestic	Roles and responsibilities for domestic activities	(4) 42.1893	0.000***
Gender of final decision maker	Gender of final decision maker	(4) 22.1878	0.000***
Support from final decision maker	Level of support anticipated from final decision maker	(8) 38.1259	0.000***
General education		(12) 25.9188	0.011**
Agricultural education		(12) 38.6645	0.000***
Training frequency	Frequency of participation in agricultural training events	(8) 29.9928	0.000***
Training confidence	Level of confidence attending training event individually	(10) 38.6094	0.000***
Organisation confidence	Level of confidence attending organisation event individually	(10) 18.5597	0.046**

4.4.2a.1 Demographics

Entry to Agriculture:

Statistical significance between entry to agriculture and visibility level is demonstrated within chi-square test to 0.01 level. Across all Cohorts, the most common route of entry to agriculture was coming from a farming background. Yet, possessing a farming background was lowest for Cohort B (48%), which also comprised the highest proportion of new entrants to agriculture via occupational choice (34%). Meanwhile, Cohort C exhibited a far lower proportion of new entrants via occupational choice (9%), while those who had entered the sector through family connection e.g. marriage (37%) was twice that of Cohorts A and B (18% each). Furthermore, around one-third of Cohorts A and B identified as 'Farmer's Wives' (33% and 31%, respectively), with this figure over doubling to 68% in Cohort C.

General and Agricultural Education:

Statistical significance between general education and visibility level is demonstrated within chi-square test to 0.05 level. The most common level of general education achieved across all Cohorts was 'higher education' (29% Cohort A, 35% Cohort B, 38% Cohort C). Cohort C represented the highest proportion of both higher (38%) and postgraduate (16%) education. Cohort A represented the highest proportion of secondary (12%) and further (24%) education, while Cohort B represented the greatest proportion of upper-secondary education (29%) and lowest proportion of postgraduate education (8%). Statistical significance between agricultural education and visibility level is also demonstrated within Chi-square test to 0.01 level. In contrast to findings regarding general education, the most common level of agricultural education achieved across all Cohorts was 'practical experience only'; Cohort A (42%); Cohort B (39%); with Cohort C being the highest (60%).

Age:

Statistical significance between age and visibility level is demonstrated within Chi-square test to 0.01 level. With regards to age, the sample appears younger than the general farming population (Defra, 2016). To calculate the average age, each individual respondent

is first attributed the median value of their age category (for example: 18-24 year category = 21 years median; 35-44 years category = 39.5 years median). The median value attributed to each respondent is then added together and divided by the total number of respondents to calculate the mean. Utilising this method, the whole sample the mean age is 40.1 years old. Cohort B represents the youngest mean age, at 33.1 years old, followed by 39.9 years for Cohort A and 42.3 for Cohort C.

Salary:

Statistical significance between salary and visibility level is demonstrated within chi-square test to 0.01 level. Similar trends for salary were also demonstrated across Cohorts. The most common salary category for all Cohorts was under £20,000/year. However, this was highest in Cohort A (71%), compared to B (61%), and C (63%). Utilising the median value of each income category to calculate the mean salary for each Cohort reveals Cohort A to be associated with the lowest mean salary; £12,636, followed by C; £16,529, then B; £21,139.

Gender and support from final decision maker:

Where respondents were not the sole final decision maker on farm, they were asked to indicate the gender of the final decision maker (male/s, female/s, joint responsibility). Here, statistical significance between gender of final decision maker and visibility level is demonstrated within chi-square test to 0.01 level. The most common gender of the final decision-maker on-farm is male for all Cohorts. However, Cohort A is associated with the lowest proportion of solely male final decision-makers (52%), vs Cohort B (70%) and Cohort C (71%). Furthermore, Cohort A is associated with the highest level of female decision makers (8%) and joint responsibility (40%). Statistical significance between support from final decision maker and visibility level is also demonstrated within chi-square tests to 0.01 level. If participants were not the final decision maker, they were asked whether the final decision maker would support a suggestion they make to significantly change how things are done on farm. Trends were similar across Cohort B and C, with a positively correlated bell-shaped graph peaking where around one-third of participants agreed that their decision would be supported. Cohort A responded most confidently overall; 45% of individuals strongly agreed their suggestion would be supported, compared to 24% Cohort B, 26%

Cohort C. Cohort C had the highest proportion of individuals who strongly disagreed that their decision would be supported (10%).

4.4.2a.2 Farm Characteristics

Farm type:

Farm type did not differ greatly across Cohorts. Across all Cohorts, beef and sheep were the most common farm types representing around one-quarter of farm types each, followed by dairy and arable, pigs and poultry, then forestry, horticulture and other. Despite demonstrating similar general trends on the whole, statistical significance between farm type and visibility level was demonstrated within chi-square tests; sheep and dairy to 0.01 level, arable and other to 0.05 level, and beef at 0.1 level. Notable differences include that Cohort B were more highly represented in dairy, and Cohort A were most highly represented in sheep and other while also being less highly represented in arable, and Cohort C was most highly represented in beef.

Farm Size:

With regards to farm size, statistical significance between farm size and visibility level is demonstrated within chi-square test to 0.01 level. Descriptively, Cohort A are associated more highly with smaller farm sizes and Cohort B are associated more highly with larger farm sizes. Similar modes are demonstrated across the Cohorts (22% and 23% of Cohorts A and C fall into 100-199ha category, and 24% of Cohort B fall within the next category up, 200-399ha). However, Cohort A retains highest representation within the smallest farm sizes. Utilising the median acreage of each size category to calculate the mean farm size for each Cohort reveals this difference, with the mean size of farms associated with each cohort: Cohort A; 243ha, Cohort C; 362ha, Cohort B; 625ha.

Farm Income:

Statistical significance between farm income and visibility level is demonstrated within chi-square test to 0.01 level. Across all Cohorts, the most common farm income category is under £20,000/year. However, this is higher in Cohort A (37%), than B (26%), and C (23%).

Utilising the median value of each income category to calculate the mean farm income for each Cohort reveals this difference, with the mean farm income associated with Cohort A to be; £42,015, Cohort C; £50,585, Cohort B; £52,581.

Diversification:

Responsibility for diversification activities was found to be statistically significant at 0.01 level, and diversification income was found to be statistically significant at 0.05 level. Cohort B was least likely to not have diversified on farm. One-fifth of respondents (20%) had no diversifications, versus around one-third of Cohort A (30%) and C (37%). Across the board, the most popular types of diversification were tourism, recreation and catering; environmental; and renewable energy. The least popular were forestry; and trading, manufacture and rural crafts. Cohort B were also more likely to be associated with renewable energy (15%) and environmental (21%) diversifications. With regards to time spent on diversifications, over half of Cohort B (62%) and Cohort C (59%) spent zero time per week, while 44% of cohort A did. Removing 'zero time' respondents and utilising the median time spent of category to calculate the mean time spent on diversification activities for each Cohort revealed Cohort A to spend the most hours per week on diversification enterprises (11.3 hours), followed by Cohort C (10.2 hours) and Cohort B (6.6 hours).

4.4.2a.3 Roles and Responsibilities

Statistical significance between roles and responsibilities for: farm management activities; practical farm work; farm admin; environment; technology; diversification; and domestic duties, alongside visibility level is demonstrated within Chi-square tests to 0.01 level. Across all Cohort's, Cohort A exhibited the highest levels of full responsibility for farm admin (64%), technology use and adoption (51%), farm work (41%), farm management tasks (39%), environmental management (37%), and non-farming diversifications (38%). Cohort B followed similar trends to Cohort A, however 'some' responsibility for tasks weighted more heavily than 'full' responsibility. For example, 32% of Cohort B undertook 'full' responsibility for farm work, versus 53% undertaking 'some' responsibility. Conversely, Cohort C exhibited the highest levels of little/no responsibility for farm related tasks including farm

management (43%), farm work (29%) and farm admin (26%), while obtaining the highest level of full responsibility for domestic activities (81%).

As such, the general trend observed is that Cohort A exhibits the greatest 'full' and 'some' responsibility for farm related tasks, followed by Cohort B, while Cohort C exhibits the least 'full' and 'some' responsibility for farm related tasks. These trends are also mirrored across results for 'time spent on activities' and 'decision making power'. Yet, two anomalies include that Cohort B exhibits lower responsibility for environmental factors than Cohort C, and lower domestic responsibility than Cohort A.

4.4.2a.4 Training and Organisations

Participation and confidence in training:

Statistical significance between participation in training and visibility level is demonstrated within chi-square test to 0.01 level. With regards to frequency of participation in training activities, the most common classification for all cohorts was 'not very frequently'. Cohorts A and B demonstrated similar trends and the highest levels of participation in training, with Cohort A exhibiting the lowest level of no participation (18%). Cohort C displayed the highest levels of no participation (35%), and lowest levels of quite frequent (6%), and very frequent (4%) participation. In terms of confidence in attending training events, statistical significance alongside visibility level is also demonstrated within Chi-square test to 0.01 level. Here, Cohort A demonstrated the highest representation as 'confident' (60%) and lowest as 'apprehensive' (29%). Meanwhile, Cohort B demonstrated the highest representation as 'apprehensive' (45%), and lowest as 'confident' (43%). Cohort C mirrored the trends of Cohort B, but exhibited slightly higher confidence (46%) and lower apprehension (39%).

Education format, topic and barriers to training:

For format of training, little differences were seen between Cohorts. Overall, the most popular format was farm tours (428 counts), followed by practical short courses (366 counts) and workshops (314 counts), while conferences (101 counts) and podcasts (114 counts) were the least popular. The most highly sought-after topics of training were

livestock husbandry (338 counts), grant applications (336 counts), farm management (307 counts) and accounting (282 counts); while the least common were domestic (77 counts), engineering (89 counts) and technology (91 counts). With regards to barriers to training, times and locations (437 counts), cost (360 counts) and accessibility/childcare (192 counts) represented the largest barriers selected.

Organisations:

Frequency of participation in farming organisations demonstrated little differentiation across Cohorts, with respondents evenly distributed across all three options ('yes', 'no but have previously', no, never'). Cohort A had the lowest number of respondents who had never participated in farming organisations (29%), while Cohort C had the highest (36%). Cohort A had highest number of respondents who presently participate in organisations (36%), while Cohort C had the lowest (27%). Level of participation was also similar across Cohorts, with 'somewhat active' being the most common for all, and highest in Cohort B (60%). Cohort C had the highest level of not active (33%), and Cohort B had the lowest level of 'highly active' (17%). In terms of confidence in attending organisations, statistical significance alongside visibility level is also demonstrated within chi-square test to 0.05 level. Here, Cohort A are most 'confident' (44%) and least 'apprehensive' (36%), conversely, Cohort B are least confident (31%) and most 'apprehensive' (47%). Cohort C reflects the trends observed within Cohort A, with slightly lower confidence (40%) and higher apprehension (45%). Barriers to participating in organisations displayed similar results across all Cohorts. The most common barriers were times and locations of meetings (396 counts), cost (251 counts) and accessibility/childcare (182 counts).

4.4.2.b Ordered Logistic Regression Model results

Findings from chi-square test were taken forward and incorporated within subsequent ordered regression statistical modelling. Variables with a univariate P-value < 0.1 were selected for inclusion in the first phase of a stepwise logistic regression model to determine those factors with independent predictive value.

In the final ordered logistic regression model only five factors remained as independent predictors of visibility level. Hours worked, responsibility level for farm management activities, practical farm work and diversification activities were found to be statistically significant drivers of Cohort type at 1% level. Meanwhile, 5% level of statistical significance was demonstrated for responsibility level for domestic duties.

An R-Squared value of 0.248 was recorded, suggesting that the model explains only around one-quarter of the variation in the response variable (visibility level) around its mean. This suggests that all factors which may influence visibility level were not included within this model, and thus this model cannot be taken to represent a definitive statement upon visibility level. As discussed within section 4.6, while this figure may be considered low by some disciplines, studies that try to explain human behaviour are documented to report R-Squared values around this level (Peterson, 2023). Further commentary around additional factors which may help to offer a more complete understanding of variation in visibility level are discussed throughout the rest of Chapter's 4 and 5.

Table 13: Ordered Regression with Visibility level (Cohort) as Dependent Variable

Variables		**Base**	**Odds Ratio**	**Standard Error**	**95% Conf. Interval**
Full-time		Not Full-time	5.87***	1.45	3.613579 9.541164
Farm Management Responsibility Level:					
	Mid	High	.579896	.1669897	.3297874 1.019686
	Low	High	.307382***	.1007296	.1617106 .5842767
Practical Farm Work Responsibility Level:					
	Mid	High	.5717512*	.1580377	3326032 .9828509
	Low	High	.1163567***	.0470097	.0527102 .2568551
Diversification Responsibility Level:					
	Mid	High	.5041397*	.1519424	.2792593 .9101106

	Low	High	.3652157***	.1058713	.2069175	.644617
Domestic Responsibility Level:						
	Mid	High	2.068152**	.5590204	1.217595	3.512867
	Low	High	1.707953	.5702174	.8877564	3.285929
/cut1			-1.540374	.332437	-2.191939	-.8888099
/cut2			-.715431	.3258657	-1.354116	-.0767459
Observations			645			
R-squared			0.2481			
Significance level: *** = 0.01, 1% ** = 0.05, 5%. *0.1, 10%						

Table 13 presents the statistical differences between cohorts as a result of undertaking order logit regression model.

Hours Worked:

The proportional odds ratio of comparing full time and part time workers on visibility level, found that for full-time the odds of high visibility level versus the combined middle and low visibility level are 5.87 times higher than for part-time. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 5.87 times higher for full-time compared to part-time, given the other variables are held constant in the model.

This suggests that full-time workers are associated with higher visibility levels as both farmers and employees. Furthermore, farmers and farm employees gain higher visibility than other labour, in part due to the number of hours they work.

Farm Management Activities:

The proportional odds ratio of comparing 'mid farm management responsibilities' on visibility level found that the odds of high visibility level versus the combined middle and low visibility level are 0.58 times lower than for 'high farm management responsibilities' given the other variables are held constant. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 0.58 times lower for 'mid farm management responsibilities' compared to 'high farm management responsibilities', given the other variables are held constant in the model. This suggests that farmers engage with

higher farm management responsibilities than employees and other labourers, and these activities in turn are associated with higher visibility.

Furthermore, the proportional odds ratio of comparing 'low farm management responsibilities' on visibility level found that the odds of high visibility versus the combined middle and low visibility are 0.31 times lower than for 'high farm management responsibilities'. Likewise, the odds of the combined categories of high and middle visibility versus low visibility is 0.31 times lower for 'low farm management responsibilities' compared to 'high farm management responsibilities', given the other variables are held constant in the model. This suggests that other labourers are more likely to have less farm management responsibility than farmers and employees, and these activities are associated with lower visibility.

Practical farm work:

The proportional odds ratio of comparing 'mid farm work responsibility' on visibility level found that the odds of high visibility level versus the combined middle and low visibility are 0.57 times lower than for 'high farm work responsibility'. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 0.57 times lower for 'some farm work responsibility' compared to 'high farm work responsibility', given the other variables are held constant in the model. This suggests that farmers are more likely to have higher practical farm work responsibility than employees and other, and as such, farm work is associated with higher visibility.

Furthermore, the proportional odds ratio of comparing 'low farm work responsibility' on visibility level found that odds of high visibility level versus the combined middle and low visibility level are 0.12 times lower than for 'high farm work responsibility'. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 0.12 times lower for 'low farm work responsibility' compared to ''high farm work responsibility', given the other variables are held constant in the model. This suggests that other labourers are more likely to have less practical farm work responsibility than farmers and employees, and low engagement with practical farm work is associated with lower visibility.

Diversification Activities:

The proportional odds ratio of comparing 'mid diversification responsibility' on visibility level found that the odds of high visibility level versus the combined middle and low visibility level are 0.50 times lower than for 'high diversification responsibility'. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 0.50 times lower for 'mid diversification responsibility' compared to 'high diversification responsibility', given the other variables are held constant in the model. This suggests that farmers are more likely to have higher diversification responsibility than employees and other, and higher diversification responsibility is associated with higher visibility.

Furthermore, the proportional odds ratio of comparing 'low diversification responsibility' on visibility level found that the odds of high visibility level versus the combined middle and low visibility level are 0.36 times lower than for 'high diversification responsibility'. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 0.36 times lower for 'low diversification responsibility' compared to 'high diversification responsibility', given the other variables are held constant in the model. Other are more likely to have less diversification responsibility than farmers and employees. Low diversification responsibility is associated with lower visibility.

Domestic Activities:

The proportional odds ratio of comparing 'mid domestic responsibility' on visibility level found that the odds of high visibility level versus the combined middle and low visibility level are 2.07 times higher than for 'full domestic responsibility'. Likewise, the odds of the combined categories of high and middle visibility level versus low visibility level is 2.07 times higher for ''mid domestic responsibility' compared to 'full domestic responsibility', given the other variables are held constant in the model. This suggests that farmers are less likely to have full domestic responsibility than employees and other, and higher domestic responsibility is associated with lower visibility.

4.4.2.c Experiences and Outlook: Descriptive and thematic analysis

No statistically significant differences were found between Cohorts with regards to attitudes and perceptions of the barriers and opportunities facing women in UK agriculture. Thus, were results found to be consistent across cohorts.

The most commonly selected barriers for women in agriculture industry were 'traditional social and cultural views' (398 counts), followed by 'domestic responsibilities' (369 counts), and 'personal confidence' (264 counts). The least common were 'social media' (7 counts) and 'education and training opportunities' (39 counts).

The most prevalently selected experiences of sexism were 'assumed not to be farmer/manager' (544 voted common, 78 voted uncommon), 'attention being brought to gender when not necessary' (517 voted common, 106 voted uncommon), 'gender dismissed where it would be important' (506 voted common, 118 voted uncommon), and 'treated as subordinate due to gender' (455 voted common, 160 voted uncommon). The least prevalently selected experiences were 'assault or intimidation' (175 voted common, 442 voted uncommon), and 'not promoted or hired' (283 counts, 320 voted uncommon).

Outlook for the sector and women's place within it demonstrates positive trends. The majority of respondents agreed that it's important to support and promote women in agriculture (94%), farming is a viable career choice for women (87%), and the position of women has improved over the last generation (87%). A total of 86% of respondents agreed that women want to hold leadership positions, yet only 19% of respondents thought women were well represented in leadership and 84% also said more should be done to support women to run farms. Meanwhile, 53% of respondents agreed that agriculture has good female role models, while 82% said more female role models are needed. Thinking about how these challenges may be tackled, 76% believed women in agriculture could be promoted without disadvantaging males, 59% agreed that women-only agriculture groups are useful (while 10% of respondents disagreed) and 48% of respondents felt there was a

stigma attached to the topic of women in agriculture. Overall, 78% of respondents agreed that they were optimistic about the future.

Furthermore, the results of six key themes and 38 individual codes presented by participants in response to the free text box at the end of the survey are shown below in Figure 15 (thematic map) and Table 14 (table of themes). The six key themes are mapped across two sets of axis: internal/external, and; challenges/opportunities. The six key themes include: Industry Structure; Roles and Responsibilities; Education and Organisations; Positive Structural Factors; Positive Personal Experiences; Challenges Topic. Thematic illustrations are also produced (Figures 15 and 16 – see Chapter discussion section) demonstrating the connected and cyclical nature of factors within an agricultural setting.

Figure 15: Thematic Map

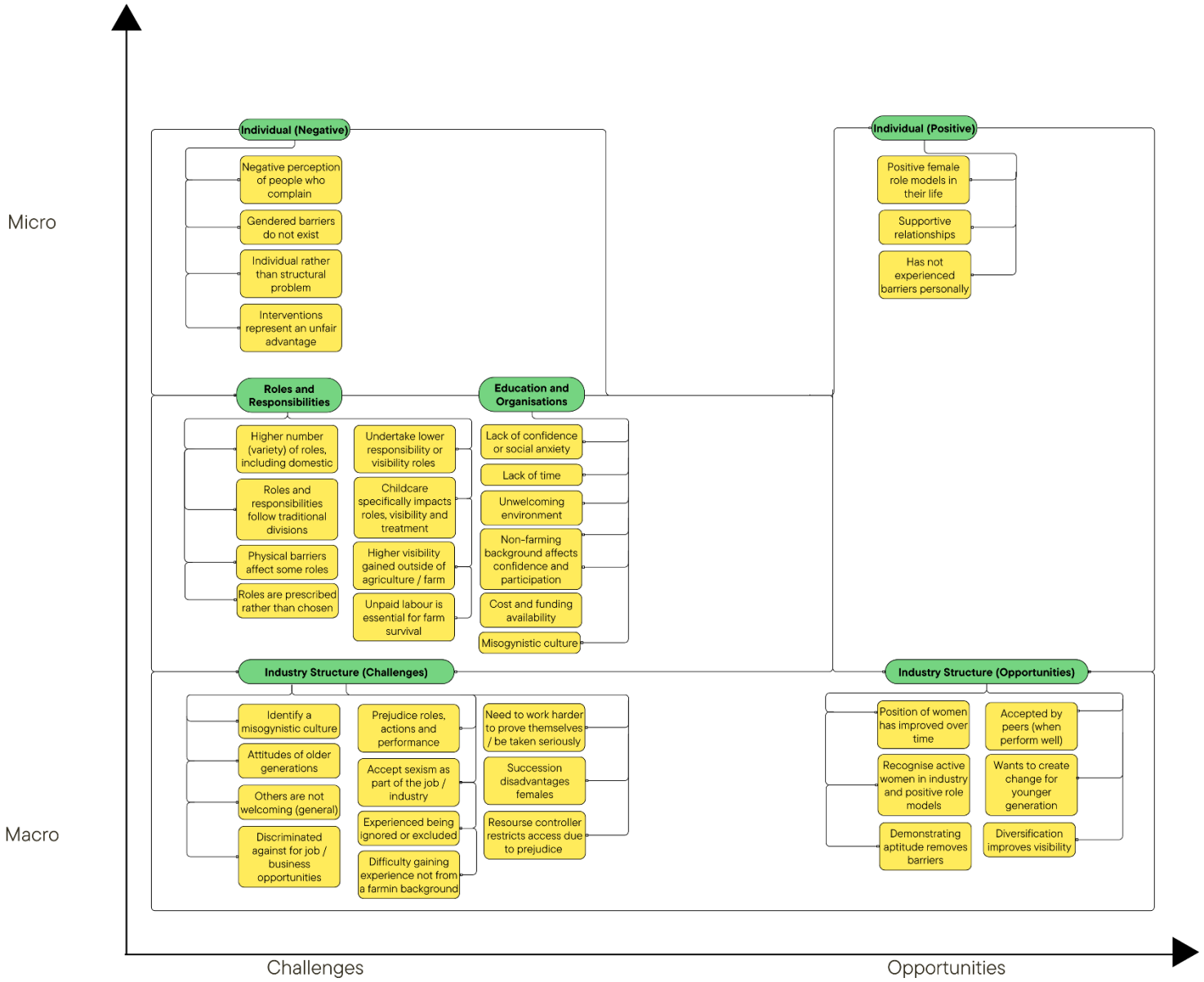


Table 14:Key themes and codes

	Challenges		
	Parent Code	**Individual Code**	**Frequency**
Macro	Industry Structure (Challenges)	Prejudice roles, actions, and performance	31
		Accept sexism as part of the job / industry	23
		Ignored or excluded	19
		Identify a misogynistic culture	17
		Attitudes of older generations	16
		Others not welcoming (general)	16
		Need to work harder to prove themselves / be taken seriously	12
		Succession disadvantages females	11
		Resource controller restricts access due to prejudice	9
		Discriminated against for job and business opportunities	6
		Difficulty gaining experience not from a farming background	4
		Total:	164
	Roles and Responsibilities	Higher number (variety) of roles	25
		Roles and responsibilities follow traditional divisions	19
		Physical barriers affect some roles	16
		Roles are prescribed rather than chosen	8
		Lower responsibility/visibility roles on farm	6
		Childcare specifically impacts roles, visibility, and treatment	5
		Gained higher visibility outside of agriculture / farm	4
		Unpaid labour is essential for farm survival	4
		Total:	87
	Education and organisations	Lack confidence or social anxiety	18
		Time constraints	10
		Unwelcoming environment	10
		Non-farming background affects confidence and participation	9
		Cost and funding availability	7
		Misogynistic culture	5
		Total:	59

Micro	Individual (Negative)	Negative perception of people who 'complain'	10
		Dismissal of gendered barriers	9
		Individual rather than structural	8
		Interventions represent an unfair advantage	6
		Total:	33

	Opportunities		
Locus	**Parent Code**	**Individual Code**	**Frequency**
Macro	Positive Structural Factors	Position of women has improved over time	18
		Recognise active women in industry and positive role models	14
		Demonstrating aptitude removes barriers	10
		Feel accepted by peers (when perform well)	7
		Wants to create change for younger generation	7
		Diversification improves visibility	3
		Total:	59
Micro	Challenges topic	Negative perception of people who 'complain'	10
		Dismissal of gendered barriers	9
		Individual rather than structural	8
		Interventions represent an unfair advantage	6
		Total:	33

4.5 Discussion

This section combines the qualitative and quantitative results and findings of the survey investigation. As such, the characteristics of each Cohort are presented to create three distinct visibility profiles, the findings of which are then contrasted and discussed within the wider context of prevailing industry conditions.

4.5.1 Collation of evidence to create visibility profiles

This section collates findings from both descriptive and statistical testing presented within the preceding section to propose and discuss three profiles characterising each visibility level. Table 15 presents these findings in tabular form.

Table 15: Profile overview

Variable	A – Farmers and Farm Managers	B - Employees	C – Other labour
Background	Most likely to have a farming background	Highest proportion of new entrants through occupational choice	Highest number of new entrants through familial connection. Highest proportion of farmer's wives
General Education	Highest proportion of secondary and further education	Highest proportion of upper-secondary education and lowest proportion of postgraduate education	Highest proportion of higher and postgraduate education
Agricultural Education	Practical experience only most common	Practical experience only most common	Highest proportion of practical experience only,

			lowest proportion of all other education levels
Average age	39.9 years	33.1 years (lowest)	42.3 years (highest)
Average salary	£12,636 (lowest)	£21,139 (highest)	£16,529
Gender of final decision maker	Lowest proportion of solely male final decision-makers. Highest proportion of female decision makers and joint responsibility		
Support from final decision maker	Highest proportion who strongly agreed their suggestion would be supported		Highest proportion who strongly disagreed that their decision would be supported
Farm type	Higher representation in sheep, lower representation in arable	Higher representation in dairy	
Average farm size	243ha (lowest)	625ha (highest)	362ha
Average farm income	£42,015 (lowest)	£52,581 (highest)	£50,585
Average farm income per ha	£172.90 (highest)	£84.13 (lowest)	£139.74
Farm survival strategies	Farm survival most likely to be supported by diversification. Higher support for farm income through off-farm work	Farm survival most likely to be supported by diversification	Farm survival most likely to be supported by off-farm work
Diversification	Most likely tourism and retailing of farm produce diversifications. Highest	More likely to have diversifications on farm. Most likely renewable and	Most likely tourism and environmental

	time spent on diversifications (11.3 hours/week)	environmental diversifications. Lowest time spent on diversification activities (6.6 hours/week)	diversifications (10.2 hours/week)
Off-farm work	Average salary £21,715. 50:50 within agriculture sector. Most likely to support farm income	Average salary £19,677 (lowest). Most likely to be within agriculture sector	Average salary £23,451 (highest). Most likely to be outside of agriculture sector
Roles and responsibilities	Greatest 'full' and 'some' responsibility for farm related tasks. Lower domestic responsibility	Similar (but lower) responsibility for farm related tasks to A. Lower domestic responsibility than A, lower responsibility for environmental factors than C	Lowest 'full' and 'some' responsibility for farm related tasks. Higher domestic responsibility
Training	Highest participation and confidence in training	High participation, lowest confidence in training	Lowest participation, similar (but higher) confidence in training to B
Organisations	Highest participation and confidence in organisations	High participation, lowest confidence in organisations	Lowest participation, similar (but lower) confidence to A
Hours worked (on farm)	Highest		Lowest

4.5.2 Overview of visibility profiles

4.5.2a Cohort A: Farmers and Farm Managers

Cohort A, farmers and farm managers, engage with higher farm management responsibilities, practical farm work and diversification activities than both employees (cohort B) and other labourers (cohort C). They are also associated with higher hours worked, lower responsibility for domestic activities and are most likely to have a farming background. In terms of farm type, female farmers and farm managers gain higher representation within sheep and other farm types, and lower representation within arable operations. Female farmers/farm managers are associated with the lowest proportion of solely male final decision-makers, the highest proportion of female decision makers and joint responsibility, and are the most likely to strongly agree that their ideas would be supported by the final decision maker; this suggests that this cohort possesses a high level of autonomy. This said, they are also most likely to receive the lowest remuneration for their work, both in terms of salary (on-farm) and farm income as well as being associated with a smaller farm size. The most common farm income survival strategy for farmers and farm managers is diversification, for which tourism and retailing of farm produce is favoured. They also spend the most hours on diversification activities per week. Off-farm work may able be undertaken to supplement farm income, this may equally be within the agriculture sector or outside of it. Farmers/farm managers are likely to be older than farm employees, but younger than other labour. They are likely to have a slightly higher level of general education when compared to farm employees, yet, represent a lower level of education in comparison to other labour. With regards to agriculture-specific education, like all Cohorts, farmers and farm managers are most likely to possess 'practical experience only'. This said, they possess the highest levels of participation and confidence in attending training events and engaging with farming organisations. Such findings correlate with the proposed 'Farm women identity conceptual framework' discussed in Chapter 2. Within this, members of Cohort A (40% of survey sample) may be classified as 'women farmers'; they undertake a variety of tasks on farm, receive clear acknowledgement of their economic contribution and have autonomy within daily and strategic farm decisions.

4.5.2b Cohort B, Farm Employees

Cohort B, farm employees, engage with lower farm management responsibilities, practical farm work, diversification activities and hours worked than farmers, but possess higher responsibilities for these areas than other labourers. They are also associated with a higher likelihood of being a new entrant through occupational choice. In terms of farm type, farm employees gain highest representation within dairy farms. They most commonly work on farms which are ran by males, but generally feel confident that their suggestions would be supported. Farm employees receive the highest level of direct remuneration for their work and are likely to work on larger farms which generate higher incomes. Farm employees are most likely to be associated with farms which have already diversified - for which renewable and environmental diversifications are favoured - however time spent on this per week is also likely to be lowest. If off-farm work is undertaken, it is most likely to be within the agriculture sector, yet, remuneration for this work is likely to be lower than that for farmers or others. Farm employees are likely to be younger than farmers and other labour and have slightly lower levels of general education. With regards to agriculture-specific education, like all Cohorts, farm employees are most likely to possess 'practical experience only'. While they possess similar (but slightly lower) levels participation in training events and organisations as farmers, they also express the lowest confidence. Referring to the proposed 'Farm women identity conceptual framework' discussed in Chapter 2, members of Cohort B (13% of survey sample) may be classified as 'working farm members'; they undertake a variety of tasks on farm, however these roles may possess lower responsibility or visibility than those of the farmer/manager. Autonomy varies with economic power relations, but they are also likely to provide valued input into daily farm decisions and strategic farm decisions.

4.5.2c Cohort C: Other Labour

Cohort C, other labour, engage with lower farm management responsibilities, practical farm work, diversification activities and hours worked than farmers and farm employees, but possess higher engagement with and responsibility for domestic tasks. They are also associated with a higher likelihood of being a new entrant through familial connection e.g.

marriage, and are more likely to identify as a farmer's wife. They most commonly work on farms which are ran by males and generally feel confident that their suggestions would be supported, but, are also the most likely cohort to strongly disagree that their suggestions would be supported. Other labourers receive lower remuneration for their work than farm employees, but a higher level than female farmers, with this trend mirrored for both farm size and farm income. Other labourers are least likely to be associated with farms which have already diversified – for which tourism and environmental diversifications are favoured - and time spent on diversification activities is comparable to that of farmers. If off-farm work is undertaken, it is least likely to be within the agriculture sector and remuneration for this work is likely to be highest. Other labourers are likely to be older than farmers and employees as well as having higher levels of general education. With regards to agriculture-specific education, like all Cohorts, other labourers are most likely to possess 'practical experience only' but also have a lower level of agricultural education than farmers and employees. They also represent the lowest levels of participation in training events and organisations, but similar (although slightly lower) levels of confidence to farmers. With regards to the proposed 'Farm women identity conceptual framework' discussed in Chapter 2, members of Cohort C (47% of survey sample) may be classified as working farm members or traditional farm housewives; they may undertake a variety of supportive tasks on farm, coupled with high responsibility for domestic activities, and as such gain lower visibility for the work they carry out. Again, autonomy varies with economic power relations, but members are also likely to provide input into daily farm decisions and strategic farm decisions. As off-farm work is a common farm-survival strategy demonstrated throughout all Cohorts, any member may also identify as 'dual occupation' identity; pluriactive women who engage and identify with economic endeavours both on- and off-farm. As Cohort C are revealed to be most likely to undertake off-farm work beyond the agriculture sector, those who identify as 'dual occupation' could be considered to be most prevalent within this category.

4.5.3 Discussion of visibility profiles

According to Shortall (2017), there are two distinct career paths for women in farming: those who enter farming and the agriculture sector by choice (including through land inheritance/farm succession), and those who 'marry a farmer' (or similarly become part of a farming family) and enter the occupation as a result. Agriculture is also an industry still typified by family units. This affects how the industry is structured and how many farm businesses operate, for example, business principals manage and provide capital to the business while being also related by kinship and marriage, while succession of business and resources represents the primary means of entry and engagement (Gasson and Errington, 1993). Furthermore, independent entry to the industry is characterised by numerous structural barriers including access to land, capital and resources coupled with low rates of return (Williams, 2006). As such, the paradigm of choice - or agency - and structure is presented, whereby choice, or the absence of choice, to enter an industry combines with existing structural forms to influence the roles, responsibilities, participation and visibility of actors who engage with it.

Shortall (2017) suggests that women who are farming by choice are highly motivated, well educated, often with an agricultural education, as well as being characteristically innovative and hard working. Cohort A, farmers and farm managers, engage with the highest levels of farm management responsibilities, practical farm work and diversification activities, and are associated with lower responsibility for domestic activities. They are most likely to have a farming background, and thus most likely to represent a member of the 'farming family agricultural workforce' (Melberg, 2003). Indeed, Zagata and Sutherland (2015) illustrate that entry to farming is most frequently though family inheritance of owned or rented private property, while Symes (1990) argued that UK farming is a closed profession, restricted to those who directly inherit commercial farming assets. As such, members of farming families often enjoy managerial ascendency and status over managers and workers and often receive greater access to resources and succession facilitating greater participation and visibility of work (McElwee and Smith, 2012; De Rosa, McElwee and Smith, 2019).

Cohort B, farm employees, have a similar level of general and agriculture-specific education and are also actively engaged in daily farming activities, but display slightly lower levels of responsibility in these areas. As such, it is interesting to follow that the greatest proportion of new entrants via occupational choice are found to be farm employees. This concurs with existing literature which suggests that new entrants – especially via the 'agricultural ladder' i.e. from a farm worker to tenant to owner-operator – are now perceived to be a rare occurrence, with the economic barriers they face deemed 'insurmountable' (Williams, 2006). Furthermore, Hopkins et al.'s (2020) Scottish study reveal that new entrants are more likely to be women and have high formal qualifications than other cohorts. They are also less likely than others to identify as farmers or make a profit, with income typically generated from off- farm and on-farm diversification. As such, new entrants may be associated with lower visibility levels as – despite actively engaging in farm work, management activities and having similar educational achievements – structural barriers including access to land, capital and social resources mean they are less likely to become autonomous farmers/land owners than those who possess a farming background and are already part of a family business (Williams, 2006).

Yet, this is not to say possessing a farming background or being part of a family farming unit does not present its own barriers. For example, farm employees within the survey receive a higher average salary than farmers. This could be explained by the family unit providing a higher amount of unpaid labour (Gasson and Errington, 1993), and the higher labour requirement and income associated with larger farms (Zeuli and King, 1998). Risk factors associated with business ownership versus employment may also be pertinent factor, tracking remuneration to business performance and the undervaluation of personal/family labour (Gasson and Errington, 1993). Furthermore, female employees are associated with a larger farm size than female farmers within the dataset. Evidence associating women farmers with smaller farm size is also found extensively throughout literature (Kalbacher, 1985; Haugen, 1990; Leckie, 1993; Gidarakou, 1999; Shortall, 2010; Hoppe and Korb, 2013; Ball, 2014), and the cultural practice of passing on large farms intact to one son is considered the single biggest barrier to women's entry into agriculture (Shortall, 2019). Indeed, studies including Alston (1998); Mann (2007); Voyce (2007); Rossier and Wyss (2008); Cavicchioli et al. (2015, 2018) illustrate that men and first-born potential successors

are still most likely to succeed the family farm. Farm size is also linked to farm type, with studies suggesting that women are more highly represented in livestock and speciality production farm types (Kalbacher, 1985; Leckie, 1993; Perry et al., 1995; Rosenfeld and Tigges, 1988; Zeuli and King, 1998; Trauger, 2004; Elias and Lundqvist, 2016). As such, this also offers explanation as to differences in farm type across the cohorts, and why farm employees may be associated with characteristically larger and more labour-intensive dairy farms, while female farmers are positively associated with sheep farms - lower land and capital requirements - and negatively associated with arable farms and their higher land and capital requirements. The combination of smaller farm size and higher unpaid labour inputs may help to explain the highest average income per ha result obtained by women farmers in the survey.

Shortall (2017) also suggests that women who enter the sector through an alternative means e.g. 'marry into farming' are also innovative and hardworking but can also be able to be more detached from the farm business, may work in a different sector, and bring different skills from outside farming. Cohort C, other labour, demonstrate the lowest levels of agriculture-specific education, engage with lower farm management responsibilities, practical farm work, diversification activities and hours worked on farm than farmers and farm employees. They also possess the highest engagement with and responsibility for domestic tasks. Despite this, they also demonstrate the highest levels of general education, are most likely to undertake off-farm work in another sector, and receive the highest salary for their off-farm work. Members of Cohort C are associated with a higher likelihood of being new entrants through familial connection e.g. marriage, and are more likely to identify as a farmer's wife. According to Farmers Weekly survey (2014), marriage remains the main route of entry into farming for 25% of women respondents, while only 2% of male respondents married into farming. As discussed in Chapter 2, marrying into the sector, and indeed endogamy (48% of all respondents identified as a farmer's wife) is said to present a range of structural challenges from both cultural norms and restricted ownership/access to economic resources (Shortall, 2002; Shortall et al., 2017), all of which affect the roles and responsibilities women undertake, and in turn the visibility they receive.

4.5.4 Experiences and outlook

As stated in section 4.4 despite demonstrating statistical difference between the Cohorts regarding hours worked, farm management responsibility, practical farm work and diversification and domestic responsibilities, no statistically significant differences were found between Cohorts with regards to attitudes and perceptions of the barriers and opportunities facing women in UK agriculture. As such, the thematic analysis of respondents' free-text survey responses were explored at an aggregate level, offering a broad cross-sectional insight into their experiences. In doing this, six key themes and 38 individual codes were identified. The six key themes include: Industry Structure; Roles and Responsibilities; Education and Organisations; Positive Structural Factors; Positive Individual Factors; Negative Individual Factors. These themes are presented in Figure 15, mapped across two sets of axis: macro / micro factors, and; challenges/opportunities. As such, the following section synthesises these findings further and explores the deeper paradigm between autonomy and structural factors, personal choice and cultural constraints, and the challenges and opportunities presented to women across the board. Figures 15 and 16 visually illustrate the interconnected nature of these themes, and how change may still be stimulated within these constraints to yield benefits to industry.

Figure 16: Thematic Illustration

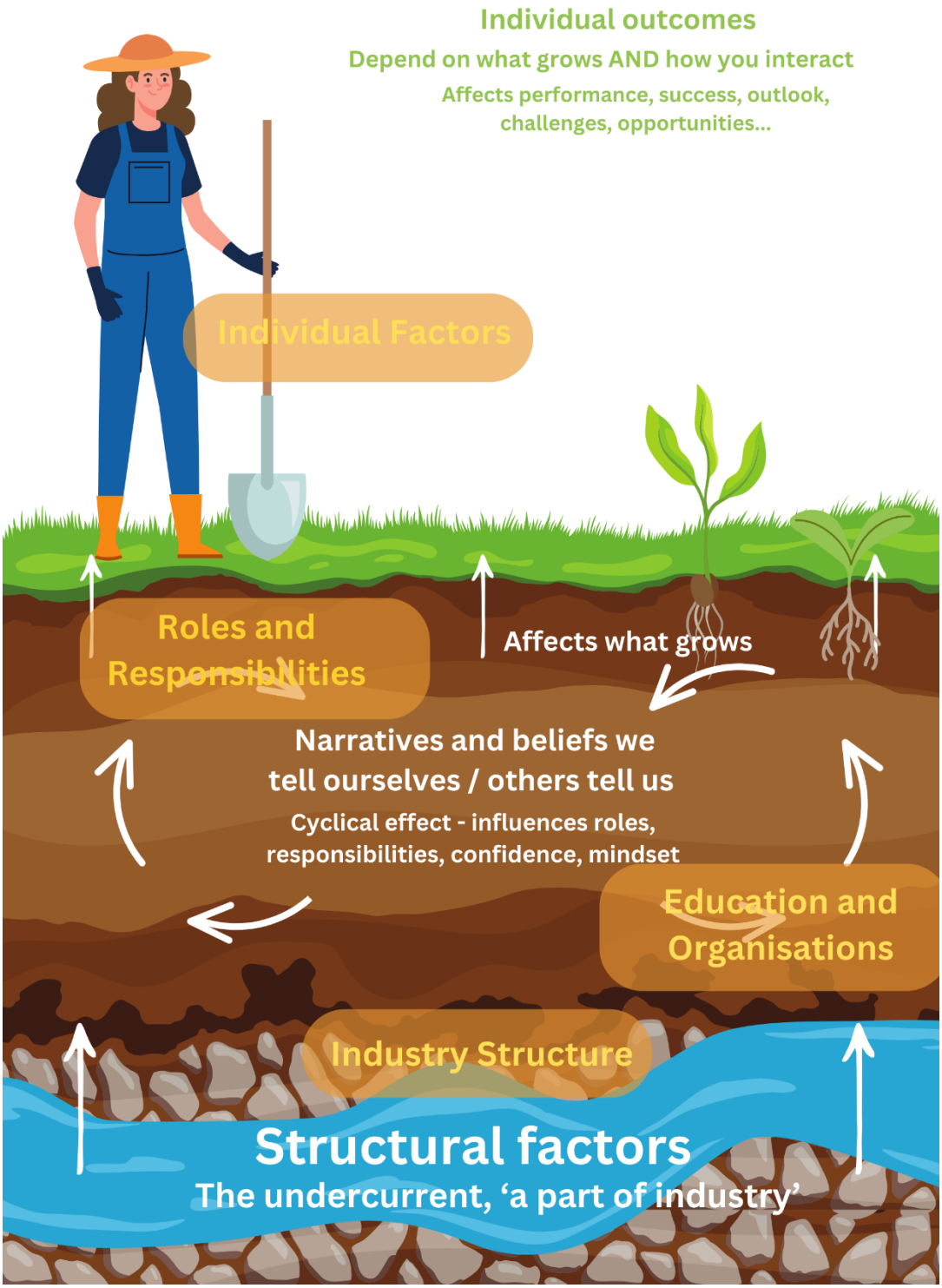
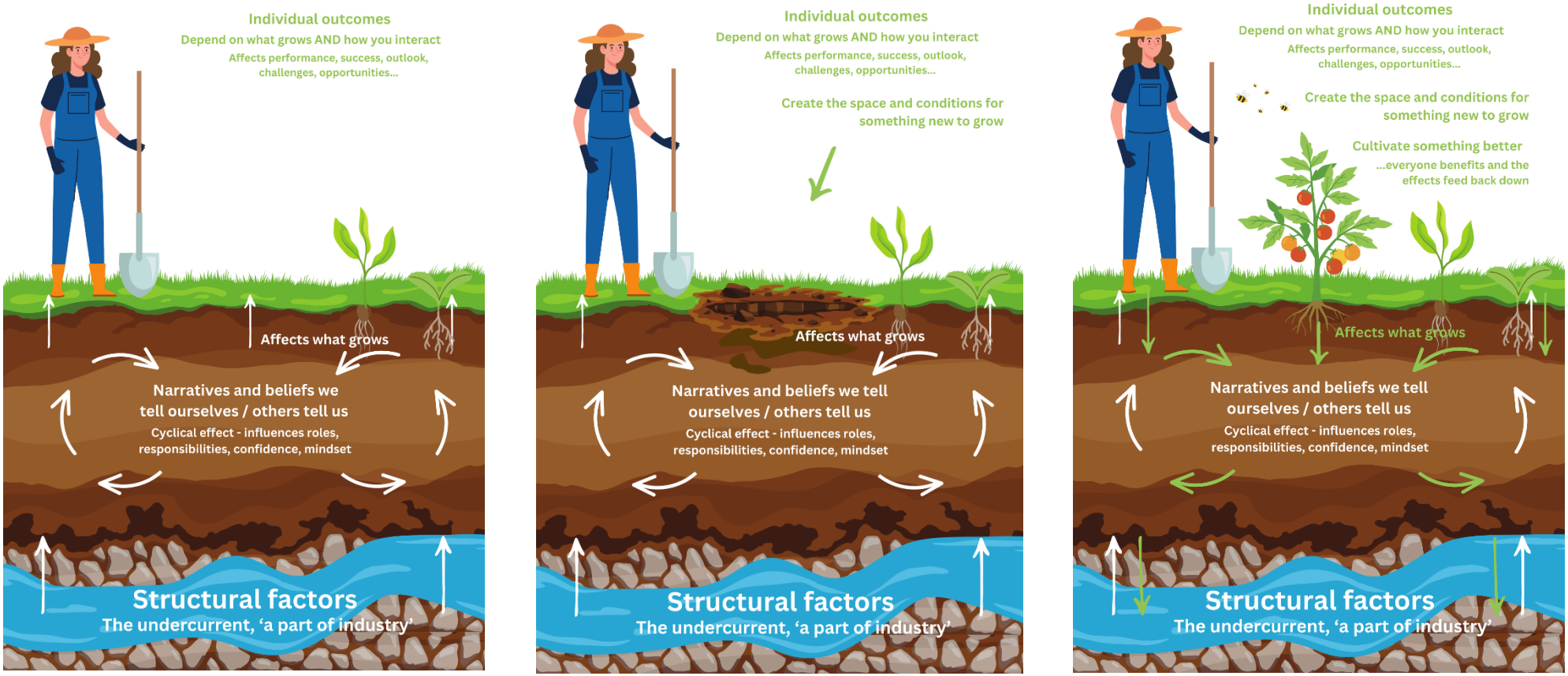


Figure 17: Thematic Illustration – Cultivating Change



Theme 1: Industry Structure

When asked 'what are the greatest barriers for women in UK agriculture', the most commonly identified barrier within both the survey and thematic analysis was 'Industry Structure'. This theme was identified on both a macro level, e.g. within groups and organisations, and a micro level e.g. everyday life on farm.

On an everyday level, respondents most commonly discussed themes of implicit prejudice towards the roles others assume they undertake on farm, needing to work harder to prove themselves, and being ignored or not taken seriously (all codes listed in Table 14). Assumed not to be in a position of responsibility was the most commonly cited experience of sexism, by 83% of respondents. Unnecessary attention being drawn to gender, and gender being ignored where it would be relevant were also key experiences, cited as common by 79% and 77% of respondents, respectively. Occupational gender typing establishes norms about what are appropriate roles for women e.g. traditionally more masculine farm activities such as operating machinery (Roscigno et al., 2007) with prejudice also relating to women's perceived abilities if about to be pregnant or with a young family (Shortall et al. 2020). Indeed, some respondents report a misogynist culture to be 'the norm' and accept a level of sexism as part of the industry, requiring women to 'rise above it' or adapt their own behaviour. These findings are supported by a wealth of literature on the topic, discussed in-depth within Chapter 1 and 2, which suggest women traditionally encounter a range of prejudicial barriers in agriculture, based on traditional norms and expectations which position women as subordinates to men, supported by gendered division of labour and access to resources (Gasson and Winter, 1992; Whatmore, 1991; Bock and Shortall, 2017). Indeed, sexist and inappropriate comments were deemed common by 69% of respondents, while social exclusion garnered 63%. The thematic analysis identified sub themes including accepting sexism as part of job/industry; identifying a misogynistic culture; needing to work harder to prove themselves/be taken seriously; and being discriminated against for job or business opportunities. Pertinently, Shortall et al. (2020) suggests that implicit social barriers such as these can endure through a culture of informal processes of social interaction which are not only difficult to prove and challenge but result in normative stances which are, in turn, accepted by both men and women.

“It often feels like if you’re a woman the assumption is: you either don’t know what you’re talking about or have to be significantly better than a man just to gain the slightest respect. When viewing or selling 99% of the time it's men I deal with and 99.9% of the time they ignore me completely and speak to my partner. Who then tells them to speak to me as I'm the shepherdess...this is nearly always responded with a sideways look at me, followed by a dumbed down conversation!”

“In this area there is a tradition for a 'night out' annually with farmers, suppliers and auctioneers. This is a male-only event. I could get on board with it being a strictly no partners event but no women seems off in this day and age. Two examples would be our vet attends and they have two partners at the vets, one male and one female, the male is invited but the female vet isn't. There was also a machinery dealer who attended until he died, his wife and daughter now run the business, the dealers ticket was given to his son in law, who is an employee of the company and not to the wife or daughter who own it!”

“The biggest single challenge is that many women with a brother are still automatically viewed as being unsuitable to carry on the family farm. Why is that still happening?”

“Even with changes in attitude, women entering [agriculture] do need to be able to have some degree of 'thick skin' to survive. I have had to put up and shut up over the years because its farming and it is what it is. Most women accept it because of the nature of the game we are in, but it shouldn’t be that way.”

Furthermore, negative views and prejudice were identified as being most commonly perpetuated by older members of the farming community in particular.

“It’s not everyone that makes women feel this way (I hope) from my experience it is a lot of the older generation who (if I generalise) are less accepting of women within the industry.”

Theme 2: Roles and Responsibilities

While the most commonly identified barrier within both the survey and thematic analysis was 'Industry Structure', the second greatest barrier affecting women's participation in the sector was reported to roles and responsibilities which were often governed by the traditional division of labour, with particular emphasis on responsibility for domestic activities. While our quantitative investigation showing that cohort C exhibited the highest responsibility for domestic activities compared to other farm identity types, our qualitative investigation and thematic analysis (Table 14) revealed that responsibility for domestic activities was in fact common across all cohorts. The thematic analysis of respondents' free-text responses also revealed the traditional gendered division of labour to be an important issue; suggesting that roles and responsibilities on farm often differ between sexes with women often expected to undertake higher domestic responsibilities coupled with a greater variety of on and off-farm roles. In turn, these factors create a higher number of time/logistic constraints and limits participation in other activities. Often, it was suggested that these roles and responsibilities arose out of structural factors and cultural norms, being 'what is expected' rather than respondents' free choice. These findings concur with those of numerous studies including Rissing et al. (2021) and Ridgeway (2009) who suggests that the roles women undertake on farms are still primarily gendered, embedded in social structures by cultural hegemony rather than personal choice (Fink 1986; Rosenfeld 1987; Sachs 1996). The view that women are more suited to some types of farming, such as animal care or paperwork, which require more essentialist feminine traits (Tomlinson, 2006; Shortall et al., 2020) is also demonstrated to exist. Another key factor is childcare, with respondents citing that women are almost always primarily responsible for childcare, in addition to participation in farm tasks (Inwood and Stengel, 2020; Shortall 2017, 2019; Rissing et al, 2021). The findings presented within the thematic analysis (Figure 15, Table 14) concur with existing industry research stating that women still bear the "lion's share" of 'invisible' family chores (Lachance-Grzela and Bouchard 2010), childcare (Bianchi et al. 2012), and family emotional work (di Leonardo 1987; Erickson 2005). In some cases, respondents suggested that personal farming routines could be built to accommodate childcare, however, incorporating childcare into farming regimes still often had clear impacts on the roles and

opportunities women undertake and often reduced their participation in on-farm activities (Inwood and Stengel, 2020; Shortall 2017, 2019; Rissing et al, 2021). Indeed, results of the ordered logistic regression model suggest that lower time worked on farm correlates with lower farm responsibilities and higher domestic responsibilities. Additionally, UK government statistics (Defra, 2016) suggest that women farmers are associated with a lower time worked annually than male farmers, with over three-quarters of female farmers (77%) working part-time versus just over half of male farmers (53%). As such, the findings of the present study corroborate Inwood and Stengel (2020), Shortall (2017, 2019) and Rissing et al. (2021) who suggest childcare and domestic responsibilities can represent major barriers to women's participation and career progression, both on and off-farm, and are largely enforced by structural factors. As such, this may be a primary contributor to the 'leaky pipeline' (Shortall et al. 2017, 2019) characterising the progressive reduction in women's market and leadership participation within the sector.

"I think a big problem is gender stereotypes in agricultural communities. In my experience, male farmers are happy enough for females to work on the farm as an equal, but on top of this women are also expected to hold a typical 'farmers wife' role. Being responsible for the house and home, including meals, washing etc. Having children can expand this gap further and is very much seen as a woman's responsibility."

"I'm on a treadmill I can't get off. I have no time spare; looking after the kids, farm, work and home. I can't see it changing as I'm battling against a lifetime of [partner's mother] doing everything for her kids, so I don't get much help and I don't see it as a choice. I think if [they] just acknowledged it slightly, that would make it more bearable."

"Once you have a family it is so extraordinarily difficult to maintain workload and children. You become pushed into childcare. I have put my career on hold (professional highly paid) because I cannot access childcare and husband works long hours alongside me in our business. I pick up 90% of childcare and with that sort of a stereotypical male/female division of labour, which is not at all what I intended."

Physical barriers were also identified as an important sub-theme of Traditional Labour Division by participants; highlighting differences in physical capabilities between males and females as a contributing factor towards some aspects of labour division on farm where it may be difficult or unsafe for women to undertake certain activities e.g. physical lifting, working with sheep during pregnancy. Overall, in similarity to findings of Keller (2014), these were not recommendations for women not to be involved in agriculture, rather considerations for their workstyles, and highlighted that different methods could be employed to account for female bodies (Shortall et al., 2017). This intersection between structural factors and biology, cultural norms and autonomy was identified as a factor which has the potential to hinder or even endanger women in the workplace if larger structural challenges were not addressed to accommodate these challenges.

"Practically my gender has held me back in some ways e.g. strength, not being allowed near sheep whilst pregnant and now with a small child some activities are just not practical, so biologically I recognise there are some limitations, but socially there are bigger barriers due to discrimination."

Theme 3: Education and Organisations

Access to education and organisations facilitates the sharing of knowledge and networks, and is a key factor influencing women's economic contribution, performance and visibility within agriculture (Slagsvold and Sørensen, 2008), yet women are often similarly associated with lower access and participation in these activities (Haugen and Brandth, 1994; Shortall, 1996; Alston, 1998; Liepins and Schick, 1998; Pini, 2002; Brandth, 2002; Safilios-Rothschild, 2006; Trauger et al., 2008, 2010; Brasier et al., 2009; Isteniˇc, 2015; Shortall et al., 2017; Shortall, 2019). Education and Organisations was recognised as a key theme, with sub-themes including: lack of confidence; time constraints; unwelcoming environment; cost and funding availability; misogynistic culture cited as barriers by survey respondents. Such findings concur with findings from Shortall et al. (2017) who's industry survey revealed that although most survey respondents would like to see more women involved in leadership of farming organisations, only about one-third were personally interested in becoming more

involved in leadership themselves, citing 'lack of time' as their main barrier, followed by the need to prioritise childcare and lack of financial resources (Shortall, 2017; 2019). As such further research suggests that the multiple roles and additional domestic responsibilities is intrinsically linked to lower levels of participation and leadership (Shortall, 2002; Little and Panelli, 2003; Brasier et al., 2009; Charatsari et al., 2013a, 2013b).

"I can't get anywhere physically without kids, farm, work and home falling to bits and causing me more bother than it's worth."

Additionally, a key component of discussion between both scholars and industry is whether women may feel uncomfortable at current training events and organisations. Not being taken as seriously, unwelcoming cultures and lack of confidence were key themes identified within survey responses, with particular emphasis upon those without a farming background. Indeed, 40% women cited lack of confidence as presenting a barrier to their participation. This is also common throughout other industries (Clarke, 2011). Existing research concurs that women may feel that they are not 'taken as seriously' as men within agricultural training and organisation environments (Shortall, 1996; Trauger et al., 2008, 2010; Brasier et al., 2009). Furthermore, a body of research suggests that implicit masculinist cultures, for example, language used, gender segregation, meeting locations (for example, evening time at public houses) and 'the pervasive operation of old boys' network' is off-putting to women (Grace, 1997; Alston, 1998, 2000; Elix and Lambert, 1998; Pini, 2002; Shortall et al., 2020). Indeed, studies have found women often reported feeling self-conscious and uncomfortable at farming events because they are the only, or one of a few, women present (Alston, 2000; Shortall, 2001; Pini, 2002) alongside non-verbal communication or 'pointed comments dressed up in humour' (Shortall et al, 2020). While studies also suggest that even 'confident women' may feel 'uncomfortable, intimidated and not taken seriously' when attending events primarily attended by men. This is also suggested to be a particular issue for young people and new entrants (Alston, 1998; Pini, 2002; Shortall et al., 2017, 2019). As such, Grace (1997), Alston (1998) and Pini (2002) identify lack of confidence and experience to be associated with negative gendered experiences including poorer access to social networks. Interestingly, some studies suggest a lack of female participation may also be commonly perceived by establishments to be an

individual rather than organisational constraint (Sinclair, 1994; Gherardi, 1995; Elix and Lambert, 1998; Alston and Wilkinson, 1998; Shortall, 2002; Shortall et al., 2020). It is suggested that in some cases, agricultural power holders may deny there are any constraints for women in achieving positions of leadership and women's silence is taken to justify their exclusion and lack of interest (Shortall, 1992, 2002; Alston and Wilkinson, 1998; Pini, 2002). According to Shortall et al. 2020, this is an example of occupational closure. In such cases, structural barriers to women's participation have been described as implicit rather than explicitly defined, and the term 'gender blind' used describe where such incidences may occur (Sinclair, 1994; Gherardi, 1995; Alston and Wilkinson, 1998), with implicit social barriers enduring through a culture of informal processes of social interaction proving difficult to challenge and change (Shortall et al., 2020).

"I have always found socialising within the agricultural sector quite intimidating. Usually dominated by males and hard to fit in and it's not always a welcoming environment. I also find there is a lot revolving around alcohol."

"Because I don't come from a farming background, I don't know whether I'd fit in. I don't feel I am recognised as a farmer and I would worry I would be the least experienced in the room - I'd just feel out of my depth."

Aside from this, as discussed in Chapter 2, existing research also suggests that women may engage less because the opportunities on offer are not consistent with their requirements (Shortall, 1996; Trauger et al., 2010; Charatsari et al., 2013; Shortall et al., 2017). As such, economic obstacles to the provision of alternative opportunities are suggested to include that providers are not aware of the demand, or differences in preferences, and are therefore reluctant organise events/information focusing upon the specific requirements of women (Barbercheck 2009; Trauger et al., 2010; Shortall et al., 2017). While research suggests that women may engage less in farm education and organisations because the opportunities on offer are not consistent with their requirements (Shortall, 1996; Trauger et al., 2010; Charatsari et al., 2013; Shortall et al., 2017); Trauger et al. (2008), Barbercheck(2009), Bock and Shortall et al.(2017) and Shortall et al. (2017) also suggest that women do recognise the areas they require training in and what kind of educational styles they prefer,

prioritising personable experiences, workshops, demonstrations and discussions as methods of information transfer. These findings concur with results of the present study, with the most popular formats of agricultural training being farm tours, practical short courses and small-group workshops, while larger and more impersonal options including conferences and podcasts ranked the least popular.

Women-only groups were also a popular choice amongst participants, with only a small proportion disagreeing that they are useful and suggesting that initiatives like this could not be hosted without disadvantaging males. Indeed, studies show that successful women's groups based upon education and networking can increase knowledge and social capital (Bell and Kilpatrick, 2000; Heins et al., 2010; Kiernan et al., 2012; Schultz et al., 2017). Studies by Trauger et al. (2008), Barbercheck et al. (2009), Brasier et al. (2009) and Shortall et al. (2017) suggest there is a demand for more women-only courses in the agricultural industry and they are an effective way to increase women's confidence, social capital and help address some barriers associated with locations and childcare. Furthermore, Shortall (2017) suggested that short courses for women who are new to farming, particularly those who have married into farming, should also be developed. Women's groups across developed countries represent a widespread policy response to women's lower representation within a range of industries including STEM (science, technology, engineering and mathematics), business and construction, and report increases women's confidence, social capital and participation (Clarke, 2011), with research suggesting that participation in women-only groups can also act as a stepping-stone towards integration within mixed gender groups as women became more established and more confident (McAdam et al, 2019). Agriculture-specific women-only groups report varying levels of interaction and influence (Chapter 2), however, a particularly recent and successful example is that of the Scottish Government who have employed a combination of research and policy measures to establish and promote the position of women in Scottish farming through the formation of the Women In Agriculture Taskforce (Shortall et al., 2019). Cited as a primary barrier for engagement with both training and organisations by survey respondents, cost is also a key factor which saw the Scottish Government pledge £400,000 per annum until 2024-25 act upon a series of recommendations aimed at improving the accessibility and provision of agricultural training opportunities to improve women's

leadership both on-farm and within agricultural organisations in recognition of the important economic benefits this can bring to rural communities and productivity (Shortall et al. 2017; 2019).

"It's pretty intimidating walking into a room full of male farmers. But I go to the women in dairy groups. It's just a bunch of like-minded people and no one bats an eyelid when you have to leave early or join with a child in tow. It's a different atmosphere."

Theme 4: Individual Challenges

Views on whether there were indeed any challenges faced by women in agriculture was found to vary on an individual level, with 'Negative Individual Views' identified as an important theme, outside of general structural factors. Sub-themes included: negative perception of people who complain; dismissal of gendered barriers; claims that challenges are individual rather than structural; and the view that interventions to improve equality represent unfair advantages. Although the number of respondents citing such views was small, it represents an important factor documented by Andrews (1981) who suggests that where male dominance comes to fruition, members of a subordinate 'outgroup' (e.g. females) may internalise some aspects or beliefs of the dominant 'ingroup' (e.g. patriarchy). This may include perpetuating biases, distastes, and the 'shedding' or distancing of identities associated with negative characteristics of the outgroup deemed necessary to comply with existing cultural scripts or prejudices of the ingroup.

"Feminists are their own worst enemy – and the worst thing for other women. I feel tarred by the same brush of those women who always have someone else to blame, why should a woman get a job over the man just because she's got a vagina?! Women get in the way of themselves by imagining people are judging or making a barrier, by acting like there's always a problem people kid themselves into it!"

"A lot of comments are made in jest and some women seem to get far too precious about it. It's all getting a bit out of hand now, pity party #meetoo posts (a lot of them

are made up), poking holes in people's genuine mistakes ("Dear Sirs" is actually correct English) and looking for a pat on the back just because they're a woman. I've never been excluded from anything by men - but have done by other women!"

Theme 5 and 6: Individual and Structural Opportunities

Despite the challenges discussed, overall, the sentiment of respondents appeared positive towards both their participation within the industry and that of other women, demonstrating personal agency and positive structural change in shaping their own experiences.

In total, 87% of respondents agreed that the position of women has improved over time. Such perceptions are reflected in 'Structural Opportunities' theme (figure 15). Respondents reported upon themes that themselves and others are accepted when they perform well, and that 'being good at your job' removes any gendered barriers, with some respondents reporting to not have experienced any gendered barriers personally. This correlates with findings from recent industry surveys in Scotland (Shortall, 2017, 2019) and Northern Ireland (NIA, 2022) which found that women are demonstrating increasing participation and agency and held a positive outlook for the sector with participants being confident that the position of women in agriculture has improved within the last generation.

"I started in farming in 1980. I was the only female at every meeting I attended but through my own hard work and proving I was knowledgeable and passionate about my chosen career I developed long and lasting respect. I think things are better nowadays than they were back then."

"We employ all females on one of our farms, it's often commented on locally and caused a fair bit of discussion and speculation - having said that they have gained respect because they are good at what they do."

Both a factor of individual action and changing industry structure, diversification also appeared to play an important role in increasing women's visibility, with time spent on

diversification highest within the female farmer cohort. Numerous studies suggest that women are associated more highly with diversification activities than male farmers (Gasson and Winter 1992; Evans and Ilbery, 1993, 1996; Benjamin, 1994; Cawley et al., 1995; Ilbery et al., 1998; Caballʹe, 1999; Carter, 1991; Gorman, 2004; Bock, 2004; Trauger, 2004; Iakovidou et al., 2009; Haugen and Brandth, 2010, 2011; Ball, 2014; Heggem, 2014; Wright and Annes, 2014). Explanations for this include that women are more able to recognise the potential for diversifications (McElwee, 2006), have more transferable skills from outside of agriculture (Carter, 1997) as well as the requirement to work businesses around other commitments such as family and childcare (Trauger et al., 2010; Hoppe and Korb, 2013; Ball, 2014). This, combined with factors such as smaller farm size and lower farm income (Kalbacher, 1985; Perry et al., 1995; Rosenfeld and Tigges, 1988; Hoppe and Korb, 2013) may help to explain this phenomenon. Further research also suggests that when women contribute to and gain visibility within diversification activities, their general level of visibility and acknowledgement of their contribution may increase (Shortall, 2002; Contzen and Forney, 2017); this could explain why diversification is well represented in Cohort A, and in turn these women are more likely to identify themselves as 'farmers' (Keller, 2014). However, although diversification may be associated with increasing recognition of economic contributions and detraditionalised identity types, lack of differentiation between income streams and the widely documented failure for many farm incomes to recognise the contribution of off-farm or non-farming incomes e.g. diversification (Gasson and Winter, 1992; Shortall, 2002; Bryant, 2002; Contzen and Forney, 2017) still presents major barriers to the true realisation of all women's on-farm contributions.

This said, recognising other active women in industry, having positive roles models, and supportive relationships in their own life appeared to play a role in supporting individual women to achieve higher visibility. Factors such as these formed a key theme; Positive Personal Experiences (Table 14). Indeed, research by Porter and Serra (2020) found that the presence of positive female role models significantly improved women's visibility in the field of economics, while Lecoutere et al. (2019) found female role models encouraged the adoption of new agricultural skills and knowledge. Women associated with the highest visibility and farm responsibilities, also correlated with highest confidence in support from final decision maker (where they were not the final decision maker themselves). This is

supported by research including Keller (2014) and Shortall et al. (2019) who suggest the visibility and contribution of farm women may in part be influenced by their immediate surroundings and support networks. Indeed, structural factors such as this may help women overcome the 'leaky pipeline' (Shortall et al. 2017, 2019) characterising the progressive reduction in market and leadership participation whereby a combination of both structural and personal barriers may prevent women's economic participation and visibility and result in a loss of skills and participation within the sector. Despite encouraging momentum being demonstrated, the need for more role models was also highlighted. Only 19% of respondents thought women were well represented within industry leadership, and 82% agreed that that more female roles models were needed.

"Minette Batters has been an amazing role model for women in agriculture. Programmes like This Farming Life have also been great to give a platform to women in farming."

"I honestly never gave a thought to the fact that I was a young woman starting up on my own. Maybe it's because I followed my mother, she was the farmer here not my dad."

"I am lucky I partner with my husband, and we work very well together to drive the business forward. To be successful we must have supportive families and be equal at home, just like if we were high achievers in other industries."

4.6 Chapter Limitations

As discussed in section 4.2, an online survey was selected as an efficient method to collect information from a large number of participants. However, in utilising an online survey methodology, a number of limitations characterised by survey constraints, errors and effects are also encountered. Survey constraints include selection bias; the survey was open for 11 days and distributed via online channels and through direct communication to industry groups and individuals. Thus, not only is coverage an issue with only individuals possessing access to time and appropriate channels being able to participate, but - although responses were filtered and those which did not meet the survey criteria were removed - an

uncontrolled recruitment method also means that the population to which respondents are distributed cannot be described and may further mean respondents with biases may select themselves into the sample.

Furthermore, although self-administered surveys may reduce concerns around research influence, such as social desirability effects, they also expose risk to response accuracy issues with both respondents and researchers alike unable to follow upon on interesting or confusing questions. Additionally, constraints related to population bias in sampling may also mean topics of importance occurred beyond the experiences of the sampled population are thus not reflected in the results yielded. To help overcome this, informal discussion was undertaken with industry actors prior to and during survey creation to ensure applicability of response options, and, overtly linked open-ended response fields succeeded structured response sections facilitating linkage during both data collection and analysis. Furthermore, subsequent thematic analysis of qualitative data utilising Braun and Clarke's (2006) six-step process of thematic analysis using NVivo12 software helped to categorise and quantify otherwise qualitative responses. Although no notable differences were recorded to exist between cohorts within the thematic analysis, this presented a useful way to objectively compare results between cohorts and identify potential population response bias.

Another limitation associated with the survey undertaken within this Chapter is incomplete response data. Indeed, 60% of respondents were classified as 'employee's' or 'other labour' and as such difficulty completing metrics pertaining to farm business economic performance may have been experienced and could help to explain comparatively high non-completion or uncertainty within these sections. As such, further analysis of these areas was limited. However useful insights yielding from other areas of the survey not requiring this knowledge were still obtained.

This said, as discussed within Section 5.4, a further limitation of the methodology employed includes an R-Squared value of 0.248 obtained within the step-wise regression modelling; which suggests that the model explains only around one-fifth of the variation in the response variable (visibility level) around its mean. This suggests that all factors which may influence visibility level were not included, and thus this model cannot be taken to represent a definitive statement upon visibility level. While this figure may be considered

low by some disciplines, studies that try to explain human behaviour are well documented to report R-Squared values of less than 50% (0.5) (Peterson, 2023); with people being harder to predict than things like physical processes. Indeed, as this Chapter illustrates, respondents experienced a myriad of circumstances and perceptions within the same industry, thus their influences upon the roles within industry are far more complex than may be deduced within a simple statistical model. As such, a combination of quantitative and qualitative methodologies have been employed both within this chapter and throughout the thesis to present these viewpoints.

4.7 Conclusion and Contribution to Knowledge

The objectives of Chapter 4 were firstly to undertake the first UK-wide primary data collection pertaining to women's own perceived roles, contribution and visibility in UK agriculture via a national survey. Secondly, Chapter 4 aimed to empirically and qualitatively assess this data. As such, this chapter contributes to knowledge by providing a new, baseline assessment upon the UK position which is supported by both empirical and qualitative analysis. Findings include statistically significant differences between the roles and responsibilities associated with different groups of women in UK farming, while further findings suggest that barriers faced women in farming may be consistent across groups, mainly characterised by structural factors. This Chapter provides both preliminary findings and helps to inform future cross-disciplinary research in the area.

Via the responses of 645 respondents, Chapter 4's empirical analysis revealed statistically significant differences between the roles and responsibilities associated with different groups of women in UK farming. The empirical investigation provided evidence that roles and responsibilities were found to differ significantly in relation to visibility level. For example, women associated with higher visibility levels were found to be associated with greater responsibility for on-farm activities, higher hours worked and lower domestic responsibilities. These findings contribute to knowledge by presenting the first UK-specific recent data on the topic and provide an empirical angle to support existing and ongoing qualitative studies in the field.

The investigation also collected qualitative insights pertaining to the barriers and opportunities facing women in the sector, which were found to remain consistent across groups, and, in the majority, be attributed to structural rather than individual factors. The qualitative aspects of this investigation provide the first recent UK specific evidence which a) supports and adds depth to the empirical findings of this investigation, and b) compliments existing international, dated, or small sample size data on the topic. As such, Chapter 4 contributes to knowledge by presenting new and significant data alongside first-hand accounts of UK stakeholders which document and assess structural barriers reported by women in UK agriculture. As such, it adds weight to previous findings that differences between individual performance within the sector may not exclusively arise through choice. Indeed, the main factors which may reduce female participation and visibility were found to be consistent across women as a whole; and reported to be perpetuated by a complex range of cultural phenomenon often governing access to a range of structural and social resources. This chapter adds new UK data to support the case that the combination of such factors may contribute to a 'leaky pipeline' between involvement and both market and leadership participation, of which the loss of skills and labour presents important economic penalties to the sector and therefore must be addressed. It also demonstrates that steps taken towards addressing these challenges have the potential to yield ongoing benefits and stimulate further change within industry. As such, these findings, from first-hand industry accounts, may be used to add weight to trans-disciplinary research and industry strategies to address implicit social barriers which are so often difficult to prove and challenge.

Part D: The findings: policy implications, limitations, and further research

Introduction

The thesis' final part draws together the descriptive and analytical review of the UK agriculture structure presented in Part B and the empirical evidence presented through investigations undertaken in Part C to assess women's economic contribution to UK agriculture and how it can be supported. Specifically, it will focus upon industry and policy recommendations, and identify areas for further research.

Chapter 5: Discussion on the findings and possible implications

5.1 Introduction

Thus far the thesis has provided a descriptive and analytical assessment of UK agriculture structure; developed an economic framework to characterise the economic profiles of UK farm women; provided empirical evidence to substantiate causality as to women farmers economic performance; presented empirical evidence assessing drivers of farm output pertaining to gender; and collected evidence characterising the relationships between activities on farm, visibility levels, and the barriers and opportunities presented to women in the UK agriculture sector. Methodologies used in pursuing these investigations have included systematic review (n=185 studies), national survey (n645 respondents), and thematic analysis, as well as advanced econometric models such as the Multiple Regression Model and Ordered Logit Model. (update intro with this too)

As such, this study is the first in recent UK literature to provide an investigation on the economic contribution of farm women that is supported by recent empirical evidence. The outcomes derived could be viewed as an initial examination of the economic contribution and characteristics of UK women in agriculture on which further research could be based. The findings herein aim to help bridge the gap between social science and economic studies, providing new perspectives within the intersection of structure and agency, and presenting a stepping-stone for further transdisciplinary research and industry actions.

Chapter 2 assessed the dual themes of structure and agency as it investigated the economic participation of UK women in agriculture through a systematic review of international literature. Utilising 185 research papers from a variety of academic disciplines, it explored differences in participation within farm women as a group; differences between farm men and women; and barriers and potential incentives to women's participation in agriculture and agricultural businesses; and brought these findings together to present an economic framework for further characterising farm women's contribution and visibility. This chapter contributes to knowledge by providing a systematic and replicable methodology whereby women's contribution and visibility with UK agriculture has been assessed through the lens

of trans-disciplinary research. This methodology, attempting to bridge the gap between economic and other social-science disciplines, is the first of its kind to be used and applied recently in the UK literature; building upon the initial methodology employed by Ball (2020) in the United States, and presents findings which may be utilised in further economic research. Furthermore, this chapter contributes to knowledge as the process yielded a hypothetical framework, consistent with cross-disciplinary findings, which may be used within both subsequent research and industry. The framework helps to segment and better understand the needs of groups of farm women which may be applied in the UK setting, while discussion around these findings draws together both structural and individual factors, providing a bedrock for further investigation.

Chapter 3 investigated empirical measures which influence the economic contribution and visibility of women farmers via an analysis of 2,300 UK Farm Business Survey business observations with the aid of multiple linear regression models. This Chapter revealed that although gender was not found to be a significant driver of farm output, significant differences were demonstrated between the characteristics of men and women farmers and their farms. Furthermore, women's unpaid labour was found to represent a significant driver of farm output. This chapter contributes to knowledge in three main areas. First, providing the first recent UK-wide empirical evidence to further the limited existing literature, and second, by revealing statistically significant drivers of farm output relating to gender. As such, both of these factors go on to address two key areas previously identified for further investigation; lack of data availability, accuracy and applicability; and, substantiating the causality of women farmers apparent lower economic performance in comparison to men. Third, UK-specific empirical evidence is provided for the first time highlighting the statistically significant effect of women's unpaid labour upon farm output.

Further examination was undertaken in Chapter 4, collecting primary data from UK industry respondents via a mixed methodology national survey to empirically and qualitatively assess the roles, responsibilities and experiences of UK farm women which underpin their economic participation, contribution, and visibility. This chapter contributes to knowledge by providing the first UK-wide primary data collection and analysis pertaining to women's own perceived roles, contribution and visibility in UK agriculture via a national survey. The

main findings from this chapter include statistically significant differences between the roles and responsibilities associated with different groups of women in UK farming, while further findings suggest that barriers faced women in farming may be consistent across groups, mainly characterised by structural factors. As such, it provides the first recent UK specific evidence which a) adds depth to the empirical findings of our investigation, and b) compliments existing international, dated, or small sample size data on the topic. Indeed, Chapter 4 presents new and significant data alongside first-hand accounts of UK stakeholders which document and assess structural barriers reported by women in UK agriculture.

As such, the aim of the present Chapter is to combine all results derived from investigations undertaken in Part C and provide a discussion underpinned by the information presented in Part B. Hence, the remainder of the Chapter is as follows: Section 5.2 discusses the findings surrounding supporting the economic contribution of women in UK agriculture; Section 5.3 discusses industry and policy implications; Section 5.4 discusses areas identified for further research; and the Chapter closes with a brief conclusion.

5.2 Supporting the economic contribution of women in UK agriculture: The findings

The FSS (Defra, 2016) shows that women represent 52% of UK family farm workers, 19% of non-family workers and 15% of both farm holders and managers. As discussed in Chapter 2, key economic differences between men and women farmers are demonstrated within existing research, as assessed within the output of 185 papers reviewed; notably characterising women with smaller farms and lower income, as well as a greater involvement with livestock and environmental farm types. Indeed, Chapter 3's multiple regression model, based upon 2,300 UK FBS observations, also suggests that descriptive differences exist between men and women's farm performance pertaining to farm size, farm type, farm income, salary, time worked annually, management input and education. Yet, where existing situational factors are controlled for, the results of statistical modelling from Chapter 3 indicates that farmer gender, on its own, is not a significant driver of farm business performance. Thus, the individual contribution of women farmers within UK

agriculture may not be significantly different to the individual contribution of men farmers when the influence of prevalent gender inequalities, for example farm size, are held constant. These findings may help to inform further research, industry initiatives, and dispel damaging narratives that gender is an independent driver of farm performance.

So, if gender alone is not a significant driver of farm business performance, then why do women's farms appear to perform more poorly across some economic descriptive measures (for example, smaller farm size and total income), and, why do women represent only a minority of farm holders, managers and non-family workers?

Chapter 2 summarises international literature, published since 1970, to propose three main on-farm economic identity types and make an assessment of the main influences upon women's roles and participation within agriculture across developed countries. Chapter 4 tested these hypotheses in the present UK setting. The findings of Chapter 2, 3 and 4 concur with the classification of participants as per Figure 12 and find similar trends of dispersion. As such, women are consistently found to be most highly represented as traditional farmwives and working farm members, and least highly represented as farmers across all methods of assessment. In other words, women with the highest levels of agency and economic visibility account for the lowest proportion of industry actors; while women with the lowest levels of agency and economic visibility account for the greatest proportion of industry actors. Thus, visibility of the economic contribution women make within UK agriculture is limited. Yet, indeed, while the individual visibility level and experiences of women may vary between cases, the hypothesis' made in Chapter 2 and subsequent investigation undertaken in Chapter's 3 and 4 find the main factors which may reduce female participation and visibility to be consistent across women as a whole. Furthermore, the degree to which certain barriers are encountered is governed by a complex relationship between existing structural components and individual agency, and, can be associated with an economic identity classification framework as hypothesised within Chapter 2.3.1, and the thematic mapping and illustration (Figure 15 and 16) presented in Chapter 4. Intersectionality also plays an important role (section 2.4).

As such, this discussion proposes that in synthesis of the findings of this investigation, and existing literature, the main barriers presented to women in agriculture may be characterised by five main areas: access to land; social processes; domestic and childcare responsibilities; access to education/training; and farm organisations. The main contributors of each area are intrinsically complex and intertwined, spanning from factors within an individual's control (internal) to factors far beyond it (external).

Access to land:

As presented within Chapter 1.1, the specialisation, intensification, and industrialisation of agricultural production systems presents a host of socio-economic impacts including increased productivity, falling commodity prices and industry consolidation. As such the economic resources required to participate within agricultural systems – most notably, land - increases, often amidst dwindling returns. Chapter 1.2 collates the effects these factors elicit upon the structure of UK agriculture systems based upon official UK data sets while Chapter 2.3.3 explores existing literature underpinning understanding in this area. As such, access and ownership of land is shown to be associated with considerable, and ever-increasing, economic resources which perpetuates access to other resources including capital, infrastructure, training and networks. Indeed, Shortall et al. (2019) suggests that access to land represents the single largest barrier to women's entry and participation within agriculture. Specifically, Chapter 2.3.3a identifies how women's access to land may be affected by traditional cultural practices, and how, for members of a family farming unit, men and first-born potential successors are still most likely to succeed the family farm. The findings of Chapter 3's multiple linear regression model shows that economic contribution individual women farmers make within UK agriculture is comparable to their male counterparts, yet women represented only 4% of this official dataset. Furthermore, women are shown to represent just 15% of UK farm holders (Defra, 2016). Thus, surveying women directly on this matter, Chapter 4 also revealed the most commonly identified barrier for women within the industry was 'traditional attitudes and cultural norms,' this included traditional views of women's role and farm succession. Furthermore, Chapter 3.4.2 also revealed women's unpaid labour to be a substantial and significant driver of farm output, yet highlighted the lack of visibility this important contribution receives due to lack of access to land. Additionally, Chapter 4.5.3 examines how for new entrants (which Hopkins et al.

2020 suggests are more likely to be women), UK farming is also considered a closed profession; restricted to those who directly inherit commercial farming assets (Williams, 2006).

Social processes:

The interrelationship between the structure of agricultural industry and its social actors is intrinsic. Building upon Chapter 1.1's overview of structural trends, Chapter 2.1 discusses the evolution of social studies within the area spanning research interests and cultural phenomenon including; the traditional gendered division of labour, pervasion of agrarian ideology, and the ability for new identities to emerge amidst structural flux. Collating cross-disciplinary research reviewed within Chapter 2, Chapter 2.3.1 found differences between male and female farm performances across 10 distinct categories including: farm size; type of production; farm income; off-farm work; age; education; land; labour; machinery and technology. Furthermore, the Chapter proposed that the economic contribution and visibility of farm women may be mapped across a conceptual framework characterising different economic identity types based upon the roles and responsibilities they undertake. Here, the literature reviewed concurred that social and cultural processes impact the roles and responsibilities women undertake, yet, are often wide reaching, implicit and characteristically complex to both isolate and quantify. As such, Chapter 4.5.4 revealed the most commonly identified barrier for women within its industry survey to be traditional attitudes and cultural norms, including traditional gendered division of labour; resulting in disparate roles and responsibilities with women often expected to undertake higher domestic responsibilities coupled with a greater variety of on and off-farm roles. In turn, these factors were cited to create a higher number of time/logistic constraints and limits participation in other activities. Often, it was suggested that these roles and responsibilities arose out of cultural norms and expectations rather than respondents' free choice. Respondents also discussed themes of implicit prejudice towards the roles others assume they undertake on farm; needing to work harder to prove themselves; and being ignored or not taken seriously. For example, being assumed not to be in a position of responsibility was the most commonly cited experience of sexism, reported by 83% of respondents. Despite this, Chapter 4 reported that, overall, the sentiment of respondents appeared positive towards both their participation within the industry and that of other women. For example,

87% of respondents agreed that the position of women has improved over time and felt optimistic about the future. Collating findings from both descriptive and statistical testing undertaken within Chapter 4, Chapter 4.5.1 suggests that women associated with the highest agency, visibility and farm responsibilities are also found to be associated with higher levels of participation and confidence in support from personal and social networks.

Domestic and childcare:

Domestic and childcare responsibilities are closely linked to social processes including gendered division of labour and, on their own, account for major differences in the work roles and responsibilities of farm women in comparison to men. While discussing the evolution of cross-disciplinary studies within the area, Chapter 2.1 examined sociological factors, such as the traditional gendered division of labour and pervasion of agrarian ideology, as factors contributing to the lower perceived valuation of domestic tasks and women's traditionally higher engagement in these activities. Indeed, Chapter 3 identified management time worked annually on-farm to differ significantly between male and female farmers as a driver of farm output. For example, total management hours for women were 17% lower than men, time spent on diversification activities was 32% lower, and time worked annually was 38% lower (Table 8). Furthermore, Chapter 4 again revealed women's primacy in responsibility for domestic tasks - regardless of visibility level - in addition to statistically significant association between higher domestic responsibilities, lower farm responsibilities and lower visibility. As such, time worked annually in association with domestic and childcare responsibilities are found to represent major barriers to women's participation and career progression, both on and off-farm.

Education and training:

Access to education facilitates the sharing of knowledge and networks and as such is a key structural component influencing economic contribution, performance and visibility within agriculture. Chapter 2.3.2 revealed that despite being associated with higher levels of general education than men farmers, farm women are consistently associated with lower access and participation in agricultural training and education than their male counterparts. Indeed, despite unpaid labourers being identified as a significant driver of farm output,

Chapter 2 also revealed them to be the least likely cohort to participate in agricultural training and education; suggesting low engagement in agricultural education is associated with low visibility. Utilising insights from cross-disciplinary research in the area, Chapter 2.3.3.b discussed how such differences may be embedded in cultural norms; linked to pervasive successional practices and traditional division of labour and responsibilities. Indeed, Chapter 3.1.1.e revealed higher agricultural training and education was found to be associated with higher visibility identity types. Building upon this, Chapter 4 revealed that women may not only not feel confident in attending current events, but competing commitments, such as family and work responsibilities, also often present major barriers to participation and thus progression. Furthermore, the chapter details that employees and new entrants alike were most likely to express the lowest confidence in participating in agricultural education and training; suggesting an association between uptake of agricultural education, and access and ownership of resources.

Organisations:

Chapter 2.3.3.c again highlights that access to education and organisations facilitates the sharing of knowledge and networks, and is a key factor influencing women's economic contribution, performance and visibility. Yet, according to Shortall (2001), there is no country where women are well represented in farming organisations. Indeed, the Chapter examines cross-disciplinary findings that suggest women are under-represented in farming organisations throughout the developed world; consistently representing the highest proportion of lower status workers while holding the lowest proportion of leadership positions. It is proposed throughout the literature reviewed that rather than being attributed to individual factors (such as lack of interest or ambition); structural and social factors within organisations (such as implicit social processes or intimidating environments) may affect participation in combination with lower levels of confidence, experience and poorer access to social networks. Indeed, Chapter 4.5.4. discusses how time constraints also play an important and restrictive role across identity types. Furthermore, Chapter 4.5.3. details that employees and new entrants were most likely to express the lowest levels of confidence in participating within agricultural organisations; suggesting an association between access and ownership of resources, and participation in agricultural organisations. In addition to this, unpaid labourers were also found to be least likely to participate within

agricultural organisations; suggesting low engagement and representation within farming groups may also be associated with low visibility.

Discussion of barriers:

The findings of Chapter's 2, 3 and 4 concur, suggesting that the main factors which may reduce female participation and visibility are consistent across women as a whole; perpetuated by a complex range of cultural phenomenon often governing access to a range of structural and social resources. It is suggested within the literature reviewed and the findings of the studies conducted as part of this thesis, that a combination of these factors contributes to a 'leaky pipeline' (Shortall, 2017; 2019) between involvement and both market and leadership participation. Here, the progressive loss of skills and labour expertise may present important economic penalties to the sector. As such, it is reinforced that differences between the activities individuals undertake may not arise exclusively through choice and are in fact a result of a combination of structural and cultural components. These findings support the notion presented in Chapter 4.5.3 that there are two distinct career paths for women in farming: those who enter farming and the agriculture sector by choice (including through land inheritance/farm succession), and those who 'marry a farmer' (or similarly become part of a farming family) and enter the occupation as a result.

Furthermore, while access to land is proposed to present the largest single barrier to women's participation and visibility within agriculture, Chapter 4.5.3 discusses how there are two main ways that women are either included (land inheritance/farm succession/supportive partnership) or excluded (new entrants/patrilineal succession) from the capital resources required to farm. In turn, capital resources, governed by cultural forces, are subsequently strongly associated with social experiences, confidence, participation in agricultural education and organisations, and thus influence the economic contribution, performance and visibility of women in the sector. As revealed in Chapter 3, when women gain the highest levels of visibility, their level of performance is similar to that of their male counterparts. In comparison, lower levels of visibility are associated with increasing levels of barriers. As such, identities associated with the lowest levels of agency and visibility, are found to be most highly associated with the highest constraints.

Resultant of this, unpaid and casual family labourers gain the lowest levels visibility. Yet, Chapter 3 also reveals both men's and women's unpaid labour time worked annually to be statistically significant positive driver of farm output. The fact that unpaid labour exerts a significant impact upon farm output, and thus farm performance, yet, often fails to be represented or even collected in farm statistics represents a large void of knowledge within current agricultural understanding and an important externality undermining the potential economic resilience and sustainability of future farming systems. Furthermore, the higher value attributed to women's unpaid labour than men's suggests key differences exist between the economic roles, responsibilities, visibility and contribution of men and women; another important oversight of both industry and policy recognition. The complex and intertwining nature of these challenges is visually illustrated in Figure 17, output from survey thematic analysis.

Figure 17 builds upon the output of Figure 16 to theorise how positive change can occur at the intersection between individual and structural components. Despite clear barriers characterising the participation of women within the sector, Chapter 4.5.4. details that women report to feel optimistic about their role and future within the sector and concur that improvements in the position of women in agriculture have been made in recent generations. Women are also revealed to recognise the formats and areas of development they require and have a desire to engage with this – provided certain barriers limiting their participation are considered. Thus, as the sector continues to face a flux of structural challenges, supporting the contribution of women to help quell the 'leaky pipeline' presents a key contributor to both realising and maintaining the economic resilience and sustainability of future farming systems.

5.3 Industry and policy implications and recommendations

As many of the challenges facing women in agriculture appear to be structural rather than individual in nature, engagement of industry and policy represents an important driver of change on both a structural and individual level. Furthermore, the UK agriculture sector continues to face a range of structural challenges characterised by ever-increasing global forces and instability coupled with embarking upon its seven-year agricultural transition

period (2021–2027 inclusive) away from CAP-like support towards the development of new domestic Agriculture Acts for England and each of the devolved nations. Thus, integration of gendered concerns into future policy provides a timely intersection.

However, despite clear differences in the engagement and performance of women in agriculture being demonstrated within a wealth of cross-disciplinary work, and while text in the forthcoming EU CAP reform which obligates EU states to "promote employment, growth, gender equality, including the participation of women in farming" neither of Defra's Farming for the Future Policy and Progress Update' (February 2020) or 'The Path to Sustainable Farming: An Agricultural Transition Plan 2021 to 2024' (November 2020) policy documents which lay out the future strategic framework for farming in England, include any of the terms "woman", "women", "gender", "female" or "equality". As illustrated in Chapter 1, this is despite government supported initiatives for women in agriculture emerging across the rest of UK devolved nations of Scotland, Wales and Northern Ireland. Furthermore, Defra's own published agriculture statistics for England specifically highlight differences between men and women farmers in its text regarding representation as farm holders, working hours (both as farmer and family labour) and farm types (Defra, 2016). Thus, a clear economic case for policy intervention within England is made by Defra's own resources yet no action has been made.

Indeed, forthcoming legislation from Defra does in fact recognise and attempt to address some of the structural challenges faced by the often closed-profession, including grants to help those who want to retire or leave the industry and to create new opportunities and support for new entrants (Defra, 2020). This illustrates UK policy makers are aware of the structural challenges embedded within the agriculture industry. Yet, while these challenges are synergistic with the hurdles faced by women, it is clearly demonstrated that such gendered challenges are much more complex and require specific attention. For example, regardless of visibility level, women are shown to still be associated with the lion's share of responsibility for domestic and childcare responsibilities; which in turn may restrict working time, roles undertaken, access to agricultural networks, and career development. The way women interact with government support and benefits appears to impact both their economic identities and participation within agriculture. Thus, policy attention should be

paid to the myriad of influences upon women's roles and participation within agriculture, which in turn affect their economic contribution specifically - in particular, childcare provision and access to training.

Furthermore, it is also important to consider whether the structure of women's involvement in UK farming may mean they are disproportionally exposed to policy changes. For example, new domestic policy aims to transition the industry towards a more environmentally and economically sustainable era of production, characterised by 'public money for public goods' (Defra, 2020) and better addressing negative environmental externalities such as pollution and carbon emissions, while rewarding positive environmental externalities such as ecosystem maintenance and biodiversity gains. This, combined with the removal of direct support may place smaller farms, and specifically livestock farms, at greater risk – two areas of which are found to characterise women's involvement in the sector.

Additionally, externalities relating to social sustainability should also not be overlooked. Unpaid on-farm labour is shown to exert a significant positive impact upon farm output and farm performance, thus, to gain more accurate insights into the structure and productivity of the agriculture sector, data collection methods informing policy should better account for these contributions. Where differences are revealed within data, these findings should be acted upon to implement more effective policy instruments which are a better fit for purpose. In addition, the domestic burden which facilitates production in an industry highly typified by family business structures still wholly fails to gain recognition due to structural constraints and narrow data collection methods, and is thus rendered invisible. Revised data collection methods which recognise the wider contributions of both productive and reproductive labour in the continuation of family farms offers improved visibility of the true economic contribution women make and may provide further impetus for the implementation of policy instruments to support their roles and ensure that women do not remain trapped by the twin burdens of patriarchy and commoditisation. Furthermore, collecting of data pertaining to, and insights relating to, intersectionality e.g. race, sexuality, background etc, will prove advantageous to progressive and equitable policy.

While the broader policy context is critical to the advancement of gender equality, industry too has an important role to play in simulating structural and individual change. Indeed, the absence of clear policy direction pertaining to gender equality places the onus upon industry to take the lead. As such, within England there are an increasing number of sector-specific grass-roots initiatives targeted at tackling the challenges of female representation and participation in the form of women-only groups and events (see Appendix E for list). Barriers to women's participation in agricultural training and organisations are clearly shown to exist, yet, involvement is shown to be associated with higher visibility. As such, appetite for women-only groups is clear, with many individuals and some organisations viewing them as an effective way to increase women's confidence and social capital while helping to address some barriers associated with locations, childcare and accessibility. Furthermore, courses specifically for women who have recently entered or married into farming represent an important area for potential gain that is, as of yet, not serviced by policy or industry. Participation in such groups can act as a stepping-stone towards integration within mixed gender groups and as such the agency of women to create and take advantage of economic and policy opportunities is essential. Indeed, the success of policy initiatives such as the Scottish Government's Women in Agriculture Taskforce, and industry initiatives such as New Zealand's Agri-Women's Development Trust demonstrates the need and ability for industry and policy to work together to identify, support and deliver on the specific needs of women and facilitate their agency. For this to happen, agricultural training providers and organisations must first acknowledge gendered challenges exist and thus examine their own conducts and processes which may perpetuate this.

As such, the multi-factorial nature of the challenges facing women in agriculture presents a complex picture, intertwining numerous structural factors while simultaneously influencing and being influenced by individual agency. Given that no singular policy or initiative can successfully address all barriers, a combination of approaches may be required. Indeed, sites of intersection for both policy and industry are plenty, thus, a systems-approach integrating gendered considerations into existing protocols may provide the means and access to stimulate change. For example, an ageing farming population and the taboo of succession planning is a key area of focus for the sector and is already targeted within numerous industry and policy initiatives. However, women are also demonstrated to be

disproportionally excluded from succession across UK and developed countries, thus, the incorporation of gendered considerations into this promotion and discussion could help to tackle some of this stigma. Examples such as this are not only cost-effective, but also have the potential to be utilised across areas such as training, education, organisations and workspaces tackling many of the challenges discussed within preceding chapters and wider research space. However, again, such strategies also rely upon the awareness and acceptance of the challenges presented which in turn rely in part upon improving methods of data collection and focus upon further research (see part D) to stimulate collective action and recognition across industry, policy and individuals. Correctly identifying and thus supporting the economic contribution of women within industry can help cultivate more economically resilient, robust and sustainable farming systems for the future.

5.4 Thesis Limitations

As discussed at greater length within each Chapter, the thesis may be characterised by a number of limitations. Mainly, these centre around a lack of data availability and methodological constraints. In particular, Chapter 2 (see section 2.6) relied upon research from other disciplines thus employed a strict methodology to draw insights, with key limitations including publication bias and the inclusion of international rather than solely UK studies. Furthermore, the conceptual economic identity framework proposed within Chapter 2 and used throughout the thesis is based upon the generalisation of findings, and therefore may not be applicable to all individuals in all situations. Chapter 3 (see section 3.5) was primarily limited by the provision of gender-disaggregated data being available from only a single source, thus impacting the ability to both cross-check findings and use more specific terms of investigation (farm output vs farm income). Additionally, recruitment methods to Chapter 4's industry survey did not yield UK representative data and may also be characterised by methodological constraints associated with online surveys including selection bias, population bias, and incomplete responses.

Indeed, a limitation spanning all chapters within the present thesis is the lack of data and assessment of intersectionality. A full comment on this is provided preceding the thesis presentation, in Section 1.4.

5.5 Areas identified for further research

The present thesis presents an initial investigation into the economic visibility and contribution of UK women in agriculture, with an interest in becoming a stepping-stone in addressing challenges presented to women's participation and leadership. As such, it is acknowledged that more research is needed in producing a thorough examination of the topic.

The areas identified as a potential interest for further research based on the investigations examined in the present thesis include:

1) The collection of more thorough data pertaining to intersectionality
2) The ongoing extension of the developed theoretical economic framework
3) The collection of more thorough data pertaining to women farmer business motivators
4) The investigation and collection of more thorough data pertaining to unpaid labour
5) Investigation of the feasibility of recommendations including:
    - Integration of gendered concerns within existing industry initiatives
    - Considerations for women without a farming background
    - Women-only organisations: the needs and motivators of industry
    - Access to and the provision of childcare within agriculture

The collection of more thorough data pertaining to intersectionality:
In Chapter 1, a comment on intersectionality is provided which acknowledges that in undertaking this investigation, which endeavours to explore differences between women as a group, some intersections are not well represented. Some characteristics (such as age, roles and responsibilities, education and organisations) receive the most coverage, while other intersections receive less coverage (such as entry to farming), and some regrettably receive no coverage (such as race and sexuality). With regards to considerations of intersectionality within wider agricultural research, Tavernner et al's (2022) investigation of applied research design suggests that although there is growing interest in intersectionality

within agricultural research (McKune et al., 2021; Mungai et al., 2017; Ngum & Bastiaensen, 2021), it's concepts and methodologies are yet to be operationalised in a "widespread or systematic way," with most intersectional analyses only investigating single identity intersections or 'snippet' approaches to intersectionality (Adaptation Fund, 2022). As such, a key recommendation of this report, both for the further extension of the present research and wider agricultural research, is to take steps towards addressing this disparity. Such recommendations may be conceptualised at both the macro and micro level. At the macro level, this could include actions such as improved data collection methods which gather additional information on previously unrecorded intersections. For example, information on race and sexuality to be collected as part of generic national surveys. In conjunction with macro approaches, micro approaches may both inform and be informed. For example, where % population of a sample is low, or specific areas are identified for further in-depth investigation, data collection and analysis may focus specifically upon key intersections to increase depth of understanding and tangible applications. Within the UK and agricultural contexts, the literature identified two pertinent intersections to include sexuality and race. Investigation of intersections such as these in future research and industry initiatives will provide tangible recognition and benefits to a diversity of industry stakeholders.

The ongoing extension of the developed theoretical economic framework:

In Chapter 2.3.2 the thesis developed a basic economic framework as an initial method to assess the contributions, visibility and characteristics of UK farm women. While this provides a useful means to broadly assess the visibility of farm women in accordance with existing literature on the topic, the collection and examination of further economic data suggests more nuanced extensions may be employed to further segment classification types and improve specificity, thus, practical applications. For example, career choice and access to land are shown to elicit major influences upon the paths and performance of women in the sector, as such, additional segmentation - for example, based upon routes of entry and access to resources - may also offer useful distinctions. Extension of this model to further classify and segment identify types as they emerge may thus help subsequent research efforts and inform industry to better define and target specific support mechanisms. In

particular, the specific challenges and needs of individuals without a farming background is a key area which would benefit from independent classification and research.

The collection of more thorough data pertaining to women farmer business motivators:
As discussed within Chapter 6.2, the largest hurdle in undertaking the current thesis was the lack of accurate and sufficient data. Despite findings in Chapter 2 review of international literature which suggests women are associated with more sustainable and environmental objectives, business goals other than profit maximisation and are drivers and users of technology; broad empirical investigation undertaken within Chapter 3 and Chapter 4 did not identify statistically significant relationships. Yet, these areas are of significant importance to UK industry as upcoming agricultural policy focuses primarily upon the redirection of direct support towards payment for public goods through environmental land management initiatives, and technological and social assets to improve productivity. Thus, more thorough empirical data collection and investigation focusing specifically upon women farmer business motivators presents an important area for further research with important economic implications and the potential to provide leverage and support in pursuit of policy aims. Further research on dual occupation statistics would also allow a clearer understanding of farm women in UK agriculture. Combining this with findings that suggest women maintain high representation across fast-growing 'environmentally conscious' agricultural markets - such as organic, local, direct-to-market and farm tourism - suggests that researching and supporting the role of women in UK agriculture has important economic implications. Indeed, as discussed within Chapter 5, the incorporation of gender into existing data collection methods, for example pertaining to farmer engagement and uptake of new policy initiatives, presents an opportunity for much needed data collection yet with little extra cost. The awareness of researchers and organisations to this requirement is paramount.

The investigation and collection of more thorough data pertaining to unpaid labour:
As revealed within Chapter 3, unpaid labourers make a significant economic contribution to UK agriculture, with a specifically higher value attributed to women's unpaid labour than men's. Yet, narrow definitions of productive labour, combined with the poorer acknowledgement it receives, presents problems in accounting for its true economic

contribution within UK agriculture. The fact that unpaid labour exerts a significant positive impact upon farm output, and thus farm performance, yet often fails to be represented or even collected in farm statistics represents a large void of knowledge within current agricultural understanding and an important externality undermining the potential economic resilience and sustainability of future farming systems. Furthermore, the higher value attributed to women's unpaid labour than men's suggests key differences exist between the economic roles, responsibilities, visibility and contribution of men and women; another important oversight of both industry and policy recognition. As such, acknowledging these barriers calls for research specifically targeted at unveiling this often-invisible labour. Such is the nature of these challenges, as it will require engagement beyond that of existing farming data collection methods and respondents, thus, understanding of the profiles or characteristics of target groups is key and links back to the ongoing extension of the developed theoretical economic framework and its aid in market segmentation and targeting.

Integration of gendered concerns within existing industry initiatives:
The integration of gender within existing industry initiatives or data collection methods is a key recommendation to policy and industry. Further research which assesses industry-wide opportunities for integration may help to facilitate its feasibility and scoping before presentation to industry. Furthermore, research investigating the barriers presented to organisations in adopting gender integrated data collection or messaging is also important to understand structural or cultural resistance, and encourage uptake.

Considerations for women without a farming background:
The research identifies a twin burden of challenges posed to new entrants to the industry, who are also women. Indeed, while no official UK statistics specifically record data on new entrants, this is identified as a key area requiring data collection to facilitate further research and analysis. Furthermore, new entrants are found to be associated with lower levels of confidence in participating in farming groups and organisations. As such, further research into the development of strategies or initiatives to help overcome these specific challenges is also recommended.

Women-only training and organisations: the needs and motivators of industry:

Women-only training and organisations are found to present a feasible option in encouraging the participation and visibility of women in agriculture. However, as women's participation in traditional agricultural training and organisations is characterised by a complex arrangement of detractors, in pursuing alternative recommendations, further research is required to gain an in-depth understanding of the demands of women and how alternative organisations could meet these - as to avoid simply perpetuating existing challenges e.g. meeting times, childcare provision, unwelcoming atmosphere etc. Furthermore, although lack of time may present a valid constraint to many individuals (Harding et al, 2014), lack of time may also be explained by a task not gaining high enough priority in comparison to other undertakings. Thus, further research identifying key motivators for women to engage with personal and professional development would help to promote participation and drive engagement in the most areas which would be most useful and impactful; delivering the greatest gains for both individuals and industry. This may be accompanied by appropriate targeting and messaging and may be aided by the ongoing extension of the developed theoretical economic framework profiles. Further economic research is required to focus on how policy can enable the educational needs of women to be met to support women's economic participation and unlock the full potential of the rural economy.

Access to and the provision of childcare within agriculture:

Access to childcare is found to represent a key barrier for women's participation in the agricultural industry. The structure of the agriculture industry e.g. family farm dynamics, often living in the same place as work, geographical spatiality, and longer than office working hours combined with traditional cultural expectations means it presents a unique selection of challenges in comparison to the general population, thus warrants specific investigation. In collecting robust empirical data and better understanding the barriers to effective childcare, research can help to address a major contributor to the masking of women's economic contribution and visibility, and facilitate the implementation of more effective industry and policy measures.

5.6 Summary and Contribution to Knowledge

This concluding Part of the thesis provided an overall commentary on the findings of the thesis by discussing the economic visibility and contribution of women in UK agriculture, how their participation is challenged, and how it may be supported. In addition, it provided implications to both industry and policy, and briefly discussed areas identified for further research.

This Chapter combined the findings of the three investigations undertaken in Parts B and C and presents the following contributions.

Research outputs and methodologies:

- Developed and tested a hypothetical framework to characterise the economic profiles of UK farm women which suggests that women in UK agriculture may be classified within three main economic identity types, linked to their visibility level. The framework helps to segment and better understand the needs of groups of farm women which may be applied in the UK setting, and may be used within both subsequent research and industry to generate more effective outcomes.
- Provided the first recent UK-wide empirical analysis, based upon the analysis of 2,300 UK Farm Business Survey business observations, to investigate women farmers economic performance. The findings suggest that there does not appear to be a statistically significant difference in economic performance between men and women farmers which can be attributed to gender. This suggests causality may be attributed to other structural factors and these findings help to inform further research, industry initiatives, and dispel damaging narratives that gender is an independent driver of farm performance
- Provided the first empirical evidence to give visibility to the role of women's unpaid labour on farm. Within the analysis of existing literature, women's unpaid labour is found to represent an important and often overlooked negative externality, whereby women receive very little recognition for the vital role they play in UK farming systems. The empirical investigation of 2,300 business units suggest that women's

unpaid labour is statistically significant driver of UK farm output. Furthermore, substantial differences between the roles and responsibilities associated with men's and women's unpaid labour were also indicated. These findings provide an empirical basis for further investigation and help provide visibility of such roles

- Provided the first UK-wide primary data collection and analysis pertaining to women's own perceived roles, contribution and visibility in UK agriculture via a national survey. Findings supported the proposition of the hypothetical profile framework and provided empirical evidence that roles and responsibilities of UK farm women differ significantly in relation to visibility level. Yet, barriers facing women in the sector are suggested to be largely consistent across all groups women and are found to be, in the majority, attributed to structural factors
- Produced published works (Dunne, Siettou and Wilson, 2021) in the Journal of Rural Studies, which has received over 20 citations

Recommendations and Implications

Bringing the findings of the thesis investigations together with existing research in the field, it is presented that the main barriers presented to women in agriculture are multi-factorial and may be characterised by five inter-connecting factors ((1) access to land; (2) social processes; (3) domestic and childcare responsibilities; (4) access to education/training; and (5) organisations).

As many of the challenges discussed within this investigation are presented as structural rather than individual in nature, engagement of industry and policy represents an important driver of change. Specific considerations presented for policy include: utilising new domestical agricultural policy to help address challenges faced by women, with particular emphasis upon both access to training, provision of childcare and access to land; investigating the roles women may play in achieving environmental sustainability targets; and the accurate accounting and inclusion of unpaid family farm labour in policy initiatives. Specific considerations presented for industry include: working with organisations to assessing inclusivity barriers to participation in agricultural training and organisations; creating new avenues which promote female participation and visibility e.g. women-only

groups; and the collection and collation of further UK specific research. Given that no singular policy or initiative can successfully address all barriers, it is recommended that a systems-approach integrating gendered considerations into existing protocols may provide the means and access to stimulate change.

Overall, the thesis concludes that the hampered visibility and participation of women in agriculture presents a negative social and economic externality restricting the resilience and sustainability of future farming systems. Moreover, as the UK embarks upon a new era for agricultural policy, the integration of gendered concerns into future policy provides a timely intersection. Pertinently, the multi-factorial nature of the challenges presented requires a similarly systems-based approach which would benefit from further research. This said, key limitations of the thesis centre around a lack of data availability and methodological constraints. An important limitation spanning all chapters within the present thesis is the lack of data and assessment of intersectionality.

As such, areas identified for further research include; the collection of more thorough data pertaining to intersectionality; the ongoing extension of the developed theoretical economic framework; the collection of more thorough data pertaining to women farmer business motivators; the investigation and collection of more thorough data pertaining to unpaid labour; and the investigation of the feasibility of recommendations including: integration of gendered concerns within existing industry initiatives; considerations for women without a farming background; women-only organisations: the needs and motivators of industry; and, access to and the provision of childcare within agriculture.

In conclusion, this study is the first in recent UK literature to provide an investigation on the economic contribution of farm women that is supported by recent empirical evidence. The outcomes derived could be viewed as an initial examination of the economic contribution and characteristics of UK women in agriculture on which further research could be based. The findings aim to help bridge the gap between social science and economic studies, providing new perspectives within the intersection of structure and agency, and presenting a stepping-stone for further cross-disciplinary research and industry actions.

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Part E: Appendices

Appendix A: Standard Output Definition

According to the Farm Structure Survey 2016, the economic size of the holding is measured using Standard Output (SO):

"For each activity on a farm (e.g. wheat, dairy cows), a standard output is estimated. The standard output is the average monetary value of the agricultural output at farm-gate price in euro per hectare or per head of livestock and by region and represents the level of output that could be expected on the average farm under "normal" conditions.

"The sum of all the outputs, for all activities of a given farm, is referred to as the economic size of that farm. The smallest farms were those with standard output of less than 25,000 euros and the largest farms were those with a standard output of 500,000 euros or more."

Appendix B: NuSearch Databases

Databases for Agriculture (37)

- ProQuest , publisher, 2002. Agricultural & environmental science collection, ProQuest.
- ProQuest publisher, 2007. Biological science collection, Ann Arbor, Mich.: ProQuest Information and Learning.
- Learning on Screen & British Universities Film & Video Council, 2013. BoB : the on demand TV and radio service for education., London: Learning on Screen : the British Universities and Colleges Film and Video Council.
- Wolters Kluwer, Books@Ovid, Wolters Kluwer.
- C.A.B. International, 1990. CAB abstracts, New York, N.Y.: Ovid Technologies.
- Thomson Reuters, issuing body, 2002. Current contents connect., Thomson Reuters.
- Networked Digital Library of Theses Dissertations & Ligue des bibliothèques européennes de recherche, 1999. DART-Europe e-theses portal, London: University College London.
- Thomson Reuters, issuing body, 2012. Data citation index., Thomson Reuters.
- Encyclopaedia Britannica, inc, 2001. Britannica academic Academic., Chicago]: Encyclopædia Britannica.

- European Patent Office, issuing body, 2000. Espacenet., European Patent Office.
- British Library & Joint Information Systems Committee, 2009. EThOS e-theses online service., Boston Spa, Yorkshire]: British Library.
- Virginia Polytechnic Institute State University & Networked Digital Library of Theses Dissertations, 1990. Global ETD Search, Blacksburg, Virginia]: Networked Digital Library of Theses and Dissertations : Virginia Polytechnic Institute and State University.
- EBSCOhost, GreenFILE-EBSCOhost 節能環保類文獻資料庫, EBSCOhost Publishing.
- Thomson Reuters & Institute for Scientific Information, 1997. InCites journal citation reports, Philadelphia, Pa.]: Institute for Scientific Information.
- JSTOR, 1995. JSTOR, New York]: JSTOR.
- Kanopy, 2008. Kanopy., Kanopy.
- ProQuest, 2000. Natural science collection, Ann Arbor, MI]: ProQuest.
- Organisation for Economic Co-operation Development, 2000. OECD iLibrary, Paris]: OECD.
- Lunds universitetsbibliotek, University of Nottingham & SHERPA, 2005. OpenDOAR directory of open access repositories., Nottingham: University of Nottingham.
- ProQuest Information Learning Company, 2004. ProQuest dissertations & theses A&I, Ann Arbor, MI: ProQuest Information and Learning Company.
- Sage Publications, 2011. SAGE research methods, Thousand Oaks, CA: SAGE Publications.
- ProQuest , publisher, 1995. Science Database., Proquest Information and Learning.
- Elsevier Science, 1999. ScienceDirect, S.l.]: ScienceDirect, Elsevier Science.
- Anon, 2005. Scopus, Amsterdam: Elsevier B. V.
- Institute for Scientific Information & Thomson Reuters, issuing body, 1998. Web of science., Institute for Scientific Information.
- Oxford University Press, 2008. Who's who ... & Who was who, Oxford: Oxford University Press.
- British Library, Joint Information Systems Committee & University of Manchester. Manchester Computing, 2000. Zetoc the monitoring and search service for global research publications., Manchester: MIMAS.

Databases for Economics (34)

- Bell & Howell Information Learning & ProQuest, 1970. ABI/INFORM global, Ann Arbor, Mich.]: ProQuest LLC.
- Learning on Screen & British Universities Film & Video Council, 2013. BoB : the on demand TV and radio service for education., London: Learning on Screen : the British Universities and Colleges Film and Video Council.
- EBSCO Publishing, 1990. Business source premier, Ipswich, Mass.: EBSCO Industries.
- Thomson Reuters, issuing body, 2002. Current contents connect., Thomson Reuters.

- Networked Digital Library of Theses Dissertations & Ligue des bibliothèques européennes de recherche, 1999. DART-Europe e-theses portal, London: University College London.
- Thomson Reuters, issuing body, 2012. Data citation index., Thomson Reuters.
- American Economic Association & ProQuest, 1992. EconLit, CSA.
- Gale Group, 2008. The economist historical archive 1843-2014, S.l.]: Gale Group.
- Anon, 1994. Emerald insight, Bingley: Emerald.
- Encyclopaedia Britannica, inc, 2001. Britannica academic Academic., Chicago]: Encyclopædia Britannica.
- British Library & Joint Information Systems Committee, 2009. EThOS e-theses online service., Boston Spa, Yorkshire]: British Library.
- Bureau van Dijk Electronic Publishing, 2000. FAME : UK and Irish company information in an instant., Amsterdam: Bureau van Dijk Electronic Publishing.
- Virginia Polytechnic Institute State University & Networked Digital Library of Theses Dissertations, 1990. Global ETD Search, Blacksburg, Virginia]: Networked Digital Library of Theses and Dissertations : Virginia Polytechnic Institute and State University.
- Thomson Reuters & Institute for Scientific Information, 1997. InCites journal citation reports, Philadelphia, Pa.]: Institute for Scientific Information.
- British Library of Political Economic Science, Cambridge Scientific Abstracts, Inc & ProQuest CSA, 2000. International bibliography of the social sciences IBSS., Bethesda, Md.]: ProQuest CSA.
- JSTOR, 1995. JSTOR, New York]: JSTOR.
- Kanopy, 2008. Kanopy., Kanopy.
- Anon, 2000. Nexis, London]: LexisNexis Group.
- Organisation for Economic Co-operation Development, 2000. OECD iLibrary, Paris]: OECD.
- Lunds universitetsbibliotek, University of Nottingham & SHERPA, 2005. OpenDOAR directory of open access repositories., Nottingham: University of Nottingham.
- Bureau van Dijk Electronic Publishing, 1990. Orbis bank focus world banking information source., Brussels]: Bureau van Dijk Electronic Pub.
- Public Affairs Information Service & ProQuest, 2000. PAIS index, Bethesda, MD: ProQuest LLC.
- Euromonitor International, 2000. Passport GMID, London: Euromonitor.
- ProQuest Information Learning Company, 2004. ProQuest dissertations & theses A&I, Ann Arbor, MI: ProQuest Information and Learning Company.
- Sage Publications, 2011. SAGE research methods, Thousand Oaks, CA: SAGE Publications.
- Elsevier Science, 1999. ScienceDirect, S.l.]: ScienceDirect, Elsevier Science.
- Anon, 2005. Scopus, Amsterdam: Elsevier B. V.
- ProQuest Information Learning Company, publisher, 1990. Social science database., Bell & Howell.
- ProQuest, 2010. Social science premium collection., Ann Arbor, MI: ProQuest LLC.
- UK Data Archive et al., 1990. UK Data Archive., Colchester, U.K.: University of Essex.
- University of Essex & Economic Social Research Council, 2012. UK data service., Colchester, Essex: UK Data Service, University of Essex.

- Institute for Scientific Information & Thomson Reuters, issuing body, 1998. Web of science., Institute for Scientific Information.
- Oxford University Press, 2008. Who's who ... & Who was who, Oxford: Oxford University Press.
- British Library, Joint Information Systems Committee & University of Manchester. Manchester Computing, 2000. Zetoc the monitoring and search service for global research publications., Manchester: MIMAS.

Databases for Sociology (45)

- Burney, C., British Library & Gale, 2007. 17th-18th century Burney Collection newspapers, S.l.]: Gale Cengage Learning.
- Joint Information Systems Committee & Research Libraries UK, 2009. 19th century British pamphlets, Ann Arbor, Mich.: JSTOR.
- Gale Group, 2007. 19th century UK periodicals, S.l.]: Gale Group.
- Cambridge Scientific Abstracts, Inc & ProQuest, 2000. Applied social sciences index and abstracts ASSIA., Bethesda, Md. ; East Grinstead]: CSA.
- Gale, 2016. Archives of sexuality & gender. LGBTQ history and culture since 1940., Farmington Hills, Michigan: Gale CENGAGE Learning.
- Learning on Screen & British Universities Film & Video Council, 2013. BoB : the on demand TV and radio service for education., London: Learning on Screen : the British Universities and Colleges Film and Video Council.
- British Library & Gale, 2007. British Library newspapers, S.l.]: Gale, Cengage Learning.
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- Edina, 2000. *Digimap maps & geospatial data for UK academia.*, Edinburgh: EDINA.
- Anon, Eighteenth Century Journals, Adam Mathew Digital.
- Encyclopaedia Britannica, inc, 2001. Britannica academic Academic., Chicago]: Encyclopædia Britannica.
- British Library & Joint Information Systems Committee, 2009. EThOS e-theses online service., Boston Spa, Yorkshire]: British Library.
- Jacobs, A.H. et al., 2000. The Gerritsen collection of Aletta H. Jacobs., Ann Arbor, Mich.: ProQuest.
- Virginia Polytechnic Institute State University & Networked Digital Library of Theses Dissertations, 1990. Global ETD Search, Blacksburg, Virginia]: Networked Digital Library of Theses and Dissertations : Virginia Polytechnic Institute and State University.
- ABC-Clio Information Services & EBSCO Publishing, 1990. Historical abstracts, Ipswich, MA: EBSCO Pub.
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- John Johnson Collection et al., 2003. The John Johnson Collection an archive of printed ephemera., Ann Arbor, Mich.?]: Proquest.
- JSTOR, 1995. JSTOR, New York]: JSTOR.
- Kanopy, 2008. Kanopy., Kanopy.
- Mass-Observation, Adam Matthew Digital & University of Sussex, 2000. Mass observation online, Marlborough, Wiltshire : [Brighton]: Adam Matthew Digital ; University of Sussex.
- Great Britain. Colonial Office, 2015. Migration to new worlds., Adam Matthew Digital.
- Organisation for Economic Co-operation Development, 2000. OECD iLibrary, Paris]: OECD.
- Lunds universitetsbibliotek, University of Nottingham & SHERPA, 2005. OpenDOAR directory of open access repositories., Nottingham: University of Nottingham.
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- Gale, 2010. Picture post historical archive, Farmington Hills, MI]: Cengage Learning.
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- ProQuest Information Learning Company, 2004. ProQuest dissertations & theses A&I, Ann Arbor, MI: ProQuest Information and Learning Company.
- ProQuest, 1791. Proquest historical newspapers. The Guardian and the Observer, Ann Arbor, Mich.?]: ProQuest.
- Sage Publications, 2011. SAGE research methods, Thousand Oaks, CA: SAGE Publications.
- Elsevier Science, 1999. ScienceDirect, S.l.]: ScienceDirect, Elsevier Science.
- Anon, 2005. Scopus, Amsterdam: Elsevier B. V.
- Social Care Institute for Excellence, 2005. Social care online, London]: Social Care Institute for Excellence.
- ProQuest Information Learning Company, publisher, 1990. Social science database., Bell & Howell.
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- Cambridge Scientific Abstracts, Inc. Internet Database Service, ProQuest CSA & ProQuest, 1990. Sociological abstracts., ProQuest.
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- British Library, Joint Information Systems Committee & University of Manchester. Manchester Computing, 2000. Zetoc the monitoring and search service for global research publications., Manchester: MIMAS.

Appendix C: FBS Graphs

C1: FBS gender data (graph)

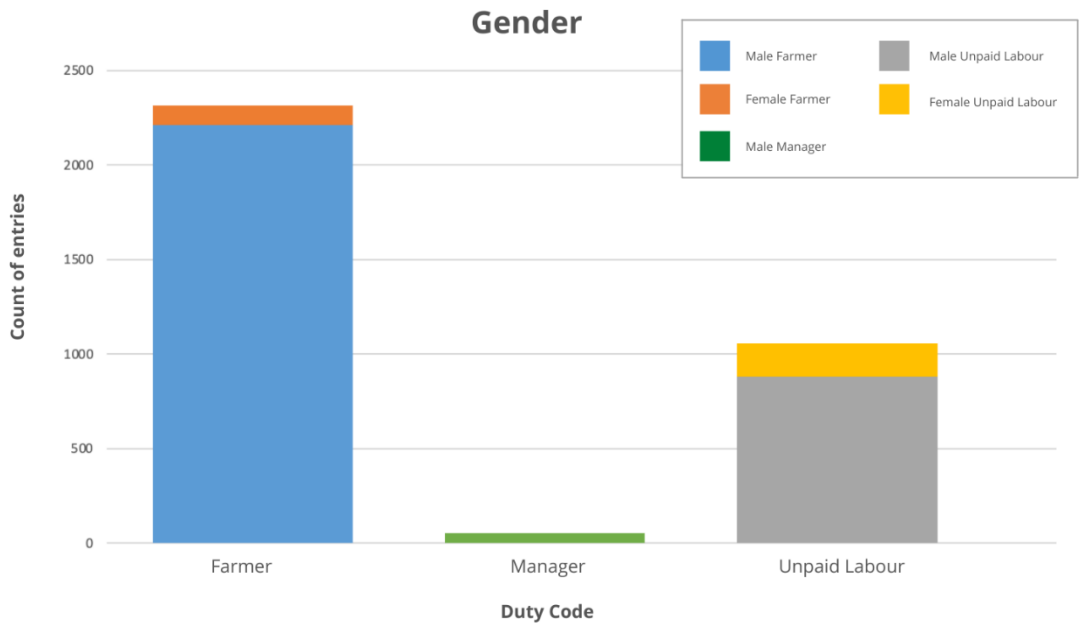

Figure C1: FBS gender data (graph)

C2: FBS farm size data (graph)

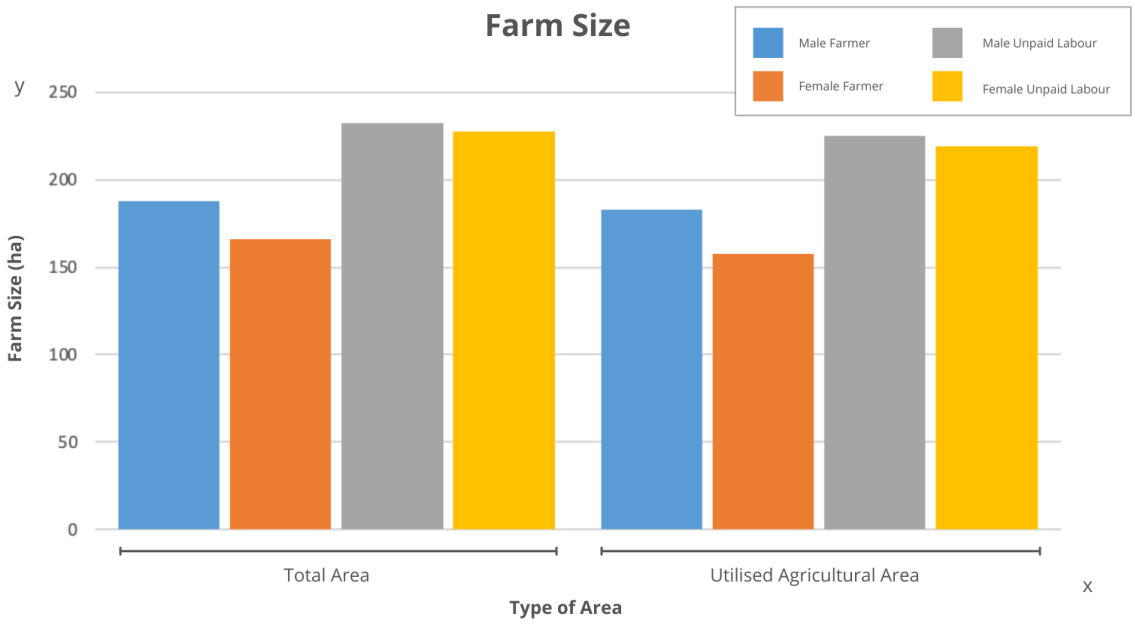

Figure C2: FBS farm size data

C3: FBS farm type data (graph)

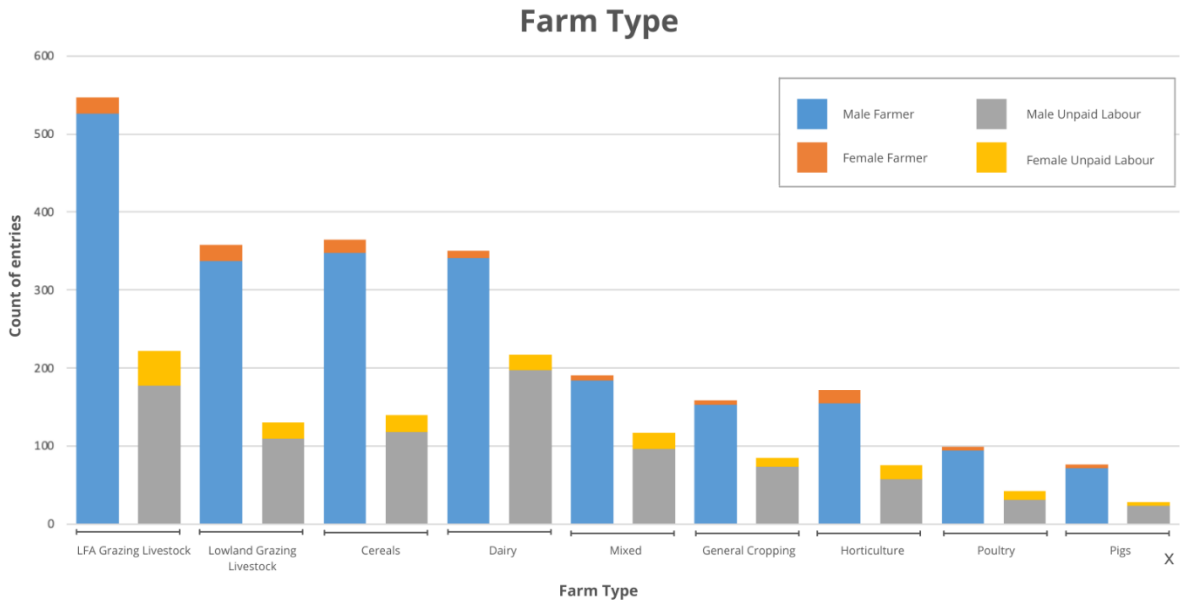

Figure C3: FBS farm type data

C4: FBS age data (graph)

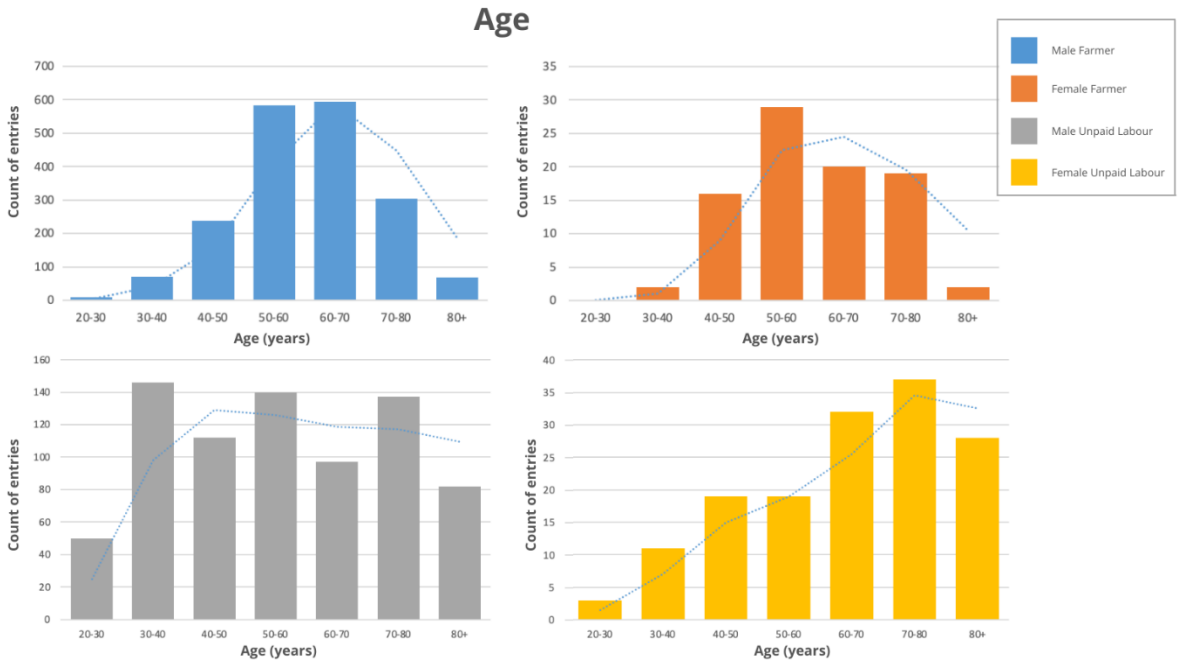

Figure C4: FBS age data

C5: FBS education data (graph)

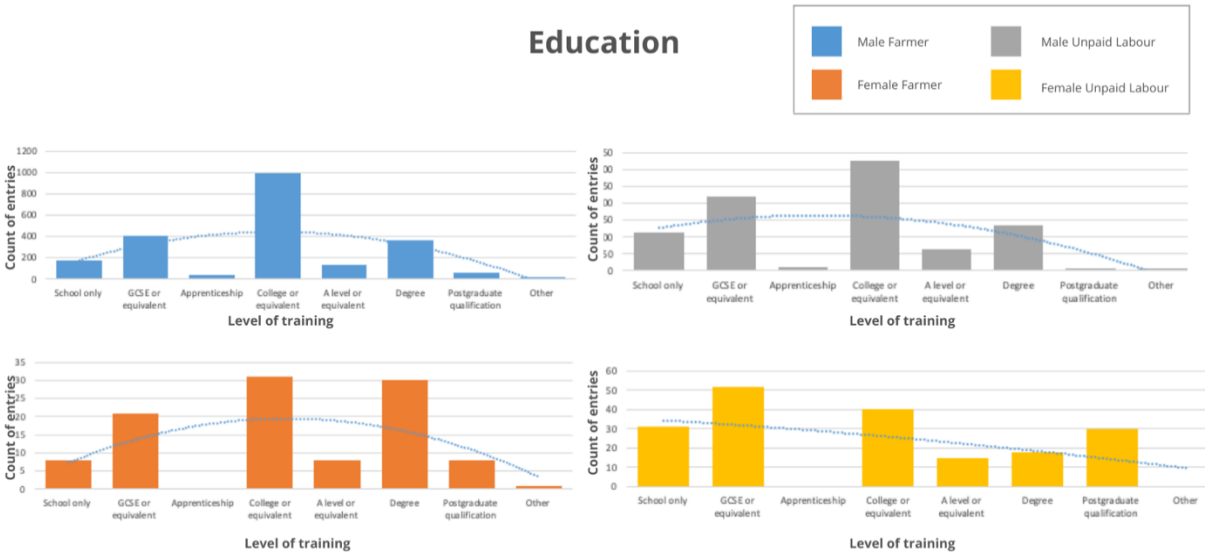

Figure C5: FBS education data

C6: FBS training data (graph)

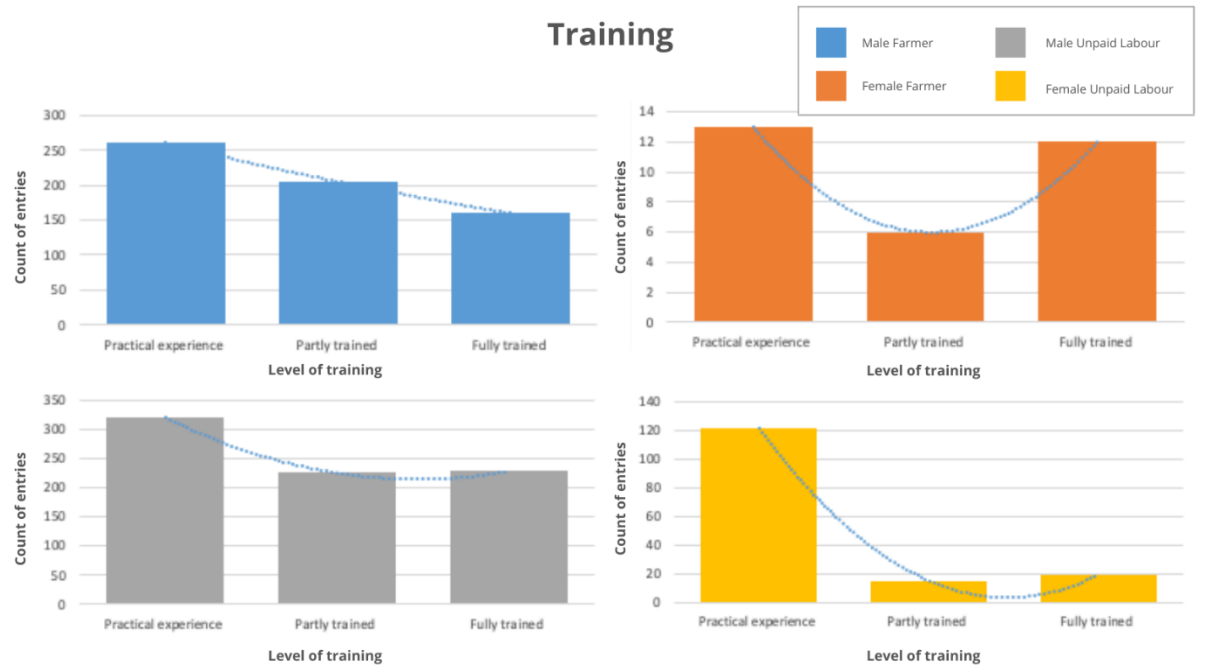

Figure C6: FBS training data

C7: FBS time worked data (graph)

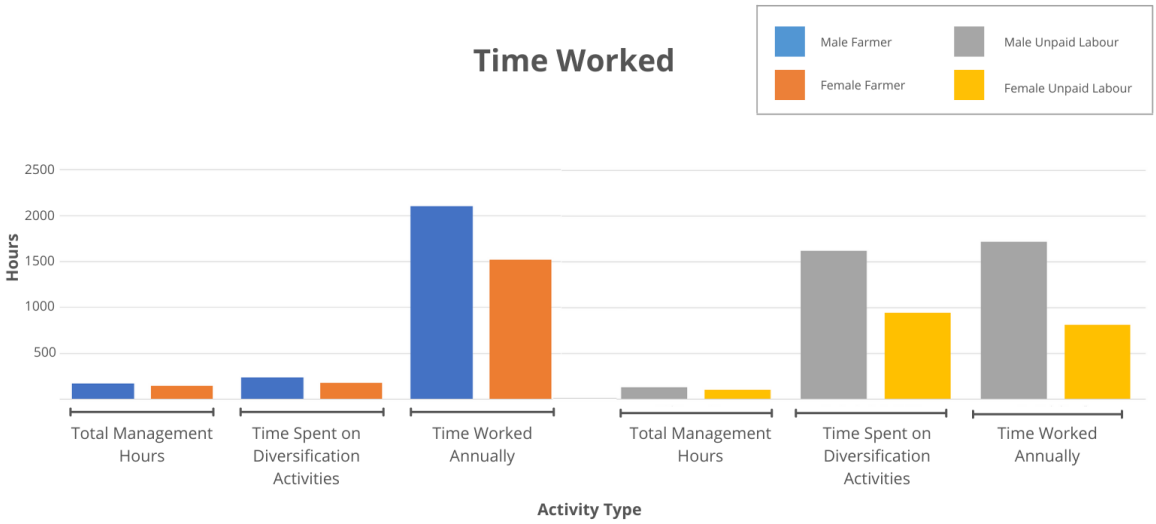

Figure C7: FBS time worked on activities data

C8: FBS time worked data (graph)

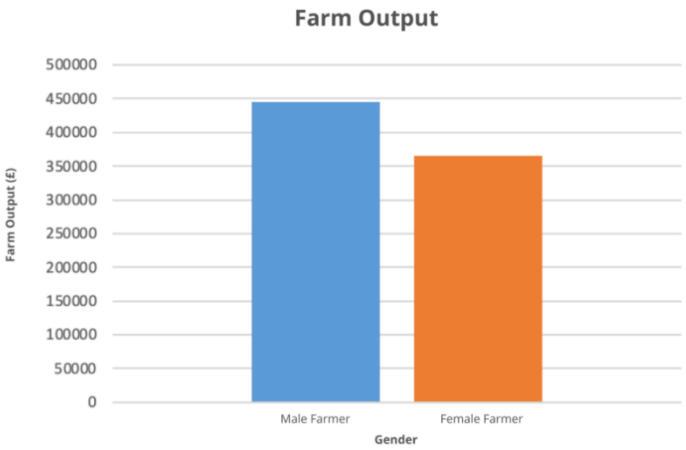

Figure C8: FBS farm output data

Appendix D: Survey Instrument and Results

D.A: Pilot Study

Before the final survey was distributed, a small pilot study was conducted with five industry actors on 1 July 2022. No remuneration was offered in return for participation.

A description of the sample is detailed below:

Participant	**Age**	**Occupation**	**Farming background?**
1	18-24 years old	Agriculture student	Yes
2	25-34 years old	Farmer + partner	No
3	25-34 years old	Agri-Industry + partner	Yes
4	45-54 years old	Farmer + partner	Yes
5	45-54 years old	'Farmers Wife'	Yes

Table D.A: Pilot sample description

Feedback from the pilot study was incorporated into the final model and is detailed below:

	Comment / Action
	Comment: Survey asks a lot of questions (40) and took over 15 minutes to complete Action: Number of questions reduced (33) and some questions simplified for ease. Now takes around 10 minutes to complete
Q2	Comment: Unsure what 'familial connection' means Action: Revised to 'family connection e.g. partner, marriage'
Q5/6	Comment: Unsure of definitions of 'general education' and 'agricultural education' Action: Revised to 'educational achievement in an agriculture subject'
Q23	Comment: Addition of 'people management' to topics of interest

	Action: 'People management' added to topics of interest
Q31	Comment: Long and time-consuming question asking for views on own experiences, and then provide a separate comment what we perceive others to have experienced Action: revised to only ask whether they deem an experience to be 'common' or 'uncommon'
Q32	Comment: too many options to choose from (5 – strongly agree, somewhat agree, neutral, somewhat disagree, strongly agree) Action: reduce number of options (3 – agree/neutral/disagree)

Table D.B: Pilot sample description

D. B: Distribution Methods

For survey distribution, the online survey hosting platform, JISC, was used and both direct industry contacts and social media (Facebook, Instagram, Twitter, LinkedIn) was used to distribute a link to this site. Participants were directed to the online survey which was formatted on JISC, completed anonymously, and may be undertaken at a time and place convenient to participants. No remuneration was offered in exchange for distribution or participation.

D.B1: Direct contacts

The survey link was distributed directly to research supporters via email. This consisted of industry/research sponsors:

- NFU Mutual Charitable Trust
- The Worshipful Company of Farmers
- The Perry Foundation
- The Clan Trust
- The Douglas Bomford Foundation

D.B2: Social Media

Facebook, Instagram, Twitter and LinkedIn were chosen for public dissemination of the survey link due to the amount of people who use these platforms; being widely used in the farming community and easy to navigate. The platforms are password accessed, and managed, but are public (depending on where the information is posted (private groups etc)).

For posting the survey in private Facebook groups, permission from the group admin/manager was obtained. These groups included:

- Agriculture and Farming UK: https://www.facebook.com/groups/AgricultureAndFarmingUK/
- British Farming Forum: https://www.facebook.com/groups/662053717646396/
- Ladies Supporting British Farming: https://www.facebook.com/groups/194811914433964/
- Ladies Who Love Livestock: https://www.facebook.com/groups/Ladieswholovelivestock/
- Yorkshire Women in Farming: https://www.facebook.com/groups/yorkshirewomeninfarming/
- Women in Agriculture: https://www.facebook.com/groups/SFwia/
- Farm Wives UK: https://www.facebook.com/groups/farmwivesuk/
- The Artful Farmer's Wife: https://www.facebook.com/groups/1006628766154378/
- Farmers Wife in Business: https://www.facebook.com/groups/716864782199141/
- Agri Wife, Agri Life UK: https://www.facebook.com/groups/1362876783841526/

The Survey link was also shared on the personal Facebook, Instagram, Twitter and LinkedIn accounts of the lead researcher also, which could be viewed and shared by connections.

C: Paragraphs attached for distribution

D.C1: Paragraph attached with any emailed/hard copy version of the survey (consent form printed/attached)

Hello, my name is Chloe Dunne and I'm a third year Agriculture PhD student at the University of Nottingham. I'm carrying out a survey on the roles and experiences of women in UK agriculture, and hope that you would be happy to complete the attached/included survey.

The survey looks into the roles women undertake on farms and their experiences of working within the agriculture sector. It also explores how education, organisations and social processes may influence these experiences.

This study is anonymous, and the data will only be used by myself. The survey itself should take no more than 15 minutes, and all questions are optional. If at any point you wish to exit the survey, there will be no penalty. This survey is being sent out to members of the UK farming community. You do not have to own a farm or be the main decision maker to participate.

I would be extremely grateful if you would answer this short survey to allow me to carry out this research project.
Many thanks,
Chloe Dunne

stycd7@nottingham.ac.uk
Project supervisor: Christie Siettou, email: Christina.Siettou@nottingham.ac.uk

D.C2: Paragraph attached with releasing the form via social media

Hi, my name's Chloe, I am a 3rd year PhD Agriculture student at the University of Nottingham.

Please see attached a short survey for my research project. The survey itself should only take 15 minutes and is anonymous. Any questions can be skipped and you can exit at any point.

The survey looks into the roles women undertake on farms and their experiences of working within the agriculture sector. It also explores how education, organisations and social processes may influence these experiences.
I would really appreciate it if anyone would take the time to complete the survey. You don't have to own a farm or be the main decision maker to participate.

Any questions please don't hesitate to ask, my email is stycd7@nottingham.ac.uk.
Project supervisor: Christie Siettou, email: Christina.Siettou@nottingham.ac.uk

Please feel free to share! Thank you

Section 1: Participant Information and Ethics Notice

Hello, thank you for your interest in our survey.

This survey looks into the roles women undertake on UK farms and their experiences of working within the agriculture sector. It also looks into how factors such as education, organisations and the media may influence these experiences.

If you choose to continue to the next page, it indicates that you:

- have read and agree to the information contained in the Participant Information Sheet and Consent Form
- consent to take part in this survey
- consent for the data you enter to be used as part of this postgraduate research project

All responses are confidential and anonymous. All questions are also optional and if at any point, should you wish to exit or discontinue the survey, you can exit the browser and there will be no consequences. The survey should take around 10 minutes to complete.

If you have any questions please contact the Research Team:

Researcher: Chloe Dunne | stycd7@nottingham.ac.uk

Project Supervisor: Christie Siettou | Christina.Siettou@nottingham.ac.uk

Section 2: Socio-demographic information

This section is designed to find out more about your background and socio-demographic characteristics.

Q1. Do you currently live or work on a farm?

Live and Work	Live only	Work only	Neither, but work in agri-industry	None of the above
48	31	13	7	2

Table D1: living/work arrangements (%) (n=645)

Q2. What best describes your entry into farming?

Cohort	Farming background	New entrant - occupational choice	New entrant - family connection e.g. partner, marriage
A (n=260)	62	20	18
B (n=85)	48	34	18
C (n=299)	54	9	37

Table D2: Entry to agriculture by cohort (%)

Q3. Which of the following best describes your role on the farm?

Full-time farmer	Part-time farmer	Farmer's wife / partner	Full-time employee (paid)	Full-time employee (unpaid)	Part-time employee (paid)	Part-time employee (unpaid)	Farm resident	Resident land manager	Other
14	14	33	7	1	4	3	3	1	3

Table D3.a: Farm roles (%) (n=947)

Cohort	Identify as Farmers Wife
A (n=260)	33
B (n=85)	31
C (n=300)	68

Table D3.a: Farmer's wives by cohort (%)

Q4. What is your gender identity?

Male	Female	Non-binary / prefer not to say
0	99	1

Table D4: Gender identity (%) (n=645)

Q5. What is your highest level of educational achievement?

Cohort	Secondary education (left before formal qualification)	Secondary education (GCSE or equivalent)	Upper secondary education (A-level, BTEC or equivalent)	Further education (apprenticeship, HND or equivalent)	Higher education (bachelor's degree or equivalent)	Postgraduate qualification	Other
A (n=259)	0	12	19	24	29	15	1
B (n=85)	0	7	29	20	35	8	0
C (n=300)	2	9	16	19	38	16	0

Table D5: General education by cohort (%)

Q6. What is your highest level of educational achievement in an agriculture subject?

Cohort	Practical experience only	Secondary education (GCSE or equivalent)	Upper secondary education (A-level, BTEC or equivalent)	Further education (apprenticeship, HND or equivalent)	Higher education (bachelor's degree or equivalent)	Postgraduate qualification	Other
A (n=257)	42	8	16	14	6	12	2
B (n=85)	39	12	15	18	5	8	4
C (n=291)	60	8	8	15	3	4	3

Table D6: Agricultural Education by cohort (%)

Q7. What is your age?

Cohort	Under 18 years old	18-24 years old	25-34 years old	35-44 years old	45-54 years old	55-64 years old	65 years old and over
A (n=260)	1	11	35	23	15	12	3
B (n=85)	0	27	41	22	7	1	1
C (n=300)	1	7	29	32	14	15	3

Table D7: Age by cohort (%)

Section 3: Farms, farm work, and occupations

This section is designed to find out more about your farm, work and occupations.

3.1: Farm Characteristics

Q8. What is your total farmed area?

Cohort	0-24 ha	25-49 ha	50-99 ha	100-199 ha	200-399 ha	400-699 ha	700-999 ha	1,000 ha-1,999 ha	2,000 ha +
A (n=258)	15	15	19	22	16	7	3	2	2
B (n=75)	5	8	7	15	24	15	8	9	9
C (n=273)	7	9	21	23	16	11	5	4	4

Table D8: Farm size across cohorts (%)

Q9. What kind of land tenures do you hold?

Owned	Rented: Farm Business Tenancy	Rented: Full Agricultural Tenancy	Rented: Short Term Lease	Other
52	16	13	14	4

Table D9: Land tenure type (%)

Q10. What type/s of farm do you live/work on?

Cohort	Dairy	Beef	Sheep	Poultry	Pigs	Arable	Horticulture	Woodland/Agroforestry	Other
A (n=597)	12	25	30	6	5	12	3	3	4
B (n=181)	20	21	25	4	4	20	4	1	1
C (n=559)	13	28	26	5	3	19	2	1	2

Table D10: Farm type across cohorts (%)

Q11. What is your farm's income?

Cohort	Under £20,000/year	£20,000-£29,999/year	£30,000-£39,999/year	£40,000-£49,999/year	£50,000-£59,999/year	£60,000-£69,999/year	£70,000-£79,999/year	Over £79,999/year
A (n=206)	37	15	6	6	7	4	2	22
B (n=31)	26	10	6	3	13	3	0	39

C (n=188)	23	13	7	11	5	6	3	31

Table D11: Farm income by cohort (%)

3.2: Farm Work and Occupations

Q12. What income/salary do you receive for your work on farm?

Cohort	Under £20,000/year	£20,000-£29,999/year	£30,000-£39,999/year	£40,000-£49,999/year	£50,000-£59,999/year	£60,000-£69,999/year	£70,000-£79,999/year	Over £79,999/year
A (n=255)	71	11	2	2	0	1	0	0
B (n=79)	61	27	5	5	0	0	0	0
C (n=258)	63	5	2	1	0	0	0	0

Table D12: Salary by Cohort (%)

Q13. What are your main roles and responsibilities on farm?

Cohort A: Responsibility Level	Farm management (n=254)	Farm work (n=256)	Farm admin (n=256)	Environ (n=254)	Technology (=249)	Non-farming enterprises (n=226)	Domestic (n=253)	Other (n=27)
Full	39	41	64	38	53	41	69	67
Some	48	57	29	34	36	29	21	19
Little or none	13	2	7	28	12	29	11	14

Table D13.a: Roles and responsibilities, Cohort A (%)

Cohort B: Responsibility Level	Farm management (n=74)	Farm work (n=79)	Farm admin (n=76)	Environ (n=74)	Technology (n=74)	Non-farming enterprises (n=71)	Domestic (n=73)	Other
Full	11	32	36	14	26	13	44	17
Some	50	53	46	26	49	27	29	17
Little or none	38	15	18	57	24	54	23	50

Table D13.b: Roles and responsibilities, Cohort B (%)

Cohort C: Responsibility Level	Farm management (n256)	Farm work (n259)	Farm admin (n=265)	Environ (n=256)	Technology (n=258)	Non-farming enterprises (n=238)	Domestic (n=273)	Other
Full	13	8	36	15	27	16	81	39
Some	42	61	38	30	37	27	14	13
Little/none	43	29	26	53	36	50	5	35

Table D13.c: Roles and responsibilities, Cohort C (%)

Q14. If you are not the sole final decision maker on farm, what is the gender of the main person/s responsible at a whole farm level?

Cohort	Male/s	Female/s	Non-binary	Joint responsibility between male/s and female/s
A (n=210)	52	8	0	40

B (n=79)	70	3	0	28
C (n=272)	71	3	0	26

Table 15a: Gender of final decision maker by cohort (%)

Q14a. To what extent do you agree with the following statement: "If I had an idea to significantly change how things are done on farm, I would be supported by the final decision maker."

Cohort	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
A (n=234)	45	32	15	6	2
B (n=79)	24	33	29	8	6
C (n=278)	26	34	23	8	10

Table 15.b: Support from final decision maker by cohort (%)

3.3: Diversifications and Off-Farm Work

Q15. Do you consider any additional income streams, such as off-farm work or diversifications, important to your farm's survival?

	Off-farm work	Income from diversifications	Income from other sources
A (n=260)	42	40	28
B (n=85)	28	34	28
C (n=300)	52	22	21

Table D15: Additional income streams important for farm survival by cohort (%)

Q16. What, if any, diversifications do you have?

	Renewable Energy	Processing and Retailing of Farm Produce	Tourist, Recreation and Catering	Trading, Manufacturing and Rural Crafts	Professional Goods and Services	Environmental management e.g. government schemes	Forestry	Other	None
A (n=367)	10	11	14	5	7	11	1	10	31
B (n=166)	15	13	14	1	7	21	3	7	20
C (n=369)	8	7	13	2	6	14	3	10	37

Table D16: type of diversification by cohort (%)

Q17. How much time, on average, do you spend per week on diversification activities?

	None	Less than 5 hours	5 - 10 hours	10 - 20 hours	20 - 30 hours	30 - 40 hours	Over 40 hours per week
A (n=229)	44	21	14	11	5	3	2
B (n=73)	62	22	8	7	1	0	0
C (n=239)	59	20	9	8	1	1	3

Table D17: time spent per week on diversification by cohort (%)

Q18. Do you have employment off-farm?

Cohort	Yes, within the agricultural sector	Yes, outside of the agricultural sector
A (n=256)	51	49
B (n=106)	61	39
C (n=308)	35	65

Table D18: Off-farm work by cohort (%)

Q19. What factors were important in your decision to work off-farm?

	Personal choice / career	Support household income	Support farm income	Lack of requirement / opportunities on farm	Encouraged by friends/family	Other
A (n=412)	32	33	20	7	4	4
B (n=120)	33	32	10	13	8	4
E (n=505)	40	31	10	10	6	3

Table D19: decision to work off-farm by cohort (%)

Q20. What is your total income from off-farm work?

Cohort	Under £20,000/pa	£20,000-£29,999/pa	£30,000-£39,999/pa	£40,000-£49,999/pa	£50,000-£59,999/pa	£60,000-£69,999/pa	£70,000-£79,999/pa	Over £79,999/pa	Unknown
A (n=207)	55	19	9	3	0	1	1	1	10

B (n=62)	44	29	8	2	2	0	0	0	16
C (n=255)	45	22	11	7	2	1	0	1	10

Table D20: Off-farm work salary by cohort (%)

Section 4: Agricultural education and organisations

This section is designed to find out more about your background and socio-demographic characteristics.

4.1 Training

Q21. Since you completed your formal education, how frequently do you participate in industry-led agricultural training initiatives?

	Not at all	Not very frequently	Somewhat frequently	Quite frequently	Very frequently
Cohort A (n=259)	18	39	22	13	8
Cohort B (n=85)	29	33	16	12	9
Cohort C (n=294)	35	38	16	6	4

Table D21: frequency of participation in training events by cohort (%)

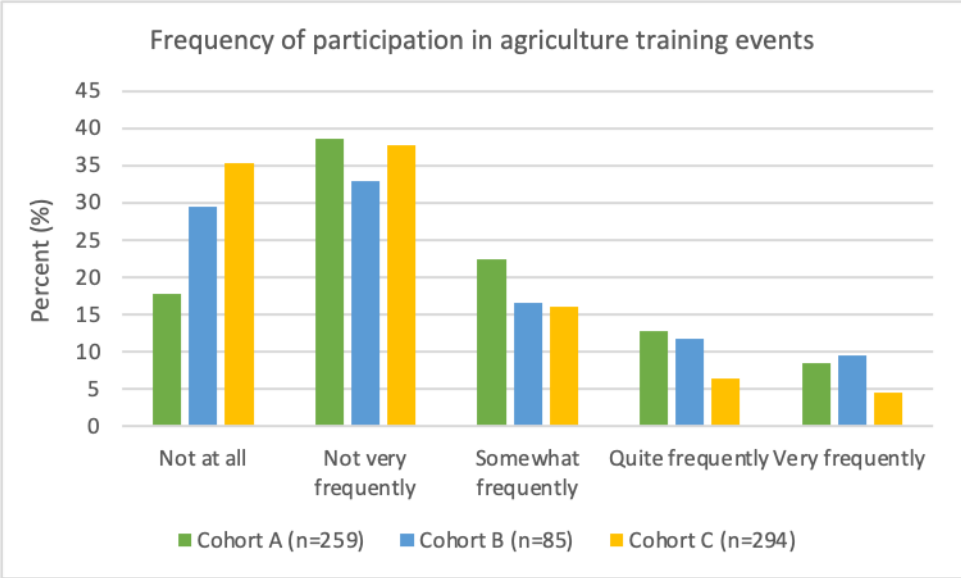

Figure D21: frequency of participation in training events by cohort (%)

Q22. How confident would you feel attending and participating in a farm training event on your own?

	Apprehensive	Neutral	Confident
Cohort A (n=246)	29	11	60
Cohort B (n=81)	45	12	43
Cohort C (n=284)	39	15	46

Table D22: confidence in attending a training event unaccompanied by cohort (%)

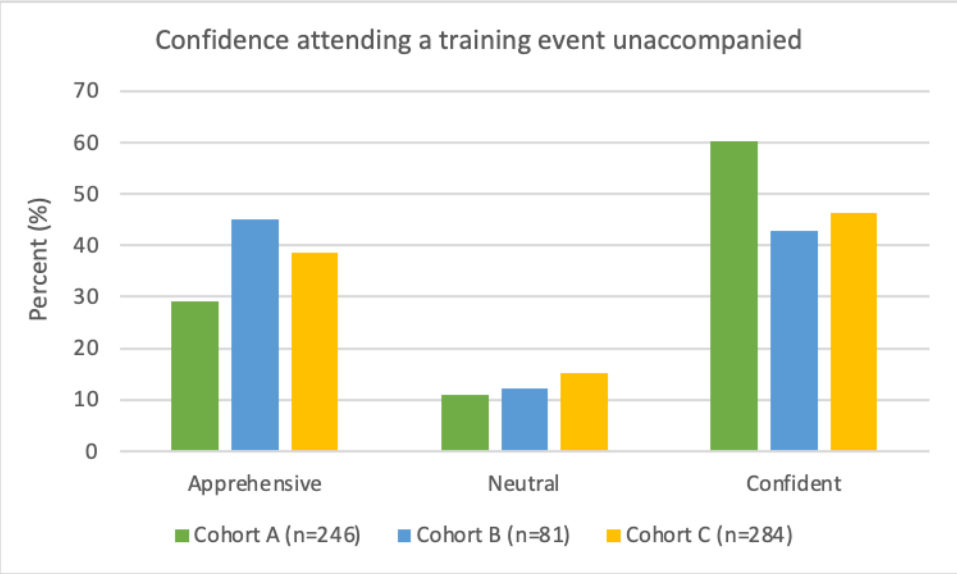

Figure D22: confidence in attending a training event unaccompanied by cohort (%)

Q23. What topics/areas of training would you find most useful?

Farm management	Accounting	Farm admin	Grant applications	Diversification	People management	Sales and marketing	Personal development	Succession planning	Sustainable and environment	Crop Production
307	282	246	336	256	110	135	131	168	215	139

Table continued…

Livestock husbandry	Health and safety	Workshop skills	Machinery operation	Agricultural engineering	Technology	Household	Other
338	172	143	151	89	91	77	9

Table D23: Preferred topics of training (all)

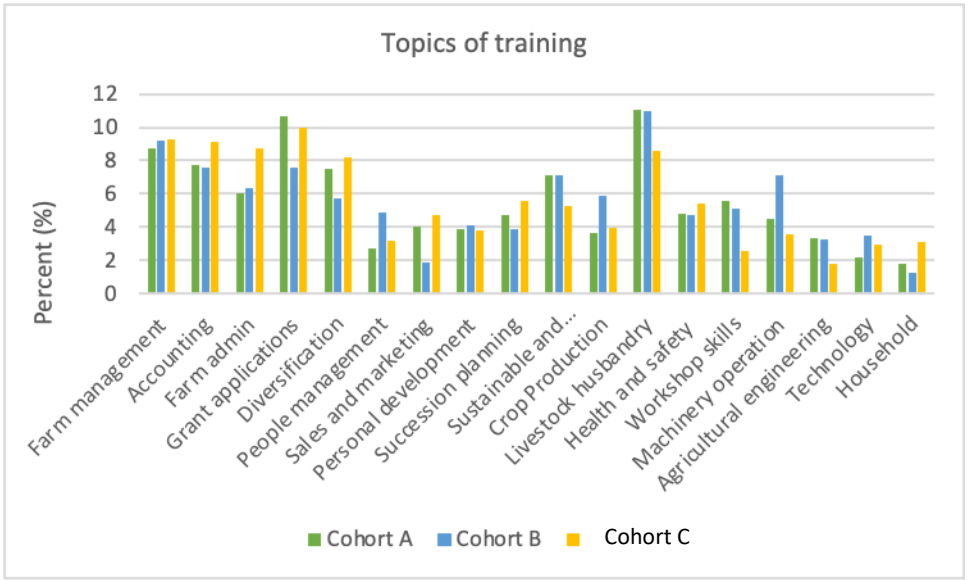

Figure D23: Preferred topics of training by cohort (%)

Q24. What formats of agricultural training would/do you most prefer to participate in?

Table D24: Preferred format of training (all)

Practical short courses	Show events	Farm tours and visits	Small group seminars (in person)	Small group seminars (online)	Practical workshops (in person)	Webinars	Podcasts	Conferences (in person)	Conferences (online)	Speaker events
366	292	428	277	178	314	208	114	181	101	134

Table D24 continued…

Interactive online resources	Online reading resources	Print reading resources	Distance learning	Local member training	Other
149	207	234	159	264	4

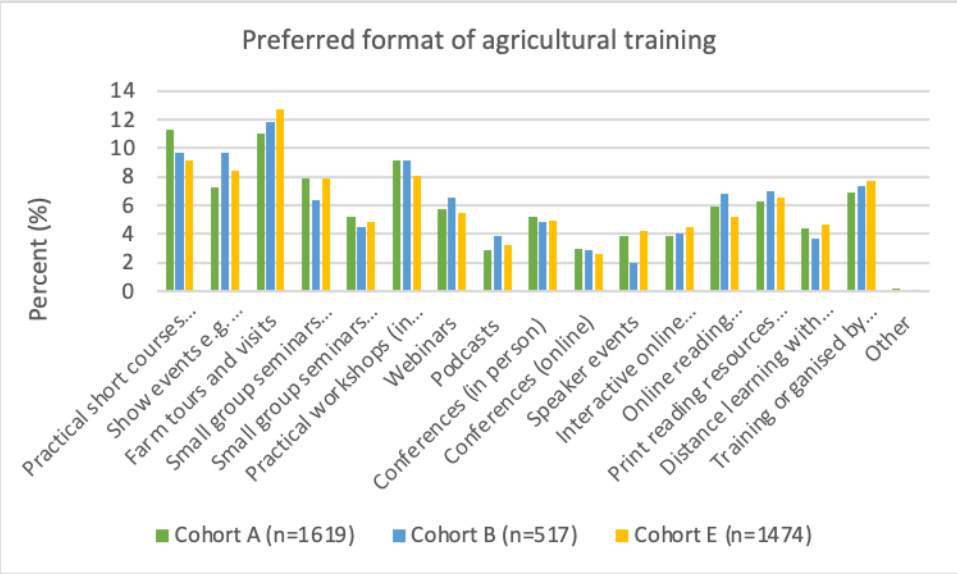

Figure D24: Preferred format of training by cohort (%)

Q25. Which factors would have the biggest influence in preventing you from engaging in agricultural training / education?

Training is irrelevant to my needs	Time and locations of meetings	Cost of training	Lack of online learning / flexibility	Training opportunities are hard to find	Accessibility and childcare	Course promotion and content	Poorly attended by women	Lack of female course leaders	Other

						lacks inclusivity			
133	437	360	87	112	192	27	95	52	28

Table D25: Barriers to training

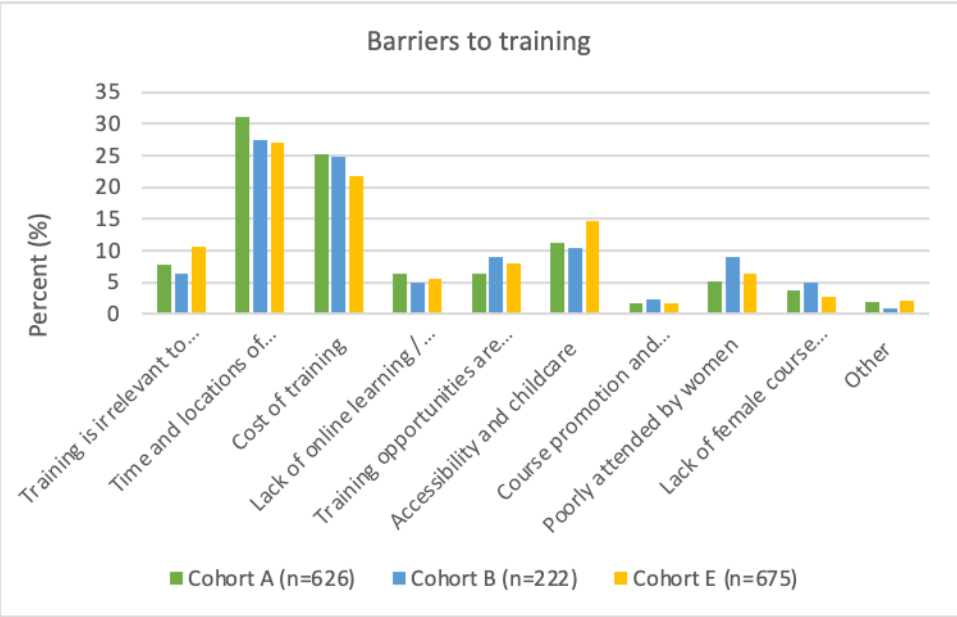

Figure D25: Barriers to training by cohort (%)

4.2 Organisations

Q26. Do you participate in any farming organisations or clubs?

	Yes - presently	No - but have done previously	No - never
Cohort A (n=258)	36	34	29
Cohort B (n=85)	32	35	33
Cohort C (n=300)	27	38	36

Table D26: Participation in farming organisations by cohort (%)

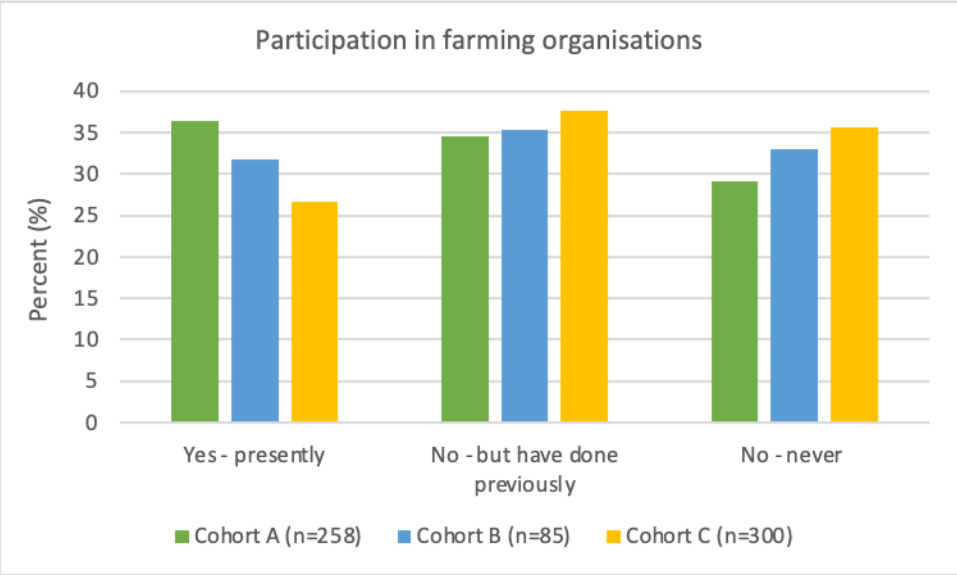

Figure D26: Participation in farming organisations by cohort (%)

Q27. How frequently do you participate in any farming organisations or clubs?

	Not active	Somewhat active	Highly Active
Cohort A (n=159)	23	50	28
Cohort B (n=47)	23	60	17
Cohort C (n=166)	33	43	25

Table D27: Frequency of participation in farming organisations by cohort (%)

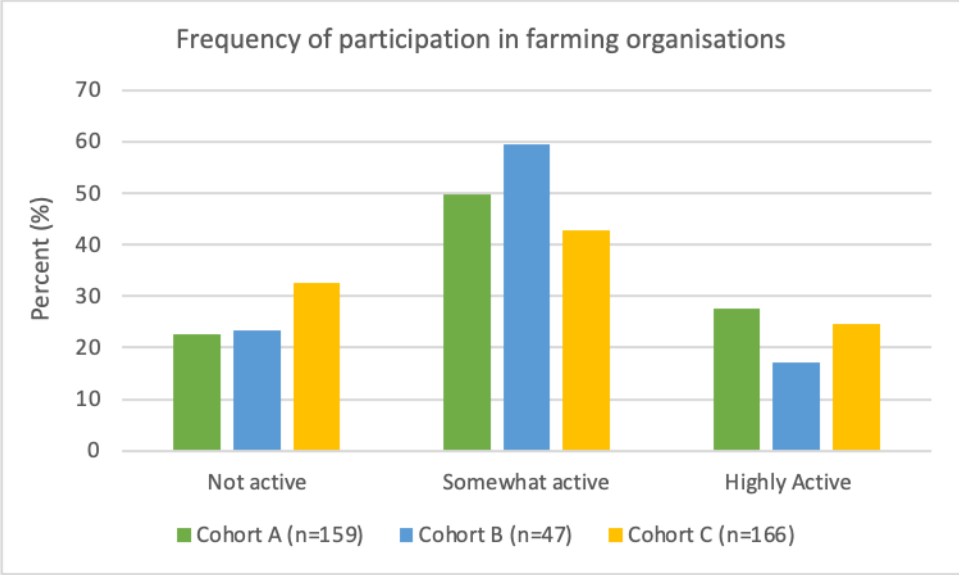

Figure D27: Frequency of participation in farming organisations by cohort (%)

Q28. How confident would you feel joining/participating in a farming organisation on your own?

	Apprehensive	Neutral	Confident
Cohort A (n=246)	36	20	44
Cohort B (n=81)	47	22	31
Cohort C (n=284)	45	15	40

Table D28: Confidence participating in farming organisations unaccompanied by cohort (%)

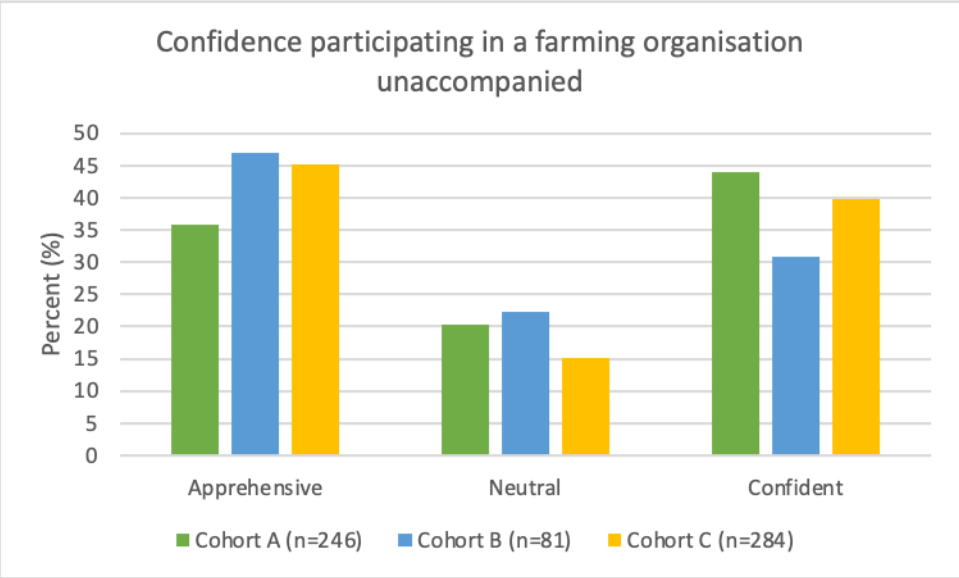

Figure D28: Confidence participating in farming organisations unaccompanied by cohort (%)

Q29. Which factors would have the biggest influence in preventing you from engaging in agricultural organisations?

Its cause and purpose is irrelevant to my needs	Times and locations of meetings	Cost of membership and participation	Lack of online participation / flexibility	Opportunities to participate are hard to find	Accessibility and childcare	Membership advertisement and promotion lacks inclusivity	Poorly attended by women	Lack of female leadership	Other
142	396	251	37	92	182	31	100	43	30

Table D29: Barriers to farming organisations

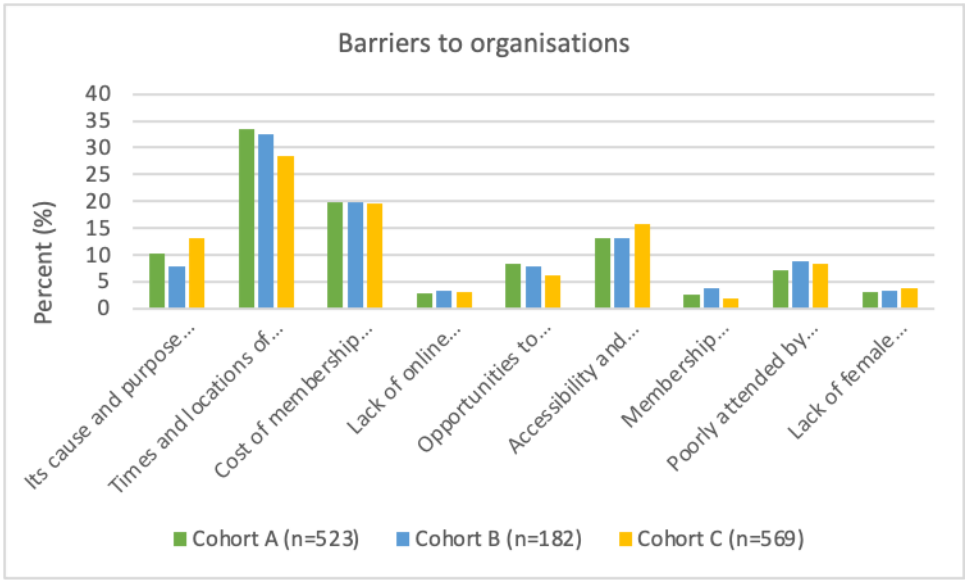

Figure D29: Barriers to farming organisations by cohort (%)

Section 4: Industry outlook

This section is designed to find out more about your experiences and outlook for the sector.

Q30. In your experience, which of the following factors present the biggest barriers for women in agriculture?

Table D30: Barriers for women in agriculture industry

Traditional social and cultural views	Personal confidence and self-esteem	Access to land	Access to capital	Access to social resources	Succession	Education and training	Media portrayal	Farming organisations	Domestic responsibilities	External time demands
398	264	243	172	39	209	39	135	163	369	214

Table D30 continued…

Social media	There are no barriers	Other
7	46	19

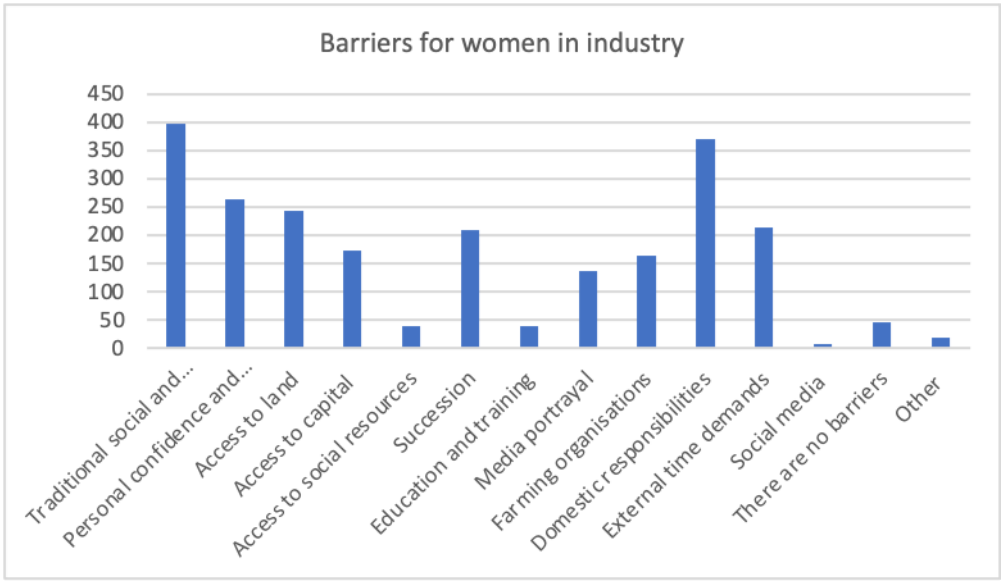

Figure D30: Barriers for women in agriculture industry

Q31. Some examples of womens' experiences are cited below. Please indicate, based on your own experience or which you have seen women encounter, how prevalently you believe such examples may occur:

Table D31: Prevalence of experiences of sexism within industry

	Unnecessary attention	Gender dismissed	Social exclusion	Sexist or inappropriate language	Assumed not to be farmer/manager	Treated as subordinate	Assault or intimidation	Discouraged from participation	Given or relieved of certain jobs	Told gender influences ability to farm
Common	517	506	412	452	544	455	175	336	450	358

Uncommon	106	118	210	168	78	160	442	282	169	260

Table D31 continued…

	Not promoted/hired	Judged untraditional femininity	Judged traditional femininity
Common	283	410	423
Uncommon	320	209	196

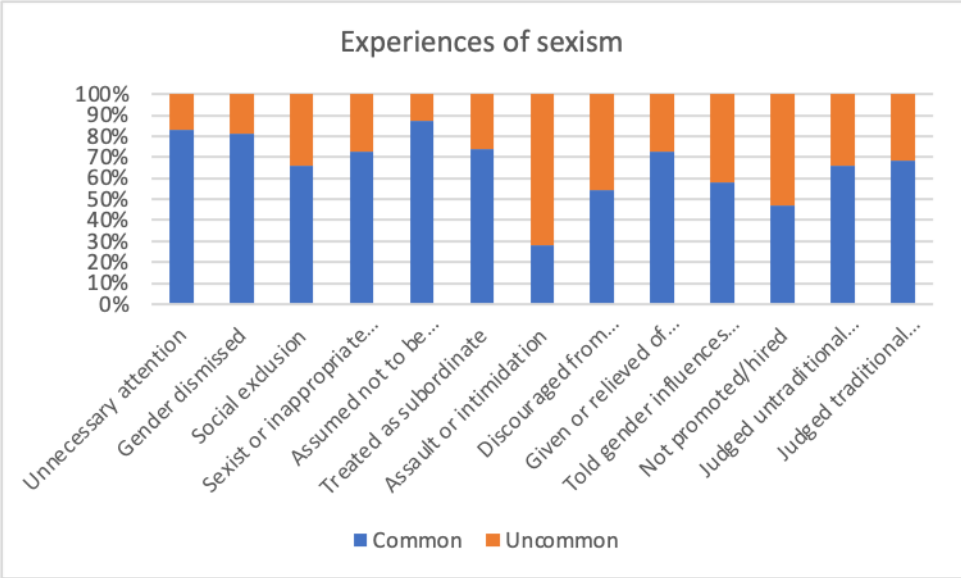

Figure D31: Prevalence of experiences of sexism within industry

Q32. Do you agree or disagree with the following statements?

Table D32: Outlook for women in agriculture industry

	The position of women has improved	Important to support and promote	More should be done to support	Women want to hold	Well represented in leadership	Good female role models	More female role models needed	Farming is a viable career for women	Women-only agriculture groups are useful	Stigma attached to the topic

			women to run farms	leadership positions						
Agree	559	600	540	548	123	341	518	551	376	304
Neutral	66	36	94	88	327	229	106	68	196	238
Disagree	14	3	6	3	188	69	11	17	64	91

Table D32 continued…

	Without conflict/disadvantaging males	Technology is exciting	I am optimistic about the future
Agree	480	528	498
Neutral	135	101	120
Disagree	20	6	17

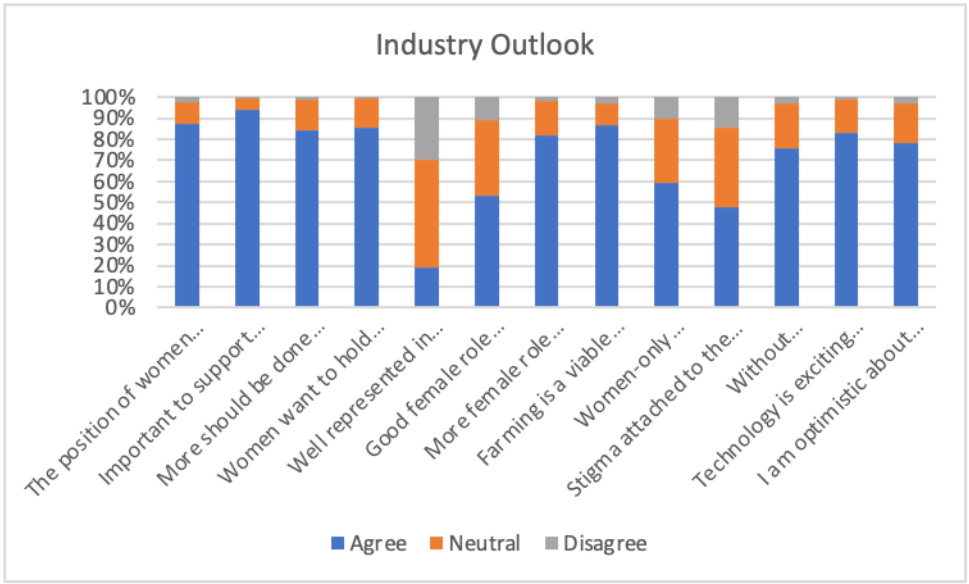

Figure D32: Outlook for women in agriculture industry

Q33: We'd like to know more about your views of any challenges or opportunities you/other women may experience. Please use this optional free text box to expand upon any aspects of this questionnaire or your own experiences.

See thematic analysis for results (Table 14, Section 4.4.2.c)

Appendix E: Current UK women in agriculture groups and initiatives

This appendix details examples of current groups and initiatives undertaken by UK organisations targeted specifically at women in UK agriculture. It comprises industry-wide initiatives; sector specific skills-based initiatives; off-shoot networking and support groups; annual conferences/events; and women's groups promoting British produce. The description of each initiative is taken from its website or webpage.

Industry-wide Initiatives:

Women in Agriculture Scotland

Website: https://www.womeninagriculture.scot
Formed from a collective of organisations: The Royal Highland and Agricultural Society of Scotland (RHASS), Royal Bank of Scotland, Scottish Agricultural Organisation Society (SAOS), Scottish Association of Young Farmers (SAYFC), RSABI, Scotland's Rural College (SRUC), National Farmers Union Scotland (NFUS), Savills and WES to support women across rural Scotland to: share experiences, seek advice, skills based learning and networking.

Sector specific skills-based initiatives:

Women in Dairy

https://www.womenindairy.co.uk
Women in Dairy is an initiative from The Royal Association of British Dairy Farmers, designed to bring women working in the dairy industry together through regional discussion group meetings to learn, network and promote the image of dairy farming.

Off-shoot networking and support groups:

First Milk Women in Agriculture

https://www.firstmilk.co.uk/news/2022/women-in-agriculture/
In 2020, First Milk launched its Women in Agriculture (WIA) group in recognition of the vital role women play in farming businesses. Comprised of First Milk's female members and farm staff, the group offers opportunity to share knowledge and experiences and connect with others. Meetings are a mixture of in-person and virtual events, as well as a WhatsApp chat.

Yorkshire Agriculture Society Women in Farming Network

https://yas.co.uk/womeninfarming/
Free network of The Yorkshire Agriculture Society, established in 2013 and providing opportunities for women to learn from each other, build contacts and offer support to their fellow members. An annual gathering is held each Autumn and members have access to a private Facebook group forum.

Annual Conferences/events:

NFU Cymru

She Who Dares Farms annual conference provides a networking opportunity for women working in the agriculture industry. Merchandise sales rase money for farming mental health charities.

Lincolnshire Agriculture Society

Annual conference provides a networking opportunity for women working in the agriculture industry in collaboration with industry sponsors

Women groups promoting British produce:

Ladies in Pigs

https://www.ladiesinpigs.co.uk
Established in 1990, ladies in pigs is a non-profit organisation that is member led, specialising in education and promotion of the British food and farming industry.

Ladies in Beef

https://www.ladiesinbeef.org.uk
Ladies in Beef is an organisation of female beef farmers who care passionately about British beef. The group was formed to help promote and drive awareness of the quality and versatility of British beef to consumers using a country-wide network of dynamic lady beef 'champions'.