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Assessing the prospects of the Sustainable Farming Scheme in Wales, fit for success or of limited relevance?

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Abstract: Post-Brexit agricultural support policy development in Wales is taking a holistic approach to sustainability combining economic, environmental and social goals in one scheme to replace the CAP. It is taking a different model compared to the other UK nations or the EU. But the challenges faced by farming have intensified with COVID and the Ukraine war including the input/output price squeeze. We used the agrarian diagnosis, a holistic case-study approach to analyse selected farm focused territories that represent typical trends in Welsh farming. We identified and quantified future scenarios relating to a range of challenges faced by Welsh farming and made a territorially sensitive impact assessment by applying those in successive steps to farm models originating from the case-studies. We first assessed the impact of the current macro-economic evolution, before considering the adoption and impact of the planned SFS with a specific focus on tenanted farms, the new form of tenancy and tree-planting, as these elements have featured heavily in stakeholder responses to the Welsh scheme. The results show that the current economic context represents a challenge for those farms using high levels of production factors. Particularly for these, it is possible to identify how the Welsh scheme could deliver many improvements; nevertheless, problems remain around impact on generational renewal, competing land uses and supply-chain and technological lock-ins.

Keywords: Territorialised, Policy impact, Agrarian diagnosis, Prospective, Farming systems

Classification of the article: Q18

Abbreviations

AR: Agricultural Revenue

AV: Added Value

CAP: Common Agricultural Policy

CS: Case-studies

DC: Dairy Cows

DK: Capital Depreciation

EU: European Union

ha: hectare

KL: 1000 litres

NI: Northern Ireland

NVZ: Nitrate Vulnerable Zone

RP: Raw Product

SFS: Sustainable Farming Scheme

UK: United Kingdom

VoC: Vale of Clwyd

1. Introduction: Studying Welsh farming at a time of Change

Farming has a special role in Wales as it has in many other European rural areas, being the main activity shaping the landscape but also an historically and socially significant activity (Midmore et al. 2005). 90% of Welsh land is used for agriculture, forestry or designated common land (Welsh Government Statistics 2021), a much higher proportion than the 70% of the UK as whole (Defra 2021). Wales as a UK-nation is a particularly green country with over 88% of its land grazed, agriculture is part of its competence. It is also economically significant, not by GDP contribution but for the role it plays in local communities e.g. in employment, spending or culturally (Welsh Government Statistics, 2021, Nieddu and Roudart, 2003 and Graves, 2022). There are more than three times as many head of ruminants in Wales than inhabitants, and livestock farming represents the dominant type in Welsh agriculture due to agro-ecological constraints (Midmore et al. 2005) that were explored in previous papers (Lenormand et al. 2022b,c).

- **Welsh farming and agro-ecological constraints and development of different agrarian systems**

Under a relatively homogenous picture, Wales features very different agro-ecological constraints between areas, going from the lowland lush hills of Pembrokeshire to the upland rough-grazing mountain with its short grazing season, colder, wetter. In appendix we added the Wales-wide map of precipitation and temperature gradient, with a gradient from the West to the East. Seasonal patterns also tend to be impacted by either the Atlantic wet and temperate flux, or a colder and drier more eastern flux (Appendix 1). Combined with the mostly impermeable and acidic (but nevertheless changing) soil, we found a gradient of conditions in each study area enabling us to split them into distinct agro-ecological areas. Combined with farming tools and techniques there are some clear limitations, around water availability, time or place where the land is accessible for livestock or machinery (due to climate conditions or risk levels).

Agro-ecological parameters represent the strictest of the limitations in which farming systems have to operate, something that has been a major factor impacting potential evolution pathways for farming systems as shown for example in Lenormand et al. 2021. In the agrarian history those limitations have already played a role in the regional and individual differentiation of farming. In policy or in our work we need to acknowledge the intra-regional area variability, uplands area are not similar as shown in Midmore et al. 2005 and even within lowlands, like Pembrokeshire we find significant milieu differences.

The analysis has been polarised around upland and lowland either in statistics, economic data or policy debates. But between regions and within region there is as a result socio-economic and cultural differences in the characteristic and potential of the farming system and landscapes.

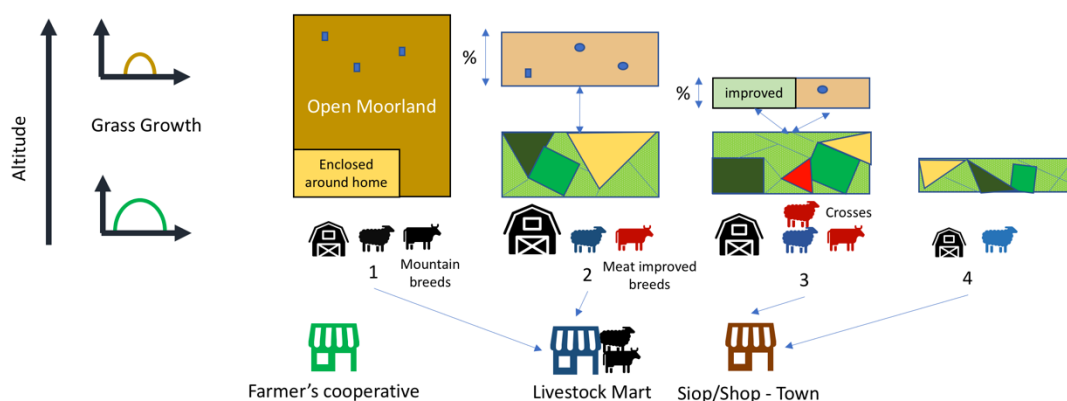
- **Welsh farming and its significant multi-functional farm supporting rural communities:**

Indeed farming is anchored in local communities' functioning and identity in Wales (Lenormand et al, 2022). The majority of farms are family operated and most have been held for several generations (Welsh Government, 2018). It is also an ageing sector in which those aged over 60 play an important part, as they operate a high percentage of farms (Welsh Government Statistics, 2020). Nevertheless, all are part of a community if only economically providing some dependable income to several members.

In Lenormand and Morse, 2022 we explored those issues by using the specific notion of SEPLs – Socio-Ecological Production Landscapes, albeit farmer’s identity has been focused on food; farms tend to be family operated and their farming practices remain anchored in a landscape, in terms of breed, production mix and method, multifunctionality with a potential diversification of farming activities. A place specific and territorialised vision of farming, with small farms on the land, mostly enshrined within the culture as shown in Howell, 1946 or Midmore and Moore-Colyer, 2005. We showcased one of those possible visions on an upland farming landscape in Figure 1, the diversity of the agrarian system and the links created are differentiated, culturally, historically and socially significant in relation to the wider environment.

Figure 1: An example of Welsh typical hill-farming agrarian system, differentiated, historically, culturally significant territorialised farming systems (By the author from fieldwork):

Agrarian System and interactions in a farmed landscapes; different scales, different systems:



Collaboration in the past	Gathering and Harvests (hay making and corn)			Harvests (or paid)
End Collaboration?	For harvest: Yes Gathering: No - Contracted			Yes
Local Livestock Market Participation	Yes	(Possibly)	No – Direct	Yes
Reclamation of Open mountain in the past Improvements to the land/Inputs use	No Extremely little	Yes – Some Some	Yes – Some Some	No Some
Reduced Mountain use in recent years	Reduced stocking density as per CAP agreement			

While recognising the Welsh identity and the specific nature of local areas in Wales there has been strong links with England and the rest of the world, representing an important economic or sociological influence. Within this framework we can see several policy or factors at play that represent long-term enshrined elements for Wales. For example the landholding structure and legal framework is inherited from centuries long evolution (Lenormand et al. 2021 or Butler et al. 2008). Commons or the general landscape organisation, or the land market structure partly derive from those.

The differentiation of production in areas offered some opportunities particularly to some lowland farmers in terms of access to some products; for example, Pembrokeshire early potatoes were popular and exported in the rest of the UK and can be produced on the milder and drier parts of the area (Lenormand, 2019). On the flipside mountain breeds have been developed and hefted over centuries on the mountain giving a special product partly recognized by the Cambrian Mountain PDO (Defra, 2021). Those links represent a certain lock-in into a production but also market opportunities through identity (Maye et al. 2016). There has been a

gradual co-adaptation of human farming and their environment over centuries within socio-ecological parameters giving a complex network of land-use.

- **Deep transformations have taken place**

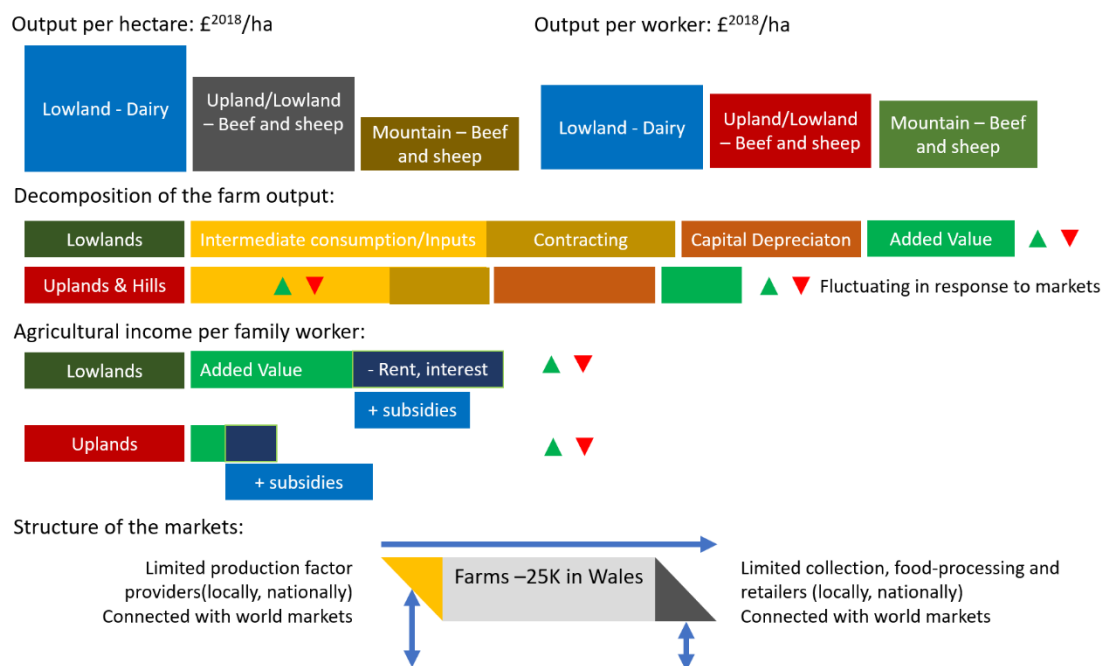
Those links have been gradually reduced as we have showed in Lenormand et al. 2022 with the implementation of the 20th century agricultural revolution. In the UK it was linked to a widespread transformation of the agrarian system. Farmers were offered a secured food-focused environment (tenancy, ownership, selling) integrated in global fluxes by governments but leaving their food transformation and other activities. Within the UK food history the early industrialization, combined to the impact of two world wars has meant that the food supply chain got industrialized and structured early. Farms have been incentivized over 70 years through multiple policies in the UK to increase food production partly during a time to deal with a long-term structural food security challenge (Lenormand et al. 2021, Defra, 2021). Labour productivity has been the main lever by which farms have been told they could remain profitable in a more challenging operating environment according to fieldwork, the average size of farms showcases that (Hodge, 2016 or Rackham, 1986). High added value production, particularly milk have been impacted more than beef and sheep farms due to subsidy support. Farm systems have differentiated following policies and market openings but also responding to rising concerns around the environment or the dominant farming model (Lenormand et al. 2021 and Lenormand et al. 2022a). The combined pressure of those have also pushed towards a reduction in farm numbers and greater integration further limiting locally enshrined and territorial linkage and innervation.

The current agrarian system is competitive, liberalised, the food and retailing supply chain is powerful and very concentrated with a clear power imbalance (information asymmetry, contract rules) unfavourable to competing farms, the land market is small in size and very competitive for very different goals (planting trees, rewilding...) (Defra, 2021 and Kantar, 2020). The agrarian system is polarized in terms of orientation and operating practices, between larger, lean, production focused and some less production focused farms, potentially with diversified income streams as seen in Lenormand et al. 2022a and matched by statistics (Welsh Government, 2020). The sector is difficult to access for new entrants in general with a generation renewal crisis around the corner and a relatively lonely and stressed system (RABI, 2020).

- **In general a hollowed out system as a result of economic analysis that took place in former papers.**

Looking at Welsh farming in general, the sector tends to focus on outputs that often fetch commodity prices, seeking standardization in terms of specifications (Lenormand et al. 2021). The farm autonomy in terms of input tends to be lower with grass-focused systems requiring cake or fertilizer to attain the required standards, the costs per animal tend to be low but the land and labour productivity tend to be high, a result of the long-term challenges. Nevertheless, the level of dependence in income remains high particularly on low added value productions and environmentally challenging conditions. The FBS data shows a sector which is challenged economically (Aberystwyth, 2021). Looking at the Figure 2 shows the scale of the challenge economically and the high inter-dependence with the supply chain and world prices that fluctuate widely as shown in Appendix 4.

Figure 2: Illustrative example of the hollowing-out of agriculture in Wales, limited margins out of fluctuating; low output valuation and inputs prices in an oligopolistic supply chain (By the author from the literature and fieldwork)



- A rising list in terms of challenges:

On the flipside challenges to livestock farming and Welsh agriculture are increasing. Long-term issues can be identified around the sustainability of the farming systems in the UK (Welsh Government, 2019) or the operating constraints of farming systems (geo-physical...); as well as climate change as a double-edged sword for mitigation and emissions of greenhouse gases (National Food Strategy, 2022). In our previous paper we explored a number of issues in the land market, the impact of past farm policy change with a polarisation and differentiation of the farm ecosystem (Lenormand et al. 2022a).

In this part we highlighted that scales play a very important role, most of all at which are the decisions made or where do the triggers, drivers or innovation originate for changes. In that case, Brexit represents a new challenge for the sector, as evidenced by Dwyer, 2018.

1.2 Brexit represents a step change for Welsh Farming:

- A changing environment for agriculture in Britain and Wales

The Brexit process has started since the vote in June 2016, 6 years in Brexit is not yet finalised and the forthcoming operating environment remains particularly uncertain for farms. The process of Brexit and the different steps within the agreement is showed in Appendix 2.

GB and the UK as a whole is not self-sufficient on food, even on indigenous food, the production levels cover approximately 76% of the food consumption but only 60% for all food. The biggest trade partner for food and beverages exchanges remained the EU in 2021 as highlighted by Defra report on the state of food security. While the UK is self-sufficient or exporting on most livestock production, it's vegetable and fruit production sector offers less than 40% self-sufficiency. We must also take into account the reliance on imported inputs; fertiliser, animal feedstuff or phyto-sanitary products. The importance of food exchanges is showcased in Appendix 3.

This sheds a new light on the negotiations between the EU and UK. As in general, Free Trade Agreement (FTA), which is a way for 2 countries to remove barriers and obstacles, converging to increase their level of partnership and their trade (USDA, 2020), but for the first time ever a FTA was about divergence. Divergence from the EU single market, the most comprehensive common market. Under which good, services or can be exchanged seamlessly smoothly erasing trade borders. It certainly helped the UK – EU trade deal to get a deal done swiftly under within minor delays. But it is not a finalised deal as many issues linked to UK future standard divergence are not solved at all but are left to future negotiations or disagreements. Farming, food and beverages in those negotiations have not been at the forefront as can be seen from challenges arising around the transit of those, particularly around the Northern Ireland border.

From an economic orthodoxy point of view it is a step backwards as it reinstates some friction at borders. Another premiere is that the UK is split under different trade and custom agreements, Northern Ireland still being part of the common market. The border in the Irish sea was the only identified way to deal with the good Friday agreement albeit it has antagonized UK-EU relationships.

This deal is fluid, it is only valid if there is a "level playing fields", if standards in the GB and in the EU are aligned. If not rebalancing with bans, tariffs and quotas could be introduced unilaterally until further bi partisan talks statute on the issue and a longer-term solution. We note that it has been the UK government intention to seek out a regulatory freedom as well as the possibility to conclude its own trade deals. For example, Defra has launched a consultation in 2021 around the use of GMO in farming.

The fact that there is no dynamic alignment planned on an unprecedented FTA is a worry, a multitude of sectors to keep track of for incremental, continuous alignment. "Brexiternity" - a constant negotiation, the multiple postponed deadline shown in Appendix 2 really showcases this problem.

- **It will be increasingly challenging to export between the UK and EU and limited other opportunities are opening:**

Exchanging agri-food goods has become more challenging, any exporter/importer need to be registered, to pre-notify the goods moving, provide individual health certificate for each batch/product crossing the border (signed by veterinary), some checks can be conducted on arrival, VAT has to be payed in the country of export, a certificate of origin (to ensure the product comes from the UK). The more diversified and fresh the products the more complex the paperwork. Given the low self-sufficiency on many food items and the long-standing link (DEFRA, state of food security 2021) imports SPS paperwork and checks have been postponed several time. Small importers/exporters have struggled to deal with the complexity which does not seem the case of the larger ones as proves the agri-food fluxes increasing in 2022 compared to 2019 (albeit this is partly due to the price inflation)(HMRC 2022). The Irish Sea border has been a challenge to operate particularly at the beginning and full checks are not yet conducted leading to conflicts between the EU and the UK.

It is possible to export lambs; beef; dairy produces with couple more veterinary and sanitary checks. In a context of reduced production in the last couple years and higher demand there has been little impact on trade flows and purchases from buyers.

Outside of the EU focus, many existing FTA have been rolled over with other countries across the globe (e.g. Japan), few new deals have been concluded, the flagships being the Australia and New Zealand ones. Those remove some key import tariffs and quotas for agri-food products putting UK dairy and meat producers in direct competition with them (Senedd, 2022).

While the deals will take effect in December, the removal of tariffs will be relatively swift and research show the small economic impact (Senedd 2022) but the consequences on the agri-food sector after modelling by Defra shows that the impact will be borne more by devolved nation than England (Defra, 2022). Since the start of the Ukraine-Russia conflict, tariffs and quotas have been waved on its imports with more competition on Poultry produces.

With Brexit there has been an increasing number of restrictions (Visa requirements). It is true for agricultural workers being allowed in the UK for seasonal work on farms, but also more widely in the sector combined to the depreciation of the pound this has represented a less interesting context for EU workers (AHDB, 2022 and EU Commission Research, 2021). 47% of vacancies were hard to fill in agriculture and there were 5,2% of non-UK EU workers in agriculture in 2015 (ONS, 2015 and AHDB, 2016), particularly on larger holdings according to fieldwork. In Wales few seasonal workers are needed due to the farm structure and farming types.

- **Brexit and state-support to agriculture**

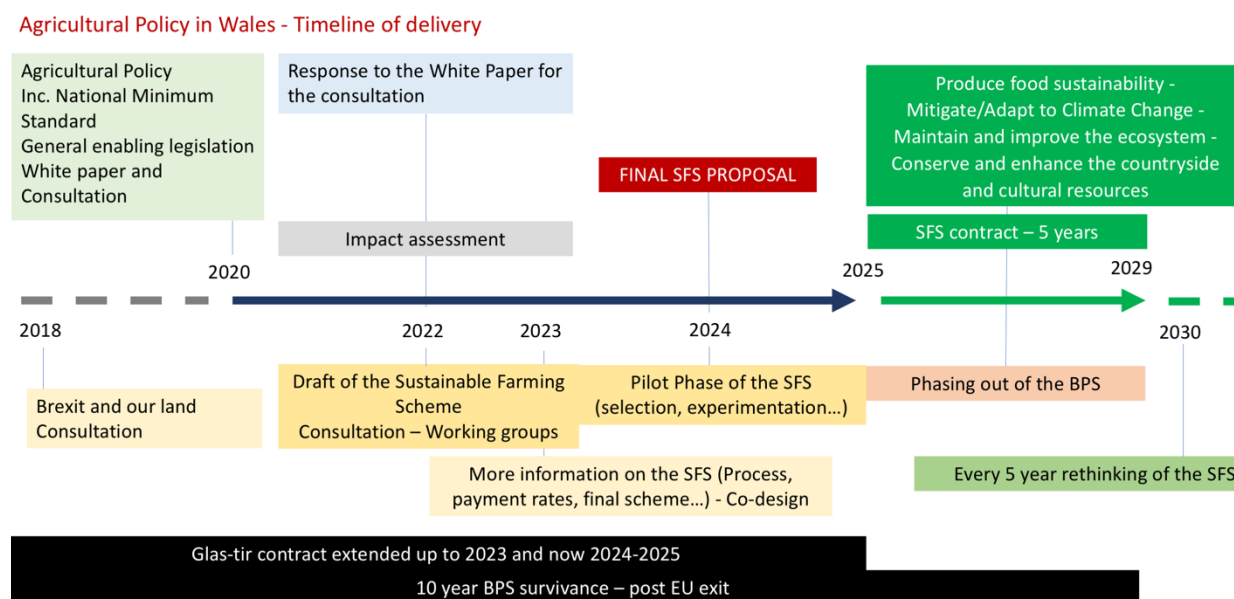
With Brexit it is also the end of the CAP although it had been devolved extensively across the UK nations, without a common framework the policy goals and measures are set to diverge, the common point being the funding coming from the UK government through a settlement with Westminster. For example, in Wales the white paper, the Welsh Agricultural Policy has pledged itself to hold to high regulatory standards combined to a “holistic” vision of agriculture, Scotland is following the broad structure of the CAP 2021, Northern-Ireland has chosen a very similar structure to the former CAP, England is developing a scheme focused on payment for environmental goods. The four nations’ goals in terms of agricultural policy are extremely different (AES Conference, 2021), and their policies will represent some potential competition imbalance across the UK in farming.

England and Wales are set to remove any direct payment for income support to farms in the future contrary to most of the EU, Scotland and Northern Ireland. But for the moment, the increased border checks hampering trade are only applied in one direction to the EU.

- **The Sustainable Farming Scheme an innovative scheme:**

The goals behind farm support has been questioned once again, most of all the income support element. The innovative policies, the future Welsh agricultural policy features a more balanced vision than the English ELMs policy with the goal of a sustainable farming sector, due to the importance of the sector for Wales as shown in Lenormand et al. 2022b or Welsh Government statistics. It combines environment, social and economic goals; food production among others. The scheme has been the result of a process of development that started after Brexit engaging farmers and the agricultural, food and environmental sector (Cf Figure 3). It is not clear whether it will replace the RDP scheme but the Sustainable Farming Scheme will be a rolling five year scheme.

Figure 3: Timeline of the development of the Welsh Agricultural Policy and main goals (By the author from the Welsh Government)



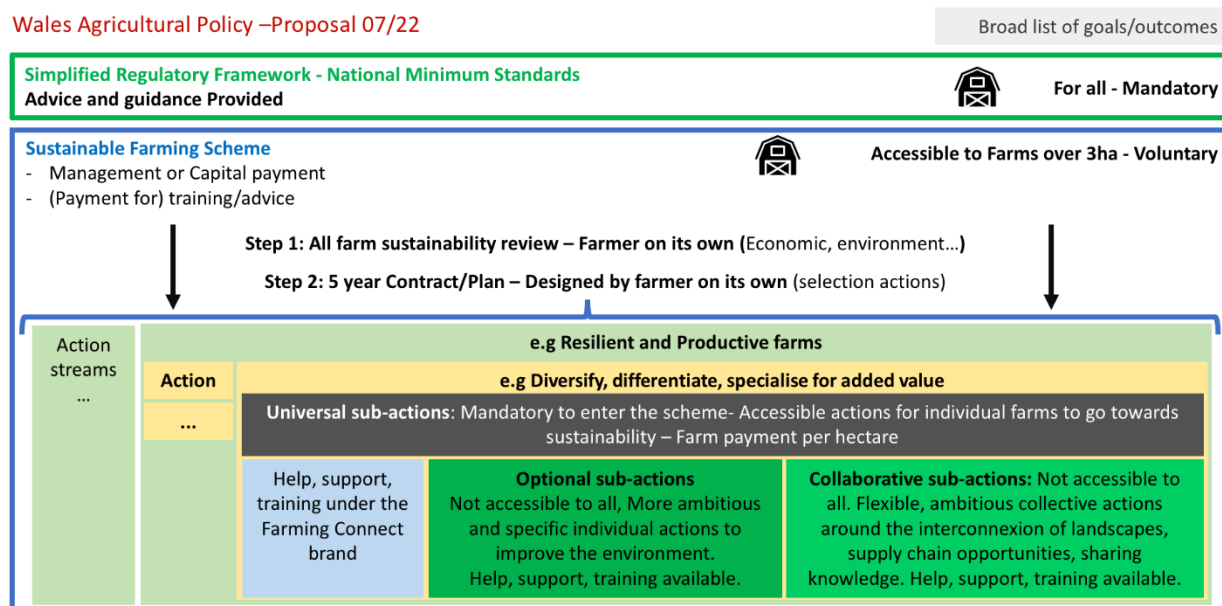
Among the principles of the sustainable farming scheme (SFS) of the Welsh Government we find: keep farmers on the land, food production is vital, a prosperous agricultural industry, open to all, a simplified, stepped approach, and finally a clear link between scheme actions and the outcomes of the “Sustainable Land Management” principles. Payments will only be awarded to go over the regulatory baseline and nothing to comply with it will be added in the scheme. A decision to put against the he Water Resources (Control of Agricultural Pollution) (Wales) Regulations to all of Wales (Nitrate Vulnerable Zone) or the will to preserve farming standards overall.

- **How to access the scheme, a more demanding process for farmers and the administration (Figure 4.)**

The SFS scheme in general tries to deliver on a wide range of objectives which makes it quite challenging to design and if it must support farmers in a range of conditions including helping to create a sustainable sector. The scheme is aimed at farms over 3ha which limits the impact for horticulture, one axis that the Welsh government has been keen to develop but only supported via capital grants at the moment (Welsh government, 2022). After doing a sustainability audit of the farm on their own, farmers will be able to apply to the scheme. It has already been recognized that some training might be required, and it is likely that many of those audits will be operated by advisors. The Welsh government made clear that the scheme was not meant to support regulatory alignment.

Looking at the scheme framework there are 5 different action streams (Table 5) in which there are different levels of actions for farms. Some universal actions, any farmer willing to enter the scheme has to do the 12 of them for a baseline payment (payable per hectare). Some optional actions to earn extra payment in exchange of targeted actions. Finally, collaborative option where there has to be a landscape wide interconnection with farmers and stakeholders, some flexibility has been built into it. Actions will be either, normative; e.g. have a certain acreage of woodland/registering in a scheme or management elements; “managed according to forestry UK guidelines”, conservation elements and even capital works.

Figure 4: General structure of the future Sustainable Farming Scheme in Wales (By the author from documents from the Welsh Government)



The payments and support can be of different kinds either management payments, capital payments either for tools/building, technical advice and tools being provided. Little has been said about how the funding will be split or how collaborative actions will work (will it be a competitive process?). But the key headline figures from the SFS draft document were focused on a 10% tree cover requirement, a 10% ecological interest area, a controversial take for most unions and farmers (NFU Cymru, 2022) albeit it appears to be more akin to land sharing than sparing, integrating different usage under the same structure and not necessarily exclusive of other uses (if they comply with restrictions). The SFS offers as in the former 2nd Pillar agri-environment scheme a tailored solution for every farm. We also note that the scheme tends to try to rely as much as possible on existing elements of the Welsh CAP, most notably the farming connect advisory service, the Rural Payment Wales agency and its tools, the structure around every option that could be very similar to the AES or the contract length.

Finally, we note that there is no mention of organic farming, of any young farmers scheme and any reforms in other agri-food element, the Welsh Government has also bought farms for afforestation (Lenormand et al. 2021). The funding settlement for agricultural policy funding will be awarded every year, its case debated against other priorities, but it seems that most option will be paid on the hectare or by the option (Welsh Government, 2022). Wales has a limited political leverage in Westminster in terms of MP seats and due to its relative political opposition, it does not show as many independence challenges as Scotland, hence the need to make a reliable and efficient (in terms of proven to deliver) case for the scheme.

The split in terms of options shows how important the ecosystem protection will be in terms of goals, it represents more than half of the actions and half of the universal ones. It has the most optional and collaborative actions as it needs to be more localised. This split seems to show a strong environmental direction of the program, but after a classification by the authors of each option within Social/Environment/Economic potential impact showed a relatively balanced 18, 23, 26 split.

- **A challenging scheme to operate?**

There are a number of challenges for the SFS aside from funding that remain around potential bottlenecks despite the choice of proven solutions by the Welsh Government for a number of elements; the advice necessary, the amount of material/contractor's hours/plants/seeds required are consequent and if not phased risk clashing. Beside we note that very little research is built into the program while several elements require it, for example around: breeding traditional animals, developing plant varieties, economic analysis. Finally, it remains to be seen the details of some options that could significantly cut the production potential of some farms or making them commit on some constraints in the long term.

Given the actions based analysis we think that the scheme manages to keep balance within its different goals despite major uncertainties around several actions and elements limit potential for investigations.

1.3 Research Questions:

We are witnessing a succession of drivers at different scales that impact farming at different scale, sometimes further than they already did, challenging the sustainability of farms. We will try to explore how those drivers are felt in Welsh farming taking into account its diversity including the possible clash between short-term challenges that have accentuated we would like to analyse the operational and resilience capacity (economically, socially) of farms in this new environment. We will also try to understand how the scheme could impact Welsh farms.

Finally, the current operating environment, notably in terms of resource availability, has been very volatile due to among others covid, geopolitical calculations by primary resource producers, and the war in Ukraine, directly relating to longer-term political choices at a wider scale. How will it combine with the policy context and impact farms.

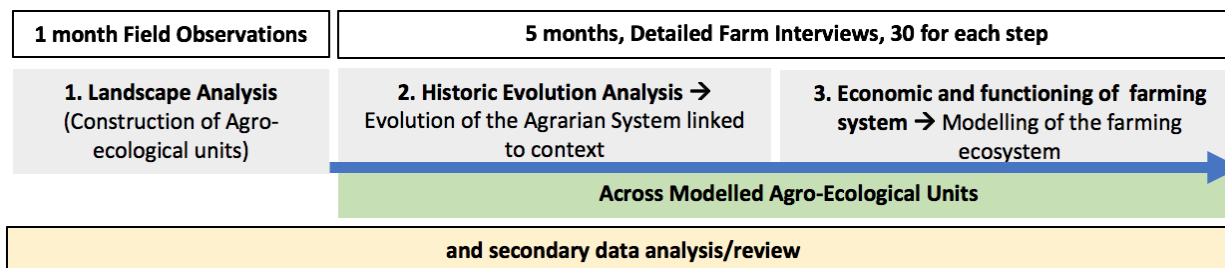
To answer our research questions and while considering the specific new Welsh agricultural policy, with its specific and farm-focused actions, large scale studies would struggle to model the changes that would take place. The goals of the policy are to change the direction of the processes of agricultural development, steer the direction of the farming sector towards sustainability. Possibilities and limitations are context-specific and linked to the environmental and socio-economic context, therefore explaining how important understanding the diversity of welsh farming would be. A systemic approach would be needed to integrate those elements and understand the factors that impact the evolution of farming and the agricultural development processes. What is their position in the welsh agrarian system in all its diversity. We could then make some evolution hypothesis from this detailed, integrative and systemic understanding.

Research method: The agrarian diagnosis to study the local impact of multi-scalar challenges and the comparative agriculture method to integrate them at an all-Wales scale.

To understand the possible impact of the Welsh government schemes we need to make sure that we take into account the environmental, economic and social determinants of farming in local areas as well as integrating this with history, culture, policies or the wider context at different scales (Cf Figure 5.), as a result the comparative agriculture theory and its core method the agrarian diagnosis was used (Cochet and Devienne 2007). This enables a holistic, agrarian systems-based approach to understand the logic and its evolutions in small agricultural areas; hence highlighting in detail the challenges impacting farming and allowing us to study impacts of change in detail. This was described in more detail in Lenormand et al. 2021. To reach this

goal, the field study features three successive and interdependent steps (Figure 5.); this in order to precisely define the agrarian system and its evolution; a tool explaining the way the milieu is used by agriculture mode of exploitation of a given environment and its evolution through time in relation to social, cultural, technical and economic systems, it has an integrative function (Cochet, 2011).

Figure 5: The agrarian diagnosis - detailed study of a small agricultural area (the authors, from Cochet and Devienne 2007)



But as a result of our research questions we would like to be able to join up and compare the challenges of our different study areas in their different dynamics, to be able to conclude at a Welsh scale on the policy development process (Cochet and Devienne, 2007). The challenges and the (potential) impacts we are trying to understand are localized, and will differ depending on the development context.

After a literature review (farming type, agricultural evolution, agro-ecological conditions), and a simple statistical analysis of small agricultural areas' farming characteristics, we selected the CS areas to reflect the diversity of Welsh farming landscapes and the nature of agricultural evolution in Wales as well as the range of agro-ecological challenges; two upland and two lowland areas (their precise location is given in Appendix 1).

- **The South Pembrokeshire study area** (studied in 2019) is located at the south-western tip of Wales: it is a coastal lowland broadly representative of South Wales. The study area covered a diversity of bedrock and a gradient of oceanic influence from Narberth to Castlemartin. South Pembrokeshire (Pbs) is a hilly lowland area under 200m of altitude with a “*bocage*” landscape¹ typical of West Wales lowlands. A gradient in climate combined with soil diversity enables a range of typical Welsh lowland agricultural production including milk, beef, sheep and potatoes. Pbs farming is very much focused on livestock and grassland.
- **The Bala area** (studied in 2020) is an upland area isolated and sparsely populated that sits on the borders of Snowdonia National Park, where farming is the dominant activity along with tourism. The lush, wide alluvial valley transitions up to green hills to reach large expanses of open mountain. The combined agro-ecological constraints (climate, relief, soils...) for farming are significant, and it features a range of beef and sheep family farms not much integrated into supply chains.
- **The Vale of Clwyd area** (studied in 2021), is organised around the Clwyd river and has a high production potential and a favourable micro-climate. It is surrounded on three sides by smooth hills transitioning to smaller open mountains that represent a gradient of conditions. There is a bigger diversity of production systems here, with different levels of outputs and integration (from high-yield dairying to extensive beef and sheep).

¹ a landscape with fields delimited by tree-lined hedges and lots of grassland

- **The Cambrian Mountain Area** – Elan Valley (studied in 2022) is organised around the Wye valley and the Elan Valley, an upland smoother than Bala’s landscapes, with lower altitude differences in the landscape but a less lush alluvial valley due to its higher altitude and very impermeable bedrock. The climate tends to be only slightly warmer. The expanse of mountain land is as important as in Bala. The area is focused on traditional grazing livestock but also features poultry units and significant tourism activity.

We use these case studies to highlight the challenges in different Welsh landscapes building from a farm-scale understanding (socio-economically, characteristics and agrarian system and environmentally). The detailed farm archetypes identified for each study area represent production systems within our study areas agrarian system, the baseline from which to study possible effects of future Welsh Government agricultural policies. These archetypes represent working farms characterized sociologically, economically and from a farming operation point of view, serving to provide an integrated unit in a modelled agrarian system.

2. Challenges: A make or break moment for a dualized and polarized farming industry

The challenges identified in part 1. could be categorised in three different categories, firstly those deemed as in the very-long term ones, that represent constraints to work with and to integrate in our work, most of them linked to history or geo-physical parameters. Then there are long to medium-term challenges which are more flexible and can still evolve marginally, and finally, we highlighted short-term challenges or shocks. The economic and environmental sustainability and high reliance on inputs is one challenge of the Welsh sector, a first step for us will be to try to assess the potential changes required on farms with the future Welsh Government scheme and whether they would make any change for this challenge. A second step will focus on short-term issues, again around the risk to lose farm with the current inflationary context, tenant farmers that could be excluded from the scheme or tree-planting both reaching the threshold of the SFS and potential competition.

2.1 What would be the impact on farm economics and farming system of this new scheme in different economic environments

The current context around farming is an interesting case-study to check the possible answer of future policies in those, as in the UK we moved from a context of relatively challenging agricultural prices before 2019 to higher agricultural prices but with inputs costs gradually increasing (HCC, 2022 and AHDB, 2022)(Cf Appendix 3).

We collected a range of different farm archetypes from the study areas to look at the possible impact of the mid-term impacts, we focus our analysis on 9 different archetypes, this allows an ease of representation while still including very different production systems representing part of the diversity of the Welsh farming ecosystem - all those originate from my fieldwork in Wales:

- A valley dairy spring calving herd with 500 Dairy Cows mostly flying herd (that could be a joint-venture, a nuance of sharefarming), a result of the development of Dairy Spring Calving farms (DSsC)
- A hill dairy heifer rearing farm with some sheep (that is linked to a lowland dairy farm) – Family Farm (FFM) (Bala)
- A beef breeding to finisher with some sheep holding a strip of land (bottom of the valley to top of the hills – rough-grazing) – Plas type, large home-style farm (Vale of Clwyd)

- An organic beef and sheep farm holding all the different categories of land but with a high and rough mountain profile. – Large FFM (Bala)
- A beef and sheep farm with a large hen unit with access to mountain land– Large FFM (Bala)
- A small holding with Beef and sheep selling locally but also rearing some calves to top up its income – Tenanted smallholding (SMH) (VoC)
- A small holding with sheep and a small hens shed selling locally – Tenanted Smallholding - SMH (Bala)
- A family dairy farm of 200 Dairy Cows based on grass mostly – FFM (Pembrokeshire)
- A family beef finishing farm with a 100 head with a high level of autonomy – FFM (Pembrokeshire)
- A potato farm Plas type, large home-style farm (Pembrokeshire)
- A small valley organic dairy farm with 90 Dairy Cows with a mixed rotation and already autonomous – (Vale of Clwyd) FFM

We want to test the future scheme structure in different economic environments, a reference environment, a future scheme one, a high inputs cost environment and finally a high output price. We take the assumption that level of funding and the split between landscapes will remain similar given the SFS draft, our horizon is 5 years, the duration of the scheme.

General assumptions :

We make different types of assumptions; some general assumptions regarding the economic and market context; that the investment context will remain favourable in the short-term with low real interest rates (Bank of England, 2022). The current trends in milk and meat markets will continue, in terms of price and volume, a low reduction in demand and supply. On market prices we assume that low input prices will occur when prices are low and that high prices would concur with high input prices (mirroring trends on commodity markets and sellers' pricing strategies - from fieldwork and secondary analysis, FAOSTAT, 2021). For ease of representation with former case-studies we will be working in £2018.

In terms of assumptions around the future scheme; We made some general assumptions around the scheme budgets with similar levels but discounting transaction costs. For example, there will be a baseline payment 10% lower than the BPS today in Wales linked to administration cost, there would be similar rules around the redistributive payments for lack of political acceptability of differential mountain payment rates (as seen in 2013).

Compared to Lenormand et al. 2022 we modelled the optional payments differently to better represent the action based vision behind the SFS, therefore the payments are a function specific to each archetype to represent accurately the balance of options retained between; farm features to maintain through management (environmental, historic), additional management work that could take place on holdings (habitat creation, water condition improvement) and payments for capital work that could take place. We do not plan the impact of the collective options, we take the assumption that they would be dealt separately.

We also chose to have some knock-on assumptions to accurately model the agrarian system; with the new scheme we expect that renting-out farmers will not be able to operate anymore, nevertheless this will trigger an increase (5-15%) in rent incorporating part of the subsidy

payment depending on the location. Farms renting previously with precarious leases can now get the subsidy. We also took into account extra needs in terms of land to adapt to the regulatory context (evolution of NVZ rules). We operate all farms with a constant workforce without any major work productivity gain in the first 5 years of the scheme.

We considered a requirement for the scheme with 10% tree cover and 10% for biodiversity management for all farms to enter it. We considered the area available on each farm for optional actions. An action plan was designed for each farm to be included in the scheme (Cf Appendix 4). Other assumptions to construct the scenarios are developed in Tables 7 and 8.

Table 7: Market scenarios retained (By the authors from interviews and farmgate input/output price evolution analysis FAOSTAT/AHDB and Lenormand 2022)

Scheme – From basic CAP data of the study areas, combined with the SFS draft policy	
Hypotheses	Funding constant. Farmed area constant. Transaction cost, 10% for the Universal and 20% for the optional scheme
(% of the land)	20% of the farm as tree planted or high ecological value 60% Universal 30-35% Optional 5-10% Collective
Universal Payment	+ £110 ₂₀₁₈ /ha Double the rate on the first 54ha
Optional Payment	+ £30-100 ₂₀₁₈ /ha management payment Function with higher payments rate than glastir, modelling more finely the balance in terms of option between work and features. By focusing on the available labour on the farm and the farm acreage we create a balancing function taking it into account. + £200-1200 ₂₀₁₈ /ha Payment for capital work depending on labour available, retained by the farm

Table 8: Market scenarios retained (By the authors from interviews and farmgate input/output price evolution analysis FAOSTAT/AHDB and Lenormand 2022)

High Prices	Low Prices
Milk: 126% - 38 pence/litre*	Milk: 95% - 26 pence/litre*
Sheep: 130% - 95 £/lamb*	Sheep: 90% - £79/lamb*
Beef: 120 % - 1200 £/Store*	Beef: 90% - £950/Store*
Hens/Poultry: 110:%	Hens/Poultry: 110:%
Input costs: 130%	Input costs: 100%
Average price given by farmers depending on their product characteristics, in interviews.	Market conditions selected as gathered from literature and interviews.
*Prices are purely indicative and do not reflect output pricing in the archetypes – prices do not represent top of the curve but more sustained levels	
**All prices would be converted to £2018 afterwards	

Like in Lenormand et al. 2022d we retained 4 different scenarios to test on the farm archetypes mentioned above. The scenarios are as follow:

- Scenario 1: CAP Reference Policy with high Prices
- Scenario 2: CAP Reference Policy with low Prices
- Scenario 2: New policy, the SFS with high prices

- Scenario 3: New policy, the SFS with low prices

In the archetypes we tried to adapt them at minima to mirror the stability of farming systems over time, we deemed that the stability of farms in their environment would lead to a relative stability despite the changing context mirrored by the scenarios.

Results

- **General observations on the economic performance of farms in the reference situation:**

In general the rate of dependence on intermediate consumption on modelled production system tends to be high, seldom under 50% of the archetypes output value for each scenario, it goes up in the low price scenario compared to the high prices, by 10% for high inputs user and more 3-5% for the lesser users.

As a result the added value per worker (Cf figure 8) showing the different level of labour productivity of the economic activity of farming and the added value is a measure of economic efficiency compared to inputs use, and this regardless of the access to production factors (e.g. land) or subsidies, its levels are under 39% of the farm raw product for all except high value added productions, but interestingly not poultry. The low price scenario is dramatic with all added values falling by 7% for low inputs and 15-18% for high inputs.

The farm income as a result depends more heavily on subsidies for all systems in the low price scenario which really, represents a situation of crisis with lower incomes per family worker but also extremely high volatility for all systems, the most stables being supported by integrated hens shed (12-17% swings compared to the 2019 reference), while high inputs high outputs have 70-90% swings, low inputs low outputs only feature 40-70% swings. The subsidy share in the agricultural income is traditionally around 10-30% for high output but can rises by 10-20 points, for low output systems it will go up by 30-40 points on an already high level, over 50% but as high as 80% in our case for beef and sheep farm with mountain land. Farm income drop under the £20K threshold for the smallholding in the low price scenario.

Overall, we showed that the archetypes are more sensitive to outputs price evolution than inputs price evolution as a result of the low margins in the sector that are reflected by the low price scenario, with high prices for output retained in the scenario 1 generating more economic value. It also shows the volatility of operating conditions and economic results on farms with low prices challenging all farms

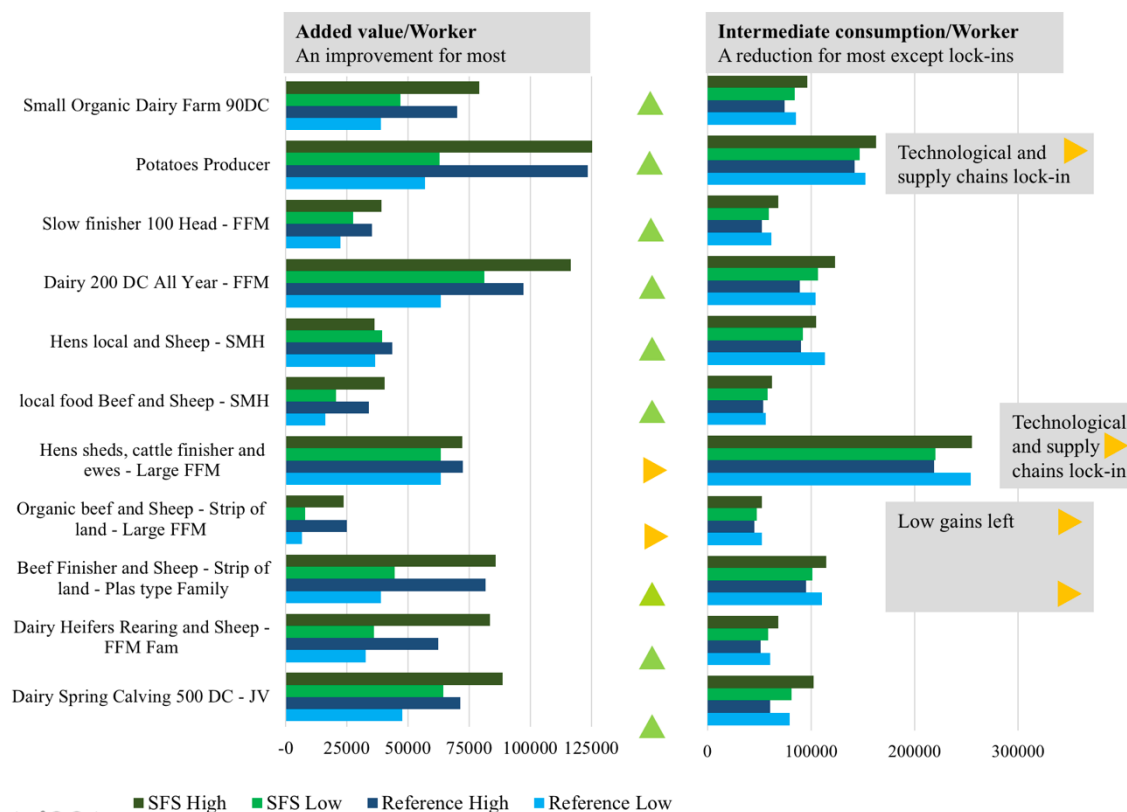
- **The SFS could improve the economics of Welsh archetypes and the inputs reliance:**

The results show that the operating constraints would be kept at a minimum for farms, some would have very little to adapt to enter the SFS scheme and could have most of the area built into it.

In Figure 8 we note that the intermediate consumption on modelled production systems tend to be down or similar in the scenario with SFS compared to the scenario without, leading the farms to more autonomous production system by input substitution. It represents a lesser share of the Raw Product, as a result the impact of the volatility is reduced. Lows in inputs cost with the SFS are not as low but neither do they go as high. More significantly so in the case of high inputs “high productivity per animal” systems that were not autonomous before (e.g. dairy or beef finishers, while there is a lesser impact on the already-autonomous slow finisher 100 Head) or on high input highly specified system that cannot switch to other inputs easily (e.g.

hens that have a technological lock-in or potatoes despite significant adaptations). Benefits are low for farms that had already adapted.

Figure 8: Comparison of the Added Value/Worker and Intermediate Consumption/Worker in £2018 in the reference situation and with the scheme in two scenarios (from the archetypes modelled from the fieldwork)



The share of the farm’s output spent in intermediate consumption goes down in every case except for organic farms and hens producers. From 10% for high inputs users to 3-5% for low inputs users or where there is little margin (organic farms already autonomous). The difference between high and low-price scenario goes down for this metric showing the reduced reliance on volatile inputs.

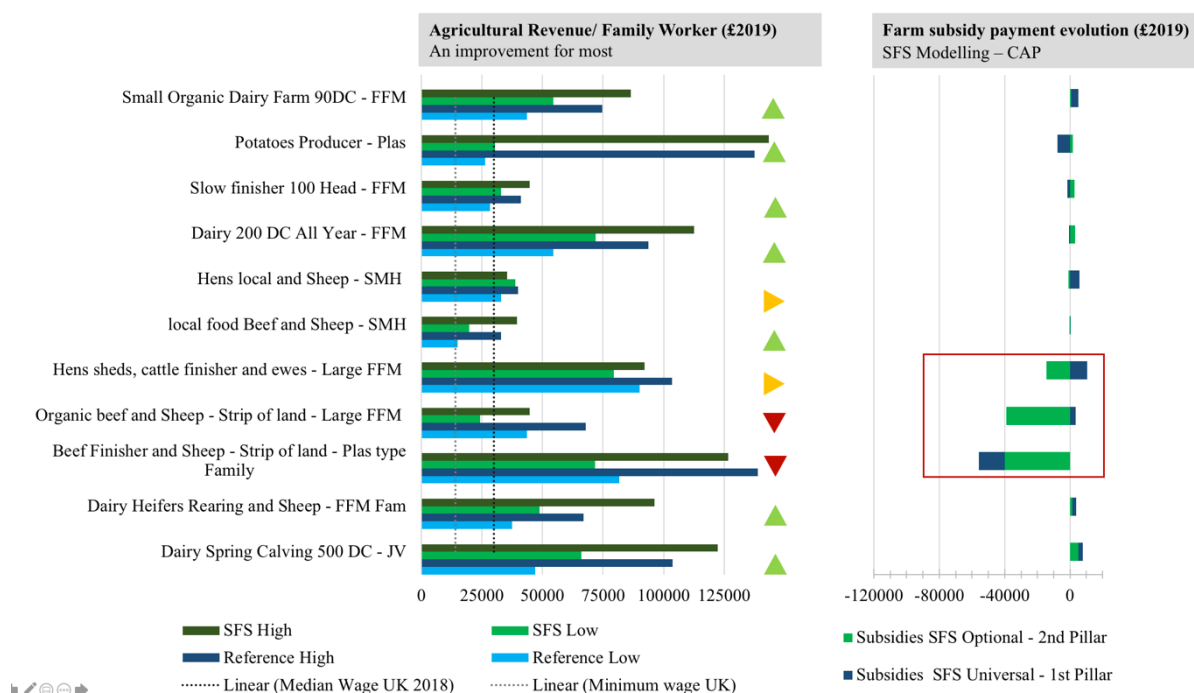
Looking at the added value, all modelled systems rely heavily on family labour, only the blue-squared, high added value production system require paid workers (more than 1 FTE), all our systems use hired-in labour built into inputs cost. In all cases except the already autonomous farms (that had a strategy in place – green circles) the results tend to be better.

Overall, the results of this first step of the SFS could be positive, it improves the economic performance even on the low added value production systems, we nevertheless note that supply chains or technological lock-ins prevent some farms to adapt. For example; poultry farms in integration cannot easily substitute home-produced food for their highly technological units and livestock, dairy farms with specific contracts in terms of levels of fat, protein, production profile might also struggle to achieve this substitution. We note that the most radical transformation result in the greater changes although it takes time to implement. For example, our 200 DC dairy farm would probably take a phased approach, working on the yield, its contract, grazing before moving towards land-use change; a 5 years project. The gains in terms of added value are impressive, from 5-15% for high inputs productions to 3-5% for low inputs users.

- The agricultural income and farm subsidy payment evolution with the SFS:

As we showed before given the low added value of some farming systems subsidy payment are an important component of farm’s agricultural revenue. We will now analyse the evolution of those two elements in our scenarios in figure 9.

Figure 9: Comparison of the Agricultural Revenue/Family Worker and evolution of the farm subsidy payment in £2018 in the reference situation and with the scheme in two scenarios, (from the archetypes modelled from the fieldwork)



Most farms would not lose out as a result of the new SFS scheme being implemented in terms of subsidy payment, with low gains for most small and medium-sized farms, representing their ability to commit to scheme actions and capital elements of the scheme (particularly interesting for seasonally heavy archetypes like potato farming or spring calving). However, there are losers large extensive farms with low amount of workers, albeit less-so than in Lenormand et al. 2022d.

Looking at the universal element of the funding, as it is now fully decoupled from landholding and linked to specific management actions, farms can retain their subsidy payments, albeit rents have increased which feeds through in the income; farms in this case would be high added value farms compensating for the drop in universal payment compared to the BPS. Those who lose out the more are large farms as a result.

In terms of optional payment there is a significant drop for large farms that had Glastir or Organic payment, the payments are now based on practices and management actions with a rationale around cost of the elements and capacity to do some work. These low-staffed extensive system with already a high productivity per worker are limited in terms of possible options in that case. We note that the small organic farm would only have a small loss, as a result of its capacity to commit to more management options requiring more labour.

The impact on the agricultural revenue from the scheme is limited, most implementing the scheme would benefit from it, with reduced volatility (from input-use reduction) and increased income. Very often more linked to the input-use reduction, with a knock-on increase in terms

of added value, but subsidy payment play a small part in it. The losers remain organic farms and very large farms with lots of mountain land due to the subsidy redistributive element due to the action-based payment.

The income increases the most on dairy systems or heifers rearing even with a production reduction. Potato farming is close behind albeit with very deep transformations. Steps towards autonomous systems are important to improve the economics of farming system even in a difficult environment focused on commodities as we didn't change the output types or the general systemic organisation as much as pure enacting a pure input substitution.

The reliance on subsidies for the agricultural income shown in Appendix 5 is lower on nearly all farms, there are virtually no change for small farms. The less positive results would be on technologically locked-in poultry farms with little margins and slightly higher costs with the SFS or the large extensive farms that have simply not enough margin to reduce cost anymore.

- **The SFS successful in terms of economics by retaining a phased approach?**

To conclude in terms of economic analysis from the Welsh entity point of view the reduction in terms of fertiliser use by 10-25% depending on farms, the reduced imports of cake from 10-25% depending on farms is overall beneficial despite the necessary increase in seed, fuel, machinery and possibly trees imports required to get to this point.

Our choice of design also had the benefit to reduce subsidy payment imbalance from a 22 multiplier to a 10 multiplier per family worker. Nevertheless, we recognise that in this case it created additional hardship for organic farms and large extensive mountain farms. While in Lenormand et al. 2022d we questioned the absence of organic payment it seems more interesting to focus on the low value of extensive farm's output or the fact that many farms could not commit to more labour intensive measures and rewarding measures with the lack of resources.

The more changes taking place, the more benefits there would be in terms of economic gains, but quite often it will require a supply-chain wide approach be it for the outputs – to accompany the changes or validate them, e.g. potatoes sizes, heterogeneity, time of delivery... - or the inputs – right amount of inputs available and adapted to the local conditions-. Further progress will require further supply chain adaptations and consumptions changes.

The root of the problem is not addressed fully, the added value levels only increase due to inputs adaptation but the agricultural revenue can still be low in low prices market conditions as shown by the farms close to our threshold in figure 9. Possible options to increase the raw product and limit its volatility can be found in: differentiating food products is a possible route, for example with certification organic or product of designated origins, diversifying income sources to increase added value for the farm can be interesting but is place-time-specific and the bulk of the output will face more difficult market conditions and the discussion around those has not been open.

Inputs use will only be compressed up to a certain level without further sector-wide transformation in Wales, for example around fossil-fuel consumption and reliance on imported machinery.

What this work shows is the interest of a phased approach, the labour available is limited on farms and archetypes are optimised in terms of labour available compared to the management required, at first incentivising inputs reduction could deliver economic benefits for nearly all farms giving more breathing room, before turning to other elements. A phased approach, with a continuous improvement from farms to the wider sector through time could be imagined.

2.2 Short-term problems clashing with the medium-term vision:

But in the shorter-term, as showcased in part 1, the coronavirus and the Ukrainian War that have led to supply chain issues, fear of shortages, high volumes of monetary inflation, high market volatility for many agricultural commodities and key agricultural inputs (FAOstat, 2022).

Those immediate challenges pose a risk as they can be difficult to negotiate when already anchored in past developing factors that constrain and limit farming system evolution. We will also question clashing challenges and land use for example the need to increase carbon sequestration to respond to the climate emergency.

Positives and negatives can be seen from this situation, i-e further incentive to reduce inputs use to accelerate the uptake of sustainable system farming system. But will farm be able to survive immediate shocks. Since 2020, no specific policy instruments have been introduced.

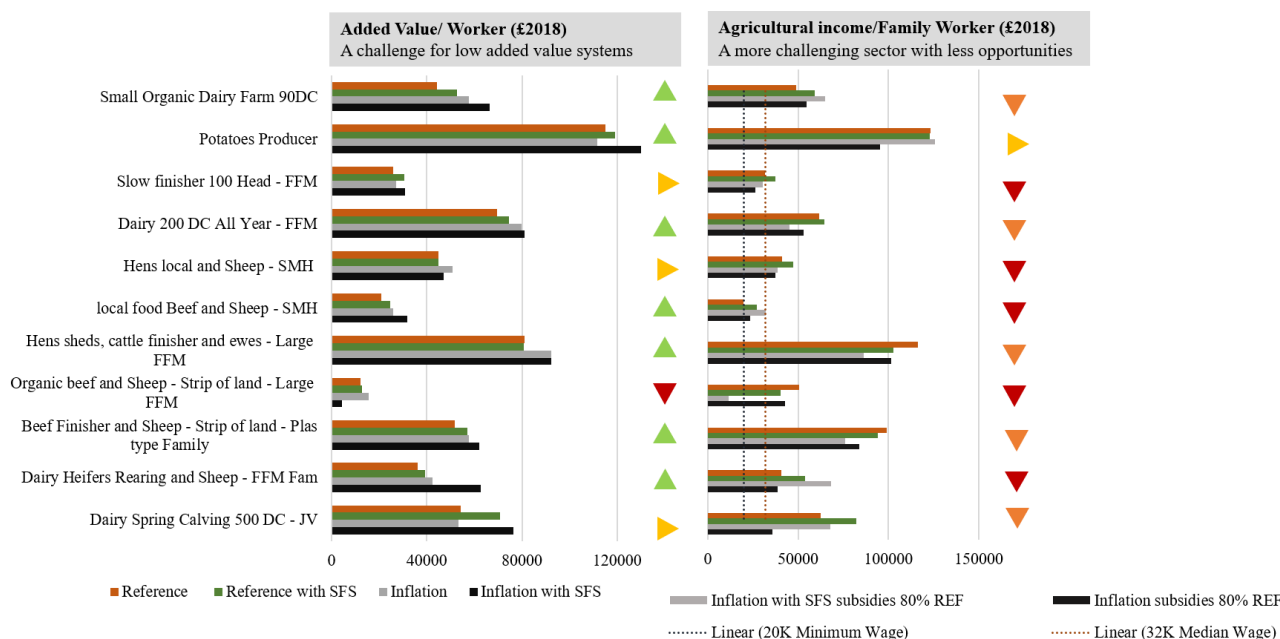
In order to analyse this following the example of 2.1, we designed different scenario to test the how solid the archetypical farming systems above would fare in a short-term context (1-3 years); with even higher inputs prices, rising interest rates as well as limited increase in output prices due to a contraction in food demand on specific product, locally and worldwide. In that scenario we also downgraded the subsidy payment as a result of combined budgetary pressures and real-term funding reduction with inflation; a 80% reduction. In this context described in the table below, table 9 we compared it to a reference situation from 2019 in terms of prices.

Table 10: Different price evolution scenario detailed per production types (From an extensive secondary data analysis)(By the author)

Reference scenario and inflation scenario (Real-cut) - £2018 prices	
Output prices: Milk: 100→120% Sheep: 100→116% Beef: 100→116% Potato: 100→115% Hens/Poultry: 100→116% Subsidy Payment: 100 → 80%	Input prices: Fertilizer and fuel: 100→170% Cake: 100→130% Rent: 100→120% Workers: 100→120% Interest rate: 100→200% from a baseline of 2% interest rate

In this scenario, inputs prices rise faster while output prices tend to stagnate or go down slightly. We also decided to run the hyperinflation context in the case where we substitute the new SFS – the future policy of the welsh government- that we modelled to the current subsidy system. The context showcased apart from the subsidy reduction is more realistic versus the situation faced by farms today.

Figure 10: Agricultural revenue per family worker for a range of modelled farming system in 3 different cases, the reference level, the inflation scenario without subsidy cut, with subsidy cut and with the SFS



The inflation scenario is more challenging than the high price scenario, looking at the added value per worker, we note that high added value system manage to increase their added value which is not the case of low added value archetypes. In that case, autonomous production system are in a better position which is showcased by AV gains for all systems with the SFS except those highlighted above. Integrated livestock finishing unit tend to fare correctly with their high integration as they are in a supportive market.

But farm income is dropping substantially in all cases as shown in Figure 10 while in the high price scenario we witnessed mostly higher incomes in the part 2.1. Looking in more details, the one that suffer the most would be those with heavy investments and high input dependence; dairy farms, potato farming, particularly with very high overheads linked to past investments, high inputs or production factors consumption. In those case, archetypes that are self-sufficient fare better, reinforcing the argument articulated around the SFS. But another factor is the reduction in subsidy payment combined to the redistributive element, hitting hard the extensive farms on low added value productions.

The position of spring calving systems, particularly the late developed ones with their more expensive access to production factors could be difficult as the archetype is closing in to the economic sustainability threshold, including due to heavy debts. The low scale, local beef and sheep producers is the only one that could see a modest total revenue increase, linked mostly to low inputs costs and its low reliance on subsidy.

We note that the SFS implementation tends to help reduce the drop in subsidy and the impact of the economic context for farms (grey bar), albeit we raise doubts on the possible speed of the implementation on farms. The design retained and the payment cut would endanger large extensive low added value farms further, organic or not.

- Investigating the challenge around tenanted farms:

There were worries that tenanted farms might not be able to adapt to the future context, a fear repeated as they would struggle to fit in the scheme. To investigate the issue, we retained the low and high prices scenarios of 2.1 with the inflation scenario of 2.2.

We used 4 archetypes representing different conditions that existed in the field, in table 10, 2 archetypes were already fully tenanted in red in the table, 2 others could be mainly owned in orange; for the others it was unrealistic given their history that they could be tenanted, we have in our case 2 types of tenancy on the whole farm arrangements; either an AHA type agreement complemented by FBTs and more unsecure tenancies or a main long-term FBT and several other FBTs/more unsecure tenancies.

Table 11: Agricultural income per family worker for tenanted archetypes in different scenarios (By the author from fieldwork and modelling)

Status	Archetype	Reference 2019	Reference Low	Reference High Prices	Reference inflation
Now fully tenanted	Dairy Heifers Rearing and Sheep - FFM Fam	32727	27776	52307	26038
Now fully tenanted	Organic beef and Sheep - Strip of land - Large FFM	26965	17023	37129	7754
Now fully tenanted	Dairy 200 DC All Year - FFM	54873	47767	74310	45134
Now fully tenanted	Slow finisher 100 Head - FFM	22462	14550	27336	11693
Already tenanted	local food Beef and Sheep - SMH -	19631	10440	31059	22575
Already tenanted	Hens local and Sheep - SMH	41045	38719	44006	35367

Looking at the economic results in terms of agricultural revenue per family worker, it is interesting to note that the tenanted farms are more impacted by the high price scenario, with increases in rents than their non-tenanted counterparts. In those cases, all challenging scenarios have the farm incomes dropping under our sustainability thresholds. Beef and sheep farms, particularly the uplands ones tend to be in a more challenging position than the high added value productions, be it dairy or hens, even at a small scale. For the later, their results are still above the median UK income in all cases. There is a particularly high-risk for non-differentiated tenanted beef and sheep farms.

Nevertheless, the impact of farm being tenanted should not be overestimated, the challenge of buying land can weigh on the shoulders of a farm, particularly in a high inflation scenario. Where the challenges might lie for tenanted farms would be in terms of operational flexibility to fit into the schemes (change of land-use), securing the necessary funding (including loans) to adapt to regulatory elements or necessary productivity investments. Finally, the cashflow put against payment dates is very important for tenanted farms, this might further pressure them on the road to differentiation, more than diversification (given again, the restrictions in terms of operations/change to the holding for tenanted farms). We note that cashflow wise, beef and sheep systems tend to be more fragile in many cases than other production systems.

Considering those challenges for tenanted beef and sheep farms, some of those, guardians of the Welsh SEPLs (Lenormand and Morse, 2022c), the options are limited to add value with the

rented land restrictions, in a sufficient manner to remunerate the different production factors. For some farms rent increases might be purely unsustainable with the current mix of production.

- Tree-planting on farm, a matter of opportunity

On tree planting we had a careful look at the current small woodland tree plantation a scheme (Welsh Government, 2022). We took the assumption given the focus of the Welsh government that it was likely that the funding levels will keep covering expenses. We think it will keep running in the SFS in the future. It will be possible to plant 2ha per application window if retained, after 5 years it could be up to 10ha. It would represent very little for large farms but given that the average farm in Wales is around 48ha and that the median size is lower than that, it could already represent more than 20% of the farm. We estimate that this programme acknowledges the fact that large farms often already hold some tree-planted land (validated during fieldwork) and that it is aimed at smaller farms.

We used the Welsh Government assumptions in terms of payment levels over the next 12 years, around £410/ha (management and loss of income), we then looked at lowering the payment in case of a shortage of funding or a non-compensation of inflation (£235/ha), we increased the payment by 50% as a way to approximate farms that farm with low inputs with a sustainable system and good quality land, like the organic dairy farm of 90 Dairy Cow economic performance of around £600/ha. £615/ha represents an increase by 50% of the payment level.

We considered two scenario, the reference one and the low input low output representing the more challenging conditions for archetypes as shown above.

Table 12: Economic results per hectare of the range of archetype studied in 2 operating scenario (Reference prices and Low Input Low Output prices), the results have been colour-coded (By the author from fieldwork)

£2018/ha	Added Value/ha		Agri Rev/ha	
	Reference	Low prices	Reference	Low prices
Dairy Spring Calving 500 DC - JV	1712	1443	821	520
Dairy Heifers Rearing and Sheep - FFM Fam	452	388	509	447
Beef Finisher and Sheep - Strip of land - Plas type Family	207	137	297	226
Organic beef and Sheep - Strip of land - Large FFM	87	37	272	219
Hens sheds, cattle finisher and ewes - Large FFM	810	755	775	720
local food Beef and Sheep - SMH - Tenanted	2082	1160	1963	1044
Hens local and Sheep - SMH - Tenanted	1493	1403	1368	1291
Dairy 200 DC All Year - FFM	2033	1843	1540	1362
Slow finisher 100 Head - FFM	369	253	452	339
Potatoes Producer	2215	994	1424	181
Small Organic Dairy Farm 90DC	694	601	765	678

Large High Yielding Dairy farm 400DC - FFM	9443	8244	5587	4320
Colour coding £/ha	<235	235-410	410-615	>615

Added value

Looking at economic performance shows that high added value producers are unlikely to go for the tree planting scheme, except for marginal land that does not benefit directly the farming system. But from this point of view, a permanent pasture providing a "medicine field" – a drought resilient fodder production is directly benefiting the farming system. Therefore, we encourage farmers to consider the system logic before focusing on marginal areas. Arguably, less motorisation/mechanisation friendly are more likely to be selected first.

Those finding it interesting from an economic performance point of view would be low added value systems (Green or Blue), mostly beef and sheep farm, particularly extensive producers, even if they must share the funding with a landlord (as showcased by the green option). For large farms, particularly in uplands they already tend to have forestry, they are used to deal with it which won't be as much the case for lowland, smaller farms. The interest for the scheme would grow in challenging market conditions as a way to make systems more resilient in times of crisis.

Looking at the levels of agricultural income per hectare would be one of wider interest for the scheme, particularly encompassing fully the lower levels of high added value productions; heifers rearing, small hen farming or small-scale dairy organic farming.

Despite the general economic vision and analysis not always supporting tree planting, there could be an operating/opportunistic logic to go in the scheme. For example, even with a high economic performance from the land in terms of added value, if this performance is not depending on the land directly it can be interesting – e.g. small scale beef and sheep or hen farming -. For tenant as shown above it could be potentially interesting depending on agreement with landlords, but it would be possible for most farms. As a result, it makes us think that due to the amount of work to do on each agreement, there might be either a bottleneck, or a one-size fits all approach from land-agents/landowners.

Finally, despite the economic rationale, we can consider the behaviour of farms; those trying to diversify and secure their income or compensating for a reduced activity on the rest of the farm, for example retiring; the potential to add up to £410 per hectare, let's say up for one farm taking it up one time adding £820 of income per year, a small amount but not a meaningless one, and a medium-term (12 years) security. Additionally, linking with our past work on the SFS, this would enable several farms to get in line or over the forestry threshold for entry into the scheme or to benefit from higher payments. It also questions whether those areas will be doubly subsidised. Something, which is unlikely in our opinion but will have to be clarified.

We then look at what the remuneration could be higher at market rates, some companies buying land to offset carbon at market rate over 10-15 year of a financial buy up are ready to pay (from fieldwork); roughly it amounts to £400-1000/ha (in 2018 value) without considering currency depreciation. We consider that the management would be relatively limited from those buyers. Those level of remunerations, in that horizon compete with the agricultural production or the Welsh government scheme.

Conclusion

The scheme as we have modelled it has the benefit of correcting some imbalance in terms of total farm subsidies by putting a threshold. This threshold could be adapted for farms with large number of workers to better take into accounts the different farm system context. The choice of scheme design meant that we noticed despite the 20% of the acreage either under trees or ecologically valuable there were definite improvement in terms of economic performance and agricultural revenue. Added value tend to be more stable if not higher and incomes depend more on subsidies and tend to be higher except for 2 production systems of our sample that are highly reliant on subsidies. More interesting are the input substitution that could take place. If those goals could be reached in the first few years of the scheme while delivering environmental benefits, it would be impressive. There were production reductions or productions at reduced specifications on most farms, from a food security point of view in a war context this could be a problem if rules are not relaxed within the supply chain.

Nevertheless, there could be problems for organic farms that rely on subsidies and produce “standard” products with little premium (beef and sheep) which could lead to many exiting the system. Farms that tend to sell products locally, SMH, fare well economically and do not depend heavily on subsidies because of their high added value product either processed or clearly identified on the market; the collaborative actions around supply chains could deliver many benefits by helping the sector to develop solutions to increase or maintain the farms economic output without adverse consequences on inputs cost. We acknowledge that our analysis is valid within a case where labour cost remains similar, which is unlikely to be the case in future months. As for now, the real labour cost has reduced. Another element difficult to assess is the impact on contractors of the scheme in terms of operating and additional needs.

The scheme as it is designed might have significant bottlenecks that will struggle to be resolved if the sector is not engaged in it holistically. For example, even with pilots scheme already existing around tree planting, the 10% threshold of tree cover on each farm might be a challenge to attain, do nursery have enough plants, is the production capacity adequate, is there enough training capacity, and fears that it might lead to a boom and bust cycle for contracting...

Additionally, many of the actions require a standard or their terms to be designed or selected among those available in the industry; for example, around carbon calculation, the choice will have to be evidenced. The Welsh Government has engaged in co-design and piloting its future scheme as shown figure 4 and it will be key to include the whole sector to have a scheme “accessible to all”, co-design groups have been pitched as the solution. Piloting could help with a bite-size approach to the scheme, stepping-up gradually the scheme. We believe from the results of this paper that focusing on objectives of improvements one after the other, for example building up hedges/trees for shelter and resilience, followed by an input reduction strategy that could deliver on environmental and economic benefits in the short to medium term.

It is necessary as the scheme current design constrains accessibility, for example due to tenancy terms it is not sure whether some tenant farmers could access the scheme, the 3ha threshold retained and the overall design of the scheme does not seem to be fit horticultural farming (that was said that it had to be developed in Wales). Going towards sustainability and decarbonation the scheme there is little to drive a weaning of from fossil fuel, protein. Those elements might be integrated in the future but they are not present at the moment, to resolve them a systemic long-term approach might be needed, for example reducing bought-in feed use might mean breeding livestock on new specifications and a change of policy from abattoir and buyers in terms of payment. Again, the collaborative action could offer some room for those operation but it might call for an easement of the vision around some option; for tree planting agro-forestry, orchard planting or wide and tall hedges could provide farming systems and

environmental benefits although not being directly considered as forestry. Without progress on fruits and horticultural products it is difficult to imagine the goal of improved food security being achieved.

There are blind angles to this policy the land market evidenced as a challenge will only be marginally impacted and generation renewal on farm will remain a challenge, the education sector is not mentioned. Finally, the scheme as such does not mention climate change in its operation which could be a real problem in terms of deadlines for farms. The 5 yearly timeframes could limit continuous adaptation to climate change of some on farm elements. We also notice the lack of research component that will be a problem to help build gradually the knowledge required to the future scheme evolutions or to drive/provide the tools for future adaptations to climate change or the scheme.

If not a revolution, this scheme is trying to deal with political and funding challenges for Wales, its orientation is positive, integrative, and certainly innovative when comparing it to other schemes. Current funding for farming was only politically ringfenced in Westminster by the Johnson's government until 2025, with a new prime minister and a cash-strapped government there might be some adaptation. The Welsh government is also taking a more careful approach to the transition to the future scheme compared to England. With that in mind current inflation (Bank of England, 2022) is driving down the real value of the payments gradually. For now, the focus might be to bring stakeholders around the current plans, evidence choose standards and specify the options while at the same time taking the sector on a learning curve, implementing gradually different ambitions into the programme within reach.

Worryingly, there would real losers in our modelling, large extensive farm and beef and sheep farms, often managing significant Welsh SEPLs landscapes. The scheme will struggle to match the interest generated by higher income generating options within its funding assumption even if it could deliver for the community.

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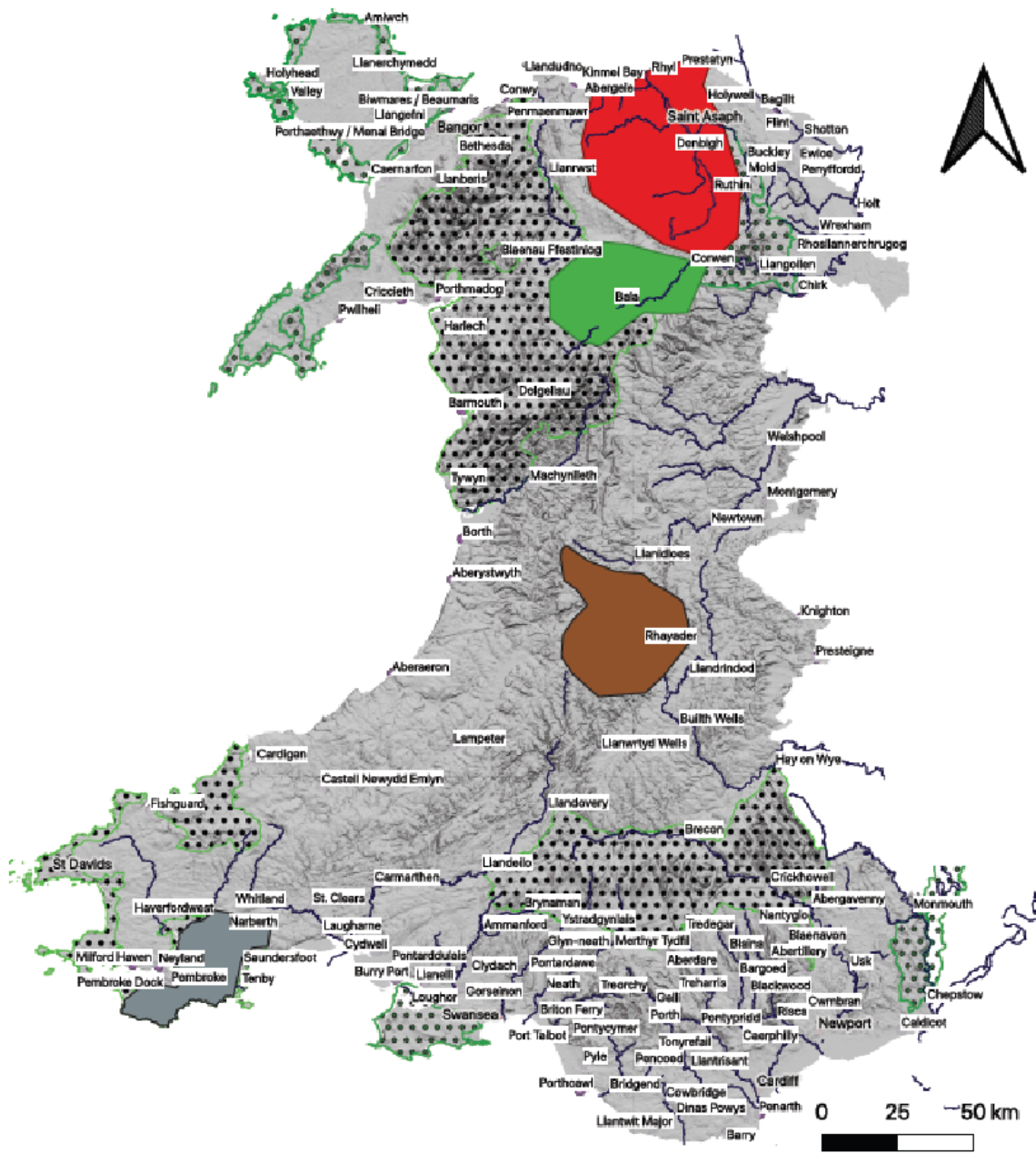
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Appendix 1: Map of the study areas in Wales (By the author)

Map of the study areas in Wales (By the author from OS, EU elevation and Welsh government data)

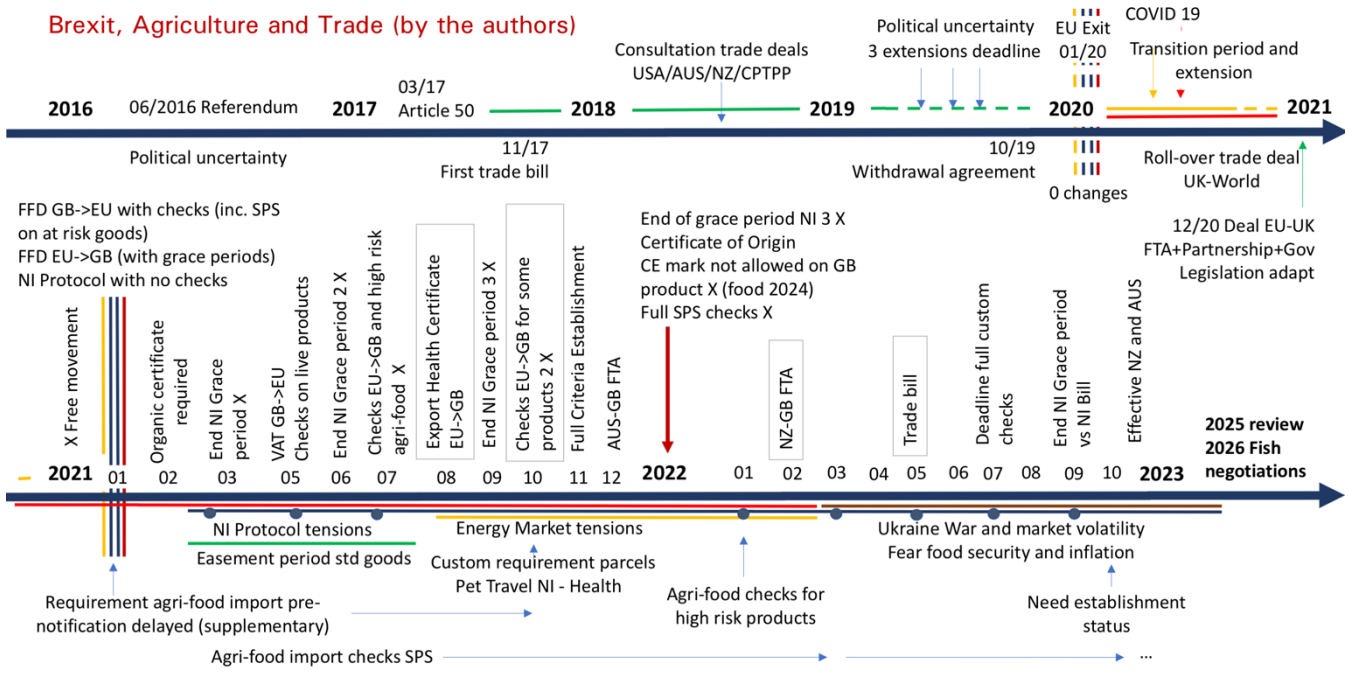


Legend:

- Study Area - Pembrokeshire
- Study Area - Cambrian Mountain Area
- Study Area - Vale of Clwyd
- Study Area - Bala - Snowdonia
- Towns
- Cities
- Rivers
- National Parks in Wales
- Area of Outstanding National Beauty in Wales

Appendix 2: An updated timeline of the UK-EU relationship will be added by the final publication (By the author from center for public policy, 2021)

Brexit, Agriculture and Trade (by the authors)

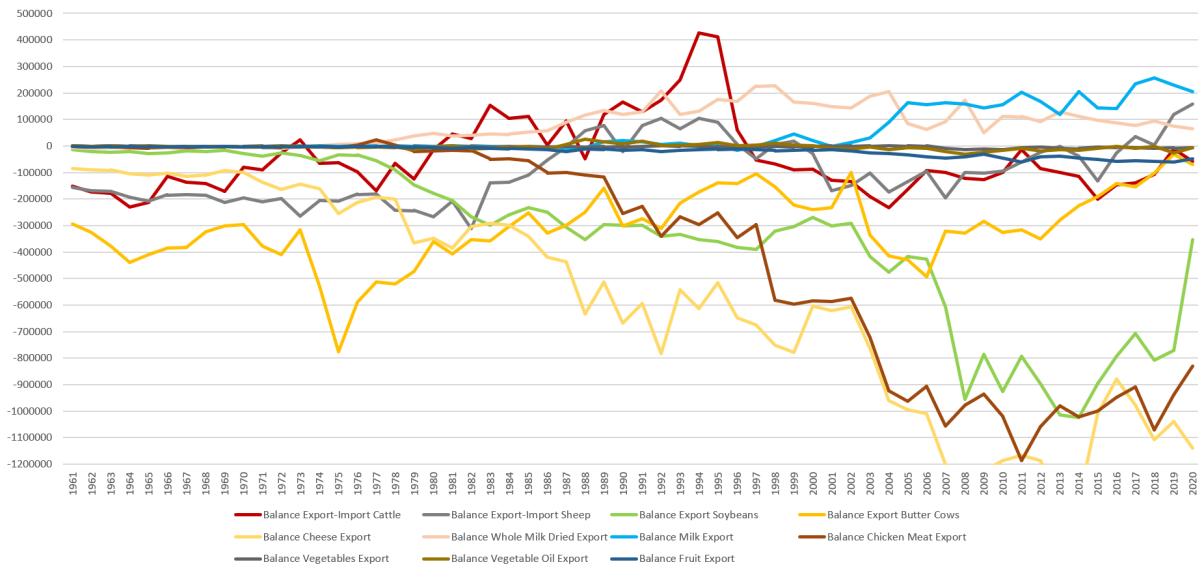


FFD: Full Frontier Declaration (Notification, VAT payment, SPS declaration, Health certificate, Certificate of origin, tariffs)
 FTA: Free Trade Agreement NI: Northern Ireland GB: Great Britain EU: European Union X: Not implemented

Source: EU commission, institute for government, house of commons

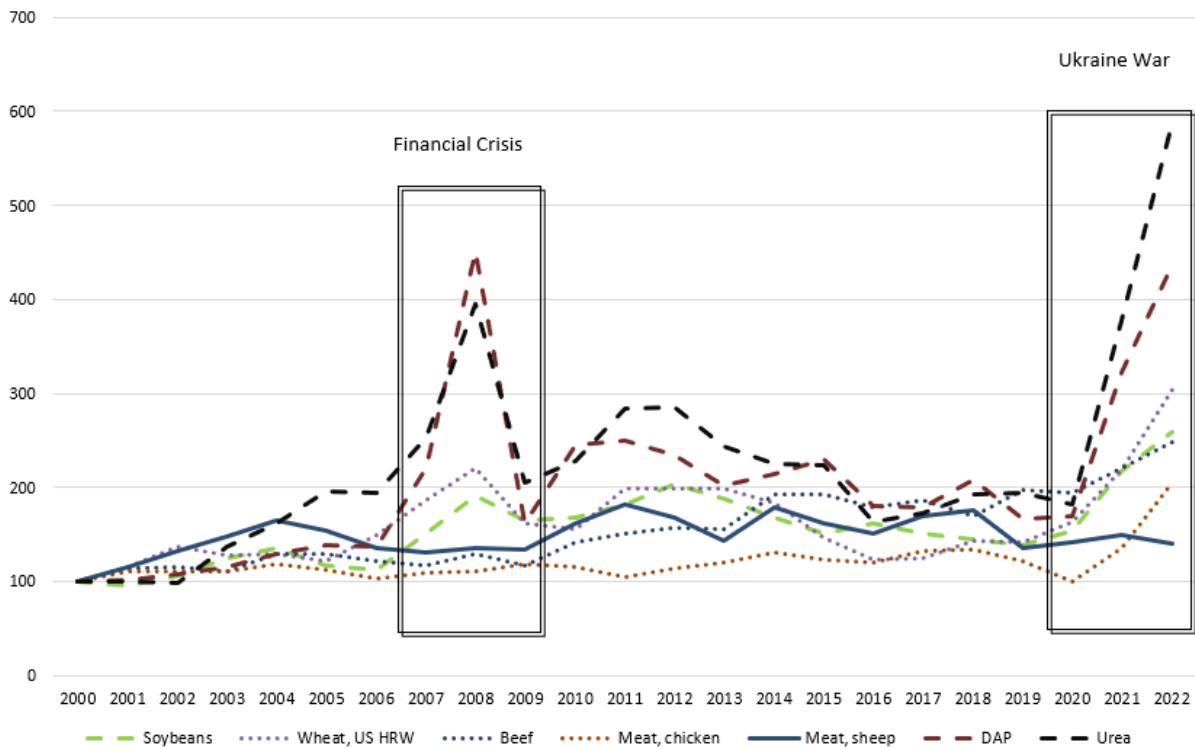
Appendix 3: Balance of export in £ on a range of agricultural inputs and outputs from 1961 and 2020

Balance of Export, Value wise on a range of agricultural inputs and outputs (1961-2020) (FAOstat Trade Series) – Positive export more than imports.



Appendix 4: Price evolution of some commodities agricultural inputs and outputs from 2000 and 2020 (By the author from World Bank 2022)

Price evolution of some commodities agricultural inputs and outputs base 100 2000 from USD (World Bank 2022)



Appendix 5: Adaptation of the selected modelled farms to the new Welsh Government scheme

Adaptations on farms to fit in the SFS scheme

Dairy Spring Calving 500 DC- 5,5 KL- Plas JV – 220ha – 6 FTE	Tree planting of 5% required. There is a need to add 15% more land (rented) to the landholding, Permanent pasture will have a different management. As it is a flying herd, the farm is heavily stocked and has a high LFU/ha. We chose the cheapest and least number of adaptations to adapt to the new NVZ rules. Increased culling to increase efficiency, 10% reduction number of cows most efficient, reduced input use by 10% cake and 10% fertiliser. Outwintering some animals on Kale and Rape, small acreage of Barley mixed with cake. Optional scheme: permanent pasture, tree parts, hedges.
Dairy Heifers Rearing and Sheep - FFM Fam – 160ha – 2FTE	Already compliant tree wise and ecological areas. Cost of production alignment for their contract but decided to go for a slower growth rate. Reduction in cake consumption - 35%, silage receive - 15% fertiliser, development cereal growing 1-2 fields (as wholecrop), turnips field for Outwintering. Trees plantation couple steep slope. Outwintering in valley. Optional scheme: permanent pasture, tree parts, hedge, rough grazing land
Beef Finisher and Sheep - Strip of land - Plas type Family – 1000ha – 4FTE	Already compliant tree wise and ecological areas. Adaptations with a bit more acreage under crops, 35ha of spring barley, reduction of cake use for sheep 60%, only protein, same for other animals. Reduce top weight of animal to save on cost 5%. Red clover. Optional scheme: permanent pasture, tree parts, hedge, rough grazing land
Organic beef and Sheep - Strip of land - Large FFM Family– 280ha – 2 FTE	Already compliant tree wise and ecological areas. Adaptations higher proportion of homegrown cereals/clover. Reduction in bought in cake - 10%. Reduction in weights - 5%. More red clover.
Hens Std, beef finisher and ewes - FFM large Family– 300ha – 3FTE	Already compliant tree wise and ecological areas, development orchard and agro-forestry. Adaptations higher proportion of homegrown cereals/clover, a little sold as it can't be used for hens. Reduction in bought in cake - 15%. No fertiliser bought-in. Reduction in weights -5%. Red clover. Optional scheme: permanent pasture, tree parts, hedge, breeds
SMH local food Beef and Sheep– 7ha – 0,7FTE	Not compliant tree wise and ecological area but low stocking density, development orchard and agro-forestry. Adaptations higher proportion of homegrown cereals/clover 1 field in partnership with neighbours. Reduction in bought in cake - 10%. Reduction in weights -5%. Optional scheme: permanent pasture, tree parts, hedge, breeds
Hens local and Sheep - SMH family– 60ha – 2 FTE	Adds land to the farm to adapt but room as little sheep. Cost of production contract possible for the inputs/outputs, local market possible to increase price. Grow crops to reduce inputs cost Optional scheme: permanent pasture, tree parts, hedges.
Dairy - 200DC Grass– 130ha – 3,5 FTE	Add 5-7% more land to be compliant, permanent pasture different management with no fertiliser. Tree planting required on 5% of the acreage, residual tree in hedges. Reduction in cake use 25%, maintain number of cows, yield down to 7.5KL, reduction fertiliser 20% past, 10% silage production of cereals to add to the mix for 25%, spring barley, add-on grazeable Kale and rape. Outwintering. Optional scheme: permanent pasture, tree parts, hedges.
100 B&S from calves– 90ha – 2 FTE	Add 5-7% more land to be compliant, permanent pasture different management with no fertiliser. Tree planting required on 6% of the acreage, residual tree in hedges. Already high autonomy, grow more crops, grow kale and rape to complement in proteins. Optional scheme: permanent pasture, tree parts, hedges.
Potato farm with on-tack livestock Plas – 260ha – 5 FTE	Reduction in fertiliser of 20%, increase in unsold potatoes by 5%, new chunky pot category taking 50% of waste, yield diminution by 10%, reduction in treatment by -20%, acreage for trees/pond/rent-in or buy with 12% more land, reduction in number of animals compared to current stocking rate -5%, a portion of potatoes sold locally at 1000€/T approx 10-30kg/d - on average 6T/yr (honesty box). Development of red clover in the rotation.
Small Dairy Farm 90 DC – FFM- 120ha – 2FTE	Reduction in cake bought-in by 20%, further development of red clover and kale and rapeseed crops, more intensive grazing technique, increase proportion of barley, introduction of lucerne in the rotation. Add 5-10% of land. Develop local sales if possible but in this one cashflow problem and busy market.

Appendix 6: Share of subsidies in the Agricultural income in % for the different scenarios (By the author from fieldwork)

