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How to counteract the agronomic and market challenges facing the UK potato industry

Written by:

Harry Barnett NSch

April 2025

A NUFFIELD FARMING SCHOLARSHIPS REPORT

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"Leading positive change in agriculture. Inspiring passion and potential in people."

Date of report: April 2025

Title	How to counteract the agronomic and market challenges facing the UK potato industry
Scholar	Harry Barnett
Sponsor	McDonald's UK & Ireland and the Royal Norfolk Agricultural Association
Objectives of Study Tour	• Can UK farmers contribute to increasing the UK potato market value chain and with other industry stakeholders halt consumption decline? • How can UK farmers effectively manage the growing risks associated with potato production? • How are the best potato farming businesses around the globe structured and identify how they overcome challenges and what makes them the best.
Countries Visited	Germany, France, Belgium, Netherlands, Poland, Ireland, USA & Canada
Messages	The future of the UK potato industry looks promising, provided that stakeholders can reverse the decline in fresh potato sales and embrace the processed potato market. Adopting new variety technologies as they become available will be essential. Farming businesses must determine how to future-proof themselves by becoming resilient amid changing market conditions and climate dynamics.

EXECUTIVE SUMMARY

Rationalisation across the potato growing sector has occurred due to the macro risks of growing and marketing potato crops. The risk and reward ratio has been unbalanced and has left potato farmers with a poor return on capital, with many exiting the industry since the turn of the millennium. Consumption of whole potatoes has also been in decline per capita as people trade into alternative carbohydrates due to cultural and lifestyle changes. UK potato production has failed to adapt to changing eating habits and, in comparison to other European nations, has a small potato processing sector.

To coincide with a shrinking UK market, the agronomic challenges of growing potato crops have increased. Pest and disease pressures have become harder to overcome through the revocation of plant protection products and the change in climate.

This study explored potato-growing practices across Northern Europe and North America to understand how businesses are addressing the macro risks involved with production. Although the structure of the sectors is very different across the two continents, many businesses face similar challenges.

Successful potato producers in the future must firstly identify what their risks are and develop long-term business strategies to manage them. To be successful, potato farmers will need to build relationships with customers to secure their end market, offering flexibility and aligning with their customer requirements. In turn, the UK sector must strive for greater self-sufficiency and put in greater measures that support the supply base. Ultimately, farmers will need to be paid fairly allowing sufficient margins, allowing for re-investment in infrastructure, equipment and, most importantly, people.

In a changing climate, potato production across the globe is going to become ever more challenging and growers will need to adapt by protecting their soils through wider rotations. Farmers will also need to implement measures to manage water more effectively. This will come from efficient irrigation systems and drainage infrastructure. Greater operational capacity to utilise tight weather windows to plant and harvest crops will be required. Variety selection and breeding will play a crucial role in farmers remaining prosperous. Plant breeders must deliver to the marketplace modern varieties that look great, taste great and have strong agronomic traits that reduce growing risks. With these challenges in mind, opportunities will arise for the best UK producers who have the skillset to adapt.

TABLE OF CONTENTS

DISCLAIMER

The opinions expressed in this report are those of the author alone and not necessarily those of the Nuffield Farming Scholarships Trust, of the author's sponsor, or of any other sponsoring body.

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CHAPTER 1: INTRODUCTION

From the age of five I have always wanted to be a farmer. What started with a love for tractors has transformed into a passion for food production and a career managing an agri-business. I was born in South Lincolnshire where my granddad was a first-generation farmer growing daffodil bulbs, cereals, sugar beet and potatoes. I spent as much time as possible here during my formative years. After leaving secondary school I spent a year working on a local farm to confirm that primary agriculture was the correct career path. Afterwards I attended Newcastle University where I studied BSc Agri-business Management. Thereafter, I have found myself on the Holkham Estate in North Norfolk where I am a director of a specialist potato growing business producing retail, seed and processing crops for UK and export markets.

Figure 1: Harry Barnett, the author, at 10 Downing Street (official residence and office of the British Prime Minister). Photo: Authors own.

My wife, Sophie, and I have made Norfolk our home with our son Charlie (aged one) and labrador Maggie; we love all things outdoors and embrace the great coastlines and rural retreats that North Norfolk has to offer.

CHAPTER 2: BACKGROUND TO MY STUDY SUBJECT

The potato has been a British staple for generations after being introduced by Sir Walter Raleigh and Sir Thomas Harriot in the 16th century. However, fast forward 500 years, the UK potato industry is now at a crossroads. Over the last two decades, UK production has witnessed a steady decline. Since the global pandemic, there has been a further reduction in the growing area. The primary reason for the reduction is due to risk. High levels of risk have been created by a shrinking marketplace, cost inflation, and increased growing challenges.

As a result, the UK potato industry has become a sector of focused growing businesses that are trading with large multinational seed houses, processors, and packing companies. Potato farmers face two large risks: one being the marketplace and the second the production risk, with each finely balanced. If the marketplace does not present enough opportunity or sufficient profit margins, then business failure occurs. On the other hand, if growers are not able to counteract growing challenges and produce optimum marketable yields, then businesses cannot perform successfully either.

Potatoes are served in a multitude of different ways and are part of most diets across the globe. In the UK, the product has the largest shelf space in fresh produce and freezer aisles in supermarkets and constitutes a significant part of a western diet. Potatoes have a production value worth over one billion pounds to the UK economy annually (Statista, 2024) with the total value chain estimated to be over five billion pounds. However, consumption of whole potatoes has been in decline per capita as people trade into alternative carbohydrates. Data shows that the average weekly consumption from a UK adult has declined from 1437g per week in 1974 to 552g per week in 2022 with 43% of the consumption now being made up of processed potato products from 8% in 1974 (Defra, 2022).

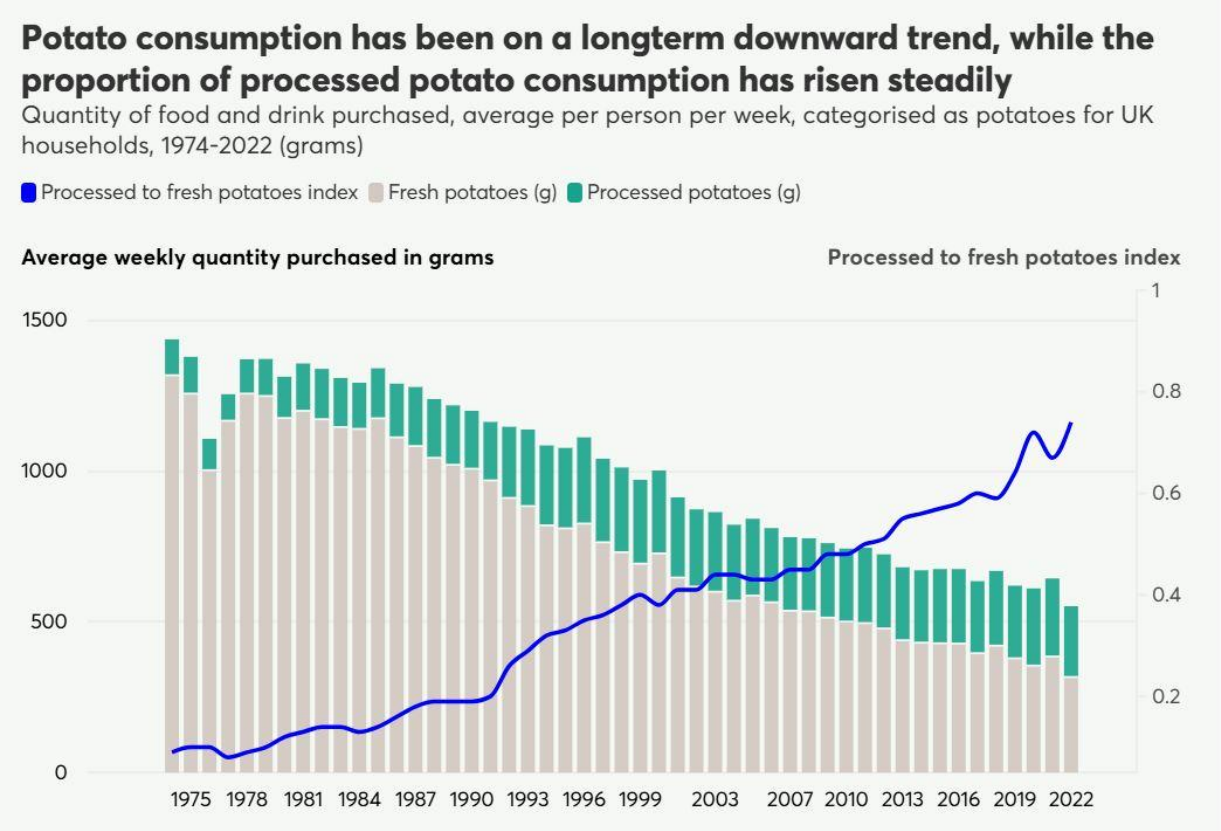

Figure 2. UK potato consumption. Nesta, 2022.

The UK also imports close to one million tonnes of prepared potato products annually, predominantly in the form of chips (World Potato markets, 2024). Both of these factors have played a huge role in the reduction of the UK potato growing sector.

CHAPTER 3: MY STUDY TOUR

Europe

Country	Date visited	Visit overview
Germany	February 2023	Fruit Logistica, machinery manufacturers and farmers
Belgium	February 2023	Farmers and processing companies
France	February 2023	Farmers, potato packing businesses and
Netherlands	February 2023 & November 2024	Farmers, breeding companies, a seed event and processing business
Poland	April 2024	Farmers
Ireland	November 2024	Farmers and potato packers

North America

Country - city	Date visited	Visit overview
USA - Washington	October 2023	Farmers, industry analysts and processing companies
USA – Oregon	October 2023	Farmers
Canada – British Columbia	March & October 2023	CSC, personal travel & farmers
Canada – Alberta	October 2023	Farmer industry analysts and packing companies
Canada – New Brunswick	October 2023	Farmers and processors
Canada – Prince Edward Island	October 2023	Potato research board, farmers, packers and processors

CHAPTER 4: THE UK POTATO MARKET AT A GLANCE

The UK potato market can be broken down into four main sectors: Retail packing, processing, general ware and seed.

Crop type	Hectares	Percentage
Ware (bagged)	18824	16%
Pre-packed	44319	38%
Processing	39151	33%
Seed	15173	13%
	117467	

Figure 3. Author's table. Data from AHDB, 2020.

Since the dispersal of AHDB potatoes the UK growing area has declined further to below 100,000has with production figures estimated from 4.6 million to 4.8 million tonnes. (Defra, 2023)

This is a decline from six million tonnes in the early 2000s where the grower number also exceeded 3,000 growers. Much of the decline has come from the packing, ware and seed sector. The processing sector in that time has increased, but not at the rate of decline from the other three sectors.

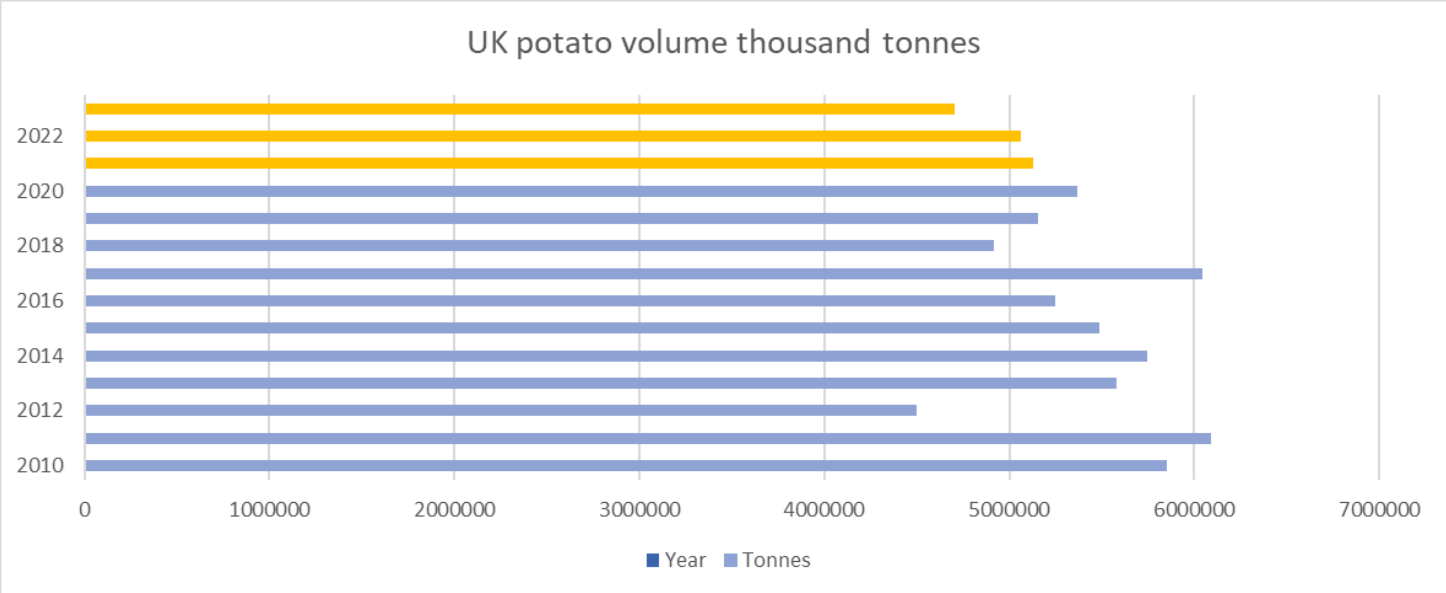

Figure 4. Table showing total UK potato production figures. Author's own graph. Data taken from AHDB, 2020 & Defra, 2023.

CHAPTER 5: CHANGING MARKET DYNAMICS

5.1 Can primary producers influence fresh potato sales?

The first question to address is why consumers have shifted from fresh potatoes to other dietary options and how primary producers can influence consumer purchasing choices. Several key factors contribute to the decline in fresh potato sales: price, consistency, convenience, waste reduction, and cultural changes in diet. Waste reduction aside, it is essential to tackle all of these issues. Consistency, convenience, marketing, and price are critical.

Insights can be drawn from the prepared potato sector, particularly from the frozen chip and crisp markets. The eating experience provided by rival carbohydrates, such as rice, pasta, and prepared potato products, is often comparable. In contrast, fresh potatoes are more complex; their flavour, texture, and cooking time can vary significantly depending on the season, variety, and storage conditions.

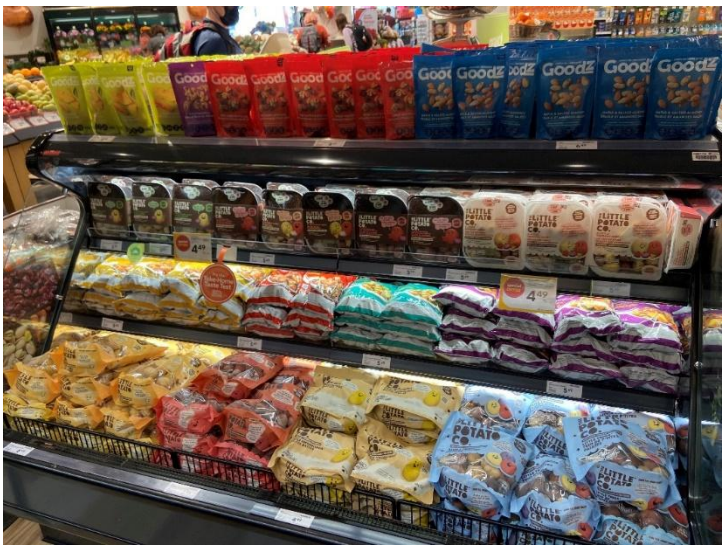

Figure 5. Vibrant packaging in Canada has helped to grow retail sales. Clever marketing promoting nutritional benefits and convenience. Author's photo.

Industry stakeholders need to collaborate to streamline the variety portfolio and encourage repeat purchases of potatoes. This needs to be combined with targeted marketing that educates consumers about the versatility of potatoes and nutritional benefits. There are missed opportunities to offer cooking instructions and recipe ideas on potato packaging. When marketed as an "all-rounder," potatoes must meet customers' expectations for that role. If the product fails to satisfy, consumers are likely to opt for alternative carbohydrate sources in their next purchase.

Convenience is also an important factor. Preparing and cooking potatoes at home can be labour-intensive and requires more cooking skills than preparing competing carbohydrates. The industry should focus on variety characteristics, emphasising taste, texture, and cooking time. The rise of air fryers presents new

opportunities for potato products, significantly reducing cooking time. For example, a baked potato that typically takes an hour in a conventional oven can be cooked in just 20 minutes using an air fryer and microwave, which is comparable to the cooking times of frozen oven chips, rice, and pasta.

Figure 6. The Little Potato Company have installed a state-of-the-art factory in Edmonton, Canada. A mixture of coloured baby potatoes is packed with herbs and cooking instructions. Author's own pictures.

What price potatoes should command at retail is a thorny topic between producers and packing companies. Retailer data across the UK shows that pack prices and promotions have a huge effect on sales, and consumers are very sensitive to price change (Kantar, 2024). Data also shows that consumers are willing to trade up for premium lines if the quality of the produce is perceived high enough (Kantar 2024). Potato farmers must be aware of both of these points and work with customers to add value. In light of this, farmers have experienced significant cost inflation in recent growing seasons and have needed a substantial uplift in contract prices to cover costs. For potatoes to remain cost competitive, increasing marketable yield and optimisation of inputs is essential. Adopting higher yielding varieties with lower waste combined with clear cost awareness will be essential over the next decade.

5.2 Embracing processing markets

Frozen French fries are one of the fastest-growing export commodities in the world, with an annual export volume increase of 23% recorded over the last five years (WPM, 2024). Large multinational companies, primarily from North America

and Europe, have developed impressive operational efficiencies and a wide variety of frozen potato products. These product lines have experienced significant growth due to their convenience and effective marketing campaigns over the past 20 years.

Country	2022	% change	5 yr % increase	2021	2020	2019	2018	2017
EU-5	1681721	2.50	8.3	1640703	1512633	1648267	1638998	1552867
Other EU	1325625	13.90	23.0	1163885	994531	1158652	1117222	1077339
North America	1433500	12.15	42.2	1278247	1120904	1045278	1065376	1008056
South America	677044	-3.26	20.0	699873	572563	600636	581783	564077
Australasia	144454	7.57	-2.0	134292	124228	130080	147604	147370
Asia	1174099	9.56	17.1	1071610	1032592	1144650	1117339	1002352
Africa	88001	-1.20	60.2	89073	63738	70438	71156	54948
UK	963150	41.23	21.2	681961	717636	873047	822135	794710
Middle East	424887	6.70	38.9	398211	326070	328705	278410	305875
Central America	371860	7.09	57.6	347253	241742	282620	262305	235915
	8284341	10.38	22.85	7505108	6706637	7282373	7102328	6743509

Figure 7. Data provided by world potato markets on UK import volumes of French fries over the last five years. Author's table. Data taken from Cedric Porter, World Potato Markets, 2024.

The UK ranks as one of the largest per capita consumers of prepared potato products globally and is the second-largest importer (Cedric Porter, WPM 2024). In 2022, the UK imported 900,000 tonnes of frozen potato products, which equates to approximately 1.4 million tonnes of raw material. This is a crucial point from a farmer's perspective. If the UK had maintained self-sufficiency in frozen potato products and quickly adapted to the changing dietary preferences of its population, the industry would not have experienced the steady decline in volume and area over the past two decades.

Several reasons explain this lack of adaptation, but fundamentally, the UK has not provided a competitive environment for producing large volumes of prepared products. Additionally, growers have shown reluctance due to fixed pricing and lower expected profit margins compared to packing, bagged ware and seed crops. The business model requires a tight focus on cost control and meticulous attention to detail to consistently achieve high yields.

Figure 8. A giant conveyor of French fries ready to be frozen in Matogues, France. Author's own photo.

In contrast, potato growers in the USA, particularly in Oregon and Washington, operate at very low-profit margins but at a large scale. Many producers have indicated that without bonuses for bruising and length, they would only be able to grow crops at breakeven.

If the UK wants to increase potato production and improve self-sufficiency, more growers will need to transition to processing or prepared markets. However, simply reducing imports and growing more potatoes domestically is not as straightforward as it seems. Barriers to entry are a significant factor in why this adaptation has been slow. Large processing factories are necessary, and with most UK plants operating at full capacity, it is challenging to reduce import volumes in the short term. Additionally, the costs associated with factory installation and UK regulations present further obstacles for investors.

Currently, it is relatively easy for large processors from Belgium and the Netherlands to transport European-grown potatoes into the UK. Therefore, if one of the major processors is to consider investment in the UK, they would need to be confident that the UK can provide a cost-effective and efficient environment for production. Demand is not the issue; 'Brexit' has also diminished confidence among many European companies regarding investment in the UK.

Globally, the growth projection for prepared potato products is significant, with analysts predicting an annual value increase of 5% up to 2035. (Business research, 2025) This creates growth opportunities for European producers. However, the tight potato rotation in the Netherlands and Belgium, currently at one in three or one in four, and the lack of available land complicate further production growth in these countries. Processors are already expanding their search for potatoes to supply their large plants into Germany and France.

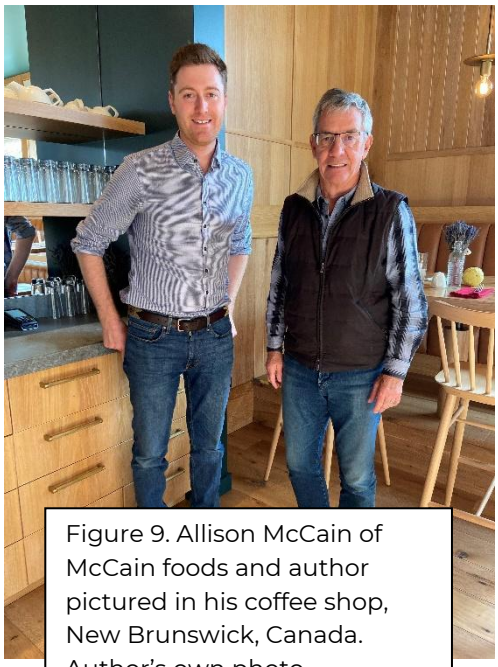

Figure 9. Allison McCain of McCain foods and author pictured in his coffee shop, New Brunswick, Canada. Author's own photo.

Although the UK is often viewed as a less competitive location for growing processing potatoes - due to lower yields, higher costs, and more expensive freight rates - it remains a stable nation with a large population and high consumption levels of chips. If the UK can achieve greater self-sufficiency, it could enable large European companies to exploit export opportunities in relatively untapped markets in Asia, South America, and Africa. The UK is unlikely to be competitive on low value lines but businesses should consider premium and niche sectors of the prepared potato market.

5.3 Price volatility - Free-buy vs Contract

Price volatility has been a large factor behind why many UK farmers have exited the industry. Traditionally, the UK and European industries have operated within a free-priced marketplace. Businesses have experienced year-to-year fluctuations in profits and losses based on supply and demand. However, fixed-price contracts are on the rise, initially driven by the US processing sector model, and have since expanded across all segments of the UK market. These contracts aim to provide both customers and farmers with price and volume certainty.

This transition in the marketplace has stemmed from the need for structure among farm businesses and financial institutions. Contracts offer security and help reduce exposure to price fluctuations. However, farmers must navigate growing challenges to meet the contracted volumes. Many producers have

indicated that recent contract prices have not provided a sufficient return on capital, and unpredictable yields have made it difficult to sign contracts.

As more potatoes are procured through fixed-price and volume contracts, the free-buy market becomes increasingly volatile. In years of overproduction relative to contracts, free-buy market prices drop significantly, making crop movement increasingly challenging. Conversely, during short supply seasons, prices in the market can soar, leading to shortages. These fluctuations pose problems for packers and processors and are likely to become more frequent due to climate change.

How large businesses manage these challenges will be noteworthy in the coming years. They may consider over-contracting to cover potential shortfalls or growing their own crops to fill supply gaps. Such businesses are generally keen to avoid paying high free-buy prices regularly and certainly do not want to run out of supply. This situation could also lead to increased imports in the short term.

5.4 Costs of production and fair profit margins

Farmers require sensible profit margins to reinvest in their workforce, soil health, and capital equipment, which ultimately makes their businesses more efficient and delivers better products to consumers. Over the last decade, production costs have risen significantly in all areas, a situation worsened in recent times by the war between Russia and Ukraine. In comparison, North American farmers operate at margins that would be unsustainable for UK businesses. The USA and Canada enjoy economies of scale, crop insurance programmes, and a broader range of plant protection products, which lower risks and enable farmers to remain prosperous at lower margins. Furthermore, many businesses have partnered with large processing or packing companies to ensure stability and share risks.

European farmers face similar growing challenges as those in the UK. However, many European farms maintain a lower cost base by utilising family labour, sharing equipment, owning land, and minimising cultivation costs. It is often argued that not all costs are adequately accounted for in the pricing of the growing crop.

As production costs continue to rise, the risk of crop failure also increases due to the high capital investment associated with growing potatoes. In the UK, producers have very little protection against crop failure, especially in the seed and pre-pack markets.

The level of growing risks and market failures is much higher in Europe and the UK, so farmers need to be compensated with fair returns on their capital to achieve stability. Stakeholders in the UK potato industry must determine what constitutes a fair return on capital for each sector based on the associated risks and set contract prices accordingly. Currently, UK farmers are in a favourable position, as demand has outstripped supply for the 2023 and 2024 growing seasons (Defra, 2024). Producers should be cautious about growing speculative potato crops if they wish to maintain margin levels. Oversupply always benefits those further down the supply chain, making it more challenging to negotiate fair contract values.

CHAPTER 6: GROWING RISKS

6.1 Reacting to a changing climate

The UK experienced one of its wettest winters in 2023/24, (Met office, 2024) while in 2022, it recorded the hottest temperatures ever, leading to depleted reservoirs. (Met office, 2022) Around the globe, similar narratives are emerging, making the impact of climate change undeniable. Potatoes are particularly sensitive to water, as they are made up of 80% water, during periods of high transpiration, a potato can consume up to 5mm of water per day. (Stalham, 2014) However, there is a balance to maintain, as excess water can lead to bacterial rotting and damage during harvest.

When growers worldwide were asked about their biggest threat to potato production, many cited climate and alterations in growing seasons. These climate challenges differ across regions. For instance, in Washington State and parts of Europe, farmers are concerned about hot, dry summers with temperatures exceeding 35°C. Conversely, farmers on Prince Edward Island and in the Netherlands face significant threats from wet springs and autumns.

Figure 10. Irrigation control station Agri-Northwest Oregon. Over 500 centre pivots are controlled here 24/7. Author's own photo.
See Case study 3 in appendices.

Ultimately, businesses around the world must adapt to these uncontrollable variables, and UK farmers will need to do the same. Capturing winter rainfall and utilising it during the growing season will become essential as summers become drier. Currently, 50% of potato crops in the UK are irrigated (UKIA, 2020). Competition for water from public supply, energy and data is increasing in the large growing regions of East Anglia and is putting a strain on water resources. Solutions will need to be found to improve water availability to keep potato production viable into the coming decades.

6.2 People, Infrastructure & Capacity

Team and infrastructure capacity plays a significant role in how farmers can adapt to weather conditions. Businesses must maximise operational efficiencies to ensure that crops are planted and harvested under optimal conditions. Due to low-profit margins, many farming businesses have been compelled to reduce their fixed assets and cover larger areas with less equipment to achieve economies of scale. However, this approach will need to be reconsidered as the climate in the UK becomes more unpredictable.

Figure 11. Top Farms, Poland, planting potatoes with eight rows working 24/7 to hit optimum planting windows. Author's own photo.

In various regions of Canada, farmers face a harvesting cut-off due to winter snowfall, and now the UK is experiencing similar challenges with high rainfall in the autumn. Customers must allow for sufficient margins that enable reinvestment and provide incentives to protect crop yields and prevent soil decline and degradation.

The most successful businesses in the world are led by individuals who can recognise, respond to, and resolve problems effectively. The UK farming industry must implement strategies to attract and retain top talent by offering fair remuneration. It is apparent that the most successful potato producing businesses have the best people, this is from an operational level through to management and ownership.

Figure 12. Farm boys, Prince Edward Island, Canada, lifting potatoes in a snow storm before the winter weather takes hold. Author's own photo.

6.3 Rotation to manage pest and disease pressures

UK and European farmers are facing increasing pressure to reduce artificial inputs due to company pledges and government incentives. The removal of these inputs raises risks and increases the likelihood of crop failures. Retailers and processors have started making commitments to transition their supply chains to 'regenerative' farming practices and achieve 'net zero' emissions. The primary goals of these initiatives are to restore soil health, enhance biodiversity, and improve the nutrient density of food.

For the potato industry, this marks a significant shift away from current practices. In many growing regions worldwide, high levels of tillage, along with inputs such as fertilisers and water, are essential for crop production. While this transition will pose challenges, it also presents opportunities for businesses that can adapt swiftly. However, growers will require support during this transition, as significant changes in practices come with risks of crop failures. Financial backing from customers and consumers will be crucial throughout this journey.

Figure 13. Gabe Brown and the author pictured at the Waitrose future farming conference discussing regenerative farming practices. Author's own picture. **See Case study 5 in appendices**

Figure 14. Wireworm found in light soils near Poznan, Poland. Author's own photo.

Additionally, pest and disease pressures are on the rise, with issues such as nematodes, wireworm, Colorado beetle, virulent blight, and various viruses affecting yield and profit margins. Potato production is concentrated in small regions where the soil is productive, water is readily available, and proximity to factories exists. This has led many farmers to adopt tight rotations of potatoes, ultimately increasing the prevalence of potato-related diseases and pests. In the USA, Canada, and parts of Belgium, potatoes are often grown every other year or once every three years. Consequently, the

presence of nematodes is causing a decline in yield where plant protection products are not applied.

The North American approach has favoured the use of soil-borne pesticides as a control measure. In many cases, these pesticides adequately suppress pest pressure but come with environmental and public health costs. As customers and the public grow more aware of the potential harm caused by these pesticides, rotations in agriculture will need to be expanded and a holistic approach adopted. Many of the products currently in use have already been banned in the UK and Europe. Moving forward, crop rotation and variety selection will become key strategies for the UK to manage pest and disease challenges as more pesticides are phased out. A wider and more diverse crop rotation will better equip businesses to tackle specific challenges.

Figure 15. The author with Christine Noronha, Mark Phillips and Greg Donald at the PEI research centre. Author's own picture.
See case study 7 on control of wireworm in appendices.

6.4 Breeding resistance

New breeding technology will transform the European potato industry in the coming decades. Large plant breeding companies, predominantly from the Netherlands, are bringing through exciting new varieties that have strong agronomic traits that have blight and potato cyst nematode resistance. Many breeders have noticed the direction of change across the European industry in recent years with the reduction in pesticides. Until five years ago, yield and market suitability were the primary targets when introducing a new variety with the former being the fundamental driver. With less inputs available, more focus is on the agronomic traits of new varieties. Breeders have huge challenge as it takes multiple replicates, multiple failures and a lot of luck to find a variety that fulfils all requirements. Cross sector varieties will help the UK industry move forward and allow much greater flexibility in growing businesses. A smaller number of varieties that will pack and process will rationalise the current portfolio and help both with customer connection and consistency of products.

All stakeholders from each sector must decide on the parameters that breeders need to target and this must be thought about for the long term not just short term. The varieties of the future will require purpose. They must firstly fulfil market specifications so process well or taste great. They secondly must achieve high marketable yields if the industry is to reduce inputs per tonne produced. Thirdly they must have strong agronomic traits that makes them robust in a changing climate with increased drought stress. This is no mean feat for breeding companies but certainly not impossible with modern technology. The UK has passed the gene editing bill and this could be a tool, however significant challenges lie ahead regarding customer acceptance and variety ownership rights. Europe is not aligned with gene editing and the vast majority of new varieties are owned by European breeding companies.

6.5 Seed - the foundation of the UK potato industry

The UK and Europe have had very strong seed industries. Climate change, regulation, cost inflation and better market options have put severe pressure on the industry on both sides of the Channel. Brexit has increased these challenges making it much more difficult to trade seed stocks between Europe and the UK. As a result, seed availability and quality are going to be compromised for the coming seasons. A clear strategy will need to be implemented by both the UK and Europe to protect input stocks from virus and disease. Increased legislation is not necessarily the answer, but the current structure needs to be addressed to make real improvements. Transparency from seed houses and growers is vital and bad practice must be stamped out. The current British Potato Trade Association (BPTA) rules and inspection process are not fulfilling their aims with too much poor-quality seed being delivered to farm gates.

Seed is the foundation of the potato industry and it is vitally important to ensure strides are taken to improve quality. With climate change and higher temperatures virus risk will become inherently higher. The UK seed sector can learn from the levels of transparency taken by North American producers. Potentially introducing a tiered pricing system into the sector would reward the very best producers, particularly those producing high grade crops. Rationalising the number of varieties and removing those with weak agronomic traits will be essential for the industry to improve quality as challenges increase. There will be

opportunities for the best seed growers who can demonstrate these skills as high quality seed becomes increasingly scarce.

CHAPTER 7: DISCUSSION

Eating habits have changed, leading to a decline in the per capita consumption of fresh potatoes. The industry needs to understand how people incorporate potatoes into their meals at home and identify the barriers that have contributed to this decline. Intelligent marketing strategies must be developed to promote the potato as an affordable, low-carbon, and highly nutrient-dense food option. Additionally, while the consumption of prepared potato products has increased, is it possible for the UK to establish a processing sector that rivals those in North America and Europe? Evidence would suggest not, but opportunities will arise in premium and niche lines as global consumption increases.

Growing challenges across the world are increasing. Pest and disease pressure is mounting across all potato regions due to a lack of rotation. The climate across the globe has become more difficult to navigate with temperatures rising, water availability becoming scarce and overcropping causing large problems to farmers. Farmers will need tools to counteract these challenges. In northern Europe, this will have to come from breeding and holistic management approaches as plant protection products are phased out and water availability becomes limited.

Overall, the outlook for the UK potato sector is promising for the remaining grower base, but action is essential. For growers to thrive, they must receive fair returns that support reinvestment and ensure reasonable profit margins to mitigate risk. Achieving this will empower growers to expand the potato value chain, focusing on better returns per hectare rather than merely increasing production volumes.

CHAPTER 8: RECOMMENDATIONS

To establish a competitive and viable industry in the coming decades, UK industry stakeholders must take decisive action in four core areas:

1. Halt the decline in fresh sales

It is imperative to understand why consumers have shifted away from potato products and to prioritise convenience and consistency. This focus will strengthen the fresh potato market. Robust marketing campaigns that emphasise potatoes' versatility, nutritional benefits, and carbon efficiency is needed to reclaim lost sales. Potatoes must be priced competitively and deliver undeniable value to consumers. Farmers are vital in this process by producing high marketable yields of varieties that resonate with consumers, encouraging repeat purchases.

2. Embrace prepared and processed products

A ready market for prepared products exists in the form of imports. The UK must strive for greater self-sufficiency in this sector. Stakeholders must actively seek innovative solutions to reduce reliance on foreign imports. Competing on price alone with European producers is insufficient; product innovation that delivers consumer convenience and consistency is essential. The UK must leverage its strengths - high demand, a stable political and economic climate, and favourable growing conditions - to attract investment in the processing and prepared sector.

3. Adopt new variety technology and safeguard the seed Industry

The industry must proactively embrace new potato varieties as they enter the marketplace. There must be a transition from heritage varieties, such as Maris Piper, to varieties that yield more, require fewer inputs, achieve higher customer satisfaction, and provide superior agronomic profiles. This necessary shift will enhance the value delivered to consumers, packers, processors, and growers alike, while safeguarding the fragile seed industry.

4. Identify and enhance business resilience

Businesses must rigorously audit their operations to ensure they implement effective root crop rotations that minimise pest and disease challenges. It is

crucial to evaluate climate resilience and develop strategies to capture and store water for times of need while draining excess water when faced with heavy rainfall. Moreover, businesses need to ensure they possess the necessary capacity and infrastructure to deliver quality products to their customers. Attracting top talent who can identify, address, and resolve challenges is crucial for success.

CHAPTER 9: AFTER MY STUDY TOUR

I am returning to Holkham Emerald with great confidence in the future of our business. We have focused on procuring and growing our own seed crops in response to the challenges faced across Europe and northern Europe. Our business has become well-integrated across all sectors of the UK potato market by carefully selecting land types and varieties that align with the correct market outlets.

We have also aimed to influence our customers in choosing varieties that not only offer value to consumers but also possess the best agronomic traits. Additionally, we have advocated for fair margins that enable us to build resilience in our business, allowing for extra capacity, the best talent, and wider crop rotations.

Our recent investment into a cold storage and grading site aims to enhance customer service while adding value to our crops. Ultimately, we are committed to producing the best quality potato crops, protecting the natural capital we grow on and creating a great workplace for the best people in the industry.

CHAPTER 10: ACKNOWLEDGEMENT AND THANKS

I am privileged to have been allowed to take the time to complete this study tour and been amazed at the opportunities that have arisen across my travels. Everyone I have met has been sincere and hugely helpful. Huge thanks must go to my family and employer, Holkham Emerald, who have given me time to fulfil travel commitments.

I must also take the opportunity to thank my co-sponsors McDonald's UK & Ireland and the Royal Norfolk Agricultural Association who have made this journey possible.

I would also like to thank the many scholars, people and businesses that have given up their time to share knowledge and wisdom on life and the global potato industry.

Figure 16. My wife Sophie and son Charlie pictured in British Columbia, Canada. Author's own photo.

10. APPENDICES/ CASE STUDIES

10.1 Case Study 1: The Little Potato Company

The Little Potato Company was founded in 1998 by Jacob van der Schaaf and his daughter Angela. Along with a small number of other businesses in North America, they have transformed the markets in the U.S. and Canada by bringing convenience, colour, and fun back to potatoes. Fingerlings, creamers, and multi-coloured potatoes have seen significant growth over the past 20 years, thanks to clever packaging, convenience, and the health benefits promoted by the company. Consumers have been willing to pay large premiums for these products compared to traditional options, driven by a clear and straightforward marketing strategy. To enhance efficiency and meet increasing demand, an industry-leading factory has been established in Edmonton.

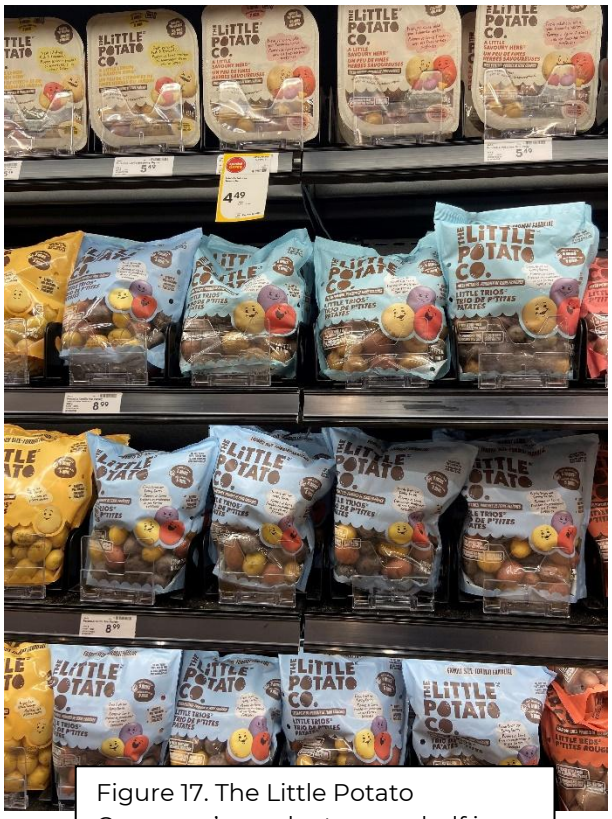

Figure 17. The Little Potato Company's products on a shelf in Lethbridge, Canada. Retail price equates to £4 per kg. Author's own photo.

10.2 Case Study 2: Allison McCain

Allison McCain, a retired family member of the largest potato processing business in the world, discussed the significant growth that frozen potato products have experienced during his career. He spoke candidly about some of the challenges the industry may face in the coming decades, particularly in relation to geopolitics and climate change. He suggested that the UK could become a viable option for building processing plants due to its high consumption rates, stable political landscape, and long-term climate suitability for agriculture.

However, he noted that shipping costs from UK ports make it an unlikely exporter. Nevertheless, with a large population, businesses may seek to reduce import volumes to meet the increasing orders from around the world. He also addressed the challenges presented by the declining number of potato growers and the decrease in yield per hectare observed in many growing regions, which partly motivated the regenerative farming strategy launched by McCain Foods.

10.3 Case Study 3: Washington & Oregon potato production

Figure 18. Author stood next to a gigantic irrigation pumping station in Oregon. Author's own photo.

Washington and Oregon represent a scale of farming that UK farmers may find hard to imagine. In these regions, businesses are cultivating potato crops on areas exceeding 10,000 acres, leveraging the abundant water supply from the Columbia River. Although rainfall is low, the soils are fertile, allowing businesses to achieve average yields of 100 tonnes per hectare.

The efficiency levels in these operations are remarkable, with companies capable of filling storage facilities at a rate of 300 tonnes per hour. Many of the larger businesses have established laboratories that enable them to customise nutrition throughout the growing cycle. Their irrigation systems can deliver between 200,000 to 500,000 gallons of water per minute, providing up to 30 inches of water to potato crops per season.

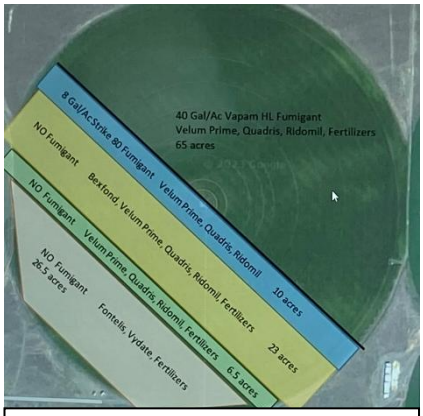

Figure 19. A pesticide trial in Washington, USA. Europe has banned many of the products used. Author's own photo.

These systems heavily rely on inputs such as fertiliser, water, and pesticides to maintain high yields. Additionally, many businesses collaborate closely with local processors. Grant Morris, the chair of the Washington Potato Board, indicated that profit margins for most businesses would be around 4% over a 10-year period, emphasising the challenges associated with securing water resources long-term.

10.4 Case Study 4: Meijer breeding station, Riland, Netherlands

Meijer is one of the leading potato plant breeding companies in the world, based in the Netherlands. Their business focuses on finding the best varieties for the future. With the help of new technology and AI, their ability to screen and replicate varieties has increased tenfold. This advancement allows them to concentrate on specific genetic traits, such as resistance to pests and diseases, carbon efficiency, and eating quality.

Breeding potatoes is often likened to breeding racehorses: while there is an element of luck involved, discovering the next top variety - similar to finding a horse like 'Frankel' - can lead to substantial income. The greater number of replicates with selected characteristics means a higher chance of success.

10.5 Case Study 5: Regenerative potato production

Gabe Brown, the author of "Dirt to Soil" and a co-founder of the regenerative agriculture movement, spoke to Waitrose's supply base about the importance of improving agricultural systems. His six principles may not align with conventional potato-growing practices in the UK, but they encourage producers to rethink the sustainability of their current methods.

Figure 20. 'Regen' fries being marketed by McCain in UK supermarkets. Author's own photo.

Brown emphasises reducing tillage, promoting crop diversity, protecting soils with ground cover, maintaining living roots, and integrating livestock - all of which can present challenges for potato producers. His sixth principle, which focuses on context, should prompt potato growers worldwide to reconsider how they produce their crops.

If producers reflect on these principles, they might achieve better yields, improved quality, and more prosperous businesses. This is a vision that the

McCain farm of the future, under the leadership of Manphool Singh, is actively championing.

10.6 Case Study 6: Alberta potato production

Alberta in the USA is prime agricultural real estate, stretching from the North to the South. Land prices across the province have increased by 500% in the last two decades. Many large agribusinesses have relocated their production to the region due to favourable government incentives, fertile soils, and good irrigation systems.

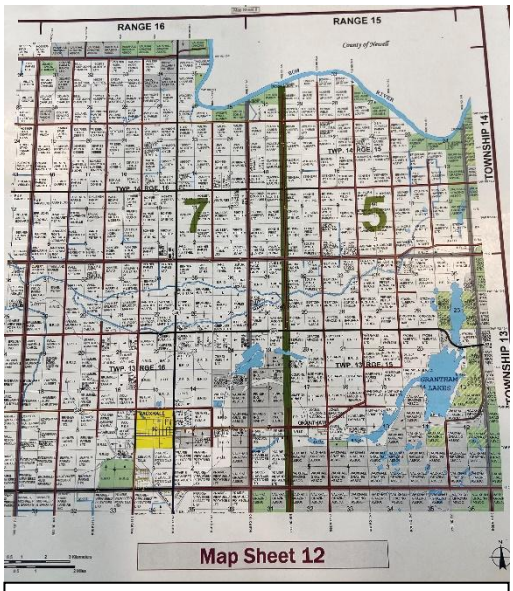

Figure 21. A map of the St Mary's irrigation district in Southern Alberta highlighting efficient layout of fields in 'quarters' 160 acres.

Figure 22. Klaas Bakker of Great North seed potatoes, a first-generation Canadian farmer originally from the Netherlands. Author's own photo.

In Northern Alberta, the seed industry is of exceptional quality. It boasts focused growers, low virus pressure, and strong marketing strategies. The extremely cold winters significantly reduce the spread of aphids and related viruses, while the vastness of the growing area ensures ample isolation from other potato crops. A small number of large seed growers take great pride in their established reputation and work collaboratively as a marketing cooperative to ensure they are perceived as high-quality producers. All seed stocks undergo post-harvest virus testing to provide complete transparency to their end users.

Strong relationships have developed among growers, with much of the seed being shipped to Southern Alberta and northern US states. The Edmonton seed growers participate in an annual seed tour to visit farms where their seed has

been sent, ensuring customer satisfaction - something that is rarely done in the UK. The farmers take pride in delivering quality and have successfully marketed their seed as 'high vigour,' allowing them to command a premium price.

10.7 Case Study 7: PEI potato research centre wireworm

In 2010, a task force was established in Prince Edward Island, Canada, led by Christine Noronha, to address the pest issue. At the time, an average of 40 wireworms per square metre were being discovered in the soil, severely impacting marketable crop yields. Christine noted that the ban on certain nematicides and fumigants had contributed to the rise in wireworm populations, combined with the practice of double cereal cropping in rotations.

Figure 23. Wireworm damaged potatoes in a waste pile in PEI. Author's own photo.

The task force's work with cover crops yielded impressive results, reducing wireworm populations by 40% per cropping cycle. A mixture of buckwheat and mustard proved to be the most effective, as the roots of buckwheat release a pheromone that disrupts the wireworm's growth cycle. While the island still faces challenges with wireworms, as highlighted in figure 23, the problem has been significantly mitigated.

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