



SCOPING STUDY FOR VERTICAL FARMING IN GWYNEDD

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CAN FRESH PRODUCE BE GROWN IN GWYNEDD?

SHORT ANSWER: Yes, we could. Technically, there's nothing stopping a vast array of fresh produce from been grown in Gwynedd. There are however a number of barriers that would need to be overcome as discussed on this section, including basic supply chain development, building up skills and raising awareness about the opportunities.

Gwynedd's land use is dominated by farming, which in turn can be categorised to 3 main sectors – dairy farming, beef production and sheep production.

Dairy farms tend to be specialist units, whereas beef and sheep production are often combined to form beef and sheep mixed farms. Some areas, such as the Llŷn Peninsula has a rich history of cultivating cereal crops. However, the amount of land used for cropping nowadays even on the Llŷn is very small with only a handful of farms that may possibly refer to themselves as mainly arable units. As the rest of Wales, horticulture accounts for a very small amount of land use in Gwynedd.

LAND USE	'000 ha
Permanent grass	147.9
Arable land	26.4
Rough grazing - Sole rights	81.4
Rough grazing - Common land (estimated)	21.2
Other land use	13.5
TOTAL	290.4

TABLE: Land use in the North West Wales Agricultural Region, 2014. (Source: Welsh Government Agricultural Statistics, 2016).

Approximate 150,000ha of land is farmed in Gwynedd. There are no publicly available land-use figures on a county by county basis. The North West Wales region used in Welsh Government Statistics is based on the old Gwynedd county and Anglesey. Based on local knowledge, it's safe to assume that the figures in the table above is heavily influenced by the large area of uplands found in Gwynedd. For example, the vast majority of the rough grazing in the North West Wales Agricultural Region will be based in Snowdonia.

Of the 26,400ha of arable land recorded in 2014 in the North West Wales Agricultural Region, 3,053ha, or just over 1% of available land, was used for growing cereals. Table 2 below shows how the land area used for growing cereals in the region in 2014 was distributed in terms of size or cereal area per farm growing cereal/cereal crops.

SIZE OF CEREAL AREA (ha)	Number of holdings	Area of land (ha)
0-4.9	63	171
5-9.9	53	387
10-14.9	26	323
15-19.9	19	328
20 and over	44	1843
Total	205	3053

TABLE: Holdings growing cereals by size of cereal area and number of holdings, in the North West Wales Agricultural Region in 2014. (Source: Welsh Government Agricultural Statistics, 2016).

Winter and spring barley crops cultivated for livestock feed would be the majority of this, with some wheat crop. 1,700ha of land was used for fodder crops to feed livestock, and approximate 100ha left bare. Grasses under 5 years old, which appear under arable land, accounted for 20,800ha of land in the region in 2014.

HOLDING SIZE (ha)	Number of holdings	Area of land (ha)
0-4.9	1577	3425
5-9.9	543	3776
10-19.9	546	7956
20-29.9	350	8762
30-49.9	441	17200
50-99.9	593	42696
100-199.9	465	64252
200 and over	308	121126
Total	4823	269193

TABLE: Holding sizes and land area managed by holding size in the North West Wales Agricultural Region, 2014. (Source: Welsh Government Agricultural Statistics, 2016).

It's probably reasonable to assume that the inclusion of large parts of Snowdonia National Park in the figures means that there are a higher number of larger holding units in the table than there would be for lowland Gwynedd on its own for example. Upland farms tend to be significantly larger in area compared to lowland farms.

As in other parts of Wales, there are a significant proportion of holdings with small parcels of land. However, it's doubtful that any of the holdings in the first 4 categories (up to 39.9ha) generate sufficient income for a person or family to rely on, and are probably

farmed part-time or rented out. It has been suggested by recent national strategy papers, that vertical farming is an opportunity to develop sustainable secondary income streams for the smaller farms.

Growing Fruit and Vegetables in Gwynedd

On the lowlands, the area's climate and soil is suitable for growing a range of fruit and vegetable crops. In reality, very little is grown, with fresh produce imported from other parts of the UK, or from abroad. Much of this has been driven by policy decisions made in the last 60-70 years. The Common Agriculture Policy (CAP) has indirectly encouraged farmers to specialise. Coupled with attractive incentives to keep cattle and sheep, farmers in Gwynedd have responded by specialising in red meat production and dairy. The current land-use pattern bears no resemblance to what the land could be used for in terms of food production.

Previous work on assessing ways of encouraging more vegetable cultivation in Wales have highlighted the following key challenges in extracting more value locally from the fruit and vegetables supply chain:

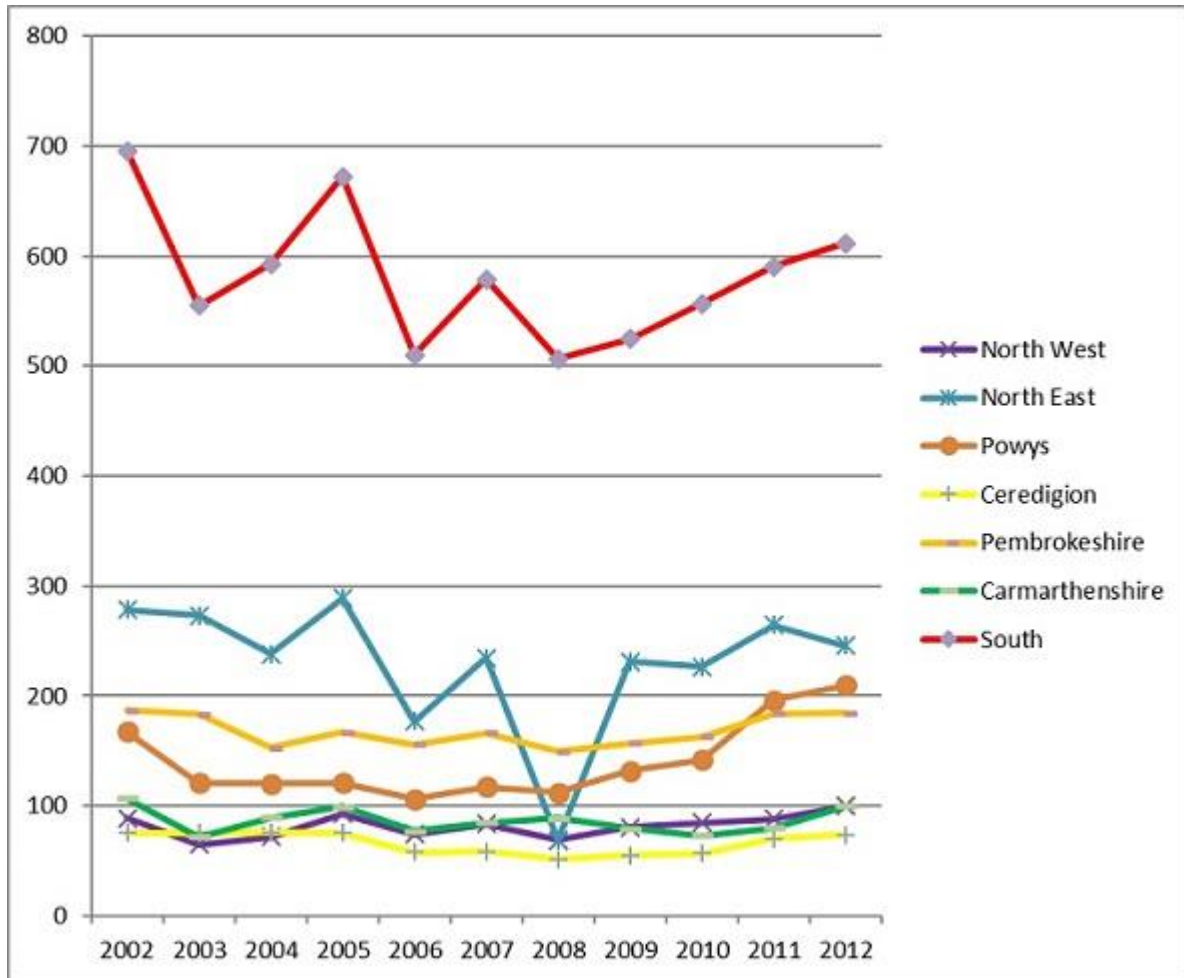
1. Lack of skills and experience in terms of growing vegetables commercially.
2. Lack of effective distribution system.
3. Lack of knowledge and awareness regarding the true needs of customers.
4. Disconnection between the start and the end of the food chain.
5. Access to suitable infrastructure, resources and starting capital.

The small size of field scale horticulture sector in Wales is largely limited by geographical factors such as altitude, soils and weather conditions which limit the land area suitable for commercial horticultural crop production. Like much of Wales' land area, many parts of Gwynedd is classified as Severely Disadvantage (SDA) or Less Favoured (LFA). However, vertical farming production systems, largely based on hydroponic technology are not dependent on the inherent edaphic and climatic features.

“Vertical farming overcomes many of the traditional barriers considered for fresh produce cultivation.”

Anglesey pioneered small-scale hydroponic production 10 years ago with the setting up of a network of pilot sites across the island. The pilot was successful in demonstrating that crops

could be cultivated to a high standard on the island for up to 10 months of the year without the need for artificial lights and heat. The failure of the pilot to lead to long-term sustainable enterprises was largely due to the lack of a suitably managed supply chain, and a lack of facilities to prepare, pack and distribute the produce effectively.



GRAPH: Amount of land used for horticulture in Wales, 2002-12 (ha). (Source: Horticulture Network Wales, 2014)

Gwynedd’s reputation as a “foodie destination” is strengthening all the time. This reputation is also linked to positive environmental and health messages, the concept of Gwynedd being “clean and green”. Vertical farming is able to build on this concept. Efficient supply chains can also ensure that these fruit and vegetables have low “food miles”.

The area’s relative isolation from the major horticultural producing areas, coupled with its cool climate means it has lower insect pests and related insect vectored disease issues than many other European countries.

Finally, the transport linkages between Gwynedd and the major populations of north-west England and the midlands via the A55 are very good. It also has strong transport links to Ireland, offering opportunities for cross border collaboration, which have already been established in a number of Interreg projects.

“A short study to identify back-haulage opportunities from Gwynedd could be useful, as anecdotally, there are more lorries heading east from Gwynedd empty than there are coming in with loads.”

Challenges and opportunities for developing Vertical Farming in North West Wales.

Horticulture in Gwynedd is close to being non-existent, despite its suitability for growing high yield of crops. The potential value of horticulture also makes it an interesting proposition for developing the local economy. On a per acre basis, crops grown in a vertical farm can generate 100x to 1000x the revenue of common enterprises such as beef or sheep units.

The list below and overleaf highlights the main challenges and opportunities facing Arloesi Gwynedd Wledig if it's to try and develop vertical farming in Gwynedd to increase the amount of fresh produce grown locally.

- 1. SUSTAINABILITY AND CLIMATE CHANGE** - There are 2 elements to the challenges and opportunities climate change creates - those linked to adaptation and those linked to mitigation.

The majority of models suggest that Gwynedd will experience more extreme weather events, especially strong winds and extremely heavy rainfall. These will present a particular challenge for developing traditional field horticulture. There is likely to be an increased level of damage to crops. Extreme rainfall events will lead to more flooding which can starve crops of oxygen and ultimately kill them, or make it impossible to go onto the land to harvest them.

Climate change may mean that there are opportunities to grow crops that are more usually found in warmer climates. The challenge here is to evaluate and disseminate information on the suitability of different varieties and species as the climate changes.

Vertical farming has a role to play in reducing the greenhouse gases which are contributing to climate change.

2. **SOCIETAL ISSUES** - A combination of macro and micro factors has focused interest on local food production, healthy food production, and secure food supply chains. Concurrently, there is great interest on the part of the public in engaging in food production. Furthermore, social care providers have recognised the benefits that involvement with horticulture can have for engaging with sectors of the community who, for various reasons, have become marginalised. This provides a great opportunity to foster and develop community and urban horticultural activities in Gwynedd in the medium to long-term.
3. **QUALITY ISSUES** - Initiatives to increase the sourcing of fresh produce in other parts of Wales have highlighted supply-side issues. New entrants to horticulture, such as farmers diversifying into horticulture, can join the market, but the quality of produce needs to be ensured through best practice in harvesting and storage, grading and packing and timely delivery.

A robust and recognised Quality Assurance procedure is one of the key tools that a producer or supplier has to inspire confidence in their product or service. There are a range of Quality Assurance schemes tailored to fresh produce.

4. **ECONOMIC OPPORTUNITY** - One of the greatest opportunity for Gwynedd from vertical farming is to address the heavily negative balance of trade in fresh produce, and to retain more money circulating in the local economy. According to the Office of National Statistics, figures in 2016 show that on average, each household spend £411 on fresh vegetables (£213) and fruit (£198) each year. With 52,473 households in Gwynedd according to the 2011 Census, that means that Gwynedd's households alone spend £21.57m on fresh produce every year. It's probably reasonable to estimated that 99-99.9% of that is lost from the local economy every year. The total expenditure on fresh produce in Gwynedd is far higher in reality, as the area has a wide choice of eating out locations that buy in food, and a very strong tourism industry that inflates the local population during the summer months.

“An estimated £21.57m is spent by Gwynedd's households every year on fresh produce.”

5. **SKILLS AND EDUCATION** - Managing vertical farming businesses requires a distinct set of skills. People interested in pursuing a business in vertical farming will need support to gain the necessary skillset to run successful horticulture units.

WHAT ARE THE MARKET TRENDS IN FRESH PRODUCE AND OPPORTUNITIES FOR GROWERS IN GWYNEDD?

SHORT ANSWER: Generally, the food market in the UK is influenced by 3 main trends – the demand for convenience, concerns over health and the aspiration for high quality. The opportunities are for high-value crops that can offer multiple cropping and are relatively simple to grow.

Convenience

Due to the pressures of modern day life, consumers have less and less time on their hands. As a result, they're always looking for foods which are convenient to eat.

Sales of ready meals and snacks continue to rise and recently, several attempts have been made by the fresh produce industry to develop products that offer the same kind of convenience.

'Ready-to-eat' salad boxes are now a common option for consumers seeking a convenient and healthy option for lunch or a snack. Higher end salad boxes will typically include a selection of salad leaves, microgreens and an accompaniment such as cold meat and possibly a dressing sachet.

Developing convenient eating formats allows a grower to add considerable value to raw ingredients. The global trade in salads that involves large multinationals makes it very difficult to compete with fresh produce alone. A vegetable grower in Gwynedd for example must consider options for adding value, even if it's only bagging fresh salad leaves.

The recent period of austerity has encouraged customers to either focus more on cheaper fresh produce that offers better value for money and to also develop an interest in 'growing your own'. Garden or allotment produce now corresponds to 3% of the fresh produce that is consumed by people in Britain.

The long term trend in vegetable sector shows that far less is being bought today compared to the seventies. Between 1978 and 2015, a decrease of 49% was seen in the consumption of green vegetables, with cabbage (down 73%) and sprouts (down 79%) being the main victims.

However, salad produce was the only part of this sector that saw an increase, with sales having increased by 33% compared to 1978. Continued innovation in packaging formats and the development of new cultivars has ensured that salads, especially niche produce such as microgreens and edible flowers, have shown good growth figures.

Health

One highly influential factor on the purchasing of fresh produce is the customers' awareness and understanding of the effect food has on their health.

According to IGD, the number of people eating their '5 a day' (fruit and veg) have increased from 32% in 2006 to 41% in 2015. 84% of customers allege that they do something every day to promote their health, be it physical exercise or healthy eating. The importance of food in terms of health can be seen in people's responses to the question "what do they do to keep healthy?"

41% of responses – Eat 5 portions of fruit/veg a day

39% of responses – More physical exercise

34% of responses – Eat low fat foods

34% of responses – Eat low sugar foods

Source: IGD, 2016.

It's clear from the responses above that food, especially fruit and vegetable, plays a vital part in people's efforts to improve their health.

The '5 a day' advice was first issued by the World Health Organisation in 1991. People are advised to eat at least 400g of fruit or vegetables a day, and this is probably the biggest campaign ever seen aimed at changing people's eating habits.

The service sector is responding to this development in consumer health awareness by introducing healthier options on their menu.

Quality

Even though quality is referred to as a notable buying trend, it can be said to some extent that customers have now come to expect products of a high quality as the norm. The challenge facing fruit and vegetable producers is whether they are able to consistently maintain the high quality throughout the year. Being local is not enough to secure trade, but it can offer a point of difference in otherwise competitive market place. Vertical farming offers a way for growers to control the growing environment and ensure a consistently high quality crop.

Other significant trends

In addition to the three main trends of convenience, health and high quality, several other buying patterns can influence the fresh produce market in Britain and these should be taken into account in any attempt to promote and support growers in Gwynedd.

The ethical shopping trend has manifested itself over the past decade. According to the Co-operative Bank in their report, Ten Years of Ethical Consumerism, the amount spent on ethical food and drink has more than tripled over the last decade.

However, not every aspect of ethical shopping has experienced these fruitful times over the past three years. The organic food market reached its peak in 2008, accounting for 24% of total sales relating to ethical reasons. This figure declined to 19% in 2009 and another decrease to 16% was recorded by the end of 2014. In the same vein, the total spend on organics has decreased significantly.

The most obvious development seen over the same time period was the popularity of local produce, which, by today, accounts for 26% of the total spend in the ethical market. According to IGD, this figure is expected to rise to 28-30% by the end of this decade.

It is clear, therefore, that people's beliefs have a strong influence on their buying habits. In the context of this study, it can be concluded that the demand for local produce is strong and likely to continue as such for some years to come.

Advantages of local food

Local food is not always better for the environment. A study by Professor Gareth Edwards-Jones from the Environment and Natural Resources Department at Bangor University in 2009 sought to analyse the lifecycle of various food items to prove that the carbon emissions of some imported food items are lower than those of similar products produced locally.

The study's key findings still applies today.

In most cases, an environmental advantage can be claimed by drawing attention to local food on a menu, but this principle should be sustained throughout the enterprise in order to gain the total respect of the customer. How many people realise for example that nearly half the carbon emissions for food are linked to the cooking process?

The possible environmental advantages are just one element of local food. Establishments and businesses that produce and promote local food should also be aware of the other advantages, which include:

1. **Health** – A local food supply chain should ensure very fresh produce.
2. **Seasonal food** – Using local food links with another trend in the market, which is serving seasonal food. Local produce can only be obtained when it's in season.
3. **The local economy** – This may be one of the strongest arguments for promoting local food, especially in rural areas; with substantial spending per head on food and eating out, the more that stays within the local economy the better.

4. **Enrichment of experience** – The experience of eating out is a vital part of the appeal of a food serving business. For the customer, especially a visitor, tasting a local delicacy can enrich their experience.
5. **Strengthening a sense of community** – Committing to support local producers can strengthen the tie between businesses and the local community.
6. **Promote a culture of respect for food** – One regular criticism of modern day life is a lack of connection between people and the food they eat. Movements such as ‘Slow Food’ are attracting growing support from people in Wales as more and more people re-discover the underpinning connection between a healthy existence and diet. A thriving network of local producers working closely with restaurants and shops can contribute toward developing a better understanding of food and, as a result, more respect.

This holistic approach to local food and drink is key for making locally grown fresh produce commercially attractive, viable and sustainable.

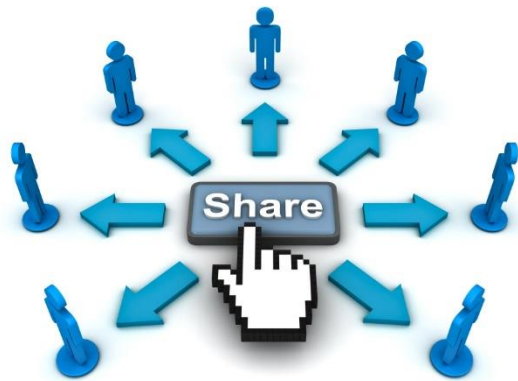
Overview of other key trends and drivers affecting consumer behaviour

The market place is a continuously changing environment, influenced by evolving consumer behaviour. Producers of any type of products or services need to keep abreast of key trends and drivers to ensure they are providing the right good to their customer in the most profitable manner. By keeping tabs of new patterns, there is much better scope for innovative producers to keep ahead of their competitors locally, nationally and globally.

Some of these trends will be driven by technological advances, whilst others will be a reflection of how socio-economic factors are evolving. A selection of 4 have been listed below and overleaf that may open up new exciting opportunities for growers in Gwynedd.

A) **CustOWNers** – Consumers more than ever want to engage with new products and services, and technological advances offers a range of new opportunities to do so.

People want to get involved with new developments from an early stage, either by contributing opinions and thoughts, possibly funding it or by getting involved in promoting it. The excitement of developing a new idea attracts potential consumers, and IT technology allows easier interaction between the business and its potential customers.



An example of this type of behaviour is the countless crowdfunding platforms now available on the internet where people can join together to support and fund a new business idea. Likewise, new manufacturing technologies such as 3D printing is expected to make it easier and cheaper to prototype new goods and develop bespoke items to meet unique consumer demands.

CustOWNers are growing rapidly in numbers and are moving from passively consuming a product towards becoming actively involved in the business. These business savvy consumers are often looking for both a financial and emotional return, and therefore only brands that are open, friendly, honest and transparent will be able to successfully interact. Businesses who've been willing and able to grasp this concept have will benefit from a loyal hardcore of customers that will be their bedrock.

Producers who are comfortable and able to embrace this principle will reap the benefit, and with such an emotive subject as local food at the heart of a business, seeking interaction and nurturing a sense of ownership among custOWNers should be very achievable. Vertical farming as a technology lends itself very well to capitalise on this trend.

B) **Mobile Moments** – Mobile handsets have revolutionised communications over the last decade. Mobile devices are set to influence even more of our lives as consumers look to their mobile devices to maximise nearly every moment.

Hectic busy lives will not deter people to continue cramming in more content, connection and consumption with their mobile handsets. 'Mobile moments' as they are called will penetrate to every parts of people's lives.

Growers keen to communicate with their customers will have to embrace new technology. Ignoring multi-media digital platforms will be too risky for businesses, as an ever increasing amount of people expect to find ways of interacting and learning more about businesses through their personal mobile devices.



- C) **Bare naked business** – Truly innovative businesses no longer aspire for just transparency. Instead, pioneering enterprises go out of their way to show they have nothing to hide.

Quoting statements on ‘values’ or the ‘business’ culture’ does not go far enough for today’s multi connected street-wise consumer. Businesses need to provide real, unambiguous and clear evidence about actual results they have achieved.

Trust in businesses have eroded over the last 10 years, creating a gap for entrepreneurial ventures with good genuine roots to capitalise by taking a very open approach to doing business.

Local growers should find it reasonably straight forward to adopt this strategy, as most will be able to show their customers first-hand the effect they are having by purchasing these items. There is no reason why a grower can take the bold step of inviting his/her customers to call round to his/her farm to visit the vertical farming enterprise. Most would probably not, but having given the offer, the grower will have given a strong message about transparency and the fact he/she has nothing to hide.

Producers who have the utmost confidence in their product should have no difficulty in bearing all to their customers.

- D) **Make green easy** – Most consumers are well aware of the environmental issues and recognise that it’s a serious problem. Despite recognising the problem only a few find it possible to take the necessary steps to transform their lifestyle for the benefit of the planet’s health.

The majority find “going green” time consuming, challenging, typically more expensive and troublesome, but these consumers are looking for quick and easy solutions that fit in well with their busy schedules - convenience is king.

Businesses who can offer consumers greener alternatives without extra hassle or asking for more money will have a significant advantage in the market place. If growers from Gwynedd can grow crops locally and bring them to the market in an equally convenient format to other alternatives, making the switch to support local growing should be a relative easy step for the green conscience consumer.

Other opportunities for Gwynedd's Growers.

However, there are a number of other organisations within Gwynedd that could be interested in sourcing fresh produce other than for cafés, restaurant and selling to consumers directly. It's always a sensible approach to consider other outlets to increase awareness, minimise over-dependency and to gather valuable experience in sectors that may offer better opportunities in the future.

Here are the other type of outlets that growers in Gwynedd could develop:

- **Retailers** – Like the food service sector, retailers are under increasing pressure from consumers to source local. The sector has undergone intensive consolidation over the last 20 years, with 4 major supermarkets now dominating up to 80% of the market. However, local convenience stores have shown good growth recently as they focus on elements that supermarkets continue to lag. Whereas a fresh produce supplier would need to offer a considerable critical mass to start negotiating with a multiple, independent c-stores offer local growers the opportunity to develop a mutually beneficial relationship. However, shelf-life and wastage will be key concerns for retailers and may cause difficulties early on in a relationship. A grower with a limited range of produce may also find it difficult to generate sufficient business from a low number of retail outlets, and with the exception of herbs, it is highly questionable whether there would be sufficient local demand for niche produce. Packaging format will be very important for retailers to ensure good shelf presentation and product protection.
- **Wholesalers** –There is a tendency for start-up growers to consider wholesalers as a costly method of reaching the markets, as wholesalers will typically be looking for approximately 20-30% margin on products they handle. However, the consolidation service and logistical expertise provided by wholesalers contributes real value to the supply chain, and should be considered as a method of reaching more end consumers in less time. There are a number of wholesalers operating in Gwynedd that could offer an option to collaborate with.
- **Processors** – These are very few and far between in Gwynedd. Processors are typically very price-sensitive and will tend to favour bulk purchases of produce. Having an

informal relationship with a salad processor, whether in Gwynedd or neighbouring counties could be beneficial if a grower expects periods of over-supply during the growing season. For example, it would be more efficient to sell produce at cost price to a processor rather than risk wasting surplus produce. A processor can therefore be a useful back-up for periods of over-supply if a good relationship can be forged.

- **Public sector bodies** – Procurement officers within public organisations have worked hard over the last few years to improve the proportion of locally produced food procured by the public sector. There are very few examples across Wales where growers directly supply public bodies, as most local growers will do so through either a co-operative or a wholesalers. Hospitals, schools and Ministry of Defence are all major buyers of food, but tenders will usually be heavily weighted on price. Whereas contracts for common root vegetables such as potatoes and carrots might be typical, contracts for microgreens and edible flowers are most likely to be very rare in the public sector. New, specialist or small-scale growers are probably well advised to leave this sector for the larger companies and instead focus on alternative outlets.
- **Online markets** – There are good examples of growers in the UK who have based their business on online trading. Chillies is a good example of a product that has sufficient value for its weight to make the cost of post and packaging viable. The South Devon Chilli Farm (see www.southdevonchillifarm.co.uk) is widely recognised as the pioneers in this market, offering a selection of different varieties of chillies through the post. Rowenna and Phillip Mansfield of Cae Gwyn Farm would be a useful contact for a Gwynedd grower to discuss with as they have been trading online under the www.herbsfromwales.co.uk domain name for a number of years. Building a successful online business requires great skill and knowledge of web marketing. Several successful examples of web trading often notes how it takes at least 6-12 months to generate a reasonable amount of trading from a website, as this is usually the time required for major search engines to properly register and start highlighting a website.

Key conclusions

1. Growers need to work with their customer base to identify and plan ahead for peak periods of demand as well as periods of slow trade. Matching production with demand can be challenging, but requires good communication lines to achieve.
2. Food businesses (both retail and service) expect to have at least twice a week delivery service. Growers need to consider if they can organise a cost-effective method of providing this service, or alternatively consider other routes to market where twice a week delivery is not a necessary cost.

3. Being a 'local' brand is not sufficient to break through in the competitive food market. Growers need to identify their key brand values and ensure these are communicated effectively to differentiate against the other brands available.
4. Businesses are usually flexible with credit terms at the start of a trading relationship.
5. Freshness and taste are 2 key factors in influencing the success of fresh produce. Being local, natural and traditional are unlikely to be sufficient brand values on their own, so growers will have to ensure the best possible eating experience.
6. There is a very strong argument that growers should focus on their produce's freshness, eating experience and their quality service in order to develop a market. Being local and natural is unlikely to be sufficient on their own, and messages about sustainability and supporting the local economy should be used as secondary messages. The dynamic nature of the food market may well mean that market conditions will change within a 3-5 year period, when it would be sensible to review the market. Gwynedd's producers however have many facets to their story, which can only help them to adapt to market conditions as and when required.

THE TECHNICAL LOWDOWN ON HYDROPONICS

Hydroponics = The technology making 'Vertical Farming' possible.

This part of the study outlines the case for why Arloesi Gwynedd Wledig should support the development and adaptation of vertical farming technology in filling the gap for locally produced fresh produce.

Hydroponics is a technique for growing crops without soil, and is very common on a global level. Nutrients are provided in dissolved form in the water whilst light, air and heat can either be provided naturally or artificially.



The potential benefits of using hydroponics within a vertical farming system are:

1. The **extended growing season** offers a wider window for production and marketing fresh produce to local customers. Being able to offer crops for a longer period of time could provide growers with a bigger income and make their business more attractive.
2. Hydroponics allows growers to produce a **wider array of fresh produce** because the system can **create the conditions for optimum growth** without having to depend on soil and to a lesser extent the weather.
3. It makes **more efficient use of inputs**, in particular water and energy.
4. The **quality** of hydroponic produce can be as good, or even better than crops grown conventionally in the open, in both taste and nutrient density. Hydroponic crops tend to be cleaner than field crops.
5. Hydroponics should make **pest management easier**. Some crops, in particular those with a short growing cycle can be grown without the use of pesticides in a hydroponic system. There is no need for herbicides due to the absent of weeds, whilst soil-borne diseases and pests have been eradicated. Integrated Pest Management (IPM) should take control of most pest problems, which is a careful combination of biological and chemical control.
6. **Higher yields** are achievable in a hydroponic system in less time compared to a soil based system.

7. **Continuous crop production** is possible as there's no need to rotate land or rest soils.
8. **Less labour** is usually required with hydroponic production. Because plants are usually grown on benches, managing and harvesting the crop should be more comfortable compared to having to bend down to the ground.

There are however certain drawbacks associated with hydroponics:

1. Hydroponic cultivation requires good agronomy and technical skills. Growers lacking in experience need to start by choosing simple growing systems to start off, and cultivating crops that are relatively easy to grow such as salad leaves, microgreens and various oriental vegetables.
2. Although cheap to run, hydroponics can involve a significant capital investment at the beginning. This has been identified as a barrier for new growers.
3. Despite having a lower pest and disease pressure, growers need to be vigilant of any outbreaks, as pest and disease problems tend to spread quickly in a vertical farming system, especially if located under protection.
4. Some species are better suited for hydroponics than others. Experience and reading about hydroponics is possibly the best way of learning what varieties grows best in hydroponics.

Hydroponic systems

Hydroponic systems are usually classified based on the method they use to distribute the nutrients to the roots. There are 3 main types.

1. Nutrient film technique (NFT)

This is the simplest and cheapest in terms of initial capital outlay.

Plants are propagated in growing blocks made out of materials such as rockwool, cocoa fibre or jute fibre, and placed in channels that look similar to house guttering. A thin film of water runs along the bottom of the channels and back to a tank at the bottom of the run. The water is then pumped back to the top of the channel where it flows back again by gravity through the roots.

In a NFT system the plants' roots are constantly in a stream of nutrient solution. The flow of nutrients is governed by the slope. Too fast a flow will damage the roots, whilst a sluggish flow will cause pooling along the joints of the channels. A 2% gradient is usually required to run a NFT system correctly.

Several channels can be connected together that run from the same water reservoir. As the crop matures, the grower can adjust the nutrient levels accordingly.

Channels are usually mounted on frames at waist height or placed on benches. The units that will be bought by this project are mounted on a racking system, placed on a frame with a set of wheels at the bottom to make the unit mobile.

Pyramid formation or a double deck is commonly used to optimise space. Some companies nowadays offer NFT systems in columns, which again makes better use of limited space.

2. Flood and drain systems

Also known as “Ebb and Flow” systems. Crops in a flood and drain system are typically grown in an aggregate such as clay pebbles, perlite or vermiculite. It is also possible to place plants grown in rockwool plugs into aggregate material.

However most of the modern systems are designed to grow microgreens using the flood and drain system, without a growing medium. Crops can be grown in shallow trays where the water and nutrients will be delivered to via a digital pump timer interface, and then allowed to drain before another circulation.

The rooting system will therefore be periodically submerged by water and then left to drain away back to the reservoir. The flooding frequency is controlled by a timer and ensures that the plant is supplied with ample amounts of nutrients.

Flooding and draining forces a continuous cycle of air circulation around the roots as new air replaces the pockets left by the draining water.

3. Aeroponics

Aeroponics is one of the most efficient systems, but also the most challenging technically, especially for a novice grower.

No growing medium is used as the plants are grown in caged holes above a tank that houses a network of mist sprayers. The fine mist creates a very efficient environment for the suspended roots, with plenty of oxygen, water and nutrients available.

Aeroponics suffered several drawbacks in its early years as engineers struggled to develop a reliable system for pumping the water at high pressure through the sprayer nozzles.

Location requirements for vertical farming

The assumption that a polytunnel or even glasshouse is required has been another barrier in the past for starting out in vertical farming.

The systems that are currently available on the market for start-up growers have been designed to operate within existing locations such as sheds, redundant farm building or even in a moderately sized garden shed. There is no need to invest in new infrastructure.

Even the basic systems nowadays allow the grower to control the nutrient level and lights, with more advanced systems allowing the grower to directly control the growing temperature. Growing crops with artificial heating is more technical and costly.

Having a favourable growing climate will help to extend the growing season and keep growing costs down. Other factors that will play a part when locating the units include.

1. **Utilities** – Growing units will need a supply of water and electricity to run the water pumps.
2. **Water quality** – Soft water is better suited to hydroponic growing. A clean supply free from excess salts and heavy metals will also improve efficiency.

Technical requirements

The following headings summarises some of the most important aspects when managing a hydroponic vertical farming system:

1. **Growing mediums** – These are required for ‘Nutrient Film Technique’ systems. Rockwool (usually marketed under the name ‘Grodan’) growing blocks work well under most conditions, from propagating seed to growing in the channels. Many favour rockwool because it’s chemically inert and stable in most hydroponic solutions, and it can provide adequate water and air holding capacities.
2. **Nutrients** – Most hydroponic suppliers will provide nutrients in powder or liquid form as part ‘A’ and ‘B’ for growth and part ‘A’ and ‘B’ for bloom. The growth nutrients should be added to the water during the vegetative stage, and the bloom nutrients during flowering. The main difference between growth and bloom is the higher nitrogen content in growth solutions. Modern ready prepared solutions can provide all the nutrients a crop requires.
3. **Ventilation** – Adequate ventilation is very important as day temperatures increase. Lettuces in particular require substantial airflow.
4. **Lighting** – Lighting may be required for access and safety purposes. Supplementary lighting to support growth comes as part of each micro pilot growing unit.
5. **Meters** – The pH of the water needs to be monitored every day. Different crops will have different requirements, but most will grow at their best if the pH is between pH6.0-6.5. Solutions to increase and decrease pH can be bought from hydroponic suppliers, as well as hand-held pH meters. The water should be well mixed before taking a pH measurement. Likewise, the nutrient level should be monitored and adjusted accordingly on a daily basis. A hand-held device called an ‘EC meter’ can be used to measure the electrical conductivity (EC) or the conductivity factor (CF) of the water. The reading from this device gives the total level of salts in the water rather than the proportion. Growers tend to rely on the nutrients manufacturers to get the proportions correct. Charts specifying the nutrient requirements of different plants

should be used when growing crops. The nutrient requirement of crops will differ depending on their growth stage.

See below for photographs of 2 micro growing units that were recently launched by a company called HydroGarden under the brand of 'V-Farm.' These units offers new growers an opportunity to learn and pilot new crops.

The system on the left hand side is based on a 'NFT' system, whereas the unit on the right is a 'flood and drain' system set-up on trays.



WHICH CROPS COULD GWYNEDD'S VERTICAL FARMERS GROW?

Here are 4 possible crops that could be grown in Gwynedd within a vertical farming system.

CROP 1: Assorted herbs

All the following plants have common characteristics and can be sown from seed and transplanted into a simple hydroponic system.

- Lemon balm
- Oregano
- Sage
- Chives
- Common thyme
- Sorrel
- Dill
- Chervil

Growing season - All the above herbs can be easily propagated from seed, and should be grown for one growing season, although some are perennials. Cuttings can be used for propagation if available. Harvesting can take place from mid April to late November in a simple hydroponic system.

Harvest – Most will be ready to harvest from the end of April onwards or within 6 weeks of transplanting. Yields of up to 1Kg/m of hydroponic channels can be expected, but sage might take a longer time to mature and the light leaves will produce less weight.

Only the top leaves should be picked at the first harvest to promote side shoots. Foliage can then be harvested at 4-6 weeks intervals until November.

Processing and market – This range of herbs can either be sold fresh for culinary uses or dried for temporary storage. Because most are fairly common, it will be difficult to compete with other herb producers, especially now that supermarkets stock good quality fresh herbs.

Further value can be added through selling essential oils for cosmetics or herbal medicines, infusions or herbal teas, dips or marinades for fish and meat, or as a compliment to other products such as salad leaves.

CROP 2: Chillies

Chillies belong to the same family as tomatoes and potatoes. There has been a surge of interest in chillies over the past 10 years as consumers explore the wide range of different cultivars that are available, each one with its unique characteristics.

Growing season – Chilli plants can take up to 4 months before fruiting. If propagated early in the year, chillies could be harvested from early June onwards in Gwynedd. A careful cropping regime can optimise the picking window to at least 6 months of the year.

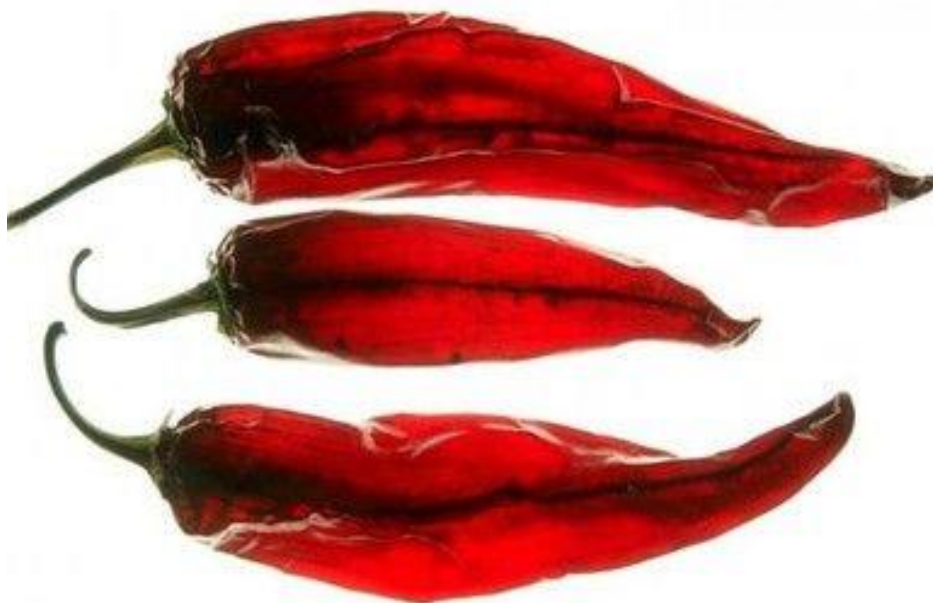
Harvest – Harvesting can begin from early to mid June, depending on variety and weather. The best time to pick chillies is just when they start to change colour. Picking at this time will stimulate the plant to produce more flowers, whilst the picked chilli will continue to ripen.

Processing and market – Chilli production is a rapidly expanding niche. Chillies, especially unknown varieties can justify a price premium. They are also easy to transport around the country.

Drying is the oldest method of conserving chillies. Dehydrators can be bought to dry chillies, which can then be either stored or grind down to powder or coarse flakes.

Chillies offer a range of possible marketing approaches. They can be easily transported around the country, and therefore sold over the internet.

A range of unusual food products can be produced from chillies including jams, jellies, chutneys, dessert sauces, beer, liquors and chocolates.



CROP 3: Oriental vegetables

A whole range of oriental vegetable seed is now available from UK seed companies. This section covers a group of oriental vegetables that require similar growing conditions. These includes pak choi, wong bok, mizuna, chinese celery and mustard spinach.

Interest in oriental vegetables has increased significantly over the past 10 years partly due to endorsement by celebrity chefs in magazines and on the television.

Oriental vegetables are convenient to cook and are healthy, making them attractive to a large section of the population. With the possible exception of pak choi, oriental vegetables or leaves continue to be a niche market in the UK.



Growing season – Most oriental vegetables have a short growing cycle and are well suited to the UK climate. Seeds can be planted directly into rockwool plugs from early February onwards, and the first harvest can take place from mid April onwards, continuing until early November.

A hydroponic system with basic heating and lighting could produce all year round.

Harvest – Harvesting can take place from the end of April onwards, and depending on the weather can carry on without artificial inputs until November. Hydroponic production produces substantial yields of oriental vegetables. It should be possible to grow 6 crops of pak choi a year in Gwynedd with each square metre of channels producing up to 60 plants each time. At the time of preparing this report, mature pak choi retails for approximately 60p each. Based on selling at 40p per head, each square metre could generate up to £144 worth of income per year. On average it will take 5-6 weeks for a plant to mature in a growing channel in addition to the 2 weeks propagating.

Processing and market – Growers have to decide at the start whether to focus on optimising hydroponics to achieve optimum output and sell the majority of the produce to a wholesaler, or aim to develop added value opportunities in addition to growing. Achieving both at the start can be very difficult unless working in partnership with other people or companies.

There are several simple added value opportunities for oriental vegetables. Due to the clean growing environment provided by hydroponics, the vegetables can be cut or prepared as part of a salad mix, or chopped for stir-fries. Further processing may involve some form of cooking or food preparation for the service sector.

CROP 4: Salad leaves or speciality leaves

A good range of salad leaves is available on the market. The choice includes rocket salad, watercress, chard, lamb's lettuce, saisi, kale, cos, endive and lollo rossa.

The growing systems for these are very similar to the one for oriental vegetables, hence no further growing information is provided in this section.

Harvesting can take place in less than 6 weeks from sowing. Good ventilation is essential, with a fan system required to stop leaf burn during summer.

Simple hydroponics is especially suited to the production of small fancy leaf type lettuces. The choice of cultivars allows a grower to produce a greater range of different shaped and coloured leaves, that can be sold directly to shops as lettuce heads or prepared into packs of salad leaves.

As mentioned under previous crops, salad leaves can be combined with herbs and oriental vegetables to create new healthy combinations.

There are already big companies in the UK and Ireland who specialise in salad packs, but there is room for further innovation in the market place through new product lines.

Rockwool grown plants can be harvested with roots still intact in the rockwool plug. Special packaging can be used to pack lettuce head with the roots still connected, which improves the keeping quality of lettuces.



What are microgreens and edible flowers?

Microgreens are a relatively new culinary trend of using small delicate salad leaves to elegantly garnish dishes. The photograph below shows a variety of different microgreens that are now commonly cultivated and used in kitchens and restaurants.



Microgreen plants are typically harvested just after the cotyledon stage when the plant possesses an active green bud and a pair of first true leaves (also called 'prophylls.')

Harvesting usually takes place around the onset of photosynthetic sustainability, when the seedling is in transition from a sprouted embryo reliant on its seed store, to a 'stand alone' organism. As a result, the very young plant has a unique blend of phyto-chemicals giving it a different flavour combination to that found in sprouts or baby greens. It is this special flavour that chefs are seeking when purchasing microgreens.

The taste provided by microgreens is usually strong, which is again an indication of its high antioxidant and phyto-chemical content. Having evolved to survive in hostile environments, the flavours were an useful tool to ward off grazing animals and harmful organisms such as fungi and bacteria.

Today, consumers are increasingly aware of the importance of antioxidants in the diet, and are more likely to appreciate the health giving properties of microgreens in a similar fashion to sprouts.

There are broadly three groups of microgreens, namely the lettuce/brassicas, herbs and vegetables.

The **LETTUCE/BRASSICA** group contains:

Red Chard - A small shiny dark red leaf that has an earthy taste.

Red and Green Mustard - One strain in particular is “Mustard in the Snow” which prefers cooler weather to grow successfully. It is a deep green mustard and like other mustard leaves has a sharp tangy flavour of mustard.

Mizuna - This is an oriental green with a dry flavour. It grows very quickly and has an attractive leaf shape that is pleasing to look at in a mixture.

Cress - Young Water Cress with its dark green rounded leaves provides a bite to a microgreen mix. Greek Cress has slimmer leaves and a hotter peppery flavour than ordinary cress.

Lettuce Leaves - There are a huge range of nicely coloured lettuce leaves for inclusion in micro greens. The following are some of the best for all seasons.

Mottistone – a green and red mottled leaf with a crinkly open habit.

Rushmore – a red lettuce with an oak shaped leaf.

Ashbrook - a green lettuce with a sharp oaked leaf.

Sylvesta - a butterhead lettuce sprouting light green.

Rouge d`Hiver - an open hearted lettuce with red streaks, ideal for cold weather.

Rocket - Both Salad and Wild Rocket have a unique nutty flavour.

Brassicas - Broccoli, kale and many of the cabbage family produce fast growing young plants. Almost all have that almost sweet cabbage flavour that lingers in the mouth.

Pak Choi - Canton and Hanaker are the two main varieties which grow into crisp young plants.

The **HERBS** list is very interesting as there are so many differing and intense flavours, shapes and aromas:

Basil – Sweet, Bush, Thai, Lime and Genovese all have their own unique flavour even in young plants. Added to this must be the Opal and Purple varieties which add a different colour and taste

Chervil – An aniseed flavoured leaf which complements the lettuce/brassica group.

Purslane - Also known as Claytonia - Golden and Winter varieties have round crunchy leaves. These do not have the strongest of flavours but grows well under Gwynedd's climate.

Chives - When cut very young, chives have that strong onion flavour unique to this herb. Garlic Chives have a slightly garlic flavour.

Sorrel – This plant has a sharp tangy flavour but it grows well in all environments. Its root system can be invasive.

Coriander – Another herb with a unique flavour and taste.

Stevia – A newer culinary herb originating from Paraguay. This plant is very sweet being over 100 times sweeter than sugar, so only a tiny amount needs to be introduced in a mix.

Lovage – A very strong celery flavour, again only a small amount is needed in a mix.

The choice of **VEGETABLES** for producing microgreens includes:

Oriental vegetables - Chinese Water Pepper, Amaranth, Water Spinach, Burdock, Salad Burnett, Minutina, Chinese Cabbage, Choy Sum, Celluce (Chinese lettuce,) Corn Salad, Japanese Parsley, Komatsuna Yujiro (a cross between mustard and cabbage,) Komatsuna Torasan, Komatsuna Sharaku, Texel Greens, Spinach, Red Orach and Perilla

Traditional vegetables (all of these need cutting very early) – Peas, Beans, Leeks, Radish and Celery.

Edible flowers are simply flowers that can be eaten, in salads, soups, drinks, jellies and all kinds of other dishes. Other than their obvious decorative appeal, there is increasing interest in their health properties, but very little work has been published on the subject to date.

Other edible uses of interest include steeping petals in oils and vinegars to add flavour or crystallising them with egg white and sugar.

Examples of popular edible flowers includes:-

- | | | |
|-----------------------------|---------------------------|-------------------|
| - Artichoke (buds) | - Broccoli (buds) | - Borage (flower) |
| - Chamomile (for tea) | - Chive (flowers or buds) | - Clover |
| - Dandelions (flowers/buds) | - Elderflower | - Violet |
| - Hibiscus | - Honeysuckle | - Nasturtium |
| - Pot marigold/Calendula | - Pansies | - Sunflowers |

Special care must be taken when selling edible flowers for selling as a large number of flowers are toxic for humans. Others may only be edible after appropriate preparations or harvested using a certain method at a certain time.

Unless a grower is highly experienced and sufficiently knowledgeable, it is strongly advisable to seek specialist assistance when developing a edible flower enterprise. Equally problematic would be the misidentification of flowers as being edible but toxic in reality.

Edible flowers are very niche, which means most people will not be aware of any allergen problems until they consume their first flower. Allergic reactions are possible, especially from eating pollen. As with salad and microgreen crops, the agronomy of the crop must be managed appropriately to minimise the risk of flowers sprayed with toxic pesticides been eaten. Likewise, dirty or insect-ridden flowers could be unfit to eat.

Reducing the risks in growing

Although it is not possible to remove risk altogether when starting a business, it is possible to take steps to significantly reduce the risk. Here is a selection of different techniques that may be adopted in order to minimise financial risks:

1. Avoid committing to paying rent or spending on processing premises at the outset by finding a suitable location that may be hired on a flexible basis as and when necessary. For example, it might be possible to hire the kitchen of the local village hall in order to produce a batch of chutneys without having to invest in a dedicated unit.
2. Take time to test the market before making a financial commitment. With an experimental product such as apple juice or mash, it's important to pilot the product with focus groups or test them on customers in a food fair or in partnership with a local shop.
3. Consider contracting the processing and/or the packaging work to another company. There are a few companies in North Wales that would be able to co-operate on this kind of "white labelling" contract. This could be a very simple model for controlling costs and minimising risk for a new business. For example, it might be possible to contract the making of chutneys to an experienced local company that could take advantage of cheaper postage and packaging costs. Such an understanding would also allow growers to keep their focus on growing and developing their businesses in the field or polytunnel.
4. Securing pre-orders. Most shops and eateries are used to dealing with food businesses and are willing to pre-order on the basis of tasting a sample of the product. In some instances, it might be possible to negotiate an up-front payment or at least a payment on receipt in order to protect cash flow.
5. Keep a close eye on spending on stock. It's far better to order specific amounts of stock such as added ingredients and bottles to correspond with orders, in order to avoid tying up cash and stockpiling, and to reduce the potential for waste.
6. Consider the benefits of avoiding making a 100% commitment to using local fruits or vegetables if an added value product is developed. Although the aim of this study is to encourage and stimulate local growing, it could be important to avoid a situation where a product is entirely committed to local produce only. The brand could instead be based on the use of local produce, but should also be open to the possible need in the future to use produce from neighbouring locations in order to ensure a continuous supply. It's also possible to make a commitment to using a certain percentage of local fresh produce, that would be entirely realistic to achieve, such as

“our products contain at least 25% locally grown baby leaves” or “contains minimum 50% Welsh grown leaves.”

7. Managing a growing enterprise and a processing enterprise at the same time is a difficult task. There is a real danger of over-stretching resources, and the business suffering as a result. The burden can be somewhat lightened by coming to an agreement with a company that provides a marketing and supply chain management service. A company such as this could lead on the marketing agenda, arrange deliveries and process the paperwork for a percentage that's dependent upon sales (thus protecting the business' cash-flow) or for a fixed monthly fee. Similarly, the administrative work could be subcontracted to another company.

Gantt chart for setting up a herbs, microgreens and edible flowers enterprise

The Gantt chart below provides an ordered list of key actions that would be required to set up a growing enterprise in Gwynedd.

A growing enterprise will always to some extent be governed by the seasons, whether that is in the sense of the weather or in terms of seasonal demand. Further information on the key actions are provided overleaf. This is an example for illustrative purposes.

KEY ACTIONS	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Complete detailed market research	■	■												
Attend hygiene course		■	■											
Secure firm intentions to purchase			■	■										
Prepare and complete business plan			■	■	■									
Liase with planning department				■	■									
Register with Council as a food business				■	■									
Secure funding for start-up				■	■									
Order equipment				■	■									
Finalise growing programme				■	■									
Inform customers of starting date				■	■									
Construct tunnel and growing system					■	■								
First sowing					■	■								
Continuous sowing					■	■	■	■	■	■	■	■	■	■
Harvesting, sorting, packing and delivery						■	■	■	■	■	■	■	■	■
Administration - invoices, delivery notes...						■	■	■	■	■	■	■	■	■
On-going marketing and sales programme						■	■	■	■	■	■	■	■	■
Clean, disinfect and rest tunnel													■	■
Evaluate and plan for next season													■	■

CHART: Gantt chart for establishing a new growing enterprise in Gwynedd.

A Gantt chart should be used as an on-going monitoring tool to assess progress against forecast and to plan ahead for busy and quiet periods. A Gantt chart is a live working document and should be revised regularly according to circumstances.

Complete detailed market research – The grower needs to decide on the route to market and carry out further research to potential customers to ensure the business is structured correctly to meet their demands. Primary research such as interviewing prospective businesses is a very good method of gaining a direct insight to a business and to possibly form what could be a long term business relationship.

Attend hygiene course – Basic hygiene courses are organised on a monthly basis at the Food Technology Centre in Llangefni. A grower is best to secure this as soon as possible in order to learn what is required and to lighten the workload later on when it will get busy.

Secure firm intentions to purchase – To increase the chances of success, a grower needs to have confidence that the produce will be sold once it's ready as fresh produce cannot be stored for more than 1 or 2 days. January and February is a good time to be discussing business with caterers in Gwynedd as they will have more time to consider different options before it gets busy once again. A grower needs to secure verbal (all the better if on paper) intents to order to provide future security before embarking on costs. This is also the time to collate information on the amount of produce required from potential customers.

Prepare and complete business plan – A business plan need to be in place by the end of February.

Liasie with planning department – Once the decision is made to move ahead or not, the grower can approach the local Planning Department to check whether permission is required. This needs to take place soon as the process could take several weeks if permission is required.

Register with council as a food business – Environmental health officer should be able to arrange a meeting within 2-3 weeks from first enquiry.

Secure funding for start-up – Funding needs to be in place before ordering as most suppliers will expect upfront payment. If a grant application forms part of the funding package, then it would be worth starting this action even earlier is possible.

Order equipment – Companies can take 2-4 weeks to deliver, so orders needs to be placed mid February.

Finalise growing programme – This will provide details on what crops will be grown (based on the business plan) and when they need to be sown. A commercial grower needs to have a “conveyor belt” mentality to growing as the tunnel needs to continuously produce without any major gaps. Sowing is therefore an on-going task and should be planned in advance. Once the growing programme is completed, the seeds need to be ordered from the supplier.

Inform customers of starting date – Clear communication is required from the outset with the customers. At least 2 weeks warning is required to provide the businesses with the opportunity to plan ahead. A grower could ask for an indication of the first order at this stage.

Construct tunnel and growing system – A tunnel needs a relatively warm day to be built (to ensure good tension for the polythene cover) and very still conditions. A team of people need to on stand-by to take advantage of a suitable window of weather.

First sowing – This can take place once the construction date is known. Seeds can be started off in trays or propagation unit a few days before construction is finished.

Continuous sowing – Part of the “conveyor belt” mentality.

Harvesting, sorting, packing and delivery – This will be started as soon as the first crop is ready. As microgreens have a very short growing rotation, this will typically be around 10-14 days after first sowing for this type of crop.

Administration – invoices, delivery notes - A successful cropping business needs to keep on top of paperwork to ensure prompt payments from customers.

On-going marketing and sales programme – This will reflect the marketing plan prepared as part of the business plan. Marketing needs to be an on-going activity to ensure current customers remain happy and loyal, and to attract more business to enable the enterprise to expand.

Clean, disinfect and rest tunnel – This will take place from mid November onwards in order to keep on top of diseases, fungal spores and pests.

Evaluate and plan for next season – The first season of growing will have been a steep learning curve. A grower needs to take on board the experience in order to prepare and improve for the following season which will quickly come around. The second season should start with first sowing during the first half of February.

WHAT ARE THE POSSIBLE BUSINESS MODELS FOR GWYNEDD'S GROWERS TO ADOPT?

Short answer: This study has identified 8 possible models, each with its own pros and cons. Which business model to choose will depend on many factors, including which market is going to be served, what's going to be grow, the proximity of the growers to each other and their level of trust.

It's clear from the research so far that the lack of suitable land and climate does not prevent growers using vertical farming systems from growing, although it should be recognised that the weather isn't always going to be favourable in Gwynedd.

These are the main obstacles facing any effort to stimulate production locally:

- 1. Lack of skills and experience in terms of growing vegetables commercially.**
- 2. Lack of effective distribution system.**
- 3. Lack of knowledge and awareness regarding the true needs of customers.**
- 4. Disconnection between the start and the end of the food chain.**
- 5. Access to suitable land and starting capital.**

The models listed over the next few pages are an effort to identify ways of overcoming these obstacles. Each model includes a description of how it could work in Gwynedd as well as a simple evaluation of the advantages and disadvantages.

MODEL 1 – Selling individually

This is the most popular choice when venturing into horticulture, but one that involves a high level of risk.

The basis of this model is that the person or business grows their own produce and tries to sell it directly.

There are several ways to go about selling directly, including:

- i) Farm gate – Produce could be sold from the farm to the public by the gate. The shop could be supervised or an honesty box system could be implemented.
- ii) Box scheme – Distributing vegetable boxes weekly for a certain value. In order for this to succeed and be cost effective, it would have to be operated in a highly populated area.

- iii) Farmers markets – Selling on a stall in a farmers market.
- iv) Supplying shops/eating establishments – Selling fresh vegetables directly to businesses in the area.
- v) Online – Products that are high in value and light in weight can be sold over the internet, but an expertise in information technology would be needed and a very good marketing campaign if this source is to be relied upon.

Even though this is the most obvious and traditional path towards growing, this doesn't necessarily mean that it's the best. In fact, previous statistics show that the demand is increasing for quality local vegetables, but that the growing industry can't respond and cope with the demand. This in itself is a good reason to look at other models as a way of stimulating more growth in Gwynedd.

Through Farming Connect, the Farm Advisory Service in Wales, it's now possible to receive substantial technical aid as an independent grower.

However, this model doesn't overcome the true obstacles that face growers which are distribution, adding value and reaching the customer. For this reason, attention is drawn to other possible models which could be used to increase productivity amongst growers in Gwynedd.

Model 1 - Advantages and disadvantages

- + (POSITIVES) Opportunity to understand customer needs and learn about growing quickly.
- + Simple model which offers the grower significant freedom.
- + Flexible model for starting out on a small scale without having to put too much pressure on the business too soon.
- (NEGATIVES) Extra pressure to grow a variety in order to keep the customer happy.
- Responsible for every aspect of the supply chain, from sowing to packing to marketing.
- Can be difficult to find the time to add value to the product.
- Distribution costs likely to be high.
- High financial risk and possibility of feeling isolated.

MODEL 2 – Simple sharing

This model is based on growers discussing and understanding each other's business in order to identify what resources they can share together without any formal contract or structure in place.

The following are all areas of business that could be shared with other growers for mutual benefits:

- Packaging and inputs procurement – Through purchasing together, growers could obtain more favourable terms.
- Sharing customer details – One producer may open the door for another producer, whilst at the same time help a customer source more local produce.
- Sharing delivery – Growers can come to an understanding to share a delivery vehicle owned by one of the group.
- Labour exchange – Growers could help each other during peak periods to avoid having to employ temporary staff or to allow producers to capitalise on large unexpected orders that they couldn't otherwise.
- Brand share – Producers with a group could agree to develop a Gwynedd based brand that they could draw up a basic protocol for and use to promote the area's producers.



There are many ways for small producers to share and collaborate together to save money and offer a better service for their customers.

It could be argued that this model should be the first step in trying to improve the local supply chain, before entering into further expenditure or commitments to work together. If this doesn't work, then the likelihood of further integration working is low.

Many growers and small scale businesses tend to work independently without exploring the benefits of working with others. It may sometimes go against human nature in business to work closely with a fellow producer, and occasionally small business can be so busy in their day-to-day issues to give consideration to the value of working with other producers.

As part of this model, producers would be responsible for changing things directly with each other. By bringing people together and cooperating it's possible to achieve much more as a unified group rather than just a collection of independent people. This model would rely on producers meeting regularly in order to share and discuss ideas and concerns.

The group wouldn't need to formalise the process or become a cooperative company, unless they wished to do so.

Model 2 - Advantages and disadvantages

- + (POSITIVES) Collaboration allow growers to integrate and share expertise and experience.
- + Simple model which doesn't affect a producer's freedom or independence.
- + Flexible model for starting out on a small scale without having to put too much pressure on the business too soon.
- + Create a rich source of ideas and ability to operate
- + Widen circle of contacts
- + Opportunities to use resources more efficiently
- (NEGATIVES) Distribution costs likely to remain high.
- Distrust/apprehension when starting off can prevent the group from developing
- Risk of becoming no more than a 'talking shop' if not facilitated effectively
- Dependent on one person or organisation to take the lead
- Any group of this kind would need to have a cluster that's quite close together geographically

MODEL 3 – Formal supply chain integration

This model differs to the first in that it proposes a more formal relationship between producers and also looks at how other partners along the supply chain could work closer with the producers. Horizontal or vertical integration can offer efficiency gains and develop new opportunities for businesses.



Forward looking retailers and professional kitchens have highlighted the opportunity for collaboration between growers to establish a

common brand under which they could all sell. By doing so, the growers could benefit from better brand recognition, and the retail and service sector could likewise use one name to represent local produce on their shelves or menus.

Producers would have to agree to grow to a certain common specification in order to retain quality and consistency across the brand.

Another example is where a group of producers decide to rent a store together or purchase a piece of machinery or vehicle together, with ownership split accordingly. Rather than just sharing as in model 2, this model suggests taking new actions together, and includes relationships that are more formal and possibly where ownership is shared.

This hasn't got to be confined to growers along, as other businesses within the chain could get involved and add greater strength to the concept.

The basic concept of this model therefore implies a group of growers coming together and recognising an opportunity to work closer with each other to achieve a common goal that will make their business easier and better for each one of them. The principle can be implied to any part of the supply chain.

Model 2 - Advantages and disadvantages

- + Integration can lower costs and provide benefits of economies of scale.
- + Easy to establish and set-up.
- + More support available for businesses working together rather than individually.

+ Working together could open up new doors that wouldn't be available if a grower stayed on his/her own.

+ Having to commit financially could encourage businesses to take the model more seriously.

- The model still relies on having one person to co-ordinate and lead.
- Businesses sacrifice a part of their autonomy in order to work with their partners.
- Disagreements and fall-outs could bring an end to the integration unless it's clearly specified before how to deal with such scenarios.

MODEL 4 – Co-operative Company

A co-operative is a business organisation owned and operated by a group of individuals for their mutual benefits. In this case, the model would include a group of growers working under a co-op structure to co-ordinate orders and deliver.

This model is similar in some extent to model 3 by emphasising the importance of working together, but in a cooperative enterprise, businesses/people join forces because the co-op will help solve or overcome a common barrier or problem.

The membership of a “Tyfwyr Gwynedd Growers Co-op” for example could be made up of local growers with a long-term collective interest of expanding their businesses profitably and who would most probably operate on a “one-member one-vote” system.

Most co-operatives succeed when members participate in transparent, fair decision-making and take an active interest in the long-term strategic planning of the enterprise. Even a small co-op would probably require elections to elect serving officers to make day-to-day decision in the interest of the membership.

Although the principle of setting up a co-operative can be appealing, the structure can be very challenging to implement successfully. However, one of the most successful examples of a food co-operative is based in Gwynedd in the form of South Caernarfon Creameries.

Just like the dairy farmers at the creameries, growers would retain the ultimate control of the co-op’s capital. Because of the numbers and size of individual producers, it’s highly unlikely that the co-op would employ any members of staff initially. Instead, a co-op could obtain and run a site for its members to warehouse goods and put orders together, before delivering to customers. Sales could take place through the co-op or alternatively it could take a percentage of sales from its members.



Any surplus money at the end of each period or year would either be used to invest in further developing the co-op or in sharing between the members as approved. Likewise, any shortfall would have to be picked up by the members.

In addition to logistical services, the co-op could assist the producers with adding value and selling, and possibly facilitate training for its members. Co-operatives also tend to have a strong sense of ethical responsibility beyond making a profit which could tie-in with the sustainable benefits of local production in Gwynedd and Wales in general.

The basic analysis for this model as seen below reflects the uncertain nature of co-ops in reality. Compared to other European countries such as France and Germany, co-ops have not been as successful in Wales, possibly due to cultural and mindset differences. To counteract this however, there are very good examples such as South Caernarfon Creameries which should act as a reminder to consider it as a future model.

Model 4 – Advantages and disadvantages

- + Can be effective way of pooling resources for sharing to achieve a common goal.
- + Encourages networking between growers and knowledge sharing.
- + A co-op would allow Gwynedd's growers to develop one strong brand for the county.
- + Members can benefit from resources that they couldn't afford on their own.
- + Joining a co-op can transform a business' fortune quickly, but the owner must be ready to sacrifice an element of control.
- The model can quickly disintegrate into chaos if members disagree or fall out.
- Members will sacrifice their freedom to operate on their own in return for becoming a member.
- Poor administration or management can be the cause of a co-op's downfall.
- The need for consensus between members can stifle innovation and ability to react swiftly to new opportunities or gaps.
- Clear communication skills are essential.

MODEL 5 – Consolidator

Both models 2, 3 and 4 are based on growers coming together to work closer in one way or another.

Whilst researching for new models, a number of examples were identified where one individual or business had seen an opportunity to add value to the supply chain by working closely with a group of producers to provide a service.

For example, what the majority of growers enjoy the most is actually growing good quality food. Marketing and going after customers is probably not as appealing despite being equally important for achieving a viable commercial business. A person or one of the growers, especially someone who had a specific skillset to offer could decide to market the food and drink on behalf of the producers in return for a commission or an agreed margin.

Likewise, a person could also act as a consolidator by offering to warehouse and sort out orders. This kind of structure could happen organically through an existing grower gradually becoming a central hub for other producers because he or she had shown a particular skill in completing the task or/and because it had the necessary facilities to do the task efficiently and well.

Participating within a group does not appeal to everybody and group dynamics may dictate that this is realistically not feasible.

The consolidator model therefore involves an individual or a business who shares the same aspiration and values as the growers and goes ahead to offer a service as part of the supply chain on a commercial business to business basis.

Model 5 – Advantages and disadvantages

- + Growers can benefit from a person's expertise in logistics or/and marketing.
- + The service available from the "consolidator" may encourage more people into growing in Gwynedd.
- + Having one less task may allow growers to focus on other aspects and increase production.
- + An effective 'consolidator' can help to co-ordinate activities within a group efficiently.
- + More outlets would be willing to deal with the consolidator due to larger choice available.

- Over-dependency on one person to achieve a critical task for a number of growers could be deemed risky for maintaining a local supply chain.
- Growers may have to sacrifice a part of their margin to cover the consolidator's costs.
- Another grower may decide to replicate the idea if it's successful and thus creating competition.
- A consolidator could face considerable financial challenges and be left exposed to swings in prices and price pressures from customers purchasing.

MODEL 6 – Joint ventures

This model is based on working closer with other selected partners along the supply chain. The goodwill observed from shopkeepers and eating venues could be further capitalised by growers through the setting up of joint ventures.

A number of shops are quite frustrated in not being able to conveniently source local fresh produce. Growers at the other end of the chain can also feel frustrated by having difficulties in accessing efficient and profitable routes to market.

A joint venture with another grower can take all kinds of shape and form, from a formal contractual arrangement to a very informal understanding sealed by a handshake.

Joint venture has the potential to work well if all parties involved benefit. Instead of investing scarce time and money to establish a new structure or service, it might be worth considering the existing opportunities for joint ventures in Gwynedd.

The most obvious place to start would be to consider what other companies in the county are currently running the necessary facilities to store produce and prepare orders, and has the capability to deliver to different outlets. There are a number of companies who are doing something similar to what a Grower's Group may want to achieve in Gwynedd, which highlights the opportunity possibly to come up with a joint venture agreement.

A joint venture can be as formal or informal as wanted by the partners involved. A simple example of a possible joint venture would be an understanding between a shop and grower that meant the retailer would commit to purchasing an agreed quantity of produce in return to either exclusivity or being given priority with supply. Not only would this provide a guaranteed market for a producer, but it would also offer assurance to the shop owner of a supply of local produce.

Growers could club together to strike a joint venture deal with a wholesale company who already runs vehicles in Gwynedd on a daily basis. Alternatively, an arrangement could be made with a delivery company to use their depot and delivery vans for a negotiated price.

Working closely with a partner along the supply chain could encourage greater innovation which seems to be lacking at the moment. A grower working closely with a premium Gwynedd hotel could develop other avenues for their product such as selling it on to guests or developing different packaging formats. Having a regular and open dialogue with a customer will allow a producer to respond quickly to new opportunities.

A joint venture between both ends of the supply chain will encourage each business to better understand each other's requirements to create a stronger and more sustainable relationship.

MODEL 6 – Advantages and disadvantages

- + Better communication channels created between producer and outlet.
- + Strengthens the supply chain by putting the emphasis on working in partnership and building a relationship.
- + Partners can identify and respond to new opportunities as a result of working closer.
- + A joint venture will provide opportunities to trial new products and ideas.
- May alienate customers who are not part of the joint venture.
- An open mindset is required from both sides for a joint venture to succeed.
- Grower could become over-reliant on one or a small customer base.
- Other producers, shops or restaurants may compete for a similar relationship.

MODEL 7 – Community Supported Growing

Community Supported Agriculture is a socio-economic model of farming and food distribution that has its roots in 1960's Japan, where a group of mothers decided they were fed up of seeing good agricultural land disappearing beneath concrete, and that they wanted more control over the food they were feeding their children.

The model is based on the community committing to support a food enterprise where the farmer/s and customers share the risk and benefits of producing food. In practical terms, this means that stakeholders in the Community invest money at the beginning of the season to fund the purchases of the farming enterprise and at the end of the animal rearing or growing season, they share the food in proportion to the amount of money they invested.

Community Supported Agriculture can take many forms. In North America, for example, it is estimated that there are over 12,500 Community Supported Agriculture enterprises. In those enterprises, the stakeholders usually receive their share of the farm produce depending on what's in season and the performance of the crops. By securing an income for the farm at the start of the season, the producer can confidently go ahead and manage the unit in a way that creates an emphasis on long-term controls, such as the quality of the soil and quality assurance.

The system also provides assurance to the producer that he/she will have a customer at the end of the season, who has in actual fact has paid upfront and assisted therefore with the cash-flow.

This system has been adopted in some parts of Europe, such as Switzerland and Germany, but examples in Wales and the rest of Britain are few and far between. In a country where there is a strong desire and belief in land and property ownership, this might not come as a surprise.

This model is typified by the 3 following principles:

1. A clear budget, agreed with the sponsors (who can be families, shops, restaurants, cafes...) for funding the production for a whole season to provide produce for a certain number of weeks.
2. A common pricing system, democratically-agreed by the farmer/s and customers alike, on the basis of the original budget.
3. A contract that states that everybody shares in the success of the crops and shoulders any failures.

More often than not, it is crops such as fruit and vegetables that are grown under this model as they are easier to forward-plan. The commitment of the stakeholders could vary

from providing part of the budget only, to being part of a team that spends a certain number of hours working for the producer each season. A model such as this offers a fantastic opportunity for the customer to be part of the growing process, which in turn, promotes understanding of food production.

This rather innovative model is made much easier nowadays with the advent of internet technology in terms of recruiting adopters and in providing the latest information.



A beehive can for example be sponsored for a year by a family or restaurant which could be viewed 24-hours via a webcam, while the beekeeper could also provide up-to-date posts via Twitter or Facebook.

The customer under this model could be offered various scales of involvement in the management of the beehive. All the major decisions for example could be made by the adopter, or alternatively the customer may decide to leave the management entirely in the beekeeper's hands.

Either way, this unusual method of direct selling could offer a totally new avenue for growers, and wouldn't necessarily have to be confined to Gwynedd or even Wales.

The chance of establishing a Community Supported Production scheme on Gwynedd is fairly low because of a lack of awareness of the model, and it appears that the best advice would be to raise people and communities' awareness of the concept, but avoid trying to take it forward until there is a greater acceptance of the model.

Model 7 - Advantages and Disadvantages

- + The model offers a robust and viable structure for long-term planning and farm management.
- + Cashflow positive, higher margin returns and some financial protection from poor weather as the grower would be sharing the risks with the consumer.
- + Significant potential to accommodate, empower and educate adults and children about the growing process, and to take advantage of the range of expertise within the community.

- + Excellent opportunities for shops and restaurants to get involved with production and provide them with good publicity stories for no extra costs.
- + Guaranteed market through the sponsors.
- + Growers can offer a range of secondary products and services to boost income such as taking advantage of the areas strong tourist trade by offering courses and tours.

- Low awareness and understanding of the model is likely to limit acceptance.
- Has not been tested thoroughly in Britain.
- Administrative burden and communication with stakeholders is likely to take a significant amount of time.

- Unsuitable for growers with poor people skills.

Model 8 – Local food exchange

The main aim of the eighth model is to offer a way of bringing together the large number of small-scale growers in Gwynedd in an organised manner.

The creation of a local food exchange means that one individual or organisation would have to take the lead and actively co-ordinate provision by local growers so that the produce corresponds to the needs of different customers such as restaurants and shops. In essence, this individual would assume an agent-like role, and would work closely with both growers and consumers alike.

By channelling a large number of growers through a single forum, it would be possible to service and satisfy a higher number of customers. A single grower might not be able to sufficiently supply a reasonably-sized hotel with herbs, for example, but by supplying through the exchange, he could partner-up with other growers to ensure that the hotel received a continuous supply of products throughout the season.

There are very few examples of this in Wales, and it could be argued to some extent that the function being described here is that of a wholesaler. However, in this instance, the difference would be that the exchange would work closely with only local growers in order to supply totally unique produce that is not available anywhere else. It's not cost-effective for most wholesalers to start this kind of service, so it's possible that there is a gap in the market, as long as there is a sufficient number of dedicated growers available.

It could also be possible for an exchange to consider operating in a flexible manner by taking advantage of suppliers' existing resources. For example, one of the growers might have a van and might be willing to take responsibility for deliveries.

The main aim of such an exchange would be the co-ordination of supply and delivery, but it could also consider providing other services to growers, such as preparing monthly paperwork and packaging.

A structure such as this would not be limited solely to the supply of fruit and veg of course. Other produce could easily be included as well.

At the outset, it would be possible to consider establishing the exchange by means of creating links with significant users. The exchange could start as a type of joint enterprise with a shop or restaurant, where the producer would initially supply only this particular business, until it grew to the point that it had the capacity to start supplying other businesses. Being at the forefront of such an enterprise would be sure to appeal to certain shops and hotels.

Model 8 - Advantages and disadvantages

+ Working co-operatively with growers who are already producing and could therefore begin immediately.

- + Could be established at a low cost.
- + Avoidance of over-reliance on one grower.
- + Effective means of connecting the two ends of the supply chain.
- + Further opportunities for expansion, including the recruitment of more growers and the addition of all kinds of local produce to the provision.
- + Opportunities to share resources, engage in joint-marketing and provide other useful services.
- Very reliant on people's co-operative nature. Everybody will need to have a strong and clear understanding from the outset.
- A high turnover would be needed in order to provide the exchange with an income.
- Need to establish a strong working relationship with both the producer and the buyer.
- Risk of alienating certain wholesalers because of the competition.

The main issue with trying to develop the vegetable growing industry in Gwynedd is the deficiencies in the supply chain. From the grower's perspective, reaching and supplying their produce is an expensive and work-intensive process, and from the buyer's perspective, the supply of local produce tends to be inconstant and unreliable. This was the key consideration in identifying and developing the eight models above.

The models outlined on the previous pages will vary in terms of their suitability to different growers and stakeholders.

PACKAGING, PRODUCE QUALITY AND FOOD SAFETY STANDARDS

It is obviously in the best interest of growers to ensure that produce reaches their final destination in excellent condition.

Recent years has seen greater accountability and scrutiny of the horticultural industry in terms of food safety standards. This study has collated information based on a grower selling on primary produce without any form of processing other than sorting and packaging.

It is strongly recommended that any grower who intends to sell to the public should consult with their local Environmental Health Officer and Trading Standards Officer and to formally register.

These officers are typically very helpful in providing information and practical solutions for small food related businesses, and should be considered as a source of support rather than hindrance. For Gwynedd, the contact details are as follow:

[Environmental Health Officer](#)

Gwynedd Council, Environmental Health Department
Swyddfa Cyngor
Caernarfon, LL55 1SH
Telephone: 01286 682824

[Trading Standards Officer](#)

Gwynedd Council
Council Offices
Caernarfon, LL55 1SH
Telephone: 01286 672255

Also see www.gwynedd.gov.uk for more information.

Subsidised food hygiene courses are available at the Food Technology Centre at Llangefni on a regular basis. Although not essential at present, it is strongly recommended that a grower completes an entry level course on hygiene.

The Centre's contact details are provided below:

Food Technology Centre

Coleg Menai
Ffordd Penmynydd
Llangefni
Anglesey
LL77 7HY
Tel: 01248 383 345

E-Mail: infoftc@menai.ac.uk or visit www.foodtech-llangefni.co.uk

The food hygiene regulation that applies to growers (as to all primary food producers) is called Regulation EC 852/2004. In Wales, as the rest of the UK, the Food Standards Agency is ultimately responsible for ensuring that this European regulation is implemented correctly.

This regulation covers all aspects of primary production, and will form the basis that an Environmental Health Officer would inspect a grower's facility. Transport, storage and handling of crops at the place of production will need to be managed with evidence to support what precautions and steps are taken to minimise contamination and health risks.

The regulation lists the following key responsibilities a grower has and needs to take measurements on, and also needs to be able to demonstrate:

- i) to keep clean and, where necessary after cleaning, to disinfect, in an appropriate manner, facilities, equipment, containers, crates, vehicles and vessels.
- ii) to ensure, where necessary, hygienic production, transport and storage conditions for, and the cleanliness of plant products.
- iii) to use potable water, or clean water, whenever necessary to prevent contamination.
- iv) to ensure that staff handling foodstuffs are in good health and undergo training on health risks.
- v) as far as possible to prevent animals and pests from causing contamination.
- vi) to store and handle wastes and hazardous substances so as to prevent contamination.
- vii) to take account of the results of any relevant analyses carried out on samples taken from plants or other samples that have importance to human health.
- viii) to use plant protection products and biocides correctly, as required by the relevant legislation.

Good record-keeping is an essential part of good hygiene management. Growers need to keep and retain records relating to measures put in place to control hazards in an appropriate manner and for an appropriate period that commensurate with the nature and size of the business. Templates for assisting in record keeping can be obtained free of charge from the Foods Standards Agency or downloaded from their website in English or Welsh.

Growers, like other food businesses are expected to make relevant information contained in these records available to the Environmental Health Officers on request.

The 3 key areas that need to be recorded include:

- i) any use of plant protection products and biocides.

- ii) any occurrence of pests or diseases that may affect the safety of products for human consumption.
- iii) the results of any relevant analyses carried out on samples taken from crops or other samples that have importance to human health.

A grower will have 2 priorities in mind when developing suitable packaging. Firstly he/she will need a solution that will adhere to the hygiene regulations as outlined above as well as trading standards, and secondly he/she will want to ensure the crop reached its customer in the best possible condition.

Once the plants have been cropped then they should be mixed to the correct requirements of the customer, weighed carefully and then packaged in either plastic punnets or bags and labelled before storing in chillers before delivery to the customer.

Whatever packaging is used correct weight and hygiene practices must be observed.

All weighing scales must be approved by the local Trading Standards Officer. There are many differing commercial scales on the market which whilst weighing correctly may not be acceptable. It is always advisable to contact your local office before embarking on a costly outlay to ensure the scales are acceptable.

Bearing in mind that many crops, such as salad leaves and herbs can be very light, a sensitive set of scales will be required. The weight stated on the packaging should refer to the content and should not be the weight including the packaging.

Harvesters will need gloves and the harvesting equipment such as cutters, containers and other instruments cleansed with proprietary cleanser before and after coming into contact with the food.

In addition to gloves, people coming into contact with the produce should be supplied with washable or disposable clothing and hair/beard nets. This will cut down on the risk of contamination.

All packaging and containers need labelling to show where the product came from and when it needs to be used by. Applying the harvesting date is advisable but not essential. From a local grower's perspective, having a harvesting date on the pack could reinforce the freshness of the product.

When work is finished for the day, floors and preparation tables should be swept and disinfected ready for the next day, harvest or shipped. All tools should be disinfected and placed out of contamination danger.

A grower should always keep on top of hygiene and trading standards procedure as an inspection could take place at any time without prior warning.

WHAT ARE THE POSSIBLE OPPORTUNITIES FOR ADDING VALUE TO FRESH PRODUCE GROWN IN GWYNEDD?

SHORT ANSWER: The list below and over next few pages identifies 6 opportunities for adding value to fresh produce crops in North West Wales in order to highlight how having a successful local fresh produce supply chain can open up new doors.

1. Washing

Washing is one of the easiest ways to add value to fresh produce.

By washing, the grower is providing the customer with the convenience of allowing them to save time whilst cooking. The exact technique and machinery that would be needed depends upon the scale of the enterprise and the type of produce being washed.

Processed produce such as this may appeal to shops, and in particular, restaurants as it would save valuable preparation time in the kitchen.

- ✓ A simple way of adding value.
- ✓ A wide appeal to different markets.
- ✓ Simple requirements as regards equipment and facilities.
- ✗ It might not add enough value.
- ✗ It isn't sufficiently distinct from other produce.

2. Fresh soup

This idea requires cooking facilities that satisfy health and hygiene rules.

Vegetables constitute the main ingredient in most soups. Market reports show that the demand for soup is increasing, mainly due to its healthy perception. A positive response to the idea of producing soup was received from supermarket buyers and distributors when they were contacted regarding added value opportunities.

According to the buyers, soups tick a number of boxes. This includes filling the gap in the market for Welsh 'Cawl', appealing to customers who want a healthy meal and providing a convenient meal for the consumer to eat at home.

As long as the main ingredient originates from Wales, it was suggested that the soup may be branded as Welsh soup. A range of different flavours could be developed. Another suggestion was the possibility of combining these with other Welsh products, such as Welsh meat and cheese.

Soups could be developed either for the retail market or for the service market, but the general consensus of opinion was that the retail market would be the most profitable.

- ✓ Corresponds with a number of trends in the food market.
- ✓ A gap in the market for Welsh soup and cawl.
- ✓ Simple cooking requirements.
- X Products with a short shelf life that would need a refrigerated vehicle.
- X Could be seasonal, with slow sales over the summer months.
- X Need to ensure a supply throughout the year.

3.Chutneys, pickles and sauces

This is the traditional way of conserving vegetables, and as with the soups, the appropriate facilities would be needed that satisfied the relevant standards.

Although the market for pickles and chutneys is quite competitive, two possible gaps in the market were identified that could be exploited.

The trend in terms of the products that are currently available is to convey a conservative and traditional image. Discussions with buyers and two high quality shop owners highlighted that there is a gap in the market for a brand of chutneys and pickles that would appeal more to a younger market. A brand that fuses a lively and funky image with different, exciting and tasty combinations of chutneys, pickles and sauces could be the way for new producers to get their foot in the door.

The second potential gap in the market is the lack of produce that is able to claim that the fruits/vegetables used are grown in Wales.

- ✓ An opportunity to break new ground with a traditional product.
- ✓ Long shelf life that can be stored at room temperature.
- ✓ Production could be adjusted to correspond to the availability of the vegetables.
- X The business' capital could be tied up in stock for some months.
- X A wide range of good and consistent cooking skills would be necessary.
- X A lot of pressure to get the branding right in quite a competitive sector.

4.Ready meals

Fresh produce could be used to provide all types of ready meals, either targeted at vegetarians or combined with a variety of meat and/or fish.

A lot of work and cost would be involved in setting up an unit to prepare ready meals, and this aspect of the business could easily take up most of a small business' energy and attention.

Each and every one of the buyers and shop owners contacted indicated that they would not advise a small business to choose this option for adding value to fresh produce, emphasizing that the ready meals market is highly competitive and one where customers are quite sensitive to price.

√ The demand for convenience foods remains strong and is likely to grow according to some forecasts.

√ Potential to add significant value to the ingredients.

√ A wide range of options as regards outlets, such as home delivery, selling through shops or supplying eateries.

X Production would have to happen on a significant scale in order to be able to offer a reasonable price.

X Produce has a short shelf life and would need to be delivered in refrigerated vehicles.

X Quite a complicated cooking and packaging process that would involve many expensive machines.

5. Microgreen juice

Fruit juices are obviously very common in the market place, but vegetable juice is not often seen on the market.

Microgreen juice however is a growing niche, which involves blending a specific ratio of different types of micro greens to deliver a balanced nutritional shot to the customer.

The current research interest in bio-mapping where people are provided with personalised diets, may offer an early market opportunity for microgreens. Work, supported by the 'Innovate UK' fund is underway to map out the nutritional content of various types and varieties of microgreens in order to cultivate specific blends of microgreens to deliver tailored nutrition. For example, a person that has been identified with deficiencies in certain types of trace elements could be prescribed with a blend of microgreens to address that imbalance.

√ Innovative produce that targets the premium market.

√ Microgreens are relatively easy to produce.

√ Adds significant value to fresh produce.

X Would need specialist machinery.

X No direct health claims could be made in relation to the juice.

Branding

There is a tendency to think that fresh produce doesn't need to be branded, and that branding itself is merely a concern for other sections of the market.

However, the clear message that came across in preparing this study was that it is necessary to invest in branding even for fresh produce, so that the customer knows exactly what the advantages are of buying products grown by a certain producer.

A brand is a constant promise to the customer. It is important that an individual eating the produce of a grower from Gwynedd understands where the food came from, and appreciates the benefits of choosing that particular product. Branding is the only means of achieving this effectively on a wide scale.

Branding does not necessarily mean packaging and labelling everything. There are new and innovative branding techniques that may be used, such as putting badges on the shelf, edible printing on fresh produce, branding boxes that are re-used and marketing the produce effectively through various media.

Foundation for profitable growing

SHORT ANSWER: Quality + Passion + Knowledge + Relationships = Profitable growing

(This section, 'Foundation for profitable growing' features a number of extracts from a recent publication titled "Top 10 Vegetable Crops for Anglesey," written by Geraint Hughes under Medwyn and Alwyn Williams' authorship for Arloesi Môn in 2017. Much of its content is very relevant to this study, and have therefore been included.)

Underpinning everything in vegetable growing is quality. Quality can be defined in many ways, including appearance, taste, colour, texture, cleanliness, shape, size, healthiness... Successful growing starts with producing quality consistently, week in week.

A key ingredient for succeeding is passion for growing crops. The task can sometimes be hard, and problems along the way is nearly guaranteed. Passion, combined with good knowledge can take a grower through these tricky periods,

"There are no short cuts in growing. A good grower knows how a crop behaves and can manipulate that to his/her benefit." Medwyn Williams, well-known and award winning grower from Anglesey.

Finally, a successful growing enterprise needs to be willing and ready to invest time in building good relationships with other partners in the supply chain. Customers, be they hotels, restaurants, shops are key partners for a growing business, as are suppliers, fellow growers and family and friends. Everybody has a role to play, and regular communication is essential to ensure everybody understands what's going on. This can be priceless when a grower faces an unexpected problem. A restaurant will not easily forgive a grower who fails to deliver without notice. However, if they are informed of a supply issue in advance, the vast majority will understand and adapt accordingly. Very often, these kinds of episodes can strengthen the trust between a grower and his/her customer.

The 'Jersey Potato Growers Group' is a good example of what could achieved in Gwynedd through determination and collaboration. Despite Jersey being less than a fifth the size of Anglesey, the Jersey Potato is an internationally recognised brand for quality early season new potatoes.

"The communication between growers, packers and customers was stunning to watch. Within a few hours, the Jersey Potato trade agent would have secured a good price for the grower, and in return the grower would have gone straight to the field to harvest. The whole chain worked like clockwork – and there's no reason why we can't aim for," Medwyn Williams.

These are the 5 key principles that can help to make cropping more profitable.

1. “Grow what the market wants, not what you like to grow.”

If a kitchen want small, slender, juicy carrots, trimmed and cleaned down, don't give them old dirty carrots straight from the field with leaves hanging off. Give the customer what he/she is asking for – this is best form of marketing.

2. “Aim for multiple cropping – micro, baby and mature.”

A crop should ideally provide a grower with 3 opportunities for generating an income. Many vegetables can be sold as micro, baby and mature versions.

This can offer a number of financial benefits. Firstly, selling the micro crop will generate cash sooner in a crop's lifespan, helping cash-flow. Sales per square metre should at least triple in value, giving a grower better efficiencies. And thirdly, it allows a grower to offer a wider range of products for little extra work. To achieve this, a grower needs to be on top of all aspects of crop management to ensure successful multi-cropping.

3. “Instilling a conveyor belt mentality to your growing regime.”

Possibly the most difficult principle to deliver – a growing system that will produce a regular supply of crop throughout the harvesting window. And to achieve this goes back to the very beginning of how and when crops are sown. Having a regular supply of a crop is important to develop a good relationship with customer.

4. “Stand out from the crowd.”

Heirloom or heritage varieties of vegetables are an untapped opportunity, especially for supplying the high-end eating venues. Chefs are looking for something new all the time, to experiment with and to add a point of difference to their own menu. Heirloom varieties can offer different textures, colours, patterns and shape, and are occasionally associated with a local story or folklore. When growing crops, a grower should consider heirloom varieties to stand out and attract more value for their crop.

5. “Crops with scope to add value”

Options for adding needs to be considered when putting a growing plan together. There will inevitably be gluts of produce sometimes - that how nature works. During these times

of unexpected over-supply, growers should have an optional selling channel for the produce, linked to a method of adding value to the crop to either lengthen its shelf-life or to process it to an alternative product that could be sold on. Growers don't necessarily need to get involved in adding value themselves. With a vibrant food sector in Gwynedd, there are a number of chutney makers, pie manufacturers and kitchens making "fresh soup of the day" in Gwynedd who'd be interested in stocking up with local vegetables. They may even end up becoming an important regular customer.

APPENDIX 1: Project management - 8 step plan

Establishing new growers in Gwynedd would mark a significant change in the area's food production system. As part of this study, various strategies and approaches were considered that could offer a structure or a plan for leading this type of fundamental change.

The most impressive, relevant and proven approach identified was the well-known, tried and tested, "Kotter's 8 step process for leading change."

Here is a summary of how that could be implemented over a 3-4 years period if funding came available to support and resource such a project.

STEP 1 – Create a sense of urgency

A sense of urgency is required to secure the co-operation and interest of potential new growers. This is arguably in place already, with many farming families for example reviewing their long-term plan in the face of pending changes to support mechanisms for the industry and possible constraints being applied to accessing important markets.

Likewise a sense of urgency can be heightened through a targeted campaign to raise awareness of the opportunities on the horizon and therefore the need to take action now.

STEP 2 – Build a task force

Major transformational change is difficult to accomplish on your own. An effective task force needs to be mobilised with enough key producers involved and ready to listen and being adaptable, creative and crucially prepared to work hard to move forward alongside other key partners in the supply chain. It also needs the skills, credibility and leadership to take producers and the sector with it.

The work of building a task force will start immediately with local stakeholders such as restaurants, distributors and processors, ready and eager to engage. A series of facilitated workshops and a programme of visits and talks will stimulate discussions, and action learning techniques will be used to allow space and opportunity for a task force to grow and to develop and implement ideas.

STEP 3 – Develop a vision and strategy

An authoritarian decree for producers to join up will not be effective. Creating and presenting a sensible and attractive picture of the future, or vision, is vitally important to bring producers and other parts of the supply chain on board. This needs to come from the task force, the producers and the supply chain themselves.

Facilitation by an experienced individual in helping a group to develop their vision could be one form of very useful support at this stage. A compelling vision will not be created in one meeting. A group will need to explore and exchange ideas over a series of meetings and workshops.

STEP 4 – Communicate the change vision

The supply chain taskforce will be responsible for this and will again benefit from facilitation support to come up with a plan to communicate their vision to the wider industry. Different vehicles could be used by the group to communicate their vision and strategies, and the group may decide to role model the behaviour expected from its members. Various digital communication platforms could allow the group to engage with a wider audience.

STEP 5 – Empower growers and customers

Steps 1 to 4 will have done a great deal to empower people. Step 5 is more focused on consolidating what support the Group has achieved and remove barriers that may still lie ahead in implementing the plan.

At this point, the stakeholders will get to grips with structure, skill requirements, systems and governance to lay the strong foundation for the organisation to deliver for many years. Who will be involved, capital requirements, the decision making process, business planning and organisation structure will all need to be tackled at this stage.

STEP 6 – Generate momentum

To build credibility and retain cohesion, growers are likely to need to see convincing evidence early on to show that their effort is paying off. Ideally, a project will need to seek quick wins, which will undermine cynics and sceptics to what is proposed, and allow momentum to continue.

Early wins should be visibly supported.

STEP 7 – Consolidate gains and produce more wins

By this step, the Taskforce may have succeeded in securing its first contract, most probably with one or more of the growers from year 1. As producers will only know too well, the “first order” is far easier than the second, third... The first success will herald the start of a

long and difficult journey of seeking more opportunities and managing existing contracts diligently and looking for ways of adding more value for producers and its customers.

Leadership will be key at this stage, as the Group aims to retain focus and momentum. Processes and systems will need to be reinvigorated, and the Taskforce may decide that it's time to hire, promote or develop people who can continue to implement the change vision post project support.

A key strategy for sustaining success and overcoming possible inertia is to put in place a system that rewards good performance and applies penalties for producers who may not perform to expectation.

STEP 8 – Anchor new approaches in the culture

After 2-3 years of operating, the results delivered by the Taskforce should be evident and impressive. The new way of supply chain partners collaborating together and working closely should be the new norm.

The culture should develop to a collaborative partnership to ensure best outcomes for all along the supply chain. This can only become culture after it is clear that it works better than the previous ways of doing business.

Support at this stage could include assistance in demonstrating the benefits of the taskforce and in providing training to ensure the skillset are updated and renewed, and that leadership development and succession is in place.



APPENDIX 2 – Useful list of vertical farming suppliers

Seeds:

- Tozers - 01932 862059 or sales@tozerseeds.com
- E.W.King - 01376 570 000 or sales@kingsseeds.com
- Moles - 01206 213 213 or sales@molesseeds.co.uk
- Elsoms – 01775 715000 or seeds@elsoms.com
- C.N.Seeds - 01353 699413 or info@cnseeds.co.uk

Plants:

- Delamore - 01945 589180 or sales@delamore.co.uk (Herbs)
- Seiont - 01286 672113 or sales@seiontnurseries.co.uk (Herbs and local!)
- Wessex plants – 01934 876435 (Brassicas)
- Westland Nurseries – 01386 41436 (Brassicas)
- Quantil - enquiries@quantil.co.uk (Brassicas)
- Farringtons – 01772 812715 (Brassicas)

Mulch, pot feeds and composts:

- Avoncrop Ltd – 01934 820363 or sales@avoncrop.co.uk
- LBS Horticulture – 01282 273333 sales@lbs-group.co.uk
- Hortec - 01295 688422
- BHGS - 01386 444100
- Henry Alty - 01772 812176

Insect/vermin proof protectant mesh:

- Agralan - sales@agralan.co.uk
- Wondermesh - sales@wondermesh.co.uk

Polythene Tunnels:

Company name	Location	Website	Phone number
McGregors Polytunnels	Hampshire	www.mcgregorpolytunnels.co.uk	01962 772368
Northern Polytunnels	Lancashire	www.npstructures.co.uk	01282 873120
Clovis Lande Associates Ltd	Kent	www.clovis.co.uk	01622 872570
Polyhouses.com	West Sussex	www.polyhouses.com	01243 554455
First Tunnels Ltd	Lancashire	www.firsttunnels.co.uk	01282 601253

Propagators and heating:

- Hotbox - 01425 618886 or sales@hotboxworld.com

Laboratory analysis:

- NRM Coopers Bridge, Braziers Lane, Bracknell, Berks RG42 6NS
- Eurofins, Woodthorne, Wergs Road, Wolverhampton WV6 8TQ

Various hydroponic equipment:

Company name	Location	Website	Phone number
Hydrogarden Ltd	Coventry	www.hydrogarden.com	024 7661 2888
Esoteric Hydroponics	Guildford	www.blunt.co.uk	01483 596490
Holland Hydroponics	Manchester	www.hydroponics.co.uk	0161 273 5995
The Hydroponic Corporation	Deeside	www.t-h-c.biz	01244 289699
GroWell Hydroponics	Solihull	www.growell.co.uk	0845 345 5172
Ponics UK	Taunton	www.ponics.co.uk	01823 275300