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Relationship Management and Lean Analysis in Maintaining Horticulture Supply Chains with Micro-businesses in Wales

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ABSTRACT

The horticulture sector is characterised by variability in production volumes and quality, fluctuating prices and goods of short shelf life. 'Lean' analysis is used to identify strengths and weaknesses in relationships between micro-businesses in horticulture. Three case studies of small horticultural enterprises, a scale prevalent in the sector in Wales, describe relationships and supply structures.

A model for the generic application of relationship management to smaller enterprises is proposed in which the effects of continued adherence in inter-company relationships, and supply system configuration, are examined in relation to the effectiveness of collaborations. Relationship management needs to be a priority in these small enterprises. Buyer dominance over suppliers may decrease the effectiveness of relationships in small and micro-enterprises in Welsh horticulture.

Keywords: lean; power; business relationships; food supply systems; horticulture

Introduction

Lean analysis

Businesses in horticulture supply chains, across the world, vary considerably in their scale and turnover and in the power within their relationships with other businesses. Horticulture is an important economic sector in Wales but horticultural producers are predominantly small scale, often being sole traders or micro-businesses (Horticulture Wales, 2015). In order to investigate the relationships managed by such businesses in the supply chain, and to propose recommendations on their performance, case studies were analysed through the 'Lean' approach with respect to inter-business relationships.

The 'Lean' approach was initially based on successful inter-company collaboration in the automotive industry, in particular Toyota, between suppliers and customers, taking raw materials through to the consumer (Womack et al. 1990). In this "vertical collaboration" each stage in the supply chain works openly with the next. In the UK, automotive assemblers introduced supplier development programmes in the 1990s to transfer knowledge and expertise to their suppliers. These original programmes have been sustained and expanded across other sectors over two decades as the 'Industry Forum' (Industry Forum, 2013a). A core part of their mission statement summarises the objective of their 'Lean' services: "... help businesses achieve sustainable, profitable growth through the continuous improvement of the capabilities of people and processes." (Industry Forum, 2013b).

The term 'Lean' has been distilled into five generic 'Lean' principles (Womack and Jones, 1996):

1. Customer Value – Start by identifying value from a customer perspective;
2. Value Stream – Use customer value to group products or services by their different supply characteristics and create a cross functional value stream team (e.g. sales, manufacturing, logistics) to manage the order acquisition and delivery processes.
3. Flow – For each value stream, map a product's progress through all of the information steps (customer order, sales processing, production scheduling etc.) and physical steps (manufacture, delivery etc.), and, for each step, ask whether the customer would be willing to pay for it. If the customer would prefer not to pay for the step (e.g. moving a product around a factory), it is 'non-value adding' and an opportunity for waste elimination. Through the systematic removal of 'non value adding' steps, the product/service is able to 'flow' more effectively to the customer.
4. Pull –When a consumer buys a product, pass the information to all stages of the supply chain. Aim for a system where a consumer buying one unit of product triggers one unit to be 'pulled' through every stage of the value stream.
5. Perfection – 'Lean's' philosophical standpoint is that it is not possible to achieve such a fixed point of performance, as the standard will decay over time in the face of a changing external environment. Therefore, the goal is to "pursue perfection" through continuous improvement of the process assisted by empowerment of the workforce.

In summary, the 'Lean' principles aim to eliminate process waste collaboratively and systematically. 'Lean' distinguishes between value added processes that the customer wants to pay for and non-value adding processes that should be a target for removal (Wee and Wu, 2009). Value-adding processes, typically, will be physical operations whilst non value-adding processes include storage and transport (Hines and Rich, 1997).

Colgan et al. (2013) have demonstrated that 'Lean' principles could be applied to a mixed arable and beef farm in order to reduce waste and improve the quality of the food supply. 'Lean' has been applied to the UK food sector through the Food Chain Centre. The Policy Commission on the Future of Farming and Food (Curry, 2002) recommended the creation of the Food Chain Centre (FCC) to "bring together people from each part of the food chain" ... to reconnect [it]". FCC applied 'Lean Thinking' (Womack and Jones, 1996) to 33 cases of supply chains, through value stream mapping, in the horticulture, red meat, dairy, and cereals sectors. These supply chains were predominantly high volume producers serving large organisations (retailers and public sector bodies) and the businesses involved reported £14.4m in annualised savings (Food Chain Centre, 2007). When analysed by sector, there was evidence to support high volume horticulture supply chains being well suited to the "Lean" approach. Many of these cases involved multiple retailers with the supply chain development model of "category management". Category management, by retailers, groups products into categories (e.g. flowers) and manages each separately. Within a category, the number of suppliers is consolidated, often with a lead supplier

consolidating inputs from smaller and primary producers (Hingley, 2005). There is usually no retailer/supplier cross-ownership and no formal, long-term contract but the arrangement with suppliers generally goes beyond a single transaction approach and onto a longer cooperation. However, there has been a recent trend towards vertical integration as retailers have taken direct ownership of some production facilities (IGD, 2012; The Grocer, 2011; Morrisons, 2012). This paper examines two variables that could affect success i.e. supply configuration and relationships.

Supply Configuration

The 'Lean' approach is recognised as important to supply chain development (Croom *et al.*, 2000) and "very much the dominant paradigm in most writing about supply chains" (Cox, 1999). In many cases, this approach (Womack and Jones, 1996) and supporting tools (Rother and Shook 1998, Hines and Rich 1998, Jones and Womack 2002) can be orientated towards a supply chain configuration of 'vertical collaboration' between independently owned organisations.

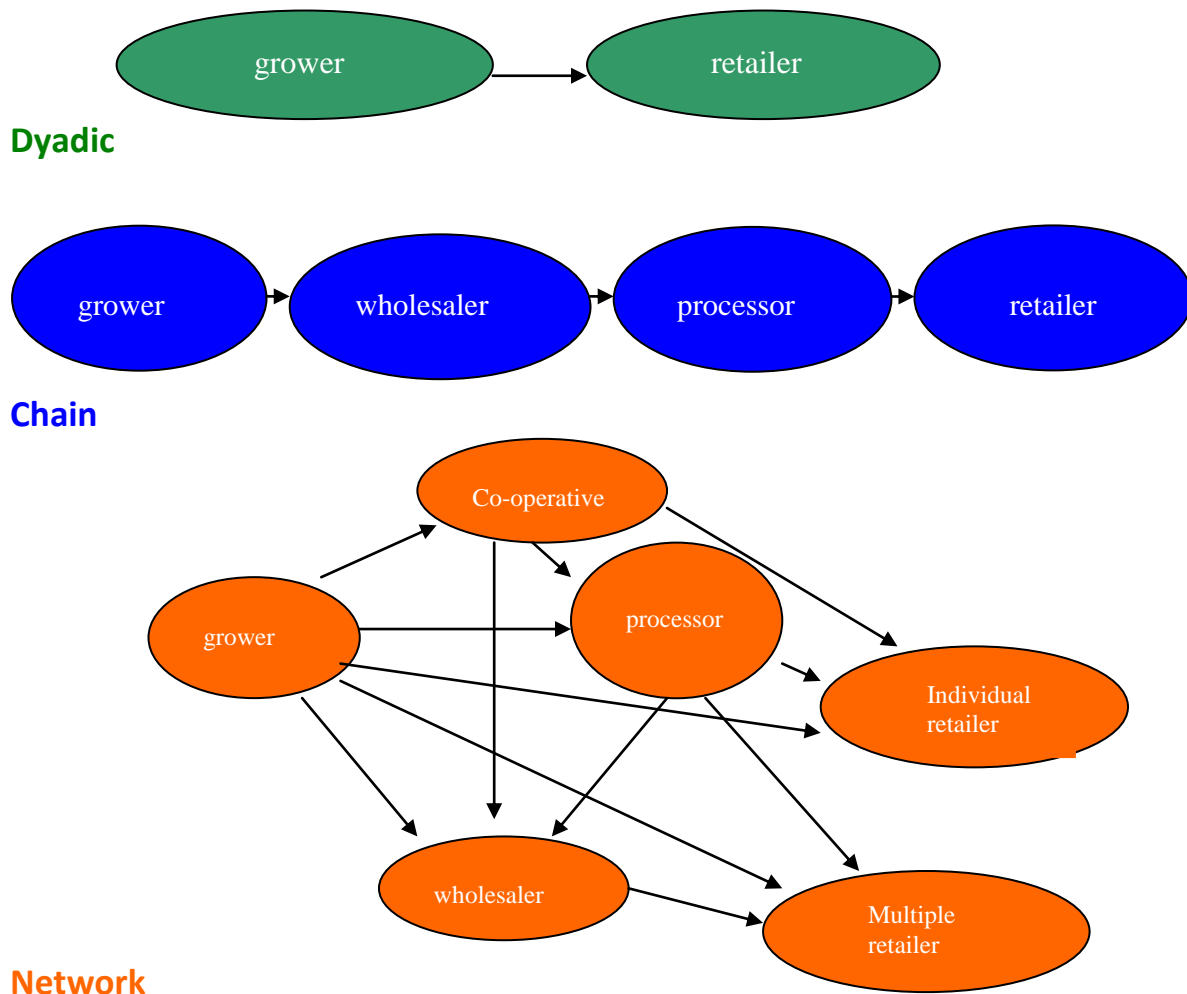


Figure 1. Examples of Horticulture Supply Configurations (Based on: Harland *et al.* (1999))

Figure 1 gives theoretical examples of some of the forms in which supply configurations could occur in horticulture. There has been less economic discussion of dyadic and network supply systems than chains (Harland *et al.*, 1999), although there has been a more recent focus on sustainable supply through dyadic analysis (Miemczyk *et al.*, 2012). The volume and complexity of transactions vary greatly from dyadic to network supply systems.

Relationships

The effectiveness of the 'Lean' vertical model has been argued to be contingent on the power balance between the buyer and supplier (Cox, 1999) that varies over time as buyers and suppliers try to improve their positions (Matthews *et al.*, 2007). Emerson (1962) described a balancing operation between two parties in terms of their power and dependence. He described the "power" of one party as the amount of resistance by the other party that it can overcome. He described "dependence" in terms of the motivational investment by the dependent party in goals mediated by the other party, and, as the inverse to dependence, the availability of those goals outside the relationship with the other party. The 'Lean' exemplars (Womack and Jones, 1996) stress the importance of avoiding a short term approach and developing long term supplier relationships.

Campbell and Cunningham (1983) described dependence relationships when either the buyer or supplier dominates the relationship. They recognised the importance of analysis of customers in establishing successful buyer-supplier relationships. Buyers dominate when there is a low need for the supplier which can arise from a variety of situations including when there are many suppliers. Supplier dominance occurs in the reverse situation. Cox (2001) elaborated on this concept by defining four conditions of Buyer-Supplier Power (Figure 2),

		Supplier Power	
		Low	High
Buyer Power	High	Buyer Dominance	Interdependence
	Low	Independence	Supplier Dominance

Figure 2. Buyer-Supplier Power (adapted from Cox, 2001)

Independence tends toward low volume relationships with no tangible gain for the parties through collaboration. In the other three instances, a level of dependence for one or more of the parties indicates that there is a significant volume of business and that collaboration has the potential to deliver supply system benefits. There is also a risk to at least one of the parties that cessation of the relationship would have a major impact on turnover. Buyer dominance is a situation where the buyer can exit the relationship at low cost and risk but termination would risk the survival of the supplier's business (Cox, 1999).

The majority of the FCC's 33 chains fell into the Buyer Dominance category, especially in the supermarket channel (Hingley, 2005, Fearn *et al.*, 2005). Within these Buyer Dominance chains, when the 'Lean' collaborative model was applied in different sub-sectors (Food Chain Centre, 2007), there were markedly different levels of success. One explanation for these contrasting outcomes is different levels of trust in the sub-sectors and a fear of opportunism. 'Lean' supply chain collaboration tools and techniques, such as value stream mapping, share information between the buyer and supplier. In this Buyer Dominance situation, when a supplier provides transparency of their process to the buyer, there is a risk that the buyer will behave opportunistically. The importance of trust and non-opportunistic behaviour underpins the exemplar 'Lean' buyer-supplier relationships (Sako, 1992, Lamming, 1993). Sako (1992) defines three levels of trust; contractual, competence and goodwill. Contractual trust refers to parties' observance of terms of an agreement, competence in their ability to deliver effectively and goodwill in not exerting power in a buyer-seller relationship.

Previous 'Lean' food sector analysis (Simons et al., 2004, Hines and Samuel, 2004) has suggested that the way in which power is exercised is the key to supply chain collaboration including factors such as trust, ownership and commitment (Hines and Samuel, 2004). Panizzolo (1998) recorded that "for a full implementation of lean principles, the most crucial factor seems to be the management of external relationships rather than internal operations".

Characteristics in Welsh Horticulture Businesses

Ahumada and Villalobos (2009) have reviewed models of agri-food supply chains in a global context and identified four main functional areas, these being production, harvest, storage and distribution. The business characteristics, which challenge primary producers of horticultural crops, are:

- Many products are highly perishable and so have a short shelf life.
- Individual products, particularly field-grown crops, are usually seasonal.
- Quality of the product is variable as it is largely subject to weather conditions and attacks by pests and diseases.
- Market prices vary rapidly and at short notice, particularly if sold through wholesale markets, as production levels, quality and competition from home and overseas markets are largely unpredictable.
- Production, for most crops, has long lead times, from crop planting to harvest, particularly in tree crops. Supply chain management techniques such as 'just-in-time' do not, therefore, lead to efficiency for the producer, but rather to wastage of a crop that has already been produced. This can have significant financial impacts for small producers that supply to multiple retailers who may reject crops.
- The sales of horticultural products may be dominated by large retailers who import products both during, and outside, local seasons.
- The nature of horticulture means that in field grown crops there is need for crop rotation so, in many cases, growers will need to vary their products, and product volumes, in successive years.

Therefore, businesses in the horticulture sector in Wales need to examine their power in relationships to ensure that they can plan their production reliably with delivery to a trusted buyer, that perishable crops are processed and sold in an acceptable time and that these smaller businesses can establish relationships that are sufficiently robust to be maintained in the face of competition from large, multiple retailers.

This paper investigates whether analysis, using 'Lean' principles, can examine power and trust and assist the effectiveness of relationships in micro-businesses. It identifies strengths and weaknesses in relationships in micro-businesses in horticulture. It is an inductive, observational analysis, influenced by Cox (1999). The cases also examine how supply configuration (Harland *et al*, 1999) may impact on the effectiveness of collaborative supply development. The effectiveness of collaboration would be revealed by the duration for which the relationship is maintained, arising from the benefits to the parties in terms of cost efficiency and reliability of supply, and the confidence in the inter-personal relationships between the parties.

Methods

Based on a realist philosophical position, the research design considered four factors; approach, strategy, time horizon and detailed data collection (Saunders et al. 2003). 'Lean' has deductive tendencies through its industrial engineering origins (Imai 1997; Ohno 1988) but the research approach was predominantly inductive, based on the observation that the success of recent food industry initiatives was contingent on supply chain structure and relationships (Simons et al. 2003, Simons and Taylor 2007, Taylor and Fearn, 2009, Mili, 2016). Case studies are appropriate where there is a focus on contemporary events (Yin 2002) and so case studies are used here.

For the current investigation, three case studies have been used to examine supply chain functioning in the sector. The cases were selected to demonstrate different supply chains within the horticulture sector and, so, the range of supply relationships that may develop. Each of these cases also provides an insight into how power relationships may be managed across the sector. One case was selected for each of the predominant short supply chains in local horticultural businesses i.e. a processing business (processing vegetarian pies), a grower of edible crops and a grower of ornamental crops. These businesses previously

had not knowingly used 'Lean' techniques and analysis. In this study, the 'Lean' tools and techniques that had been successfully applied to high volume horticulture by FCC were applied to these low-volume, supply systems.

The businesses selected were micro-businesses having less than 10 employees or a turnover of less than €2m as defined by the European Commission (2003). The template for data collection was the FVCA (Food Value Chain Analysis) methodology developed for the Food Chain Centre (Simons et al, 2003; Simons and Taylor, 2007). For the current study, this methodology was compressed to suit the smaller supply structures such that the activity steps within that methodology, derived from those given by Simons et al. (2003):

- Introductory Discussion: to agree a main contact, in each of these case studies being the proprietor, and develop a timeline for the investigation which lasted a period of eight weeks.
- Value Chain Analysis Workshop: introducing the methods and discussing relationships in the supply chain. A "current map" was created of physical and information flows relating to a product. This map was supplemented by on-site mapping.
- Future State Cross-Company Value Chain Workshop: defining an ideal state that is achievable and developing an action plan for improvement linking customer value and supply chain processes.
- Presentation of the Value Chain Summary to the business's participants and facilitation of the implementation of improvement.

There were two types of outputs from the cases; deductive operational improvements and inductive observational findings. The deductive findings were practical, value-chain findings in areas such as customer value, supply chain effectiveness and operational efficiency. The inductive observations on supply configuration and relationships, which are collated in this paper, provide an analysis of 'Lean' supply contingencies.

This paper uses the lower dependency of one party in comparison with the higher dependency of the other party as an indicator of the relative power in the relationship being greater for the less dependent party. This is considered in a qualitative rather than a quantitative sense.

Case Studies

Three case studies represented the horticulture sub-sectors of produce (*GrowFarm*), added-value manufacturing (*MealCo*) and ornamental flower production (*FlowerCo*). The names of the businesses used in this paper are not the registered names of the businesses so that their discussion in the paper will not impinge on their activity. However, permission has been received by the businesses to use these examples.

'GrowFarm' (fresh produce)

GrowFarm is a long established, sole-trader, grower of seasonal vegetables with a short supply chain. It serves customers between Cardiff and Swansea through direct consumer sales, farmers' markets and wholesale trade (Figure 3).



Figure 3. The 'GrowFarm' Supply System

'MealCo' (manufactured meals)

MealCo is a limited company that sells high quality, vegetarian, prepared meals from its production factory unit to Welsh regional farmers' markets and to cookery courses or events. It also has an intellectual property rights, value stream network which licenses recipes for others to manufacture and sell at regional markets across a wide geographic throughout the UK (Figure 4). A licensing model has recruited 23 members in the UK.

MealCo's licensing model aimed to develop an intellectual property network of retailers delivering their recipes throughout the UK. The business model involved set up costs of about £400 per member to access recipes, cookery training from *Meal Co* and equipment to sell at local farmers' markets. The ongoing licence requires members to pay a levy of between £11 and £25 on each occasion the brand and recipes are used at a farmers' market. A *MealCo* case study finding was that 37.5% of product purchase costs were transaction costs of negotiating, ordering and administration. So, there would be a substantial potential benefit in consolidating suppliers.

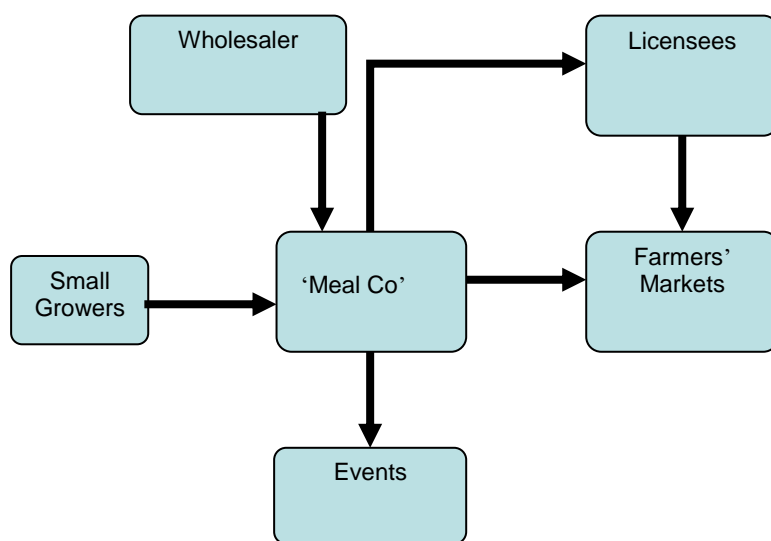


Figure 4. The 'MealCo' Supply System

FlowerCo (seasonal flowers)

FlowerCo is a wholly-owned family business in South Wales that grows and sells cut flowers with the unique selling point of regional provenance. From January to March, the 20 hectare farm picks into an on-site pack-house with refrigerated storage. FlowerCo has started to develop further capacity through external growers. The pack-house delivers the flowers daily to DistCo, a distribution centre 20 miles away. These are consolidated by DistCo with other products for delivery to two supermarket distribution centres which feed 25 Welsh supermarket stores. FlowerCo also serves farmers markets and wholesalers (Figure 5).

FlowerCo represents only a small, seasonal proportion of distribution volume at DistCo. Consequently, this limits DistCo's allocation of time and resources to collaboration activities. Within this constraint DistCo worked openly with FlowerCo, providing management information on forecasts and shipments. This was important to FlowerCo as the variability in demand in the market place was amplified by retailer ordering processes giving high peaks and troughs of demand to the grower. FlowerCo used DistCo information to analyse orders to help align demand to product available in the field. In the physical supply chain, there was an opportunity to reduce the turnaround times for delivery vehicles moving from FlowerCo to DistCo, and from DistCo to the supermarket.

The *FlowerCo* case particularly demonstrated openness to external ideas about process improvement. For example, the packing facilities have been mapped using 'Lean' supply tools (Hines and Rich 1998,

Jones and Womack 2002) and a new pack-house layout was developed and tested for the forthcoming season. *FlowerCo* has recruited two other, non-horticulture farms and supported them in entering the cut flower sub-sector by sharing knowledge and resources.

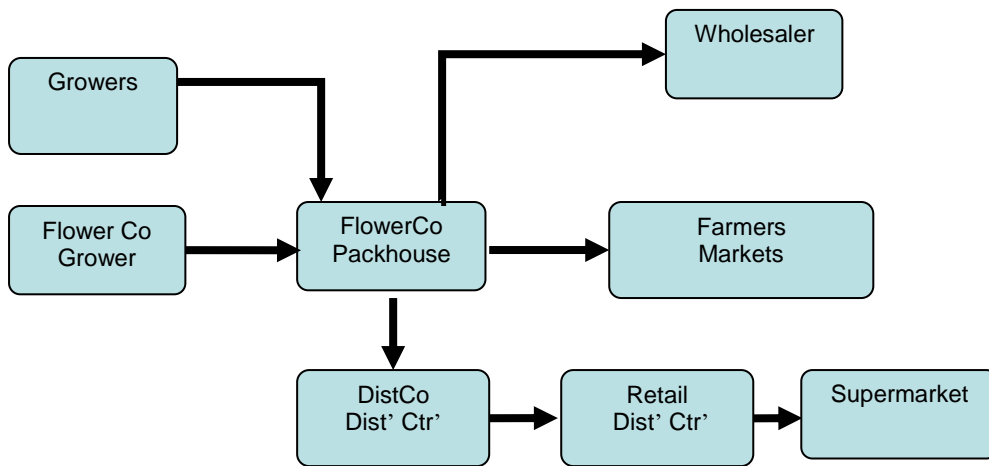


Figure 5. 'FlowerCo' Supply System

Supply Collaboration Effectiveness

The case results are considered in terms of the Supply Collaboration Effectiveness Model (Figure 6).

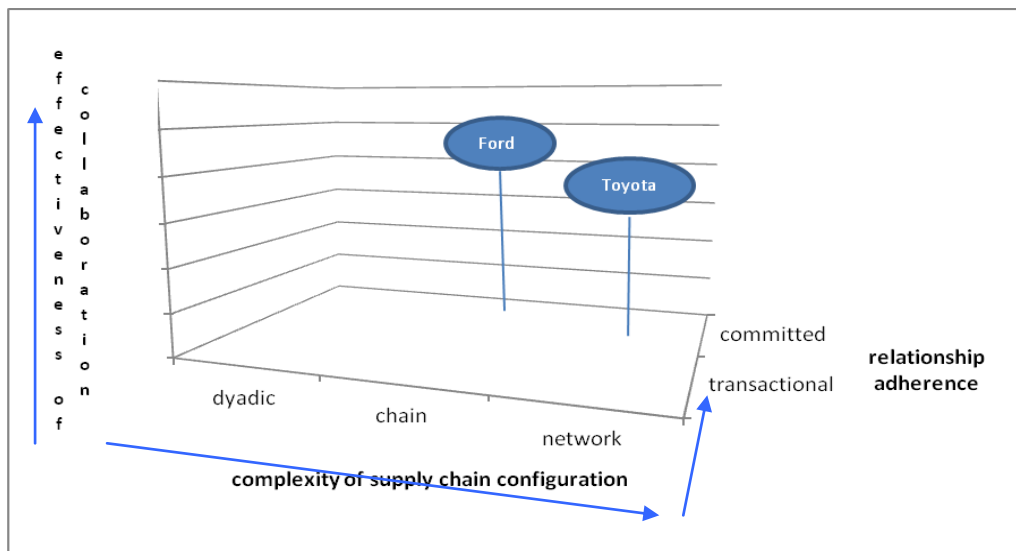


Figure 6. Supply Collaboration Effectiveness Model

Figure 6 proposes, diagrammatically, a model of supply configuration (x axis) and relationship adherence (z axis) with a resultant output of effectiveness of collaboration on the supply system (y axis). In this diagram, systems range from simple dyadic relationships, with a small number of product variants, to complex networks with a high number of product variants. Relationship adherence relates to how power is used and the parties' confidence in the relationship. Cook and Emerson (1978) concluded that interpersonal commitments impede or affect how power is used. This definition of relationship adherence relates to time but is not defined as a specific period or contract type but rather relates to the 'Clockspeed' of the supply system. 'Clockspeed' is the time required to mitigate facets of supply system

risk such as product life cycle, asset investment periods and asset specificity. For example, in horticulture a contractual commitment of one year might be considered committed for a fresh produce crop but only short term when related to the growth and supply of ornamental trees. This has connotations of 'Lean' being focussed on long term collaboration.

The model in Figure 6 leads to the proposal that the effectiveness of collaboration is dependent on the degree of adherence in relationships, and that the difficulty of achieving adherence increases with supply system complexity. As the effectiveness of the collaboration decreases this relationship and, so, this link in the supply chain, is weakened. Therefore there is a risk that the supply chain will not be sustained.

The positioning of a supply system in the diagram is subjective. To illustrate the model, this paper gives positions to organisations that have been discussed in the literature on 'Lean'.

- The early 20th century Ford example (Harrigan, 1984) is a moderate chain configuration based on a single supply chain structure with a limited product range (Model T in one colour!). Relationship adherence to collaboration is argued to be very high through vertical integration providing secure, long-term, static relationships.
- The post war Toyota example (Womack *et al.*, 1990) has a more complex supply system relating to the greater variety of car models offered, leading to a high volume of transactions due to a large number of component variants. This high number of variants would assert that Toyota had a high supply configuration complexity. However, supplier rationalisation and just-in-time delivery systems are argued to mitigate the complexity. Toyota's supplier development has built long term relationships with suppliers using its buyer dominance position in a positive way. On this basis Toyota is plotted as having a relatively high relationship adherence.

It is expected that, with its fragmented ownership, Welsh horticulture has a low effectiveness of collaboration. For best practice in horticulture supply, a key source is the Netherlands which has the largest horticulture sector in Europe which, in 2015, exported an estimated €20.7bn (USDA Foreign Agricultural Service, 2015) indicating the extent of its relationships. The cooperative grower ownership has survived to a large degree. These marketing cooperatives, when serving smaller customers, will be Supplier Dominant in a similar way to automobile manufacturers with a network of distributors. When serving major retailers they will have a position of interdependence. In contrast to the FCC, with its upstream vertical integration controlled by the retailers, this gives the prospect of downstream vertical integration which responds better to customer value (Guan and Rehme, 2012).

Historically, 'GrowFarm' had a significant portion of its business with wholesale customers but experienced opportunistic trades in which wholesalers had the power to buy at distress prices. Over a number of years, this dependence on the wholesale route has been significantly reduced through the development of direct consumer sales. This has been achieved through direct sales, box schemes (in which a variety of available, seasonal vegetables are selected by the supplier and sold as a box of goods to the customer) and farmers' markets. This is evidence of supplier behaviour aimed at improving the buyer/supplier power configuration through time (Matthews *et al.*, 2007), moving from buyer dominance to independence or supplier dominance.

MealCo's model was one of commitment to cooperative principles with a philosophical position based on the proprietor's strong belief in ethical food production and distribution. The recruitment of licensees to operate at farmers' markets was conducted with an assumption that these values were shared and that there would be good relationship adherence. However, relationship opportunism became apparent. *MealCo* reported that approximately half of new licensees did not set up successful businesses, mostly because they could not master the cooking process. For those businesses that succeeded with the *MealCo* format, there were two groupings:

- licensees who traded at markets and loyally paid their fees.
- opportunist licensees who made the business work well for themselves but did not adhere to the licensing agreement.

The opportunist behaviour was attributed by *MealCo's* founder to a contractual attitude - "if there is a way of getting around it – they will". Behaviour included non-payment of fees or re-branding a similar product. One example was noted of a highly successful member indicating that they were withdrawing from ready meals but subsequently selling slightly different products opportunistically under a different brand in a region covering ten farmers' markets. *MealCo* made legal protest but found enforcement was prohibitively expensive and complex. The Proprietor remarked "It is possible to tweak the recipe and it

can be passed off as their own". Defensive measures against these opportunists were considered including getting help from the lawyers of trade organisations to draw up tighter contracts. However, these tactical measures were not seen as addressing the fundamental issue of the tendency to defect from the agreement. These pre and post contract transaction costs (Williamson 1975, Williamson 1986) led to *MealCo* rethinking their business model to plan a UK wide distribution system with fewer, more consolidated, trading relationships. One consolidation option under consideration was large retailers. This would indicate that *MealCo* considered that moving from independence/interdependence with multiple buyers to buyer dominance might reduce the risk of an opportunistic outcome. This is tentative evidence that the reliability of long term commitment behaviour, within a power position, is more significant than the power position itself.

For *FlowerCo*, each year the supermarket buyer confirms the contract to supply less than one month before commencement of the delivery. Late commitment from the supermarket to each season's supply is a situation of buyer dominance. *FlowerCo* does not take such a short term view but assumes that the retailer has the commitment to continue the relationship. One of their strategic responses is to create long term capacity for Welsh-provenance cut flowers by working openly with other producers and their distributor. That cannot be quickly replicated by competitors. As a contingency to the short term contractual position with their main supermarket channel they maintain good relationships with wholesalers and Farmers' Markets by supplying them with a proportion of their output.

In relation to the Supply Effectiveness Model, figure 7 proposes a position for each of the cases.

- *GrowFarm* has simplified its configuration from chain to direct sales to the customer. By working on customer loyalty, it has increased commitment and is proposed to have a highly effective collaboration.
- *MealCo* in regard to its cooperative model has developed a varied network of distributors that have proved complex to manage. So, they are positioned in a complex supply chain configuration. Whilst *MealCo* has shown full commitment to these relationships, some distributors have responded opportunistically reducing the relationship adherence. The system is therefore proposed as being less effective in collaboration.
- *FlowerCo* is evolving upstream to form a network through horizontal collaboration with other growers. This moves it to a more complex supply configuration. However, it is positioned as having good moderate effectiveness in collaboration through its long term commitment with *DistCo* whilst its effectiveness is moderate in its seasonal supermarket contracts because it is managing some uncertainty with commitment to the relationship, albeit with some contingency planning.

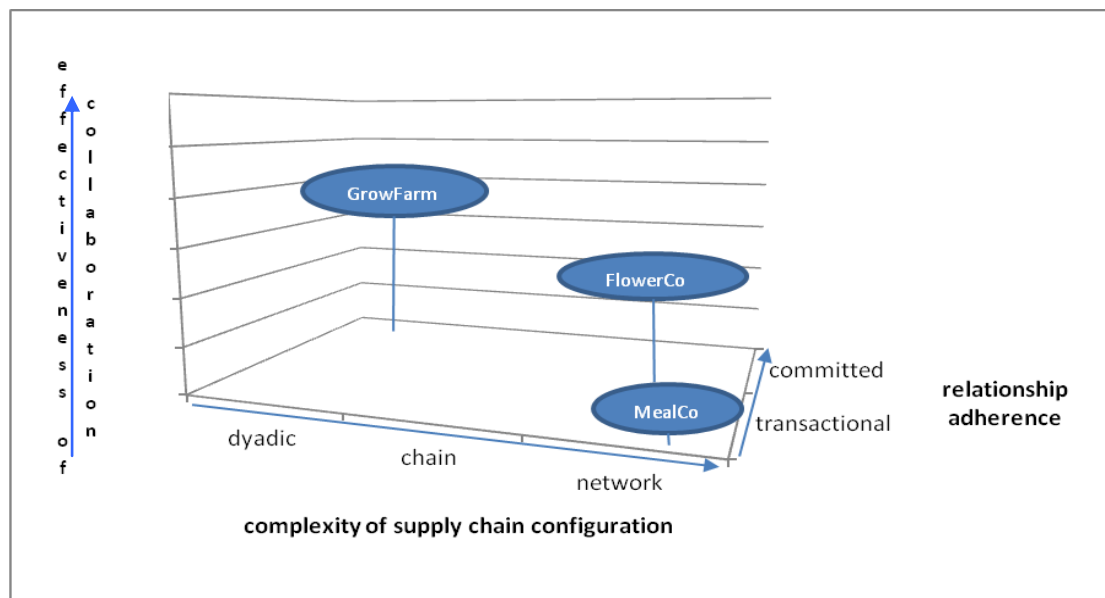


Figure 7. Supply Chain Effectiveness of Case Study businesses

Within each case it is possible to identify different configurations e.g. dyad, chain or network and some uncertainty about the buyer/supplier long term position. Table 1 summarises each case in terms of its configuration and relationship.

Table 1.
Case Study Summary

	Configuration	Relationship
'GrowFarm'	Dyadic	Buyer Dominance
'Meal Co' (Local Market)	Dyadic	Supplier Dominance
'Meal Co' (Licensing)	Network	Buyer Dominance
'Flower Co' (Downstream)	Chain/Network	Buyer Dominance

Discussion

Discussion of the empirical findings

Management of relationships in horticulture businesses is required to maintain the value stream flowing across organisations. Some of the most successful, horticulture value chains in the FCC Value Chain project (Food Chain Centre, 2007) could be attributed to an openness to share information on processes along the supply chain. Two of the three cases in the current Welsh horticulture study demonstrated similar levels of openness and commitment to long term relationships. *FlowerCo* shared information with its downstream supply chain and had a strategy of building competitive capacity for the future with other farms, albeit with an exit strategy to alternative channels in the event of non-renewal of the retailer contract. *MealCo* demonstrated long term commitment to a cooperative relationship with other retail market outlets with contractual arrangements in place. These written agreements were in practice unenforceable in the face of opportunistic behaviour by some of *MealCo*'s licensees. It would seem that *FlowerCo*'s approach of managing risk through keeping open an exit channel was more effective than *MealCo*'s written contracts. Both trust and power were used by the businesses though an element of doubt remained in trust relationships such that the power of an exit channel was retained. Overall from the cases, there was an overall tendency towards commitment behaviour.

The business approaches for the case studies are as follows. The aim of *GrowFarm* is to protect its current customer base and maximise profitability for existing capacity. It has a simple dyadic configuration making relationships straightforward to analyse and monitor. It is a defensive position with longer term vulnerability to new entrants with larger box schemes, but is attempting to protect this position by developing customer loyalty. The maintenance of customer loyalty will require continuous monitoring and assessment with innovations to maintain buyer interest.

With *MealCo*'s activity in the local market the aim is to develop the product and generate income to support wider geographic sales. In order to be successful this approach would benefit from following *GrowFarm*'s dyadic, loyalty approach. In its licensing operation the network has had significant opportunistic contractual problems. However, a modified business model may be more successful with better contracts and/or faster new product innovation to create interdependence. However, it is recognised that by operating through a network configuration, analysis of customers will be more complex for a small business with limited time resources, and hence, less reliable than in a dyadic configuration. *MealCo* is proposed in the Supply Chain Effectiveness model as having the lowest effectiveness of collaboration of the three case studies. Improvement for this micro-business would occur, within this model, from reducing the complexity of the relationship configuration and increasing relationship adherence.

FlowerCo's cut flower capacity takes several years to develop and '*FlowerCo*' is openly creating a network to provide capacity of Welsh Provenance to provide an offering of long term appeal to retailer(s). The success of this newly developing network cannot yet be assessed. Downstream *FlowerCo* works collaboratively with larger buyer dominant organisations, thereby being part of a chain configuration. It is using competence trust to help retain continuity. However, it has recognised the risks of buyer dominance in the chain, in the event of non-renewal of the annual contract, and so has developed its alternative wholesale/farmers' market channel.

Implications and recommendations for action

Barratt (2004) identifies the issue of the "resource intensive nature of collaboration". The Welsh Horticulture case studies are small, low volume businesses and, so, making changes can be a significant use of resources. However, such cases are indicative of Welsh Horticulture. In 2007, Single Farm Payment data showed 389 horticulture businesses in Wales greater than 0.3 hectares (Williams, 2010, p10) whilst larger companies turning over at least £60,000 in Wales (Williams, 2010) represented just 0.5% of UK horticulture turnover. In response to an enquiry from the authors to the Horticultural Development Company (HDC), in 2011, there were 11 companies that paid a total of £22,000 in levy in Wales representing 0.3% of HDC levy income (source: enquiry to HDC).

It is proposed that it would be appropriate to focus on generating capability for the smaller organisations in Wales so that they could interact effectively in dyadic, chain and network situations. Asynchronous Learning Networks would assist the development of supply chain configurations in small and micro-enterprises. A sector 'Lean' approach would need to access information on the types of Learning Networks available and their cost implications.

For lower volume, small and micro- suppliers 'Lean' training may also be appropriate. The purpose of the "Learning Networks" would be to increase the capability of the industry to achieve effective supply through allowing smaller organisations to engage and disengage rapidly in networks or chains. Vertical flow could be created as a result. Such flexible, transient connections have connotations of the integration of 'lean and agile' supply (Naylor et al, 1999, Bruce *et al.* 2002). These Learning Networks would need to ensure that a link is maintained between the producer and the consumer so that the requirements for products, and the quality needed, is known and planned (Haugum and Grande, 2017)

The Supply Chain Effectiveness model presented (Figure 6, Figure 7) of relationship adherence and structure is a tentative indicator that adherence becomes more difficult with structure complexity. It is proposed that this could be a useful concept to use at the commencement of 'Lean' initiatives in order to identify the types of relationships available and the subsequent 'Lean' changes that would be most appropriate. It is postulated that the simpler the relationship configuration, and the more committed the relationship, the more effective collaborations become. Businesses would look to improve the variables of relationship configuration and of commitment in order to improve collaboration and so move along planes in the model.

Conclusion and limitations

'Lean' is a discipline that systematically removes non value-adding information and physical activities along the supply chain from raw materials to the consumer (Womack et al 1990). The identification of non-value-adding activities is related to transaction costs as well as pure manufacturing costs. In Transaction Cost Economics (Coase, 1937, Williamson, 1975, Williamson 1986), 'Lean' waste elimination addresses both types of transaction cost i.e. external buying costs through 'Lean' sourcing and supply (Hines, 1994) and internal administration costs through 'Lean' production methods (Ohno 1988). 'Lean' sourcing consolidates suppliers, thus reducing the number of supply relationships.

Supplier rationalisation with fewer buyer-seller relationships has an important secondary impact. It makes it more economic for companies to improve their processes together. Typically, 'Lean' cases (Womack and Jones 1996) involve consolidation to single or dual suppliers which reduces the system's transaction costs. This, in turn, leads to suppliers having dedicated capacity and specific assets for their customer, creating prevailing conditions for opportunistic behaviour (Williamson, 1975). However, transparency of the whole process presents the opportunity for renegotiation by more powerful participants. The current study proposes that relationship adherence and supply system structure are considerations in 'Lean' collaboration.

Particular consideration should be made in the analysis of relationships to include:

- How business models could be modified to mitigate against opportunism and rather to achieve long term commitment. Engelseth (2016) noted that developing short supply chains gave greater transparency which resulted in reciprocal interdependency improving the exchange economy.
- How unsatisfied supplier demand can be met. This may require business co-operation and the development of Learning Networks. In Ireland, the horticulture sector supported by the levy body, identified an unsatisfied customer need for high volume mushroom growing. This resulted in the development of a cluster of growers who produce approximately 64,000 tonnes of mushrooms annually (Teagsac, 2013). This makes it the largest sector in Irish horticulture.
- How small and micro-enterprises can continue to survive and play their role in the social integrity of communities. There is an indication from this study that, as the relationships in the horticulture industry in Wales are predominantly of buyer dominance (the buyer has the option of purchasing products from elsewhere), there is a pressure on the current structure of the industry, which would have negative social implications for business sustainability in rural communities in Wales. That pressure is towards creating larger suppliers which can supply large and demanding retailers. This could be mitigated by maintaining a variety of product outlets for smaller producers and by developing appropriate relationships and configurations for these producers. Narrod *et al.* (2009) note that small food businesses may still have an influence in large markets if they act collectively to optimise the economies of scale (e.g. bulk purchasing, equipment sharing) and to cluster necessary skills. The application of Lean Management has emphasised environmental and economic sustainability increasingly since 2010 (Martinez-Jurado *et al.*, 2014).

A clear understanding of the correlations between relationship adherence, the complexity of the supply chain configuration and the effectiveness of the supply chain collaborations will improve concentration by businesses on these determinants.

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