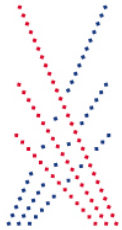

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A Product Service System (PSS) approach in the UK agricultural sector– issues, directions and implications

Dr Kamal Qazi
School of Strategy Marketing and Communication
Leeds Business School
503 Rose Bowl, City Campus, Leeds, LS1 3HE, United Kingdom
Tel: +44 (0)113 8124714 | Email: k.qazi@leedsbeckett.ac.uk

Andrew Serotsky
School of Strategy Marketing and Communication
Leeds Business School
City Campus, Leeds, LS1 3HE, United Kingdom
Email: A.Serotsky6962@student.leedsbeckett.ac.uk

Dr Muhammad Amjad
Salford Business School
333 Maxwell Building, University Road, Salford, M5 4WT
Tel: +44 (0) 161 295 2762 | Email: M.Amjad@Salford.ac.uk

1. Abstract

Uncertain economic and political factors are forcing businesses to rethink their competitive advantage. Such is the case for the UK agricultural sector, it is not immune from such challenges. This paper investigates how Product Service System (PSS) can make a difference to the sector. There is a sparse amount of PSS research in the UK agricultural sector, issues of performance in the sector is reviewed, benefits highlighted on how PSS can bring a sustainable competitive advantage to the sector. The advancement of customer satisfaction and monitoring the progression/performance with Life Cycle Analysis (LCA) and The Balanced Scorecard is suggested.

Word Count: 5779

Keywords: Product-Service Systems, PSS, Servitization, Agriculture, Competitiveness

2. Introduction

It is felt that there is a critical need for the topic of this research to be explored, given the impending issues such as the financial hardship Brexit is expected to bring to the UK sooner rather than later, where labor could become scarce with the freedom of movement act affected (Isaac, 2019), as well as the potential restrictions through the supply chain of the agriculture sector – sourcing materials abroad could become problematic if a "No Deal" Brexit can't be avoided (The Economist, 2018). Exploring strategies and remedies to these stark issues are the main motivations behind this research as the prolonging and sustaining of the agricultural sector in the UK is vital to the livelihoods of most communities as well as the farmers themselves. Such are the expected short falls economically, all which will be discussed in the research, other methods must be considered by the sector, such as PSS, which has limited scope in this industry currently, could have a major impact on the progression of agriculture here in the UK.

The continued economical struggle has seen sluggish growth (Allen, 2015) but this coupled with the barriers Brexit will bring to agriculture, the importance of this research is extremely high and valuable to all stakeholders, as a solution to the mounting problems could be found in the implementation of PSS – minimizing high up-front costs, whilst maintaining the use of machinery, improving output, could prove priceless to an industry to dependent on factors such as weather and yield. The research question surrounds PSS as a potential solution to the

agricultural sector, how it would be implemented (on mass/gradually), and the receptiveness of the sector to change its ways after decades if not centuries of the same or similar processes. Questions must also be posed around the sustainable nature of current farming processes, using pollution heavy machinery and less than environmentally friendly disposal methods – this has been researched somewhat in the southwest of the UK, but the uptake has been low (Falloon & Kahana, 2018). The methodology used will be secondary research only relying on current literature and PSS practices known inside and outside of the agriculture sector worldwide. Narrative analysis will be used to critically analyze the literature and evaluate how a performance measurement strategy could be implemented into the agriculture sector within the UK, giving a step by step guide as to how this can be accomplished successfully. This will form the outline of the research, a review of the agriculture sector, followed by a performance measurement strategy and then recommendations and conclusions based upon this – with limitations of the research detailed at the end of the paper.

3. A review of the agriculture sector in the UK

The agriculture sector has a key role to play on the overall economy in the United Kingdom employing over 466,000 people in 2016, with 71% of land in the UK used for farming alone – 17.2 million hectares (Department for Environment Food & Rural Affairs , 2016). As of 2016, the agricultural sector in the UK employed roughly 466,000 staff (Downing & Coe, 2018), when concerning the broader scope of the agri-food sector, which includes manufacturing and distribution, the workforce exceeds 3.5 million people – 13% of the total UK workforce. This means that any positive changes to the products/services offered by the agriculture sector will be felt on a large scale by the UK – such is the level of impact the sector has on the UK.

The agri-food sector contributed £109 billion to the UK economy in 2015, with the agricultural sector counting for 8% of the total figure (National Farmers Union, 2017) – these figures show the importance of the sector in the UK, and the reliance residents of the UK have on agriculture and vice versa, despite agriculture only accounting for less than 1% of the total national economy (Department for Environment, Food and Rural Affairs, 2017). Moreover, the agriculture sector is helping combat carbon emissions such as gasses and ammonia, whilst increasing their own production, they have done this by embracing technological advances, such as solar power, wind power and using energy produced from biomass (National Farmers Union, 2017).

With changes already underway to build sustainability, PSS implementation could have a similar impact given the need to reuse and recycle products and parts to increase length of life

from the manufacturers point of view. Given the size of the sector in the UK, the move to PSS could have dramatic effects on the environment's health long term.

Another reason a change in method is vital, is Brexit – the EU has had a fundamental impact on UK agriculture through the Common Agricultural Policy (CAP). CAP is a system of financial support measures and programmes under which UK and Europe work, it also regulates the market and provides free movement of labour (HM Government , 2014). Withdrawing from the EU, means the UK will withdraw from the CAP (House of Lords, 2017). Without the aid of CAP, the agriculture could suffer difficulties consequently with losses of funding and labour.

3.1 Product Service Systems: The Concept

PSS is a business model that focuses on increasing value and creating stronger relationships between manufacturer and end user (Baines, et al., 2007). Rather than focusing on a traditional transactional approach to a transfer of ownership of a product on purchase/sale basis, PSS places the emphasis on optimising value to the customer through additional add on services without the outright ownership of the product. This reduces the capital requirement to the end user of securing the use (output) of the product. This lowers the environmental impact as the manufacturer focuses on the lifecycle cost and retains ownership. The knowledge transfers back to the manufacturer can enable design improvements to the product, and in turn develop and increase organisational capability and competitive advantage to the manufacturer and end user (Qazi, 2016). An example of this is Rolls Royce, who adapted their business model to incorporate a lifecycle and service and maintenance package rather than an outright purchase of an airplane engine. By charging the customer by the hour for flight times, this removed the upfront capital cost to the customer, reduced the need for the customer to retain their own service team and provided data back to Rolls Royce who used this information to improve the performance of the engines (Baines, et al., 2007). This strategic approach allows the seller to differentiate their offering from price led competitors. In the literature to date, the goals of PSS are described as a combination of increasing competitive advantage, reducing environmental impact throughout the lifecycle and satisfying customer needs (Baines, et al., 2007). Lately academics such as Manzini have extended this by including sustainability as an objective, and a broad consensus amongst academics that PSS was a way for manufacturers to increase differentiation, create a stronger customer relationship but also to support future revenue growth beyond the sale of the product (Zancul, et al., 2011).

However, implementing PSS successfully is not straightforward and there are many challenges which will be discussed later in the paper, but what is clear is that to achieve a successful

outcome (whatever that may be) PSS design needs to consider the needs of the customer when designing the product, the entities (providers, manufacturers), and all actors involved in fulfilling the customer need (Nemoto, et al., 2013).

3.2 Types of PSS

Product orientated PSS involve the least change from the traditional purchase/sale model. Ownership can change hands from supplier to customer, with the differentiation from competitors being the additional product servicing or training to optimise the customer benefit. In agriculture this could be. A Use orientated PSS can be described as selling the use of a product or service, in exchange for a pre-agreed payment. Ownership remains with the seller and the buyer simply gets the benefit of the use for an agreed period. For example, this could be leasing a combine harvester or tractor and pay for the time the machine is in use. John Deer currently offer a form of PSS, although the term is not used in their advertising, and depending on contracts can either by an example of product or use PSS. They offer use for a fixed or rolling period, where ownership is retained and includes a full service and maintenance package (John Deere, 2018). A Results orientated PSS can be described as buying a pre-agreed result rather than use or ownership of a service. you are, in effect buying an outcome. For example, Baines et al (2007) describes selling laundered clothes rather than a washing machine. In Scotland, biomass farmers have created a result orientated PSS by selling heat instead of wood. For example, farmers are working in partnership with local operators of power plants. They get paid according to the power produced and sold back to the national grid. These have been termed as “heating service enterprises” (UNEP, 2015). Another example, from the horticulture industry is where the farmer pays for a crop management service to reduce crop loss from insects. The service provider and farmer agree a desired outcome, and the PSS provider uses natural predators to achieve the desired outcome. This has found to reduce water and pesticide use, and thus creates a more sustainable and safer working environment, with the additional benefit of marketing the finished product as pesticide free (Tischner & Vezzoli, 2018).

Tukker (2004) suggested there were eight models of PSS (*Figure 1*). The provider would determine the model which best suited their business, and the type of product or service they either offered or intended to offer. Starting at the first two types within the Product Oriented PSS, to the last (pay per service and functional result) the product becomes less of the core component of the model. In the results-oriented category, Tukker argued that these offering would naturally be more bespoke to the client, thus focusing on solutions and results from a

service perspective rather than the functionality of the product alone. To ensure the successful implementation of PSS, Tukker suggested JCB are an example who have adapted their service offering to better serve their customer. The customer can still purchase a JCB machine outright and obtain full ownership. At the buyer's request, this can be with additional service and support. (JCB, 2018) Using the Tukker model this would be a product-oriented PSS. However, they also offer leasing and rentals which could place them in the Use Oriented PSS. This does show that businesses are adopting multi solutions to fulfil the customer needs, increase product differentiation, and to achieve additional revenue post sale and from alternative Use-orientated business models.

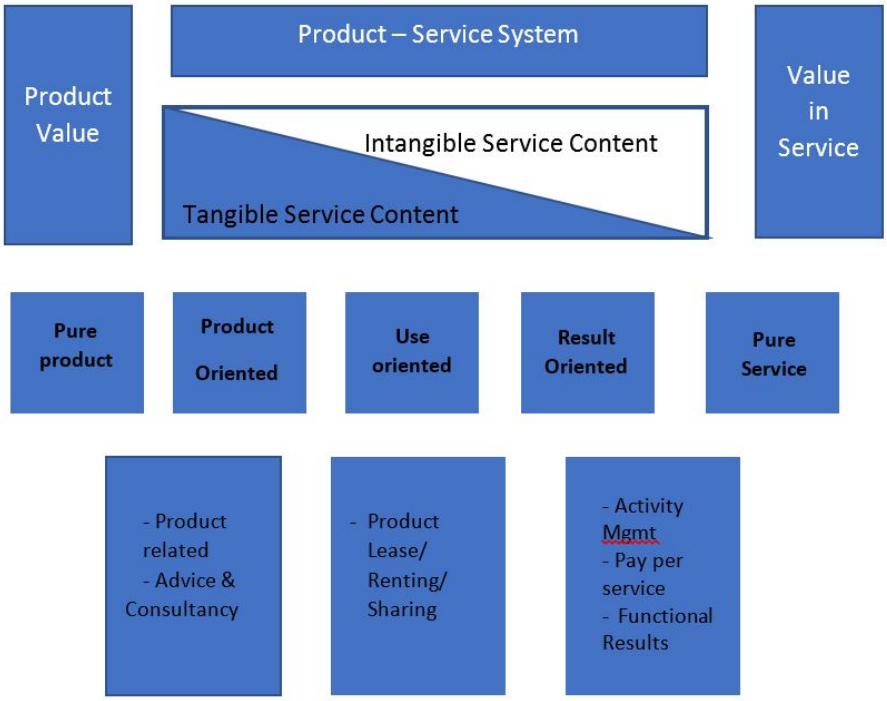

Figure 1: Types of PSS Systems. Adopted from (Tukker, 2004)

3.3 Evolution from Ownership Model to Use Model

Figure 2 depicts the stages of buying and decision making required to adopt a full PSS business model. It is for the manufacturer or provider to determine at which stage their offering would be best placed. Stage zero represents where the current or traditional model of purchase and sale, while stage one represents an improved service offering to include a warranty (the beginning of PSS). This is more complicated for the manufacture/provider and transfers an element of risk back to the manufacturer/provider. However, the service offering is improved as the buyer now receives assurances that in the event of a fault, they will be covered during that period. Both stages zero and one rely on the traditional purchase/sale transaction model. Stage two requires a change in mindset from the buyer who may still want the sense of

ownership without the capital expenditure and is the beginning of changing the mindset to one of efficiency. Stage three requires further shift from the buyer and manufacturer. The manufacturer bears significant risk in that they retain ownership of the harvester, the maintenance and support, and the buyer (farmer) only pays for the period when they need it. Capital expenditure is removed from the buyer, who simply pays for time the harvester is rented. This could be by the hour, day, week and so on. The final stage in this example is for the buyer to switch mindset to one of viewing the offering from the manufacturer as a solution to a problem. For example, the solution may include a specialist to harvest the crop, or the manufacturer offering further on-site training to support the farmer. The clear differentiator of this stage, according to Tukker would be that the provider would be free to choose the machinery required to fulfil the customer need (Tukker, 2004).

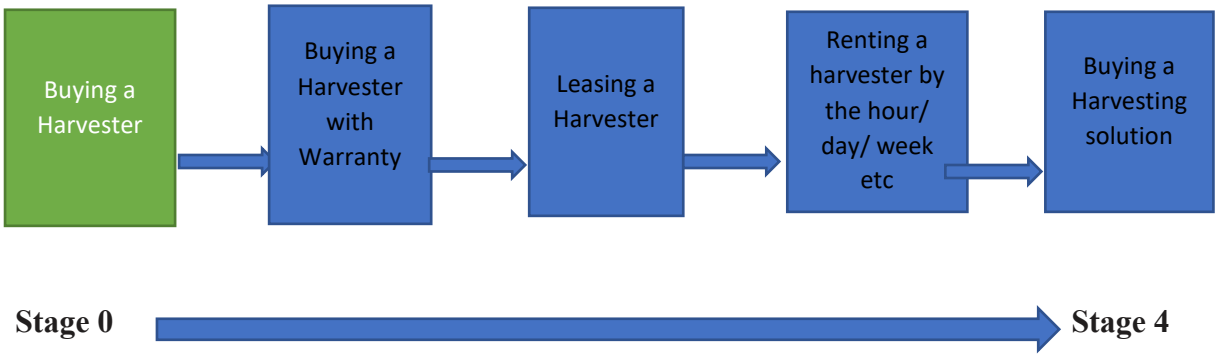

Figure 2: Evolution to a PSS Business Model

3.4 PSS or Servitization – The Agriculture Sector

There are many similarities between servitisation and PSS, having an impact on the supply chain from the manufacturer to the farm when concerning the agriculture sector. Servitisation was thought up by Vandermerwe and Rada in 1988 who defined it as "Market packages or 'bundles' of customer focussed combinations of goods, services, support, self-service and knowledge" (Vandermerwe & Rada, 1988). This echoes PSS in that an organisation is adding value by offering additional services to products - Kryvinska said both concepts strive for the same goal, have the same motivations, and same drivers (Kryvinska, 2014).

Wijnberg argues that manufacturers increasingly engage in servitisation and formulated a value-based framework, whilst PSS has not quite reached the agriculture sector on a large scale – it shows that there is a framework for PSS in place for the sector to shadow. Wijnberg states products and services differ with regard to the value that is created by the tangible elements and the interaction moments between manufacturers and customers (Wijnberg, 2016).

There is some evidence that PSS is beginning to be implemented within the UK agriculture sector through OMEX – a leading supplier of fertilisers. They offer limited services to customers, such as after-sales support and expert consultancy service based on the latest industry practice (Omex UK, 2018) – whilst limited, it is still considered evidence of PSS impacting the sector. Secondly, there is evidence of leasing or gaining agricultural equipment on finance, through BNP Paribas Leasing Solutions – who offer equipment on a lease agreement – like in the automotive industry, offering sales support and after care (BNP Paribas , 2018). In the main, the PSS options available to UK farmers are very limited, based on the research undertaken in this literature review.

3.5 Gaps in the literature

There is a distinct lack of literature and resources surrounding the use of PSS within the agriculture sector in the UK after completing a thorough literature review in this specific area. This is not limited to the UK either, there is a huge lack of articles, journals and papers in general about PSS use in the agricultural sector. This means this poses a huge gap of knowledge as to how successful implementation has been – or the openness from the sector to change to PSS from buying the products outright. With the agriculture sector being around for hundreds of years, there is expectation that they would be reluctant to change what has been successful in the past – this backed up by minimal literature and evidence available, especially given the large number of smaller, family run farms for example – such smaller, family run farms, can have a lack of formal strategic management focus, due to the physical nature of the labour excluding creative work and strategic thinking (Andersson, 2002).

There is an opportunity for a scholarship to further this work by investigating through primary data to see what the actual barriers, opportunities and challenges are faced by the sector when it comes to implementing PSS as a strategic competitive tool. Currently this paper through secondary data was able to bring out that there is a lack of awareness and knowledge within the sector leading to hesitance and willingness to try something new. The 2X2 Matrix framework for product-service is suggested as a starting point.

4. Performance Measurement Strategy -How PSS can be Implemented in the Sector

The implementation of PSS into the agricultural sector will be a slow process, as there are several factors that must be examined and researched, as well as a strategy designed to monitor the performance. Ziout and Azab (2015) gave an example of how PSS can be implemented –

shown below *(Figure 4)*. It is a very basic/skeleton schematic diagram but shows the process it will undertake.

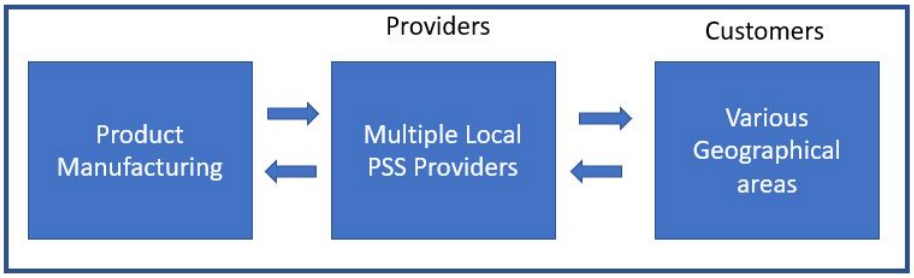

Figure3 : Schematic diagram of a proposed PSS Adapted from *(Ziout & Azab, 2015)*

As mentioned above, there are many factors affecting the success of implementing PSS within the agriculture sector. A PEST analysis *(Figure 5)* has been undertaken to identify relevant macroenvironmental factors within the UK.

Political	**Economical**
• Brexit – loss of subsidies when withdrawing from EU – huge concern affecting whole sector. • Brexit could lead to changes in taxation policies and regulation laws. • UK agriculture is under one national law rather than regional like US. • Global tensions risen since Brexit.	• Due to Brexit, access to labour may be hindered as they will be minimal, if any freedom of movement through EU countries to the UK. • Costs such as maintenance, running, end-of-life costs are likely to increase given uncertain economy. • Despite Brexit, the UK economy is growing, as is GDP per head.
Social/Cultural	**Technological**
• Much more concern around "green" ways of working – agriculture bad reputation given use of machinery. • Imagined threat to health due to pesticides, occupational hazards etc. • Agriculture is not the most fashionable industry to work in – seen as old fashioned.	• Agriculture sector relies on innovative technology to slash margins and meet demands – does not come cheap. • Technology partnership with EU at stake due to Brexit • UK traditionally a leader in developing new technologies and ways of working.

Figure 5: PEST Analysis of external agriculture sector - sources used: *(HM Government , 2013)*, *(Demos, 2013)*, *(Jackson & Strauss, 2016)*, *(Swinbank, 2017)*

Based on the key factors from the analysis completed, it is imperative that the agriculture sector in the UK, begin to move away from their traditional model to a PSS model, not that this comes

without risks, but given the circumstances with Brexit, and the environmental issues broadening, PSS could be the perfect way forward for the sector.

The method of implementation suggested to enable practitioners to implement PSS could be through the concepts of lean manufacturing. It could enable businesses to create a measurement of progression over a long period of time. This will also enable the performance to be monitored with clear goals and targets in which lean is identified with, such as reducing waste and not seeing economies of scale as an advantage as such, whilst creating value throughout the supply chain from manufacturer, to farmer, to customer for example. Below is a simplified plan of implementation noting the most important stages.

STAGE 1 – Gather vital information from agriculture supply chain – are they open to a change from traditional approach to PSS?

STAGE 2 – Market Research to gain insight into what customer's needs/wants are based on a PSS. Build initial relationships.

STAGE 3 – Investigate whether a complete PSS is possible from manufacturer, to local PSS provider, to customer – or whether a partial PSS is more suited.

STAGE 4 – The physical implementation of PSS within the sector

STAGE 5 – Monitoring of the PSS through lean operations and Life Cycle Analysis

The first stage of implementation of PSS within the sector would be to gather information from the current agriculture supply chain as to whether they are open to change to PSS from their traditional approach. There is a common perception, whilst the larger organisations would accept change, the smaller, more family run organisations would be more reluctant and use to a certain way of life. Ultimately there are three factors that drive an organisation towards PSS, which are Financial, Strategic and Marketing (Baines & Lightfoot, 20) – given the issues PEST analysis found, there is an argument that all three of these drivers are in use. If these drivers can be argued to the organisations within the industry most reluctant to change, then there is a higher likelihood of participation.

The second phase would surround market research to establish what is good and bad with the industry – as there is no real evidence of prior implementation in this industry. This will help form the needs and wants of the customer (farmers). This phase would also involve listening to concerns the farmers have regarding the risk anticipated, and uncertainties with change, technically and organisationally. Other concerns would involve PSS responsiveness – how

efficiently can PSS providers adapt to changing needs of customer, whilst ensuring the highest level of customer satisfaction will be needed to reassure customers in the implementation.

The third stage would decide as to whether there would be a complete PSS through the whole supply chain from manufacturer, through to local provider and then the customer. Having undertaken the PEST analysis to identify any potential issues, there seems no reason why there could not be a complete PSS in the UK – unlike Canada (Ziout & Azab, 2015).

Next, would be the actual implementation of PSS into the industry. The first key activity of the PSS would be the PSS providers taking over responsibilities the customer previously held, an approach to this is providing the customer with a complete lifecycle solution, from installation and then throughout its entire life period (Reim & Lenka, 2017). This action allows the customer to release responsibility in maintaining and servicing the machinery, which hopefully will come as a relief, thus building the relationship from the beginning in lessening the customer's immediate workload. By taking over the operational activities, the customer involvement will increase from the early stages, helping to develop knowledge and predict the customer's requirements – this is delivering value and value creation.

When commencing implementation, ensuring delivery is localised is of great importance, this means the PSS can be monitored close hand, with support to the customer given as part of the service. Considering traditional methods of supporting operations, these are known to have longer response times (Reim & Lenka, 2017) – the PSS provider must make sure they are localised to avoid this issue and decrease down time as much as possible, whether this is personnel attending the farm to help with a breakdown, or sending a spare part – these seemingly smaller factors are critical to the success of a PSS. Another factor within the early stages of implementation are forming of new routines – the agriculture sector will be used to specific routines – delivering PSS will change and develop new routines, such as much more communication with external parties, such as the PSS provider.

As discussed, there are many stages of implementation, and these do not come without significant risks if all stages and factors are not studied carefully. With impending factors such as Brexit, and the possibility of a "No Deal Brexit" – for which Jeremy Hunt called "Brexit Paralysis" (Quinn, 2019) – change is becoming a necessity, rather than a choice, communicating this to the agricultural sector is one of the key factors in a successful implementation. Based on this, the choice of revenue model is important, in particular at the beginning of implementation, for the agriculture sector, using a pay-as-you-use model will be beneficial for both the PSS provider and the customer. This will allow the customer to use the

machinery only when they need, only paying for it when they need, given the unpredictability of the sector, this would be hugely beneficial to the customer.

4.1 Monitoring performance of the PSS through the supply chain

Monitoring the progress and performance, or lack of, is a vital step for PSS to succeed throughout the process from installation to the end of life. The main performance measurement tool in the long-term would-be life cycle analysis for the PSS provider, this has been recommended due to the environmentally friendly manner in which a PSS operates. A key feature of PSS delivery is the ability of machinery to be reused, repaired and recycled wherever possible, thus limiting the impact it has on the environment (SolidWorks, 2018). The LCA or cradle-to-grave has the ability to monitor all functions within the PSS, measuring factors such as recycling levels, waste management and generally the inputs, outputs and processes a product's life undertakes from cradle – the raw material, to grave – disposal of the product – in this case – machinery. With the agriculture sector using heavy machinery such as grain spreaders and tractors, allowing the performance to be measured not only helps the environment, but makes the sector more sustainable – and the supply chain more valuable/harder to imitate. A life cycle analysis (LCA) would be undertaken, it can then be benchmarked over a specific period of time, usually yearly, where the performance can be measured, and goals set. The overall aim of a PSS is to make the sector a circular economy (The ELC, 2018), with emphasis on recycling, reducing and reusing wherever possible.

This method of performance monitoring and measurement synergises with the aims and objectives of PSS – along with lean operations, providing an ideal structure for the sector to be monitored, with clear goals surrounding the environment. It does have limitations in that a PSS is about more than just the environmental factors, other factors such as customer satisfaction must be taking into consideration, this is where the second performance measure will be introduced – alongside the LCA, the Balanced Scorecard – see *Figure 6*.

Completing a Balanced Scorecard (BSC) will allow for a full-scale monitoring process of the implementation and the performance of the PSS through differing channels such as financial and customer performance/satisfaction. It will also measure the internal and external efficiencies of the PSS in the sector allowing an overall strategy to be built up whilst improvements can be made (The KPI Institute, 2018). The potential limitation with the Balanced Scorecard is that smaller farms, generally run by families do not necessarily have a strategic management plan – instead focussing on the physical nature with zero creativity.

Compiling a Balance Scorecard will enable the sector to set objectives, measures, targets and initiatives over a specific period of time (Paustian, 2016), for example a measure could be for PSS providers to achieve high levels of customer satisfaction, with a specific percentage in mind – the target. The initiatives will help the PSS provider achieve this, such as improve service levels or competitive prices/incentives. Below is a graphic of how the Balanced Scorecard works, alongside it is monitoring/performance measures.

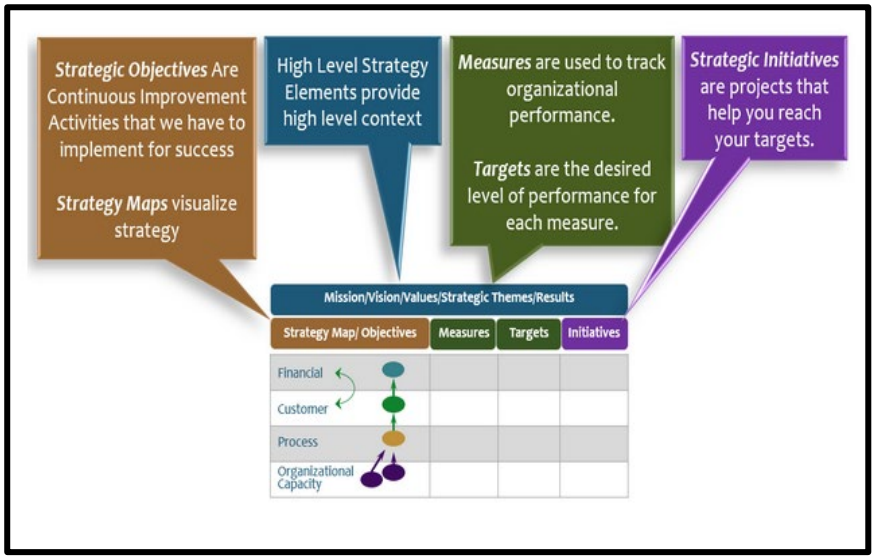

Figure 6 : The BSC *(BSI, 2018)*.

Monitoring the performance of the PSS within the agriculture is a fundamental step in ensuring the implementation is successful, and which specific areas need improving. Using lean methods such as continuous flow, reducing waste combined with LCA means the environmental performance can be measured throughout the sector. The BSC will monitor the other areas of performance, such as the financial aspects, the customer satisfaction and the processes. Implementing PSS is a complicated, and fairly tested in the scholarship, so monitoring the whole process is seen as a key area for future research.

4.2 Benefits from Implementing PSS Strategy in Agriculture Sector

There several benefits the farming community can gain by implementing a lean strategy when delivering PSS into the industry. The first and probably the most significant is the elimination of costs through product ownership, which is extortionately high when considering pieces of machinery. This will enable the business to run with higher capital without the fear of having to buy thousands of pounds worth of equipment at a given time. This reduction in overall costs also includes the maintenance, refurbishment, and running costs, as these factors would generally be included in the PSS. This is a huge benefit to the farms, as they will have continuous support from their local PSS provider, have working equipment year-round without fear of failure. This will help build stronger relationships between the two as oppose to the

more traditional method of buying machinery outright as there will be regular communication back and forth – such is the nature of PSS.

Secondly, the farming businesses will benefit greatly from the PSS providers' expertise and knowledge. The local PSS supplier will deal with several customers, with several queries regarding their needs, wants and issues. This knowledge they possess will far outweigh the customers such are the differing variants the supplier will experience daily about the products and their performance. This will streamline the processes of the customer, as the local PSS provider will be on hand to provide expertise regularly, rather than the customer having to search for a solution themselves – thus ridding the customer of waste – both in the product standing idle and the wasting of time for example.

The agriculture sector is a temperamental industry, with varying results based on factors such as the weather. By working with a local PSS provider, the customer can obtain a high quality and performance solution – catered specifically for their needs, this may change as the seasons pass – when certain items/equipment are needed. Such a package will be guaranteed to achieve specific end results by the PSS provider.

Another benefit to the customer is the elimination and reduction of risks in which the customer will find if the product was bought in the traditional way. The PSS provider can train and give knowledge to the customers and their employees on health and safety, ensuring risks are kept to a minimum – increasing efficiency, through a reduction in workplace accidents. In addition, a PSS will help decrease personnel training requirements, as part of the service is to make sure customers know how to use machinery effectively and safely – this will save the customer time and reduce waste in human error.

By implementing PSS within the sector, it will impact lean measures naturally – by creating value and reducing waste, whilst having a continuous flow of goods and services through the supply chain. Introduction of PSS within the sector will develop the traditional approach from high production – leading to waste and surplus, to a lean approach (Resta & Powell, 2015) – a focus on producing only when needed – as the farmers could have the ability to lease machinery only when needed for example, at specific times of the year. These measures act as a massive benefit to the customer's efficiency.

5. Recommendations and Conclusions

Whilst PSS is not necessarily a new phenomenon, applying it to the agriculture sector is, and its implementation has not been recorded per se' in the UK. Agriculture has been around thousands of years and the sector is notorious for its stubbornness to change (AgriLegacy,

2018) – this is potentially a reason as to why a PSS has never found its way to the sector in full – albeit partly in some practices noted previously in the research. The agriculture sector is performing well in the UK, but with drastic change imminent in the form of Brexit – changes must be made for the sector to remain strong and flourish in times of predicted hardship. Addressing this head on, in the form of a PSS within the sector can help combat any issues covered in this paper, thus scope for it to succeed, as the manufacturing sector has shown – any sector must move with time. Arguably there is a case for future research into PSS and the agriculture sector – there is limited studies of PSS with industries like agriculture been implemented and track its success. In conclusion, the sectors willingness to change to something new is fundamental, this decision hinders on any success a PSS can achieve – such a drastic change from the traditional method must be accommodated by all members of the sector from manufacturer to end user.

This research places heavy emphasis on the Brexit issue, with good reason as documented within this research, it's felt that this will stand the test of time and that it's not the whole basis of this research, as there seems to be unrest across Europe in regards to the European Union, with Greece and Spain sharing their grievances with the European Union (Waterfield & Coates, 2015) – both have significant agricultural sectors. This shows this paper has a wider scope than just Brexit – it could impact other countries in years to come facing similar difficulties, where ground breaking legislation could impact the agriculture sector profoundly both positively and more likely, negatively.

5.1 Limitations to the research

There are some limitations to this research, first and foremost, the lack of primary research conducted in and around the agriculture sector in the UK. This was due to a couple of main factors, firstly the time constraints around the research was tight, and given the lengths it would take to conduct such proper research, it was felt unnecessary to do so, unless it was to be completed properly and in a high enough detail. The second reason was communication and location, somewhat linked with time constraints, communication with farmers proved extremely difficult, they are in an industry where they work from sunrise to sunset with no reliance on technology – such as email/mobile phone to communicate with. Location was also tricky, with farmers usually based rurally in the countryside, with every party having very busy schedules, it was logistically unviable to conduct visits to sites within the sector.

Another limitation was that Brexit hasn't happened yet, which means despite predictions and outlooks, it's difficult, if not impossible to imagine how the UK economy and the agriculture

sector will be affected in the main until Brexit happens, and what deal the government will take.

Given the limited evidence of PSS being used currently, it's difficult to assess the outcome or success rate, so this must be classed as a limitation, despite the obvious evidence it would be successful given the lowering of costs and more reliable machinery – it's noted it has success out of the UK, in countries like India, and there are versions of PSS implementation in the UK, but not documented on a scale usable to say it'd guarantee a higher success rate than current methods/processes.

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