

This item was submitted to [Loughborough's Research Repository](#) by the author.
Items in Figshare are protected by copyright, with all rights reserved, unless otherwise indicated.

Integrating products and services through life: an aerospace experience

PLEASE CITE THE PUBLISHED VERSION

PUBLISHER

© Emerald Group Publishing Limited

VERSION

AM (Accepted Manuscript)

LICENCE

CC BY-NC-ND 4.0

REPOSITORY RECORD

Johnstone, Stewart, Andrew R.J. Dainty, and Adrian Wilkinson. 2019. "Integrating Products and Services Through Life: An Aerospace Experience". figshare. <https://hdl.handle.net/2134/4460>.

This item was submitted to Loughborough's Institutional Repository (<https://dspace.lboro.ac.uk/>) by the author and is made available under the following Creative Commons Licence conditions.



CC creative commons
COMMONS DEED

Attribution-NonCommercial-NoDerivs 2.5

You are free:

- to copy, distribute, display, and perform the work

Under the following conditions:

 **Attribution.** You must attribute the work in the manner specified by the author or licensor.

 **Noncommercial.** You may not use this work for commercial purposes.

 **No Derivative Works.** You may not alter, transform, or build upon this work.

- For any reuse or distribution, you must make clear to others the license terms of this work.
- Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.

This is a human-readable summary of the [Legal Code \(the full license\)](#).

[Disclaimer](#) 

For the full text of this licence, please go to:
<http://creativecommons.org/licenses/by-nc-nd/2.5/>

Integrating products and services through life: an aerospace experience

Stewart Johnstone, Andrew Dainty and Adrian Wilkinson

ABSTRACT

Purpose

Explores the evolution of 'product-service' (P-S) strategies in the aerospace sector. Despite the widespread perception that aerospace organisations are advanced in terms of P-S integration, little is known about the realities of P-S provision in the sector. Much of the existing literature is normative and prescriptive, focusing upon what organisations aspire to do, but offers little insights into how attempts to integrate products and services occur or the challenges organisations encounter.

Design/methodology/approach

Presents an in-depth case study of an international aerospace Original Equipment Manufacturer (OEM), referred to as 'JetCo'. A total of 18 interviews were conducted with key actors involved in the operationalisation of P-S strategy within defence aerospace and civil aerospace divisions. In addition, analysis of internal company documentation was also undertaken.

Findings

Reveals that current P-S strategy, which builds upon a long history of service offerings, initially evolved separately in each division in response to the particular markets in which they operate. However, there was evidence of a corporate-wide strategy for P-S provision being developed across divisions to improve co-ordination. This was founded on the recognition that P-S delivery requires the development of a stronger customer orientation, better knowledge and information management strategies, and the engagement of employees. A key challenge concerned integrating the product and service parts of the business to ensure consistent delivery of a seamless value offering to customers.

Research limitations/implications

The research is limited to a single case organisation in the aerospace sector, and as such the findings are not necessarily generalisable to other contexts. Nevertheless, the research provides important insights into the organisational challenges of P-S provision, and as such the findings are of interest to researchers, managers and policymakers across industries involved in P-S provision.

Originality/value

The paper offers fresh empirical evidence into the development of P-S in an organisation drawn from a sector often flagged as an exemplar of P-S provision, and provides insights into the complex realities of P-S implementation and delivery. Notably, it highlights the challenge of attempting to embed an organisation-wide 'service culture' in pursuit of integrated P-S delivery, and questions the nostrums and overly simplistic models which pervade the current solutions discourse.

Paper Type: Research paper

Keywords: Product-service, through life, aftermarket, services, aerospace

Integrating products and services through life: an aerospace experience

Stewart Johnstone and Andrew Dainty
Department of Civil and Building Engineering, Loughborough University, UK
and
Adrian Wilkinson
Griffith Business School, Griffith University, Australia

INTRODUCTION

The growth of services is one of the major trends of recent years. This is reflected in the changing structures of contemporary economies in the developed world where services now account for the majority of employment, as well as the bulk of national output. Nevertheless, 'service' is a broad term for a heterogeneous range of activities. Sasser *et.al* (1978) were some of the first commentators to use an influential and enduring characterisation that recognised services as intangible, perishable, difficult to standardise, and as not having a separate point of production/consumption. These are often referred to as the 'IHIP' - intangibility, heterogeneity, inseparability and perishability - characteristics. More recently, however, the differences between products and services have become increasingly blurred with a number of commentators questioning whether such a definition of service remains useful (Vargo and Lusch, 2004; Lovelock and Gummesson, 2004). Lovelock and Gummesson (2004), for example, suggest that some contemporary services have characteristics which are the opposite of IHIP characteristics, being they are tangible, homogenous, separable and durable. They suggest that the customer experience of a service process in-use, or a service output, may be quite tangible, while many services are increasingly homogenous through standardisation and automation. In relation to inseparability, with the provision of services such as cleaning or insurance the customer does not have to be directly involved, and the outsourcing of services actually increases the separability (Araujo and Spring, 2004; Lovelock, 2004). Thus, for Vargo and Lusch (2004), the IHIP characteristics are 'myths' which do not really distinguish manufacturing from services, but may simply propagate inappropriate normative strategies.

¹ Corresponding author s.johnstone@lboro.ac.uk

Despite the inherent complexities in constructing a widely applicable definition of service however, the notion of an organisation's 'service mix' can still be usefully be thought of as a continuum ranging from 'pure service' at one end, and 'pure product' at the other (Sullivan, 1982). Service operations have been of particular interest in the field of operations management since the early 1980s (Johnston, 1998), although much of the focus has been upon services *versus* product management, as opposed to service delivery in predominantly product organisations (e.g. Johnston, 2000). Again, this reflects the view that service operations are different to product operations (see Sullivan, 1982, 212), and may explain why service management is recognised as a specialist area across management research in marketing, operations and human resources. However, service and manufacturing operations share the characteristic that they are both concerned with transforming inputs into outputs through various processes (Johnston and Clark, 2001). Moreover, the reality is that many organisations blend products and services to meet specific customer requirements.

The blurring of the boundaries between products and services is becoming increasingly apparent in traditional engineering organisations where the provision of services to clients has often been thought of as a low value, low status activity (Lester, 1988; Marceau *et.al*, 2002). Though services of some description have almost always been offered, they have normally been concerned with routine and reactive maintenance to support the product (Bowen *et.al*, 1989). Indeed, service arrangements may even have been given away 'free' in order to secure a potential product sale (Lele, 1997). However, it has been argued that this view is changing, as traditional 'product-dominant' organisations revise their business models in an attempt to develop their service operations into strategically important, lucrative profit centres in their own right (Lele, 1997; Oliva and Kallenberg, 2003; Wise and Baumgartner, 1999). Similarly, in the field of operations management, Spring and Darlrymple (2000) trace the development of manufacturing strategy 'competitive criteria' and note how it has gradually evolved from a focus on cost, quality and

delivery reliability in the 1960s, towards flexibility and innovativeness in the 1980s, with service gaining status as a potential 'order winner' in the 1990s. The most extreme manifestation is traditional 'product' organisations attempting, or being urged to attempt, to provide integrated product and service offerings to customers known as 'solutions' or 'product-service systems' (Baines et.al, 2007; Neely, 2007). It is the investigation of the strategies enacted to realise this vision that form the subject of this article.

The paper explores the evolution of 'product-service' (P-S) strategies in the aerospace sector. Despite the widespread perception that aerospace organisations are advanced in terms of P-S integration (Baines et.al, 2007; Ward and Graves, 2007) little is known about the realities of P-S provision in the sector. Much of the existing literature is normative and prescriptive, focusing upon what organisations aspire to do, but offer little insights into how attempts to integrate products and services occur, or the challenges organisations encounter. Accordingly, the remainder of the article is structured as follows. The next section presents a review of the emerging 'product-service' literature, and explores what product-service means, why organisations may be interested in developing PS, and how they actually deliver such offerings. It then outlines recent developments in the aerospace sector in particular. The research methods are then outlined before a case study from the aerospace sector is presented. The paper concludes with an analysis of the findings and then draws some conclusions.

THE 'PRODUCT-SERVICE' PHENOMENON

What is product-service?

The growth in the importance of services in traditional manufacturing organisations is reflected in the literature by a trend towards 'integrated solutions', 'product-services' or 'product service systems' (Baines *et.al*, 2007; Cook *et.al*, 2006; Davies *et.al*, 2006; Mont, 2002; Neely, 2007) Various other terms have also been used to describe the increasing attention paid to developing service offerings, including 'servicisation' (Quinn *et.al*, 1990), 'servitization' (Vandermerwe and Rada, 1988; Van Looy *et.al*, 1998), 'going downstream' (Wise and Baumgartner, 1999), 'winning in

the aftermarket' (Cohen *et.al*, 2006), 'new manufacturing' (Marceau *et.al* 2002) and 'high value manufacturing'. Product manufacturers have been exhorted to integrate services into their core product offerings if they are to maintain their competitiveness (Bowen *et.al*, 1991; Davies *et.al*, 2006; Gadiesh and Gilbert, 1998; Quinn *et.al*, 1990, Wise and Baumgartner, 1999). This integration of goods and services means that the value proposition need not necessarily imply ownership of the associated product, but an arrangement that delivers 'value in use' (Baines et al, 2007; Grönross, 2007).

Why product-service?

The literature also suggests several advantages of developing service strategies. Benefits for the provider are said to include services are often more profitable than physical products (Cohen *et.al*, 2006), as well as balancing the effects of economic cycles and in providing a more stable cash flow to organisations (Anderson *et.al*, 1997; Quinn *et.al*, 1990). Companies such as IBM, GE and Siemens are often cited as exemplars of organisations which have attempted to capture attractive service revenues, and where services now account for a majority of total revenues (Mathieu, 2001; Gebauer *et.al*, 2008). It is also proposed that they offer several marketing benefits. For example, services may offer an important source of differentiation in a competitive and technologically commoditised market place (Heskett *et.al*, 1997), enhance the value of the good (Frambach *et.al*, 1997), and act as a potential generator of additional demand for products from both new and existing customers. Services may also offer the opportunity to lengthening customer relationships reflecting the long-established notion of relationship marketing in the marketing literature. Finally, such strategies may enable firms to meet changing client demands, fitting with organisational trends towards outsourcing (Brax, 2005), downsizing, the creation of more flexible firms, and focusing upon core competencies (Windahl *et.al*, 2004).

How do firms develop integrated 'product-services'?

The literature of the last two decades suggests that organisations pursuing P-S strategies pass through a number of stages. In 1988 Vandermerwe and Rada

proposed three steps to servitisation. Firstly, the organisation is either a product or service provider. It then combines products and services into offerings. The last step is where products and services are combined into much more complex and integrated product and service offerings. Similarly, Van looy *et al* (1998, 34) suggest that manufacturing organisations seeking to transition towards becoming 'solutions providers' tend to develop capabilities in delivering products and associated services in an integrated manner by passing through three main phases. Initially, the company must possess the capability to manufacture or supply goods. Next, it begins to offer additional services which compliment its product portfolio. Finally, the company practices 'servitization' by marketing different product/ service combinations. It is at this stage where opportunities for competitive advantage and added value are likely to emerge as the offering becomes more strategically aligned with customer need. Again, Oliva and Kallenberg (2003) also propose a continuum associated with shifting 'from products to services'. The phenomenon is summarised by Baines *et.al* (2007) who suggest that a P-S system can be thought of as a special case of servitization, where the emphasis switches from 'sale of product' to 'sale of use', in other words where the customer pays to *use* the asset rather than to *own* the asset.

Thus, a key criterion for becoming solutions focused is that the creation of value must be understood through the eyes of the customer (Brady *et al* 2005a). This reverses the traditional view of value creation, which tends to be product-forward in its orientation (Slywotsky and Morrison 1998). The new model is therefore primarily concerned with supporting client processes and business strategies, in turn allowing customers to focus upon their core business (Parasuraman, 1999). As such there are important implications for operations management (Baines *et.al*, 2007).

Despite the theoretical attractiveness of the concept, reviewing the P-S literature reveals several significant weaknesses in the extant body of work. Firstly, there is the issue of definitional ambiguity leading to the possibility that researchers are actually comparing very different organisational strategies under the 'P-S' umbrella. For example, the literature identifies various different types of arrangement ranging from enhanced service offerings through to fully integrated solutions. Moreover,

studies have been conducted across different sectors with very different product and market conditions, and in different countries where P-S manifestations may be quite different. Gebauer et.al, (2008) highlight the need for a more nuanced analysis which takes account of issues of environment-strategy fit. The literature also tends to imply an organisational transition from one steady-state to another (i.e. from products to services), and yet few studies reveal the realities of enacting such strategies through empirical investigation. Examples are typically characterised by vignettes limited to the views of a few select senior managers and focus upon what organisations are said to be doing, or what they are ostensibly trying to do, but little is said about how this actually plays out in practice. Accordingly, normative and prescriptive models of 'how' to achieve success dominate the extant literature but offer little insights into how attempts to integrate products and services occur and the challenges organisations encounter (Neely, 2007; Windahl and Lakemond, 2006). The consultancy literature in particular, offers rhetorical and undoubtedly alluring 'advice' on how to develop services. Yet even the academic literature reveals little about how companies enact and experience product-service strategies. As Windahl (2007, 76) acknowledges, there is now a need for empirical examples of integrated solutions to help determine the importance of contextual factors and differences across industries.

This article addresses two central research questions. Firstly, what does P-S actually mean to the organisational actors that attempt to enact it, and what is it expected to achieve? For example, do the expectations of academics and theorists accord with those of the organisational actors charged with its implementation. Secondly, what are the operational implications and experiences of P-S? The change and transition required of P-S is largely portrayed as unproblematic and uncontested within the existing literature, but it is unclear as to whether this reflects the realities of creating a PSS within the context of contemporary aerospace organisations. In order to examine these questions, a detailed case study from the international aerospace sector is presented. However, before presenting the study it is useful to trace briefly the development of P-S within this sector as a contextual backdrop to the insights presented below.

PRODUCT-SERVICE IN AEROSPACE

Aerospace is often held up as an exemplar of the trend towards P-S integration (Baines *et.al*, 2007; Kerr and Ivey, 2001; Neely, 2007; Oliva and Kallenberg, 2003; Ward and Graves, 2007). Arguably, the nature of the sector presents an ideal opportunity for joining-up product and service offerings. Lorrell *et.al* (2000) suggest that aerospace is generally characterised by low rates of production, small total outputs, and high per-unit costs. Original Equipment Manufacturers (OEMs) are expected to be highly responsive to the requirements of customers who have a degree of control over the final product, especially in the military sector.

Historically, many airlines had their own in-house Maintenance, Repair and Overhaul operations (MRO), while OEMs focused upon design and manufacture. Since deregulation in the 1970s, new independent suppliers emerged to meet the needs of new airline entrants, competing on a relatively low cost basis. Established airlines responded either by outsourcing some of their own MRO, or developing enhanced internal MRO capability to service other airlines. Often OEMs provided MRO during the initial warranty period with airline MRO providers taking over as main providers because of their large inventories and global service presence. Near the end of the useful life of a unit, independent MRO suppliers often offered the most economical option. However, aerospace OEMs entered the market in the early 1980s through acquisitions and joint ventures with various other operators (Lorrell *et.al*, 2000).

Traditional OEM service was carried out on a 'time and material' model, with high mark-ups for spare parts and often long lead times. In contrast, the 'P-S' business model is taken to mean an arrangement characterised not by the physical exchange and sale of an engine, but with engine manufacturer providing what is often referred to as 'power-by-the-hour'. In other words, the customer pays to *use* the asset, and in return the manufacturer provides the *availability* of the asset. The emergence of "power by the hour" as a service has enforced providers to rethink their technology offering (IfM, 2003); the manufacturer must provide ongoing real-time monitoring and through-life service of the engine in order to deliver the availability of power. This in turn, requires a closer relationship between manufacturer and customer.

Lorrell *et.al* (2000) suggests three main drivers for the shift towards integrated products and services in the aerospace sector. The first concerns changing customer demands, with customers increasingly interested in purchasing 'capability' rather than a tangible gas turbine product. Evolving business models in commercial airlines are moving towards 'virtual airlines' which focus upon their core business of moving people or freight from point to point. Secondly, from the perspective of aerospace OEMs, there is the opportunity to increase and develop new revenue streams. Notably, given the long-life of the products this enables such firms to exploit their installed asset base. Thirdly, in a competitive marketplace, P-S may be viewed as a way for OEMs to protect their intellectual property rights, to differentiate their value offering, and exploit the strong brand associated with their product reputation. These market characteristics and drivers provide the contextual backdrop against which the case study company studied within this paper attempted to enact its product-service strategy.

METHODS AND RESEARCH CONTEXT

Given the research aim to understand more about how and why P-S plays out in a particular organisation and sectoral context, the nature of organisational processes, as well as the need to understand the meanings actors associate with the notion, a qualitative approach was deemed appropriate. Such an approach enables researchers to examine and interpret phenomena in their natural settings, and to understand the meanings people bring to such phenomena (Denzin and Lincoln, 2003, 3). Specifically, a case study research is also useful when the aim of research is to answer 'how' and 'why' questions (Yin, 2003). This resonates with the central aim of this research: to understand how and why P-S plays out in practice, as perceived by different organisational actors. Clearly, the soft intangible variables in question would be very difficult to capture with reductionist methods. Case study research is also a useful design when the aim is to understand more about process (Bryman, 2008; Burns, 2000; Hartley, 1994; Merriam, 1998). Thus, the research was designed to capture rich insights into the P-S strategy and its implications from the perspective of the key actors with responsibility its operationalisation. Clearly, the central research questions of this study would not be easily discernible from a

survey. For example, given the conceptual confusion surrounding the notion of product-service, it would be difficult to check that respondents are interpreting questions in standard ways. Use of quantitative indicators to 'measure' product-service is therefore inherently problematic, and using raw outcomes as indicators may reveal little about how product-service is understood and enacted. A case study approach thus provides the opportunity for the 'story' to be clarified (Stake, 1995).

The selection of cases is central to theory building from case study research (Eisenhardt, 1989). In selecting a suitable case a degree of 'purposeful sampling' was employed, in that the organisation under study (referred to by the pseudonym JetCo) is widely seen as an exemplar of a firm with a successful 'product-service' strategy and as such maybe be deemed an 'extreme' or 'deviant' case (Patton, 2002). As was discussed above, very few studies provide any empirical evidence in relation to the operational realities of P-S. Moreover, there have been few attempts to develop a better conceptual understanding of the operational implications of such strategies, with much of the work conducted to date resulting in managerial prescriptions for enacting the strategy. Thus, as with much case study research, the aim was not to generate findings which are generalisable to other organisations, but rather to generate findings which contribute to broader theory, i.e. 'analytical' or 'theoretical' generalisation (Eisenhardt, 1989; Yin, 2003). A total of 18 interviews were conducted with key actors involved in devising and operationalising P-S strategy. These informants were carefully selected to represent a stratified cross-section of key managers with responsibility for the implementation of the strategy.

The interviews were conducted in 2007, and typically lasted around sixty minutes, although several lasted up to two hours. These allowed rich and detailed accounts of individual experiences and perceptions to be obtained. Interviews were semi-structured around themes including the espoused business strategy of JetCo, actor understanding of the notion of 'product-service', the implications of enacting such strategies, and the associated challenges. A key advantage of the interview was the flexibility it affords, and the ability to uncover how respondents perceive and interpret situations and events (Bryman, 2008). This fits with the aim of the research, which was to obtain rich contextual data and to allow new patterns and themes to

emerge. The informants provided a cross-section of perspectives from operations managers at different levels including the Director of Information Strategy, the Operations Centre Manager, the Head of Programme and Systems Engineering, and Business Development Managers. Other interviewees had roles directly concerned with the explicit development of aftermarket services across different parts of the business. Job titles included the Vice President, Director, and Business Managers for Aftermarket Services in both the Civil and Defence divisions. Again, interviewees do not represent a random sample of employees but rather a sample of individuals whose role involved a significant contribution to devising and enacting organisation's product-service strategy. As well as representing the key people leading the service integration strategy within the organisation, this purposive sample also provided a perspective of key constituencies from across the organisation responsible for 'bringing policies to life' (Purcell et.al, 2003). Thus, it builds upon existing research focusing upon the views of top management alone (Gebauer et.al, 2005; Oliva and Kallenberg, 2003).

Interview themes included past and current business strategy, development and implementation of the aftermarket service portfolio, and the challenges and prospects for aftermarket services in the future. All interviews were recorded, transcribed verbatim and subsequently coded, using both categories which reflected the research questions which informed the interview template (Lofland and Lofland, 1995), as well as new categories which emerged from the data (Saunders et.al, 2002). Examples of these categories include JetCo business strategy, divisional business strategy, manifestations of P-S, and challenges to P-S delivery. As such, the analytical framework was both deductively and inductively derived; the major headings and areas of exploration were derived from a fairly structured template, but the specific issues faced in operationalising P-S strategy were largely emergent. Moreover, 'analysis' did not form a discrete phase of the research, but rather the analysis and data collection process occurred concurrently (Eisenhardt, 1989).

Informants also provided various documents relating to the P-S strategy and these provided a valuable source of methodological triangulation (Denzin, 1970), as well as the opportunity to gain additional contextual understanding. The multidisciplinary

research team also afforded the opportunity for investigator triangulation (Denzin, 1978). The research also benefits from a longitudinal aspect in that engagement with the organisation has been ongoing for a two-year period as part of the wider programme of research of which this study is a part. Findings were also presented to senior managers through a written report and interactive feedback session. These afforded the opportunity for the research team to check interpretation, to clarify any uncertainties, and to gain useful feedback on the findings. Thus, such feedback sessions also formed an integral component of the data analysis process.

RESULTS: DELIVERING PRODUCT-SERVICE AT JETCO

JetCo is a significant provider of power systems and service with a global presence. The two divisions which formed the focus for this research served the Civil Aerospace sector (from international airlines to small executive jets) and the Defence sector, which supplies power for military fleets. *JetCo*'s reputation is founded on a global reputation for manufacturing excellence and high quality products, which is a determining factor in the success of the organisation, although growing after-market services has been a stated aim of the organisation across its business units since the 1990s.

Why product-service?

P-S was believed to provide benefits for both the OEM and its customers. For the OEM, the *JetCo* service strategy was said to concern capturing the opportunities associated with a large, technically complex installed base which requires considerable ongoing maintenance activity. Although *JetCo* has always sold spares, the 'new' service model was described as proactively engaging with customers to provide them with a comprehensive suite of aftermarket support, as opposed to a more reactive, ad hoc service model. The development of service operations has been described as a gradual evolution culminating with the recent introduction of service packages for customers across industries and sectors, and entering managed contracts where *JetCo* assumes some of the risk. When purchasing an engine, customers have a choice of different service packages offering a range of

aftermarket and support services, on an agreed 'cost per flying hour' basis. The new high-value offering was said to offer "comprehensive engine availability" rather than a product plus ad hoc provision of spares, technical support, and repair and overhaul services. These offerings can be either standardised packages or customised depending upon the specific needs of the client. For JetCo an important benefit of offering systematic through-life product support includes smoother and more robust revenue streams, in contrast to the traditional 'time and material' model. Though product differentiation through innovations in engine technology has always been essential, service was viewed as an additional source of differentiation in an intensively competitive global marketplace. It also enabled JetCo to expand its service portfolio to include On-Wing, Component and Power Plant services. The model requires a closer relationship with the customer and as such creates higher "switching costs". However, it was stressed that the business retains a strong commitment to new product development, as this was viewed as laying the foundations for future product sales and aftermarket service support. Due to the fact they were no longer selling a product commodity but something with added value, there were new revenue opportunities for managing some of the risk associated with maintaining these high-value assets.

In turn, customers were said to benefit from the specific product knowledge available from the OEM which designed and manufactured the product, and access to an extensive repair chain, all at a competitive price. Through-life product support packages were also said to take some of the uncertainty away from airlines, allowing them to budget on a more transparent 'cost-per-hour' basis. It was also suggested that it allowed airlines to focus upon their core business. As one manager explained, *"An airline's normal concern is to put passengers/cargo on an aircraft and move them from point A to point B with the least disruption. So the aim is for us, as the provider of power, is not to interfere with that operation"*. In the current climate, this business model was said to be particularly attractive to commercial clients looking to rationalise their supply chains. It was also seen to complement the strategies of both traditional flag carrying airlines moving towards a more efficient cost model, as well as overtly 'low cost' carriers looking to outsource aspects of their operation. Similarly, in the defence sector, there was also increasing emphasis from military

clients on reducing their maintenance workforce in order to cut costs and retain focus on operational capability.

Ultimately, both JetCo and the customer were said to benefit from a greater alignment of their respective business interests. Whereas under a 'time and material' arrangement, product failure could be profitable for the OEM, the fixed cost P-S model means that both the OEM and customer have a shared interest in product reliability and continuous improvement through life. As one senior manager explained, *"We've got this alignment now that says a very reliable engine is good for the customer and it's very good for us too. I guess that's the magic trick that's transformed our view of the business and made us understand our customers' requirements much more clearly"*.

How is product-service enacted?

P-S offerings have evolved differently across the organisational divisions, reflecting the different conditions of their respective markets. Indeed, the complexity of the organisation meant P-S delivery was viewed as increasingly requiring the intra-organisational co-ordination of the various different functions, structures, countries, regions and customers. As one senior manager explained: *"We employ thousands of people in many different countries, the company is complex...[there are various] organisations, structures, functions, nationalities, regions, business sectors, and customers, and these aggregations don't exist in isolation."*

In the Civil Aerospace sector it was proposed that providers had to be responsive to new market opportunities linked to the launch of new airframes. Managed effectively, such a strategy had long-term benefits in smoothing out cyclical revenues associated with peaks and troughs in airliner sales. Aftermarket services were also seen to present opportunities which were seen as crucial to protect their core product business in a competitive marketplace. However, service development has meant increasing involvement in the provision of services JetCo has never provided before, such as inventory management and engine logistics, in contrast to the

traditional spares planning and sales organisation. This necessitated the development of new capabilities within the organisation.

By contrast, the Defence business was described as more “stable” and as providing a reliable business stream. This is due to a history of steady business from national government clients, whose procurement strategies were said to have been more focused upon obtaining “cutting-edge” products perceived to be the most reliable and innovative, rather than on the basis of lowest cost or comprehensiveness of service offerings. In Defence, product development opportunities in terms of technological innovation were viewed as increasingly limited, requiring the business to proactively seek new market opportunities.

Traditionally, military customers were said to have been happy to maintain internal capability and use the OEM as a supplier. However, increased cost pressures from military customers had led to the bulk of domestic sales now procured with a through-life service arrangement. Developing international aftermarket service operations were thus seen as a key strategic priority for Defence, although it was recognised that there are political and national security implications with the provision of aftermarket services abroad. The need for bespoke offerings was said to mean less opportunities to ‘scale up’ offerings to multiple defence customers.

Operational implications of product-service

Despite evidence of a clear service strategy, it was widely recognised that further progress needs to be made to further integrate their P-S offerings. To this end, several implications of P-S delivery emerged from the data. These are explored below.

Customer-orientation

The first issue, which was raised by almost all respondents, concerned the development of an appropriate customer orientation in order to deliver world-class service. It was suggested that customers have gradually switched from being focused on initial unit product cost and product reliability, to focus on service

delivery, timeliness, and quality. For the customer the acid test of their service experience was said to be to reduce operational disruption. This required working much more closely with customers in order to shape the way in which service quality was defined and delivered, which had implications for the way in which services were internally constituted and managed. As one senior manager explained, “*We’ve all grown up in the SMART objectives world...a black and white world... into a services world ...where when we deliver something and the customer is delighted, they actually up the bar next time*”. There was a belief that the organisation had to shift from short-term performance measures such as cash flow and profit, in favour of long-term metrics which include customer satisfaction and ‘renewal desire willingness’. It was also suggested that service delivery is much more subjective and ambiguous than the process and procedure driven product environment. Moreover, the service environment was also said to be inherently more volatile as, “*one day your customer is happy and the next day he’s not*”. There was also the feeling that with a technical issue there are normally clear procedures in place, whereas with a service delivery issue, it can be much more difficult to address. Such ambiguity could prove difficult for those rooted in a technical orientation to respond to.

Not only were customers’ service expectations said to be constantly shifting and often rising, there was also the challenge of customers expecting immediate answers. For JetCo, this related to a perceived need to be more responsive as P-S required more interactive operations with customers in real time, and the ability to mobilise support ‘on demand’. Service development has required, for example, the deployment of more JetCo resources offsite at customers operations rather than the company base. Though service units have always existed in some form, the key difference was said to be much wider scope of service, and the more proactive approach and relationship P-S demands. One interviewee described the role as “*being the eyes and ears of the customer*”. Continually improving service quality was seen as a key enabler of winning in the aftermarket throughout the business.

Knowledge and information management

A second issue concerned effective knowledge and information management to enable P-S delivery. This was viewed by many respondents as an important enabler

of competitive P-S offerings. Various IT tools have had to be developed and implemented in order to facilitate new service activities such as the management of fleet, or the history of the major components and maintenance of an engine. Customers can also access some of this information for example to obtain real time progress reports on the status of their equipment. Attempts to bring data together had posed challenges with regards to the alignment of IT systems and servers to support the effective storage and retrieval of information as it was required. However, exploiting the learning that accrued through the use of the product was also seen as important, despite the difficulties in identifying actionable knowledge and learning opportunities. Given the OEM heritage of the business, learning experiences afforded by service provision were not always fully exploited. Traditional structures were viewed as excellent for promoting deep specialised knowledge, but not always facilitating the breadth required to transfer more generic lessons. As one manager explained, *“There’s recognition that there are a lot of people doing a lot of good things that we need to get joined together”*. This was particularly the case with respect to integrating service knowledge into new product design. The company was actively attempting to improve its knowledge management and learning strategies, in order to further exploit its intellectual capital..

Overall, improved information and knowledge management strategies were thought to be essential, especially as organisational growth has made it increasingly more difficult to rely on personal relationships and networks. At an operational level it was believed that better information management would result in better decision making, and in turn better service for customers. Most informants comments that this was inextricably linked to broader issues of innovation. Though technical innovation was well embedded, there was a newly defined requirement for innovation across and between technical, service and commercial domains.

Organisation and employee engagement

A third set of issues concerned organisation for more responsive service delivery, and the resultant need to engage employees in supporting the new business model. Again, almost all respondents stressed the importance of people management issues as a key enabler of P-S delivery. In terms of work organisation, a good

example is the creation of a twenty four hour operation centre. The idea was to provide a customers' with a single point of contact with the organisation, where customer needs could be initially screened and often rapidly resolved by a central operations team. This was said to free up time for other staff to focus upon the completion of longer-term issues without the distraction of operational enquiries. The operations rooms were staffed by employees in a variety of customer service and specialist engineering roles. Many of these had been seconded to work with the airlines to get a richer view of the airline environment. In this way, JetCo had begun to propagate a "service ethos" across the organisation.

The need for different behaviours, especially in relation to customer responsiveness, had resultant implications in terms of work organisation, training, recruitment and skill development. Thus, it was recognised that P-S delivery also had various implications in relation to human resource management strategies. For example, in order to attract high calibre employees into service operations, it was recognised that 'Service' (as a functional area) needed a strong development pathway for employees, as is the case for production-oriented functions. There was also a need for more innovative recruitment strategies in order to attract the right people to cope with growth in the operations room, customer business, engineering, service engineering and repair engineering. The business also recognised the need to develop new business analysis skills in order to shift the focus from how products are performing to how the business is performing. Aligning other HR systems such as reward and succession planning was seen as a priority for inducing the necessary cultural shift.

Challenges of delivering product-service

Several challenges emerged in relation to developing P-S delivery, many of which stemmed from the organisational complexity inherent in delivering integrated products and services across different sectors. In particular the disconnection of products and services and embedding servitization in what has historically been a

'product-centric' culture render the transition problematic from an operations management perspective. In particular there was perceived need for a stronger 'internal customer' mentality, with employees understanding where they fit into the delivery effort as a whole. It was believed encouraging people to think outside of functional role and through the timeline of the product would result in better service and ultimately, a higher value proposition for the external customer.

Though JetCo has always had a service organisation, delivering P-S required an increased level of co-operation and interaction between the service and product sides of the business. Difficulties galvanising the organisation around the service proposition had been compounded by the need to provide bespoke offerings to different customers across various market sectors. Thus, the requirement was to embed customer centricity throughout the business. As one senior manager explained, *"the small apex of the pyramid that works with the external customer have always had service behaviours, that's their job. The remainder of the iceberg under the water that doesn't see the external customer, that's what we're focussing on"*. This view was echoed by a Service Manager who explained how, *"we need to make sure other areas deliver the service we need"*. There was recognition that a good service department can only do so much without the commitment of the rest of the organisation. However, the two sides of the business were said to be very different, reflecting the different roles they played in ensuring customer needs were met, A challenge was capturing the potential synergies between the two in order to deliver a seamless experience for customers

This clearly relates to what was described as an embedded engineering culture of 'product-centricity'. This was most clearly manifested in terms of a lack of understanding of customer needs, and the customers point of view, as one senior manager explained: *" we design these complex high value propulsion systems with turbine blades that see temperatures exceeding the melting point of the metal from which their made.... from a technological viewpoint they are splendid and wonderful"* but such product innovations are not always fully appreciated by some customers who may view a jet engine in more crude commercial terms as *"as a tube they stick on to their aircraft to make it get to where they want it in a predictable and reliable*

way". In other words P-S requires a high degree of mutual empathy between the OEM and the customer in terms of what they expect from each other, as well as an understanding how each organisation and industry works. Somewhat paradoxically, this lack of what was termed "genuine customer focus" – knowing what the customer *really* needs – was almost hindered by organisational processes set up around product excellence, compliance, and delivering to specification. Clearly in an industry like aerospace product excellence and compliance are still essential, but the challenge for OEMs is to meet the increasing expectations of customers who appear to be 'raising the bar'. Customers' expectations of a seamless product-service requires the organisation to be increasingly "*efficient, responsive and nimble*" in order to deliver both quality products *and* service excellence. With P-S strategies, knowing what the customer needs is complex, as the remit becomes much broader and related to the delivery of specified outcomes.

DISCUSSION

The case study presented within this paper has revealed that the aims and rationale for P-S delivery broadly reflect those suggested in the literature. Drivers such as smoother revenue streams, global competition and technological commoditisation resonate with the existing literature espousing the benefits of more integrated delivery models for both the customer and supplier (see Anderson *et.al*, 1997; Brax, 2005; Davies *et.al*, 2006; Gebauer *et.al*, 2005; Heskett *et.al*, 1997; Sawhney, 2004). However, theory and practice are more divergent when it comes to the complexity of enacting product-service strategies. Specifically, the existing literature either reveals remarkably little about *how* organisations attempt to deliver P-S in reality, or at most present P-S as a simple transition between two steady states (Oliva and Kallenberg, 2003; Van Looy *et.al*, 1998; Vandermerwe and Rada, 1988). Such studies imply a planned and linear approach to organisational change (Lewin, 1958), and offer a variety of recommendations attempting to make the purported 'transition'. These assumptions appear deeply flawed in the context of this study, which suggests that the implementation of service strategies are inextricably linked to issue of the wider organisational change agenda. As such, the reality is much more open-ended, and linked to issues of power, politics, constantly shifting organisational priorities,

changing customer demands, and a turbulent business environment (Dawson, 1994; Dunphy and Stace, 1993; Peters, 1989). Moreover, the P-S strategies investigated here naturally had to be tailored to meet the specific demands encountered by two divisions of a single organisation. Though the offerings share common core ideas in terms of offering 'availability' and a shift in the balance of risk, they have had to reflect the different histories, structures and needs of the markets they support. While changing customer demands had created a greater 'customer pull' for P-S in the Civil Aerospace business, in Defence there was more of an emphasis on 'supplier push' of integrated solutions. Another factor was that aftermarket development became attractive in Aerospace earlier partly to counter the highly cyclical nature of the product sales business, while these waves of demand are less significant in the Defence division. The nature of clients in the Defence sector, and more intimate supplier/customer relationships required, also meant that developing an international client base of P-S was significantly more complicated.

The realities of product service within this case study also highlight the importance of organisational context in the enactment and operationalisation of P-S strategy. Though much of the existing literature presents exemplars of P-S delivery from a wide range of sectors including aerospace, manufacturing and telecommunications (Baines *et.al*, 2007; Davies *et.al*, 2006; Neely, 2007; Oliva and Kallenberg, 2003; Ward and Graves, 2007), there are dangers of making cross-sectoral generalisations regarding such strategies which may be highly context-specific. Thus, there is a need for a more nuanced understand which considers issues of environment-strategy fit (Gebauer *et.al*, 2008; Neu and Brown, 2005). The case has also highlighted the apparent lack of attention within the literature to the implications of product-service strategies. This research revealed several implications of developing a P-S strategy. For example, there was the issue of developing a customer orientation. The need to develop a more proactive customer orientation reflects the challenge of actually seeing value through the eyes of the customer (Brady *et.al*, 2005; Slwotsky and Morrison, 1998), in order to become genuinely 'client supporting' as opposed to 'product supporting' (Mathieu, 2001). The need for such a shift was evident, with the service operation described as acting as "the eyes and ears" of the customer, supported through the secondment of customer-facing

JetCo staff into customer businesses in order to understand 'value' through the customers eyes. On the other hand, it was believed that this also meant the risk that service employees "go native", viewing the business "too much from the customers perspective".

Several challenges have emerged in developing P-S strategies within complex environment of the aerospace sector. Integrating product and service parts of the business, and embedded engineering cultures perpetuating what was often referred to as a culture of 'product-centricity', are key in this respect. Moreover, the problem was not one of developing service within JetCo per se. Rather, the challenge was that of actually integrating service and production operations, as without this intra-organisational integration, the customer may perceive a fractured or incomplete service, thereby undermining the value proposition of seamless service upon which it is predicated. It was suggested by the actors involved that these issues have important implications for both knowledge and information management, and human resource management strategies. However, as many of these challenges concern the actual processes in the implementation of the strategic vision, and meeting constantly rising customer expectations, they clearly also have implications across the operations management remit.

The development of a customer orientation requires a view of organisational processes which have a direct impact on the external customer such as delivery, customer services and quality control. Developments in relation to work scheduling, resource and capacity planning were crucial to ensure activities and projects are managed and completed in a timely way. There were implications for job and work design, of which the creation of 24/7 service operations centres presented the best example at the time the research was conducted. There were also challenges in relation to operational locations, with services increasingly demanding global responsiveness and a need to have operations geographically close to customers. Though JetCo has always had a global presence, manufacturing capacity is generally concentrated in a few strategic locations worldwide. Joint ventures with regional MRO organisations is an example of one response to this challenge.

CONCLUSION

This paper set out to address two research questions. The first concerned what P-S actually means to organisational actors, and what is expected to achieve in the specific context of the international aerospace sector. The differences between products and services have become increasingly blurred, with organisations in many sectors seeking to benefit from the revenue potential of the integration of product and service operations through life. However, despite the theoretical attractiveness of the concept, this research has revealed that benefiting from this business paradigm is significantly more complex and sector determined than much of the extant literature portrays. Specifically, there is a lack of a detailed understanding of how P-S strategies are operationalised in practice.

In order to try to address some of the deficiencies in the literature, this study examined the challenges inherent in enacting P-S within a leading organisation within the aerospace sector. The case study organisation, Jetco, had developed a comprehensive strategy to benefit from the after-market opportunities afforded by their extensive installed asset base. However, the study revealed that it is perhaps not appropriate to view the product-service phenomenon as a “transition *from* products *to* services” as is presented in much of the recent P-S literature. This overly simplistic notion belies the reality of how JetCo actually sought to operationalise such a strategy. Rather, their focus was on delivering products and services as a complex, high-value and largely customer-specific proposition which is likely to evolve through life. Thus, embedding ‘service’ within and across a prevailing product-oriented business is key. The principal challenge was, therefore, about how to galvanise the entire organisation around a new value proposition: the provision of power. The implications of this strategy in such a staunchly traditional organisation with a worldwide reputation for quality products cannot be underestimated, given the new ‘dual game’ required the simultaneous and integrated delivery of world-class products and services.

Moreover, whereas the literature suggests that organisations pass through a number of neat evolutionary stages in their quest for product-service delivery, this research reveals that the reality of product-service strategies is far more complex. Within a large global organisation such as JetCo, where the 'new' service model has been evolving organically since the 1990s, each division has responded pragmatically and opportunistically in response to particular contextual factors. Like many large global organisations, JetCo is more accurately viewed as a pluralist coalition serving different several product markets, mostly but not exclusively within the distinctive context of the aerospace sector. We suggest this renders universalistic notions of 'best practice for product-service' found in the current literature – which fail to take account specific issues such as industry context and sectoral dynamics - deeply flawed. Indeed, even within the context of a single organisation like JetCo, there was deep scepticism regarding the feasibility or desirability of a 'one-size-fits-all' model.

The second research question examined the operational implications and experiences of P-S in response to the existing literature, which portrays such strategies as seemingly unproblematic and uncontested. Several challenges emerged in the context of the aerospace sector including the context of increasing organisational complexity, lubricating relationships between the products and service businesses, and revising traditional management practices to support a seamlessly aligned product-service business. In particular, combining the traditional focus on product cost, reliability and excellence with a focus on outstanding service delivery, timeliness, and service excellence is far from straightforward. Though there was recognition of the need to develop more intimate long-term relationships with the customer, this was difficult to achieve in practice due to financial performance measures, and the diverse and dynamic nature of customer expectations. Moreover, simply 'meeting' customer expectations was no longer enough to sustain these long term relationships; this contrasts with the product-oriented 'compliance to specification' model. A second issue concerned effective information and knowledge management in order to capture and exploit the data available in order to improve business decision making and ensure customer needs are effectively and consistently met. Exploiting learning opportunities throughout the organisation

represented a real challenge in this regard. Thirdly there were organisational issues concerning the need for appropriate human resource management strategies to facilitate the development of an appropriate organisational environment for P-S delivery. There were implications across HR including work organisation, employee involvement, training and development, and recruitment and retention. Again, whilst the existing literature alludes to the HR and KM aspects of P-S, such references remain superficial, rhetorical and vague, and say little about how the P-S vision can be achieved. In order to advance the debate, there is a real need for more empirically-informed and critical debates around the meaning, operationalisation and implementation of current P-S strategies across industry sectors.

ACKNOWLEDGEMENTS

The contributions of our project team and our industrial collaborators are gratefully acknowledged. The project is funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Economic and Social Research Council (ESRC) under Grant Numbers EP/C534220/1 and RES-331-27-0006. We would also like to thank the two anonymous referees for their helpful and insightful comments.

References

Anderson, E. Fornell, C. and Rust, R. (1997) Customer satisfaction, productivity and profitability: differences between goods and services, *Marketing Science*, 16(2) pp129-45.

Baines, T. Lightfoot, H. Evans, S. Neely, A. Greenough, R. Peppard, J. Roy, R. Shehab, E. Braganza, A. Tiwari, A. Alcock, J. Angus, J. Basti, M. Cousens, A. Irving, P. Johnson, M. Kingston, J. Lockett, H. Martinez, V. Michele, P. Tranfield, D. Walton, J. and Wilson, H. (2007) State of the art in product-service systems, *Journal of Engineering Manufacture Part B*, pp1543-1551.

Bryman, A. (2008) *Social Research Methods*, Oxford University Press, Oxford.

Bowen, D. Siehl, C. and Schneider, B. (1989) A framework for analysing customer service orientations in manufacturing, *Academy of Management Review*, 14, p.75.

Brady, T. Davies, A. and Gann, G. (2005) Creating value by delivering integrated solutions, *International Journal of Project Management*, 23(5), pp.360-365.

- Brax, S. (2005) 'A manufacturer becoming service provider—challenges and a paradox', *Managing Service Quality*, 15 (2), 142-155.
- Cohen, M. Argrawal, N and Arawal, V (2006) Winning in the aftermarket, *Harvard Business Review*, May, 129-138.
- Cook, M. Bhamra, T. And Lemon, M. (2006) The transfer and application of product-service systems: from academia to UK manufacturing firms, *Journal of Cleaner Production*, 14, pp.1455-1465.
- Davies, A. Brady T. and Hobday, M. (2006) Charting a path towards integrated solutions, *MIT Sloan Management Review*, Spring 38-49.
- Dawson, P. (1994) *Organisational change: a processual approach*, Paul Chapman, London.
- Denzin, N.K. (1970) *the research act in sociology*, London, Butterworths.
- Denzin, N.K. (1978) *The research act: a theoretical introduction to sociological methods*, New York, McGraw-Hill.
- Dunphy, D. and Stace, D. (1993) The strategic management of corporate change, *Human Relations*, 46(8), 905-18.
- Eisenhardt, K.M. (1989) Building theories from case study research, *Academy of Management Review*, 14(4), 532-550.
- Frambach, R.T., Wels-Lips, I. and Gu'ndlach, A. (1997), "Proactive product service strategies:an application in the European health market", *Industrial Marketing Management*, Vol. 26No. 4, pp. 341-52.
- Gebauer, H., Beckenbauer, B. and Fleisch, E. (2004), "How to innovate customer support services in manufacturing firms?", in Edvardsson, B., Gustafsson, A., Brown, S.B. and Johnston, R. (Eds), *Service Excellence in Management: Interdisciplinary Contributions*, Proceedings of the QUIS 9 Conference, Karlstad, June 15-18, pp. 397-406.
- Gebauer, J. Fleisch, E. and Freidli, T. (2005) Overcoming the service paradox in manufacturing companies, *European Management Journal*, 23(1) pp.14-26.
- Grönroos, C (2007) In search of a new logic for marketing: the multifaceted service logic, Paper to 21st Service Workshop, University of Westminster, November.
- Heskett, J. Sasser, W. and Schlesinger, L. (1997) *The Service Profit Chain*, Free Press, New York.
- IfM. (2003). *Living without production, if we can*. Cambridge Manufacturing Review, Summer 2003, Institute for Manufacturing, University of Cambridge.
- IFM (2006) *Defining High Value Manufacturing*, IFM, DTI & CBI.

- Johnston, R. (1994) Operations management: from factory to service management, *International Journal of Service Industry Management*, 5(1), pp.49-63.
- Johnston, R. (1998) Service operations management: return to roots, *International Journal of Operations and Production Management*, 19(2), pp.102-124.
- Johnston, R. and Clark, G. (2001) *Service operations management*, Pearson Education.
- Kerr, C. and Ivey, P. (2001) A strategic review of the large civil aero-engine market and the paradigm shift to a service oriented environment, *The Aeronautical Journal*, May, pp.287-293.
- Lele, M (1997) After-sales service: necessary evil or strategic opportunity, *Managing Service Quality*, 7(3), pp. 141-145.
- Lester, R (1998) *The productive edge – How US industries are pointing the way to a new era of economic growth*, New York: Norton.
- Lofland, J. and Lofland, L. (1995) *Analysing social settings: A guide to qualitative observation and analysis*, Belmont, Wadsworth.
- Lojo, M. (1997) *Contracting for high technology industrial services*, Sloan School of Management.
- Lorell, M. Lowell, J. Kennedy, M. and Levoux, H. (2000) *Cheaper, faster, better? Commercial Approaches to Weapons Acquisition*, RAND.
- Lovelock, C. and Gummesson, E. (2004) Whither services marketing? In search of a new paradigm and fresh perspective, *Journal of Service Research*, 7(1), pp.20-41.
- Marceau, J. Cook, N. Dalton, B. and Wixted, B. (2002) *Selling solutions: emerging patterns of product-service linkage in the Australian economy*, Australian Expert Group in Industry Studies (AEGIS), University of Western Sydney.
- Mathieu, V. (2001) Product services: from a service supporting the product to a service supporting the client, *Journal of Business and Industrial Marketing*, 16(1) pp. 39-58.
- Merriam, S.B. (1998) *Qualitative Research and Case Study Applications in Education*, Calif, Jossey Bass Publishers.
- Mont, O. (2002) Clarifying the concept of product-service systems, *Journal of Cleaner Production*, 10(3), pp. 237-245.
- Neely, A. (2007) *The servitization of global manufacturing: an analysis of global trends*, 14th European Operations Management Conference, Ankara, Turkey.

- Oliva, R. and Kallenberg, R. (2003) Managing the transition from products to services, *International Journal of Service Industry Management*, 14(2), pp.160-172.
- Parasuraman, A. (1999) Customer service in business to business markets: an agenda for research, *Journal of Business and Industrial Marketing*, 13(4), pp.309-321.
- Patton, M.Q. (2002) *Qualitative evaluation and research methods*, Sage, California.
- Peters, TJ (1989) *Thriving on chaos*, Pan London.
- Purcell, J. Kinnie, N. Hutchinson, S. Rayton, P. and Swart, J. (2003) *Understanding the people and performance link: unlocking the black box*, CIPD, London.
- Quinn, J. B., Doorley, T. L. and Paquette, P. C. (1990) 'Beyond products: services-based strategy', *Harvard Business Review*, 68 (2), 58-60, 64-6, 68.
- Sawhney, M. (2004) Creating growth with services, *Sloan Management Review*, Winter, pp.34-43.
- Sasser, W. Olsen, R. Wychoff, D. (1978) *Management of Service Operations*, Allyn and Bacon, Boston.
- Saunders, M. Lewis, P. and Thornhill, A. (2002) *Research methods for business students*, 3rd Edition, Prentice Hall, London.
- Spring, M. Dalrymple, J (2000) Product customisation and manufacturing strategy, *International Journal of Operations and Production Management*, 20(4), pp.441-467.
- Stake, R. (1995) The Art of Case Study Research, in N.K. Denzin and Y.S Lincoln (Eds) *Handbook of Qualitative Research*, London: Sage, pp.435-454.
- Sullivan, R.S. (1982) The service sector: challenges and imperatives for research in operations management, *Journal of Operations Management*, 2(4), pp.211-214.
- Van Looy, B Gemmel, P, Desmet, S, van Deerdonck, R, Seernels, S 1988 Dealing with productivity and service quality indicators in a service environment: some field experiences, *International Journal of Service Industry Management*, 9(4).
- Vandermerwe, S. and Rada (1988) Servitization of business: adding value by adding service, *European Management Journal*, 6, pp.315-324.
- Vargo, S. and Lusch, R. (2004) Evolving to a new dominant logic for marketing, *Journal of Marketing*, 68(1), pp.493-495.

Ward, Y. and Graves, A. (2005) Through life management: the provision of integrated customer solutions by aerospace manufacturers, University of Bath School of Management Working Paper Series, 14

Ward, Y. and Graves, A. (2007) Through life management: the provision of total customer solutions in the aerospace industry, *International Journal of Services Technology Management*, 8(6), pp455-477.

Windahl, C Andersson, P Berggren, C and Nehler, C. (2004) Manufacturing firms and integrated solutions: characteristics and implications, *European Journal of Innovation Management*, 7(3), pp.218-228.

Windahl, C., Lakemond, N. (2006), "Developing integrated solutions: the importance of relationships within the network", Volume 35, Issue 7, p 806-818.

Windahl, C. (2007) Integrated solutions in the capital good sector, Doctoral Thesis, Linköping University, Sweden.

Wise, R. and Baumgartner, P. (1999) 'Go Downstream: The New Profit Imperative in Manufacturing', *Harvard Business Review*, Sept/Oct, 133-141.