The servitization of manufacturing; a review of literature and reflection on future challenges

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Abstract

Servitization can be considered as a shift from selling products to selling an integrated combination of products and services that deliver value in use. The concept embraces service-led competitive strategy, providing increased revenue stream and profit margins, and an opportunity to differentiate from products originating from lower cost economies. This paper aims to report the state-of-the-art of servitization by presenting a clinical review of literature currently available on the topic. The literature review process is described and the extent of literature on this topic summarised. On this basis, the paper defines the servitization concept, reports on its origin, features and drivers, gives examples of its adoption along with future research challenges.

Key words: Servitization, service, integrated solutions, product-service system

1. INTRODUCTION

Servitization, the term coined by Vandermerewe & Rada (1988), is now widely recognised as the process of creating value by adding services to products. Since the late 1980s its adoption as a competitive manufacturing strategy has been studied by a range of authors (e.g. Wise & Baumgartner, 1999; Oliva & Kallenberg, 2003; Slack, 2005) who have specifically sought to understand the development and implications of this concept. This literature indicates a growing interest in this topic by academia, business and government (Hewitt, 2002), much of which is based on a belief that a move towards servitization is a means to create additional value adding capabilities for traditional manufacturers. These integrated product-service offerings are distinctive, long-lived, and easier to defend from competition based in lower cost economies.

Since the term servitization was first captured in the work of Vandermerwe & Rada (1988) there has been a steady flow of research papers. For example, our study shows that currently there are approximately 60 papers published directly on this concept, with an additional 90 or more being quite closely related. The collective contribution of these papers has not yet been summarised and so, as a platform for furthering research, a review of the servitization literature is appropriate. Hence this has been the motivation behind our study described in this paper.

This review of literature is explicitly concerned with servitization. We should note, however, that there are a number of other closely related research communities. The work on Product-Service Systems (PSS) (Baines et al, 2007; Goedkoop, 1999; Mont, 2000; Meijkamp, 2000; Manzini & Verzolli, 2003) is particularly closely related. Many of the principles are identical (Tukker, 2006). The difference arises in the motivation and geographical origin of the research communities. PSS is a Scandinavian concept which is closely coupled to the debates on sustainability and the reduction of environmental impact. Other research communities deal with similar concepts (e.g.: Integrated Vehicle Health Management (IVHM) (Fox&Glass, 2000; Baroth et al, 2001) and Services Sciences (Chesborough&Spohrer, 2006). To date, these communities have largely developed in isolation with few researchers forming links.

The study described in this paper has taken the form of a clinical review of literature that has been published, explicitly, to contribute to the servitization debate. Our methodology has consisted of identifying relevant publication databases, searching these using a wide range of key words and phrases associated with servitization, and then fully reviewing each article in turn. From these reviews

it was possible to compile a set of key findings. These findings and their implications for research are all described. The structure of this paper reflects this approach. First, the research methods are described and the initial results of the search for relevant literature are presented. Key findings are then presented through analysis of the literature. Finally, the results of this analysis are summarised and discussed, and conclusions are drawn.

2. RESEARCH PROGRAMME

2.1 Aim, scope, and questions to guide research

The aim of the research presented in this paper has been to identify, interpret, and summarise the literature currently available on the topic of servitization. In determining the scope of this study, the focus has been on articles that are central and relevant to servitization within a wider manufacturing context. For instance, papers that deal with the application of service concepts to manufacturing, the management of the transition from products to services, the provision of integrated solutions and value creation through service offers, have all been considered relevant. Examples of publications that are clearly within the scope of this review are those such as Vandermerwe & Rada (1988) in which the authors define the concept of servitization and, Wise & Baumgartner (1999) who discuss manufacturers moving downstream into more lucrative product related services. Outside the scope of our study at this time are articles that deal exclusively with pure services provision.

To guide this review of the literature a series of questions have been posed. Our intention is that these should help to ensure a thorough and comprehensive review, but that they won't necessarily lead directly to research findings. These questions are:

1. What is meant by servitization and how is it commonly defined?

2. How does a servitized organisation differ from a conventional manufacturer?

3. Where are the leading examples of servitization?

4. What guidance is there in the literature for a manufacturer seeking to adopt servitization?

5. Overall, what are the characteristics of the current body of literature on servitization?

These questions highlight that this study has focused exclusively, and somewhat pedantically, on the literature that is directly associated with servitization. Outside the scope of our work have been contributions on topics such as Product-Service Systems. As we have noted, there are many similarities and cross overs between these two communities of researches, however to date there have been few explicit links. This is demonstrated by the lack of cross-referencing between the two communities. This situation will undoubtedly change; indeed this paper itself contributes to this homogenisation through the reworking of definitions in section 3.1. Yet in this paper we sought to capture how the servitization community has independently evolved to this point in time. Hence, we treat the servitization topic similarly to our review on PSS published in Baines et al (2007).

2.2 Search strategy, results and analysis

The search strategy was developed by first identifying the relevant data sources, time frame, and keywords. Initially a very broad selection of databases was identified to cover a diverse range of publications (e.g.: journal articles, conference proceedings, theses, books, and trade journals). These databases included Compendex, Inspect, and Emerald, along with the more traditional library cataloguing systems. For completeness an Internet search was also conducted using a similar process to that used with the library databases. Collectively these provided access to a wide variety of sources (e.g.: Harvard Business Review, Industrial Marketing Management, International Journal of

Service Industry Management, and European Management Journal). Keywords were identified that were directly associated with servitization (e.g.: service-centred, service-oriented, service integration, product support, integrated solutions, post-sales, product-related services, after-sales). Many of these key words were combined with 'manufacturing' in order to ensure their relevance to this study. This set was then expanded and refined as appropriate articles were discovered. Initially, this study focused on literature published between 1988 and 2008, with their citations being cross-checked to ensure that any earlier publications were also captured.

By searching the chosen databases, using the keyword over the selected time period, a large number of article titles were uncovered. These lists were then edited to remove any duplicate records, and the titles were checked to ensure relevance to the review. The abstracts of all the remaining articles were then considered and, unless thought inappropriate, the full paper was then read. Initially, the search terms identified about 150 articles, reports, and books. These were then carefully filtered to establish 49 documents that were directly relevant to our research enquiry. Subsequent cross-checking of references increased the list to 58. The analysis itself was aided by applying mind-mapping techniques to capture and cluster the main themes and contributions. It is the analysis of these articles that forms the basis of the findings in this paper.

3. ANALYSIS OF THE LITERATURE

There has been a steady output of research papers on servitization since 1988 (see figure1). The papers reviewed originate in the USA (40%), UK (20%), Switzerland (15%) and the rest of Western Europe (25%). The literature studied covers a range of topics. These have been grouped into 'themes' and the analysis of their coverage by authors is shown in figure 2. In table 1. codings ***, ** and * have been used to indicate a 'focus on', 'detailed discussion of'' or 'refers to' the particular theme. The majority of authors cover the classification of servitization (e.g. Chase and Garvin, 1989; Voss, 1992; Mathieu, 2001b). drivers of servitization (e.g. Wise & Baumgartner,1999; Lewis et al, 2004; Mallaret, 2006) and the guidelines and methods for the implementation of servitization strategies (e.g. Foote, 2001, Oliva & Kallenberg, 2003; Gebauer et al, 2005)). Interestingly few authors directly address the definition servitization (e.g. Vandermerwe & Rada, 1988; Howells, 2000) or its evolution in manufacturing (e.g. Brax, 2005; Davies, 2006). Over 30% of authors cover the topics of the challenges facing manufacturers who are moving into services (e.g. Martin & Horne, 1992; Miller, 2002, Slack, 2005), the structure of servitized organisations (e.g. Quinn, 1990; Galbraith, 2002; Gebauer et al, 2006). There is variety of papers based on case studies. These we separate into 'inductive' (studies used to develop theory) and 'deductive' (studies demonstrating the adoption of theory). Examples of inductive studies are Voss (1992); Cohen et al (2006) and for deductive studies, Cook et al (1999); Robinson et al, 2003. Other authors have covered a variety of topics including, for instance, service design and industrialisation (e.g. Levitt, 1976; Alonso-Rosado et al., 2004; Johansson and Ohlager, 2006), blueprint development (Vandermerwe and Rada, 1989; Stile, 2003; Shostack, 1982).

4. GENERATION OF KEY FINDINGS

4.1 Defining 'servitization'

Clear definitions are the starting point for all research. Here, the terms service and product are intrinsically linked to discussions about servitization. Product terminology is generally well understood by manufacturers. In the world of manufacture a product is typified by a material artefact (e.g.: Car, boat, plane). The term 'services' is more contentious, often used loosely and defined based on what they *are not* (i.e. a product)). Here, the word 'services' usually refer to an offering (e.g.: maintenance, repair, insurance). For the purpose of this paper, we will consider that services are an "economic activity that does not result in ownership of a tangible asset" (Oxford English Dictionary, 1999). The first use of the term servitization was by Vandemerwe and Rada in their 1988 *European Management Journal* article titled 'Servitization of Business: Adding Value by Adding Services'. They defined

servitization as “the increased offering of fuller market packages or ‘bundles’ of customer focussed combinations of goods, services, support, self-service and knowledge in order to add value to core product offerings”. Here, they took the view that ‘services are performed and not produced and are essentially intangible’.

There are other definitions of servitization in the wider literature (see table 2). Throughout these the delivery of product-based services is central, and generally they are all broadly in agreement with the definition provided by Vadamerve and Rada (1988). One slight deviation is Lewis (2004) who refers to the idea of a functional product. In the Product-Service Systems (PSS) literature this is considered as a specific type of product-service offering (Tukker, 2004). This highlights the many similarities between the servitization and PSS research communities. Although these have emerged from differing perspectives on the world, they are converging towards a common conclusion that manufacturing companies should be focusing on selling integrated solutions or product-service systems (Tukker 2006). A link with servitization is also identified by Baines et al. (2007) who define a PSS as an integrated combination of products and services that deliver value in use. Although these two bodies of research have developed separately, it now seems appropriate to refine the servitization definition to encompass the PSS theme. This leads us to provide the following definition for servitization.

Finding 1: *Servitization is the innovation of an organisations capabilities and processes to better create mutual value through a shift from selling product to selling Product-Service Systems*

4.2 The evolution of servitization

There is little literature evidence recording the evolution of servitization within manufacturing industry. Vandermerwe and Rada (1988) describe how companies initially considered themselves to be in goods or services (e.g. product manufacture or insurance), and then moved to offering goods combined with closely related services (e.g. products offered with maintenance, support, finance), and finally to a position where ‘firms offer “bundles” consisting of customer focussed combinations of goods, services, support, self-service and knowledge’. They termed this movement the servitization of manufacturing. In management related literature, servitization development is commonly traced back to the early 1990s. However, Davies et al. (2007) point out that the industrial marketing literature suggests that pioneering applications originated in the 1960s with the introduction of ‘systems selling’ strategies. In the evolution of servitization, many manufacturing companies have moved dramatically into services and so caused the boundaries between products and services to become blurred.

The most highly cited papers have come from the USA followed by contributions from the UK and Western Europe. These papers are general found in managerial and business practitioner literature (e.g.: Harvard Business Review, International Journal of Operations and Production Management, Industrial Marketing Management, International Journal of Service Industry Management and European Management Journal). The authors of these papers tend to be from the Operations, Production, Services, Business Management and Marketing fields. Interestingly, the use of the term servitization only appears in those papers that offer a definition (see table 2). The concept of servitization is covered implicitly in a range of topics related to the integration of products and services. These include, for example, service business expansion (e.g. Vandermerwe et al., 1989; Wise and Baumgartner, 1999; Martin and Horne, 1992; Oliva and Kallenberg, 2003; Brax, 2005; Gebauer et al., 2004; Gebauer and Friedli, 2005), solutions provision (e.g. Foote et al., 2001; Galbraith, 2002; Miller et al., 2002; Davies, 2004; Windhal et al., 2004; Davies et al., 2006; Windahl and Lakemond, 2006; Davies et al., 2007), after-sale marketing (e.g. Cohen et al., 2006; Cohen, 2007), and service profitability (e.g. Coyne, 1989; Samli et al., 1992; Anderson and Narus, 1995; Gebauer et al., 2006; Gebauer and Fleisch, 2007).

Finding 2: *Since servitization was first coined in 1988, there has been a growing output of papers from the USA and Western Europe that appear mainly in managerial and business practitioner literature, with authors tending to be from Operations, Services and Business fields.*

4.3 Features of servitization

Manufacturing companies have been selling services for some time. Traditionally, however, the tendency has been for managers to view services as a necessary evil in the context of marketing strategies (Wise and Baumgartner, 1999; Gebauer et al., 2005; Gebauer et al., 2006). Here, the main part of total value creation was considered to stem from physical goods, and services were assumed purely as an add-on to products (Gebauer and Friedli, 2005; Gebauer et al., 2005). From this beginning, there has now been a dramatic change in the way services are produced and marketed by manufacturing companies. The provision of services has now turned into a conscious and explicit strategy with services becoming a main differentiating factor in a totally integrated products and service offering. Today, the value proposition often includes services as fundamental value-added activities (e.g. Vandermerwe and Rada, 1988; Quinn et al., 1990; Gebauer et al., 2006) and reduces the product to be just a part of the offering (Oliva and Kallenberg, 2003; Gebauer et al., 2006). Indeed, some companies have found this to be a most effective way to open the door to future business (Wise and Baumgartner, 1999).

A key feature of servitization strategies is a strong customer centricity. Customers are not just provided with products but broader more tailored 'solutions'. These deliver desired outcomes for specific customers, or types of customer, even if this requires the incorporation of products from other vendors (Miller et al, 2002, Davies, 2004). This use of 'multi-vendor' products to deliver customer centric solutions is exemplified by Alstom's maintenance, upgrade and operation of trains and signalling systems, and similarly Rockwell's on-site asset management for maintenance and repair of automation products. Oliva & Kallenberg (2003) consider this customer orientation to consist of two separate elements. Firstly, a shift of the service offering from product-oriented services to 'user's processes oriented services' (i.e.: a shift from a focus on ensuring the proper functioning and/or customer's use of the product, to pursuing efficiency and effectiveness of end-user's processes related to the product). Secondly, a shift of the nature of customer interaction from transaction-based to relationship-based (i.e.: a shift from selling products, to establishing and maintaining a relationship with the customer).

There are a variety of forms of servitization with the features differing for each. The literature identifies potential applications along the so-called 'product-service continuum' (Oliva and Kallenberg, 2003; Gebauer and Friedli, 2005; Gebauer et al., 2005; Neu and Brown, 2005; Gebauer et al., 2008). This is a continuum from traditional manufacturer where companies merely offer services as add-on to their products, through to service providers where companies have services as the main part of their value creation process (see figure 3). As observed by Gebauer et al. (2008), companies have to look at their unique opportunities and challenges at different levels of 'service infusion' and deliberately define their position. This is envisioned to be a dynamic process, with companies redefining their position over time and moving towards increasing service dominance.

Finding 3: *There are various forms of servitization, They can be positioned on a product-service continuum ranging from products with services as an 'add-on', to services with tangible goods as an 'add-on' and provided through a customer centric strategy to deliver desired outcomes for the customer*

4.4 Drivers of servitization

Commonly the literature suggests three sets of factors that drive companies to pursue a setvitization strategy; namely, financial, strategic (competitive advantage) and marketing (e.g. Mathe and Shapiro, 1993; Mathieu, 2001a, Oliva and Kallenberg, 2003; Gebauer et al., 2005; Gebauer et al., 2006; Gebauer and Fleisch, 2007).

The main financial drivers often mentioned in the literature are higher profit margin and stability of income (Wise and Baumgartner, 1999; Gebauer et al., 2005). For manufacturers with high installed product bases (e.g. aerospace, locomotives, and automotives) Wise and Baumgartner (1999) estimate that, in some sectors, service revenues can be one or two orders of magnitude greater that new product sale. Slack (2005) agrees, and points out that in these sectors higher revenue potential often exists. Likewise, Sawhney (2004) identifies companies that have enjoyed success with this approach (e.g.: GE, IBM, Siemens and Hewlett Packard) and achieved stable revenues from services despite significant drops in sales. Ward and Graves (2005) emphasise that the increased life-cycle of many modern complex products, such as aircrafts, is pushing the most significant revenues downstream towards in-service support. These product-service combinations tend to be less sensitive to price based competition (Mallaret, 2006), and so tends to provide higher levels of profitability in comparison to offering the physical product alone (Frambach et al., 1997). Finally, product-service sales tends to be counter-cyclical or more resistant to the economic cycles that affect investment and goods purchase (Oliva and Kallenberg, 2003; Gebauer and Fleisch, 2007). This can help secure a regular income and balance the effects of mature markets and unfavourable economic cycles (Brax, 2005; Mallaret, 2006).

The literature frequently refers to strategic drivers that are largely concerned with gaining competitive advantage. These use service elements to differentiate manufacturing offerings and so provide important competitive opportunities (e.g. Frambach et al., 1997; Mathieu, 2001a; Gebauer and Fleisch, 2007). Competitive advantages achieved through services are often more sustainable since, being less visible and more labour dependent, services are more difficult to imitate (Oliva and Kallenberg, 2003; Gebauer et al., 2005; Gebauer et al., 2006). While discussing these aspects, many authors (e.g. Coyne, 1989; Frambach et al., 1997; Mathieu, 2001a; Gebauer and Fleisch, 2007) reflect on the increased commoditisation of the markets, where differentiating strategies based on product innovation, technological superiority or low prices, are becoming incredibly difficult to maintain. Frambach et al. (1997) point out that the value-add of services can enhance the customer value to the point, where, homogeneous physical products are perceived as customised. These increase barriers to competitors (Mathieu, 2001a).

Marketing opportunities are generally understood as the use of services for selling more products (e.g. Mathe and Shapiro, 1993; Gebauer et al., 2006; Gebauer and Fleisch, 2007). The service component is well known to influence the purchasing decision and assessing its importance has been a lasting tradition in marketing literature (Mathieu, 2001_a; Gebauer and Fleisch, 2007). This is especially true in B2B or industrial markets where customers are described as increasingly demanding for services (e.g. Vandermerwe and Rada, 1988; Oliva and Kallenberg, 2003; Auramo and Ala-Risku, 2005; Slack, 2005). Reasons for these are pressures to create more flexible firms, narrower definitions of core competences and higher technological complexity, and these often lead to increasing pressures to outsource services (Lewis et al., 2004; Auramo and Ala-Risku, 2005; Slack, 2005). Services are also claimed to create customer loyalty (Vandermerwe and Rada, 1988; Ojasalo, 2007; Correa et al., 2007) to the point where the customer can become dependent on the supplier. Services tend to induce repeat-sale and, by intensifying contact opportunities with the customer, can put the supplier in the right position to offer other products or services (Mathieu, 2001a; Mallaret, 2006). Finally, by offering services, companies gain insight into their customers' needs and are enable to develop more tailored offerings.

Finding 5: *Servitization frequently occurs because of financial drivers (e.g.: revenue stream and profit margin), strategic drivers (e.g.: competitive opportunities and advantage) and by marketing drivers (e.g.: customer relationships and product differentiation).*

4.5 Challenges in the adoption of servitization

The adoption of a servitization strategy brings with it significant cultural and corporate challenges. (Vandermerwe & Rada, 1988; Wise & Baumgartner, 1999; O&K, 2003, Brax, 2005; Slack, 2005). These can be broadly categories into integrated product - service design, organisational strategy and organisational transformation.

The design of services is significantly different to the design products since, by their nature, services are fuzzy and difficult to define (Slack, 2005). This may discourage companies from expanding the service dimension, particularly because they need to take account of competition outside the usual domain from unexpected rivals including their own suppliers, distributors, and customers (Vandermerwe and Rada, 1988; Mathieu, 2001a; Oliva and Kallenberg 2003). Risk also needs to be considered in the design process as undertaking activities previously performed by customers can present new challenges (Slack, 2005). Here, marginal risk incurred might outweigh the benefits of increased profit potential. Finally a focus on communication strategies that clearly describe the value proposition to the customer need to be considered in the design of service provision (Mathieu, 2001b).

Manufacturing companies that decide on a service-oriented strategy have to adapt the necessary organisational structures and processes (Mathieu, 2001a; Gebauer et al., 2005; Oliva & Kallenberg, 2003; Gebauer and Fleisch, 2007). Here, there are challenges in defining the organisation strategy necessary to support the customer allegiance required to deliver a combination of product and services (Wise & Baumgartner, 1999). Adopting a downstream position, such as the provision of installed base services, organisations have to be service oriented and value services (Oliva & Kallenberg, 2003). These organisations provide solutions through product-service combinations and tend to be client-centric and providing customised, desirable client outcomes organised around particular capabilities competences and client requirements (Miller, 2002). Case studies reported by Windahl (2004) support this view, highlighting the importance of client partnering and expanded competences in providing integrated solutions. However, Mathieu (2001a) points out that service management principles are often at odds with traditional manufacturing practices.

Attempting to transform a traditional manufacturer to the required organisational strategy for effective servitization sets-up particular challenges. The service culture is specific and different from the traditional manufacturing culture (Mathieu, 2001) and a shift of corporate mindset is necessary to take on services and prioritise their development with respect to more traditional sources of competitive advantage (Coyne, 1989; Oliva and Kallenberg, 2003; Slack, 2005). This will require significant changes to long-standing practices and attitudes (Vandermerwe et al., 1989; Foote et al., 2001). For example, abandoning their product-centric structure in order to become more customer-centric (Foote et al., 2001; Galbraith, 2002; Windhal and Lakemond, 2006). Implementing these changes, companies are likely to meet resistance from areas within the organisation where the service strategy is not understood or because of a fear of infra-structural change (Mathieu, 2001_a). Creating a service-oriented environment and finding the right people for the service dimension is key to success. In providing services, managers must be convinced that people are their main asset (the major shift required in moving from a manufacturing to service culture) (Mathieu, 2001 a). However, there are many cases in the literature of companies that, despite making the transition into services, did not get the expected correspondingly high returns (e.g. Coyne, 1989, Neely, 2007). Gebauer et al. (2005) termed this the ‘service paradox in manufacturing companies’ and related it to both organisational and cultural hurdles.

Finding 6: *The adoption of servitization by a conventional manufacturer principally presents challenges for service design, organisation strategy and organisation transformation*.

4.6 Industrial examples of servitization adoption

A number of authors have studied the adoption of servitization by companies based on case study work (Wise & Baumgartner, 1999; Mont, 2001; Miller, 2002; O&K, 2003; Mathe, 2004; Davies, 2004; Davies, 2006). Key examples of this work are presented in table 3. All these are cases of companies moving to exploit downstream opportunities from services. Typically, they fall into four categories (Wise & Baumgartner, 1999): Embedded Services which allow traditional downstream services to be built into the product (e.g.: Honeywell's AIMS for in-flight monitoring of engine systems); Comprehensive Services such as those offered by GE around its product markets (e.g. GE Capital's financing activities); Integrated Solutions where companies look beyond their traditional product base to asses the overall needs of customers (e.g. Nokia's move to network-infrastructure solutions); and finally Distribution Control as used by Coca-Cola to grab shelf space in its high volume low margin supermarket segment. The adoption of servitization to provide customers with functional results is discussed by Howells (2000) in the case of Rolls-Royce's offering of guaranteed flight hours from their aero engines ('Power by the Hour') and by Mont (2001), who describes Xerox's move from the provision of photocopiers to offering 'document management'. Miller (2002) and Davies (2004) describe examples of the provision of integrated solutions and view these as 'integrated combinations of product and/or services that are tailored to create desired outcomes for the customer'. Davies (2004) concludes that suppliers of capital goods are moving into integrated solutions provision form different position up and down the value stream; he notes Alstom's transport solutions, Ericsson's mobile networks and Thales's training solutions as exemplifying this move. In addition companies such as W S Atkins and Cable & Wireless with strong systems integration capabilities, exemplify the move into providing services previously carried out by their customers.

While the examples in table 3 typify cases of leading practice, they also indicate the limited nature of exemplars in this field. The majority of these are large multinationals supporting high-value capital equipment. This leads the authors to summarise:

Finding 4: Examples of leading practice in the adoption of servitization are focused on larger companies supplying high-value capital equipment such as Alston, ABB, Thales and Rolls-Royce. These demonstrate how traditionally based manufacturing companies have moved their position in the value-chain from product manufacturers to providing customers with integrated solutions that can include multi-vendor products.

4.7 Previous research aiding in the adoption of servitization

Section 3.6 has highlighted that the principal challenges in the adoption of servitization are in the areas of the design of the service, organisational design and organisational transformation. This section summarises the work done to date, in the existing literature, to overcome each of these challenges. This work takes such forms as case studies, guidelines, methodologies and techniques.

There is little previous work offering guidelines, tools or techniques, for the design of integrated products and services. The existing work is typified by Coyne (1989) who advocates that services design should be approached using a set of hard business decisions that employ the same rigorous attitude used to develop products rather than simply consider this as a variation of the marketing mix. Effective customised and flexible service offerings can be achieved by combining a base package of standard services with particular service options that are valued by individual customers (Anderson; 1995; Neu, 2005). Similarly, other authors (e.g. Miller et al., 2002; Davies, 2004; Davies, 2006; Davies et al., 2007) observe that in providing integrated solutions, there is a need to design services as modular units that can be 'mixed and matched' in different combinations to meet specific customer

and market requirements. Such product-service combinations are considered by Alonso-Rasgado (2004) as functional products and therefore suggest that general service design processes are inappropriate.

Guidance in the literature on how to approach organisational strategy is largely limited to anecdotal evidence from case studies that suggest good practices and processes for implementation. For example, Davies (2006) draws lessons from five cases to surmise that, for success, companies need a clear understanding of what they do well and what new capabilities they need to develop. Likewise, Davies (2004), Oliva & Kallenberg (2003), Gebauer (2005) identify the value of a phased introduction of added services in order to achieve successful implementation of service strategy in manufacturing companies. This is seen to provide a safer journey for companies along the road to servitization. However, Brax (2005) observes a paradox here, in that services introduced in this way can be perceived as secondary to the tangible product and hence may lack cross-functional support, leading to failures in service operations. Davies (2003), Oliva & Kallenberg (2003), Gebauer (2005) and Brax (2005) all identify the establishment of de-centralised customer facing service units with profit & loss responsibility within the organisation as a key factor in a successful service strategy. These should be run as a separate business units and operated with the metrics, control systems, and incentives of a professional service organisation (Oliva and Kallenberg, 2003; Gebauer et al., 2005; Gebauer et al., 2006). According to Sawhney et al. (2004), running the product-service business separately mitigates the risk of moving outside existing organisational capabilities. Other approaches to servitization described in the literature include collaborative arrangements with partnership and / or outsourcing agreements with third parties (Mathieu, 2001a; Sawhney et al., 2004; Windahl and Lakemond, 2006). In this type of approach Gebauer et al. (2008) observes the involvement of customers as development partners.

The state of previous research on organisational transformation is similar to that of organisational design. There are a small set of case studies which draw lessons from the practices of successful companies (e.g.: Davies (2004); Miller (2002)). Examples include Gebauer and Fleisch (2007) who investigate typical behavioural processes in these companies which, in some respect, can discourage executives from service investments. Gebauer et al (2005) also note the importance of training and empowering people delivering service so that they can be effective and efficient. They observe that empowerment of this kind is only possible if employees have the mindset to establish a service culture. A number of authors (Oliva and Kallenberg 2003; Gebauer et al. 2006; Gebauer and Fleisch, 2007) identify the separate service organisation as the way to create a service culture, with the associated underlying norms and values, without replacing the manufacturing value set. This can help to avoid a clash between a dominant manufacturing culture and the service-related counterculture. Similarly (Windahl and Lakemond, 2006) consider that isolating the service organisation from product development and manufacturing operations may be a critical success factor for managing the transition.

Overall, we have found that the existing guidance in the literature on how to servitize an organisation is limited and this leads to our finding of:

Finding 7: *There is a paucity of previous work that provides guidance, tools or techniques, that can be used by companies to servitize.*

4.8 Future research challenges for servitization

The principal challenges in the adoption of servitization are in the areas of categories into service design, organisational strategy and organisational transformation (section 3.6). Within the literature there are only a few guidelines on how to overcome these challenges, with almost no tools or techniques available (section 3.7). This leads us to identify that the major gaps in the existing literature are in these areas, and that the following research questions can be posed:

1. How can / should competitive integrated product-service offerings be designed within the context of an industrial organisation?
2. What is / should be the organisational strategy to deliver competitive integrated product-service offerings?
3. How can / should traditional manufacturing firms make the transition to a servitized organizational strategy that delivers competitive integrated product-service offerings?

In terms of research methods, most papers in this field are based on case study research. They are largely descriptive, focusing and giving an illustration of the adoption of servitization by traditional manufacturing companies. There are no examples of more prescriptive approaches using techniques such as action research. We believe that this highlights that the research community is principally taking a reporting role. While valuable in itself, there is clearly an opportunity for researchers to be more active in forming actions rather than simply providing a commentary on the successes or failures of others. We suggest therefore that a third, and significant challenge for future work, is for the research community to engage in more prescriptively in the change process by more actively engineering the tools and techniques that are needed by practitioners.

Finding 8: *The principal research need is to engineer tools or techniques that practitioners can apply to help in service design, organisational design and organisational transformation.*

5. CONCLUDING REMARKS

Our review has identified 58 papers that are directly related to the topic of servitization. These have been analysed, interpreted, and summarised. From this eight key findings have been established. In summary, servitization is the innovation of an organisations capabilities and processes to shift from selling products to selling integrated products and services that deliver value in use. This concept originated the USA in the late 1980s and, to date, most contributors have been academics and practitioners from the Operations, Production, Services, Business Management and Marketing fields. There is also a striking overlap between servitization and product-service system concepts. Servitization is being driven by ever more complex customer needs and demands and a need to defend against product competition particularly from lower cost economies. There are a diverse range of servitization examples in the literature from aerospace, transportation, automation, machine tools, printing machinery and other capital equipment. These tend to emphasize the potential to maintain revenue streams and improve profitability particularly in industry sectors where there is a high installed base of products. Companies recognise that delivering services is more complex than manufacturing products and requires different approaches to product - service design, organisational strategy and organisational transformation. There is little work however that can be used to help practitioners, and so this forms the basis of research challenges in this field.

Servitization does not however represent a panacea for UK manufactures. It is a concept of significant potential value, providing routes for companies to move up the value chain and exploit higher value business activities. This message is reinforced through the successes of companies such as Rolls-Royce with 'TotalCare'. These concepts must not be considered as universally applicable. While it is difficult to imagine that any manufacturer can succeed without offering some

services (e.g. after-sales support, training, finance), these need not form the basis of a competitive strategy. Success is also possible through excelling at either product leadership or operational excellence. For those manufacturers that do see the provision of services as key to their future, there are still significant challenges to be faced. To be both effective and efficient, manufacturers need, for example, to be able to understand how their customers will value their services. Similarly, they will need to be able to configure their products, technologies, operations, and supply chain to support this value offering.

The findings presented in this paper provide a useful review of servitization and a platform on which to base more in-depth research. As we mentioned earlier though, this is only one community of researchers contributing to the broader topic of service-led competitive strategy. Others exist, particularly in the area of Product-Service Systems (Baines et al, 2007). To complete the formation of a truly inclusive literature review, the contributions in these themes need to be drawn together. This therefore will be the topic of our future research.

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