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INNOVATION FOR A CIRCULAR ECONOMY: EXPLORING THE ADOPTION OF PSS BY UK COMPANIES IN THE BABY PRODUCTS SECTOR

ABSTRACT:

Several authors have commented on the relatively slow rate at which Product Service Systems (PSS) have been adopted in B2B networks. Despite some prominent examples, such as the provision of integrated lighting systems to Sainsbury's (supermarket chain) by Parkersell in the UK, and the 'pay per copy' (lease and take back) systems provided by copier companies such as Xerox and Canon, PSS has not been widely adopted even though the business case seems sound. Consequently, the question of identifying and overcoming barriers to PSS adoption has become an important research topic. In this study we explore barriers to the adoption of PSS in the UK baby products industry using a qualitative research design employing in-depth interviews with baby products suppliers (manufacturers) and buyers (retailers). The novelty of the approach adopted in this study is that key concepts from the Industrial Networks Approach are used to frame the analysis. Buyers and suppliers of baby products acknowledge the value of the PSS approach, but PSS adoption is found to require considerable adaptation to conventional patterns of inter-organizational interaction.

KEYWORDS: Product Service Systems; ARA Framework; Sustainability

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COMPETITIVE PAPER

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INTRODUCTION

Sustainability has been defined as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED. 1987); and, ‘consuming resources at a rate which allows them to be replaced, and only producing pollution at a rate that the environment can assimilate’ (Peattie 1995:33). Product service systems (PSS) not only offer a range of benefits to firms in supply chains, but also provide opportunities to enhance sustainability in business relationships and networks (Baines, Lightfoot et al. 2007). Baines et al (2007:3) offer a synthesis of the many definitions of PSS: ‘product(s) and service(s) combined in a system to deliver required user functionality in a way that reduces the impact on the environment’. Value is created by PSS for the user without the conventional need for material ownership of the means of production (Manzini and Vezzoli 2003), which results in dematerialization. In common with much IMP thinking (Håkansson and Snehota 1995), with PSS suppliers strive to provide solutions for customers through the application of resources and the coordination of activities, but with far less emphasis on ‘selling’ the customer a major item of equipment.

Several authors have commented on the relatively slow rate at which PSS has been adopted in B2B networks (Mont 2002, Cook, Bhamra et al. 2006). Despite some prominent examples, such as the provision of integrated lighting systems to Sainsbury’s (supermarket chain) by Parkersell in the UK, and the ‘pay per copy’ (lease and take back) systems provided by copier companies such as Xerox and Canon, PSS has not been widely adopted even though the business case seems sound (Baines, Lightfoot et al. 2007, Vezzoli, Ceschin et al. 2012). Consequently, the question of identifying and overcoming barriers to PSS adoption has become an important research topic. In this study we explore barriers to the adoption of PSS in the UK baby products industry using a qualitative research design employing in-depth interviews with baby products suppliers (manufacturers) and buyers (retailers). Buyers and suppliers of baby products acknowledge the value of the PSS approach, but PSS adoption is found to require considerable adaptation to conventional patterns of inter-organizational interaction.

The issues associated with the implementation of PSS have not previously been analysed using the conceptual tools associated with the IMP approach. The purpose of this paper is to investigate PSS implementation, and in particular the issue of unexpectedly slow uptake, using a conceptual framework derived from the industrial networks (IMP) approach to analysing business markets. The key concepts that are employed for this analysis are the ARA framework (Håkansson and Snehota 1995); the 4R model (Håkansson and Waluszewski 2002); inter-firm adaptations (Hallen, Johanson et al. 1991, Brennan and Turnbull 1997); and, the light and dark side of network forces (Johansson 2012).

The paper is structured as follows. Following this introduction we devote the next section to explaining the meaning of and the origins of PSS. There follows a section in which the conceptual tools used in the analysis are outlined. Then, after a description of the qualitative research approach that was used, we present and discuss the results from the empirical study.

The paper concludes with observations on the practical implications of this research and some suggestions for future research directions.

PRODUCT SERVICE SYSTEMS

Design and industrial ecology literature proposes Product Service System (PSS) as a sustainable business model with potential to bring about social and environmental benefits. PSS is defined as a competitive ‘system of products, services, supporting networks and infrastructure, which satisfies customer needs and has a lower environmental impact than traditional business models’ (Mont 2002:239). In other words, PSS is an example of functional provision, where it is the overall function delivered by the system and its consequent value to the customer that is important (Vargo and Lusch 2004, Tukker and Tischner 2006). By definition, the concept implies a holistic approach to innovation whereby actors from different industries, knowledge hubs (universities and research centres), governmental institutions and users combine efforts in innovation for sustainability by establishing collaborative networks facilitated by policy makers.

The existing literature on PSS highlights the virtues and portrays PSS as a potential solution to the negative environmental impact of economic activities (e.g. Manzini and Vezzoli (2003); Mont (2002), Tukker and Tischner (2006)). It is argued that PSS has a great potential to improve resource productivity (Cook, Bhamra et al. 2006) because of an expected reduction in product proliferation arising from more sustainable multiple product use (Lee, Lu et al. 2007) and longer product life cycles (Mont 2002). In addition, the model shifts the responsibility related to the end of products’ life cycles to suppliers thus supporting closed loop industrial systems where materials are recovered, reused and recycled. The social benefits of PSS include wider accessibility of products by market segments with lower purchasing power (Manzini and Vezzoli 2003). Thus the PSS business model has the potential to offer environmental, commercial and social benefits, resulting in de-commoditization of business offerings, customer retention and market share protection (Mont 2002, Kimita, Shinomura et al. 2009).

Recent criticisms have been levelled at the PSS research community, for portraying the concept as a panacea for resolving environmental problems and cultivating a ‘myth’ of universal sustainability and applicability (Tukker and Tischner 2006:1553). For example, the potential for resource productivity improvement has been ‘downgraded’ from a factor greater than ten to a factor of two in some cases (Cook, Gottberg et al. 2012). However, PSS researchers have long identified potential constraints, e.g. a possible fall in industrial production with economic repercussions (Mont 2002) and rebound effects that nullify the environmental benefits when consumers increase their consumption when they learn of societal and environmental savings (Manzini and Vezzoli 2003, 2005). In addition, important issues such as consumer acceptance (Rexfelt and Hiort af Ornäs 2009, Catulli 2012), business viability (Tukker and Tischner 2006), compatibility of PSS with a culture of consumption (Catulli, Lindley et al. 2013), and the attitudes of business managers (Mont 2002) have been acknowledged.

PERCEIVED BARRIERS TO ADOPTION AND IMPLEMENTATION

Despite the desirability of the diffusion of sustainable PSS solutions, large scale implementation has yet to occur (Vezzoli, Ceschin et al. Forthcoming). We argue that this failure to take hold is partly derived from lack of knowledge, competence and capabilities that need to be addressed. The learning and knowledge acquisition needs of suppliers aiming at implementing PSS

solutions, and policy makers that want to support this implementation can be identified from the range of challenges which existing literature claims businesses face in adopting PSS. In this paper we want to concentrate on barriers connected with business' knowledge and capabilities.

Barriers to the implementation of PSS can be internal or external to the focal organization, and both have implications for knowledge acquisition and management. Internal barriers can be cost related, concept design and organizational barriers. Implementing PSS as a business model means that customers transfer risk, responsibility and liabilities connected with product ownership to suppliers (Mont 2004). At the network level, the challenges can include difficulties with gaining trust, conflicts of interest and lack of acceptance of these service driven offerings (Mont 2004). Another barrier is a lack of understanding of the marketing implications of these business models. For example, one of the limitations of PSS is the assumption that consumers are mainly interested in the functional value of products (Stahel 1997, Manzini and Vezzoli 2003, Vargo and Lusch 2004). However, consumers derive other forms of value, in addition to functional value, from the acquisition of products; notably, symbolic (Baudrillard 1998) and hedonic (Richins and Dawson 1992) value. Ownership of products represents for consumers a means of self-expression (Belk 1988) as well as a mechanism of socialization (Schouten and McAlexander 1995), and assists them to express values that drive their consumption behaviour (Richins 1994). This is a considerable challenge for PSS in consumer markets, which means that suppliers wishing to implement PSS- especially if they are mainly manufacturers – need to develop service marketing capabilities that can enable consumers to identify themselves with these new service driven offerings.

Specific internal barriers can be cost related, associated with concept design and organizational barriers (Mont 2004). Costs issues involve the needs for suppliers to “internalize” some costs associated with running products. For example, Zip Car, a car sharing company, needs to internalize both insurance costs and such costs as cleaning and maintaining the vehicle, as well as end of life disposal costs.

Another problem is that PSS suppliers would have to face uncertainty on the volume and frequency of the return flow of products back from customers (Mont 2004). Concept design issues would be exacerbated by possible needs of designing products ad hoc for PSS (Catulli, Cook et al. Forthcoming).

Limitations of current technologies, for example ICT systems to optimize “on-demand” availability, and gaps in the knowledge that can be accessed by companies to inform adequate research methodologies are further barriers constraining the wider adoption of the PSS model (Cook, Bhamra et al. 2006). Companies are apprehensive that implementation of the PSS model will force them into cannibalizing their original business model. Dangerously, this view is shared by knowledge brokers such as advisers within knowledge hubs and institutional technology brokers, whose predetermined resistance may result in failure of the model due to lack of adequate facilitated transfer (Cook, Bhamra et al. 2006). These cultural limitations are tightly linked to the investments which have locked companies in organizational structures that make PSS implementation problematic (Cook, Bhamra et al. 2006).

Research has also identified a range of legal problems around the implementation of PSS. In the UK, for example, renting out or leasing products in many cases requires suppliers to obtain a Consumer Credit License (OFT 2008). Other reasons for concern include tax liability, health and

safety considerations and the related liability in case of accidents (Benkler 2004, Anonymous 2013).

In spite of the limitations, environmental, innovation and design experts, and policy makers continue their encouragement and support of the PSS implementation. Funding agencies support small scale projects to evaluate the benefits and feasibility of PSS (Ceschin 2012). Yet, the resulting propositions are heavily challenged when trying to turn the testing grounds into viable market niches (Hoogma, Kemp et al. 2002, Ceschin 2012). Some suggest that this failure is due to a lack of attention to the needs of consumers and insufficient market research (Hoogma, Kemp et al. 2002, Catulli, Cook et al. Forthcoming) but it appears that there is also a significant resistance from businesses. This resistance, and the consequent failure to adopt, can be attitudinal, such as companies' resistance to undertaking end of life responsibility (Mont 2002) and underestimation of the environmental potential of PSS (Sakao, Sandström et al. 2009).

So what are the characteristics of those companies that seem to have succeeded in adopting the PSS business model? Corporate culture driven by production and sales volumes seems to be an important factor affecting companies' propensity to adopt the PSS model, and so are corporate competences and capabilities, as well as businesses' ability to cooperate (Cook, Gottberg et al. 2012). Companies that make the transition to PSS successfully seem to be those with existing service-orientated competencies (Cook, Gottberg et al. 2012). Adverse factors, on the other hand, such as a low level of receptivity to PSS expertise, arise from the limited ability of businesses to establish and work in networks (Cook, Bhamra et al. 2006, 2012). The need for companies to work in integrated networks is argued to represent a critical obstacle to the successful adoption and implementation of the PSS provision (Mont 2002, Evans, Partidario et al. 2007). In effect, open firms, with a successful track record in implementing innovation are better positioned to adopt PSS.

DEVELOPMENTAL NEEDS

The barriers examined above imply that in the case of PSS suppliers need to enhance their risk management skills, put in place processes and resources to absorb life cycle and after-life responsibilities, and design strong cost management capabilities. Marketing companies need to build specific marketing and relationship management capabilities, in order to be able to cater to consumers' needs for symbolic and hedonic value as well as functional. Financial management capabilities are needed both for the costs implications and for the uncertainty in the cash flow deriving from basing the income on service level agreements instead of outright sale. This might require acquisition of the ability to involve "enabling" financial companies that can underwrite some of the risk and supply finance. For example, in a recent pilot implementation of an electric bus service in Milton Keynes, enabling company MKP Arup Sustainable Projects (MASP) bought the electric buses and leased them to bus operator Arriva, which therefore did not need to undertake all the risk and costs (Miles and Potter 2013). Suppliers would need to upgrade their competences and resources in reverse logistics. Because of the potential legal implications of product – service delivery solutions that are likely to be tightly regulated because of their credit requirements, companies would need extensive learning and vetting by the authorities before they can implement a PSS provision.

Based on the premise that one of the important benefits companies and policy makers would want to gain from PSS is environmental sustainability, suppliers would also need access to

environmental management and sustainable design capabilities. These skills would need to enable the suppliers to strike a balance between the environmental performance of a PSS and the benefits accruing to the customers. This knowledge, furthermore, is a key asset because it is a key value that a supplier can deliver to a customer (Manzini and Vezzoli 2003, Mont 2004).

In order to embrace sustainable PSS businesses would need advanced system, product and service design capabilities. This would require access to considerable knowledge and technical resources, which is difficult because barriers have been identified in the transfer of specific PSS knowledge from academics to UK manufacturing firms (Cook, Bhamra et al. 2006). This is caused by the inadequate access to PSS knowledge and expertise available from knowledge hubs such as Universities and research centres (Cook, Bhamra et al. 2006), which has been attributed to the lack of qualified intermediaries such as consultants and social entrepreneurs (Cook, Gottberg et al. 2012). Suppliers involved in the implementation of PSS need to have access to specialist knowledge, be receptive to these capabilities and they need to be assisted by knowledge brokers (Cook, Gottberg et al. 2012). These factors are affected by various pressures, e.g. legislation and competitive pressures, as well as market failure.

One of the important considerations on the knowledge and skills necessary for PSS to work is that its success needs to be an evolutionary change supported by market competitiveness (Cook, Gottberg et al. 2012). Too many of the applications of PSS have been designed as “protected” market “demonstrators”. There is a danger in the “artificiality” of these solutions. The problem is that as soon as these offerings are implemented in the open market they fail to compete with traditional ownership solutions.

CONCEPTUAL FRAMEWORK

The theoretical background to this work is derived from three principal bodies of research: the development of thinking concerning the service/good distinction (Lovelock and Gummesson 2004); the IMP approach to studying business phenomena that focuses on the relationship and the network as the appropriate units of analysis (Håkansson and Snehota 1995); and, the idea derived from economic sociology that markets are not natural and impartial arenas but are constructed (Araujo, Finch et al. 2010).

The relatively clear-cut distinction between services and goods that was once largely accepted has been subject to extensive critique from a number of angles in recent years. The consensus that services could be satisfactorily defined, and distinguished from goods, using the dimensions of intangibility, heterogeneity, inseparability, and perishability has broken down (Lovelock and Gummesson 2004). Key, emerging concepts that are found in recent debates concerning the putative distinction between the marketing of services and of goods include servitisation (Roy, Shehab et al. 2009), the rental/asset paradigm (Lovelock and Gummesson 2004), service-dominant logic (Vargo and Lusch 2004), and the service (or servitisation) paradox (Spring and Araujo 2013). Servitisation refers to changes in the vertical scope of manufacturing firms as they seek to integrate service activities into their market offerings. In the rental/asset paradigm a customer firm rents the services of an asset, the ownership of which is retained by the supplier firm; Lovelock and Gummesson (2004) argue that this operationalises a critical underlying characteristic of a service, namely non-ownership. The implementation of the rental/asset paradigm, through practices such as ‘power-by-the-hour’ that are popular in the airline industry, neatly illustrate the central point of Vargo and Lusch (2004) that customers want to extract use

value from their exchanges with suppliers, and that use value derives from the services provided by good rather than from the goods themselves. However, although manufacturing firms have embraced servitisation enthusiastically, researchers have found that revenue and profit gains from moving into service provision are often not as large as expected: the service (or servitisation) paradox (Gebauer, Fleisch et al. 2005, Neely 2008).

The first extensive explanation of the IMP approach is found in Håkansson (1982). It is argued that the relationship rather than the discrete transaction is the appropriate unit of analysis in business markets; that both the buyer and the seller are active participants in an interaction process; that there is considerable stability of relationship structures in business markets; and, that buying and selling are similar processes that should be studied simultaneously. The central conceptual framework was the Interaction Model, comprising the buying and selling parties to the relationship (each sub-divided into the individual and the organisational level), the interaction environment (e.g. market structure), the relationship atmosphere (power-dependence; conflict-cooperation; closeness-distance; mutual expectations), and the elements and processes of interaction (short-term exchange episodes and long-term relationship processes). Håkansson and Snehota (1995) represents the principal exposition of industrial network theory, an important development in IMP thinking. The relationship unit of analysis is not abandoned, and it is emphasised that structural elements of relationships (continuity, complexity, symmetry and informality) and process elements (adaptations, cooperation-conflict, social interaction and routinisation) remain of interest and important. However, the influence of one relationship on another takes centre stage, with chain dependencies between relationships resulting in "a form of organization we have chosen to qualify as a network" (Håkansson and Snehota 1995 p19). Change in one relationship can propagate through the network of interconnected relationships, and the network "form of organization" is a rather curious one that has neither a centre nor boundaries. Relationships are conceptualised to have three layers, and each business relationship can be characterised in terms of the relative importance and the complexity of each of the three layers. These three layers are the elements of the best-known conceptual framework to emerge from Håkansson and Snehota (1995): the AAR (activities, actors, resources) model. The relationships within an industrial network can be analysed in terms of the links between their activities, the ties between their resources, and the bonds between their actors. Håkansson and Waluszewski (2002) divided resources into two categories, technological and organizational resources, and then sub-divided each category into a further two categories, constituting the 4Rs model of resources —products, production facilities, organizational units, and organizational relationships. From the IMP perspective firms implement adaptations in their business operations both for individual dyadic partners (inter-firm adaptations) and at the market, network or environment level (Hallen, Johanson et al. 1991, Brennan, Turnbull et al. 2003). Inter-firm adaptations can be classified in terms of their scope and the degree to which they are planned (Brennan and Turnbull 1997). An important theme in the IMP analysis of inter-firm relationships and networks is that close connections between firms have a dark side as well as a light side, so that it cannot always be presumed that a closer relationship is a better relationship (Håkansson and Snehota 1998, Noordhoff, Kyriakopoulos et al. 2011, Johansson 2012).

In this paper we accept the principal argument of Araujo et al (2010) that the marketing discipline has neglected markets, and has represented them as passive backgrounds against which marketers operate their marketing strategies. Marketing activities are performative; that is, they contribute to the construction of markets (Araujo, Finch et al. 2010). We also agree with

Doganova and Karnøe (2015), who point out that if markets are not natural, impartial arenas for competition but are constructed, then they can be hostile to products with new qualities that do not conform to the rules and metrics of existing market architectures. Doganova and Karnøe (2015: 23) argue that this is particularly the case for products such as PSS with new, environmentally-friendly qualities where: “existing market architectures are transformed and value metrics are extended beyond the economic performance of goods to include their environmental impact”. From this point of view a key role is played in the formation of markets by market devices: “material and discursive assemblages that intervene in the construction of markets” (Muniesa, Millo et al. 2007:2).

The specific gap in knowledge to which this work seeks to contribute is the analysis of the difficulties encountered by actors (firms and others) engaged in the process of developing a non-ownership market model for durable baby products. Spring and Araujo (2013) investigate the nature of the connection between services and manufacturing in manufacturing-oriented supply networks. They present an in-depth case study of a manufacturing firm that is seeking to incorporate greater service components into their market offerings, as a means to offer enhanced value to OEM customers and differentiate the company from lower-cost overseas competitors. Spring and Araujo (2013) note that the examples that they investigate had all been brought successfully to fruition, and that their case study was situated towards the production end of the manufacturing/services continuum. They suggest that further research should be undertaken looking at examples of service development further removed from production operations; and, of instances of service development where the process was more problematic. This study presents an analysis of an empirical context that meets these criteria. The focus is on product-service-systems in the baby products market. As we will see, the adoption of PSS in this context has been beset by difficulties, many of which arise towards the retailer and user ends of the supply chain.

Table 1 provides a summary of the key theoretical concepts derived from the review of the literature and used in the analysis of the empirical data for this study.

Table 1: Principal Concepts

Concept	Source
The ARA framework <ul style="list-style-type: none"> • Actors – Actor Bonds • Resources – Resource Ties • Activities – Activity Links • (Ideas – Idea Couplings) 	(Håkansson and Snehota 1995, Freytag and Young 2014)
Governmental Actors	(Johansson 2012)
Established Business Relationships	(Johansson 2012)
The 4R model Technological Resources – Products & Production Facilities Organizational Resources – Organizational Units & Organizational Relationships	(Håkansson and Waluszewski 2002)
Dyadic Effects and Network Effects <ul style="list-style-type: none"> • Trust • Cooperation • Conflict • Power • Adaptation 	(Håkansson 1982, Håkansson and Snehota 1995)
Adaptations at the Environment Level and at the Dyadic Level	(Håkansson 1982, Brennan, Turnbull et al. 2003)
Classification of IMP (Dyadic) Adaptations <ul style="list-style-type: none"> • Strategic • Emergent (Evolutionary) • Tactical • Socialization 	(Brennan and Turnbull 1997)
Market Devices	(Doganova and Karnøe 2015)
Light Side and Dark Side of network forces	(Johansson 2012) Also see (Noordhoff, Kyriakopoulos et al. 2011)

METHODS OF DATA GATHERING AND ANALYSIS

The study is based on ten semi-structured open-ended in-depth interviews with suppliers - manufacturers and retailers – from the baby care products sector. The study applies the principle of data source triangulation, whereby the phenomenon of interest is studied across organizations. The interviews lasted on average 60 minutes and were conducted from January to June 2012. In addition, two focus group workshops were organised. All respondents were employees with strategic authority, i.e. Marketing Directors and COOs.

The study adopted an unstructured approach to the data analysis, allowing themes to emerge from a close reading of the interview transcripts. The data were initially broken down into categories corresponding to the interview questions. The categories were then searched for patterns and reoccurring events (Gephart, 1993, Turner, 1994). Finally, the identified patterns were checked for a fit with existing concepts.

To ensure reliability, all the interviews were tape-recorded and transcribed, and consistent data coding and sorting were deployed. Internal checks on the validity of the data were in place whereby the emerging conceptual categories were continuously refined in parallel with the process of interviewing. Last but not least, all respondents agreed to respond to follow-up calls for the purpose of clarifying ambiguous points and commenting on the truthfulness of the interpretation.

The data from the interviews was analysed using the *a priori* themes shown in Table 1, while additional themes were allowed to emerge from the data (*in vivo* themes). The following *Findings* section is organised around five principal *in vivo* themes that emerged from the data. The way in which these *in vivo* themes are linked to the *a priori* themes of Table is outlined in Table 2.

The five *in vivo* themes are 1) concerns about direct interaction with consumers, 2) power conflicts with dyadic partners, 3) product quality and liabilities, 4) concerns with financial issues and 5) logistics investments. It is also evident from the data that an underlying difficulty for the firms involved in this study is the adaptation of their business and marketing practices, which are primarily designed to function in a B2B environment, to circumstances in which they have to deal more closely with end-consumers as well as business customers.

Table 2: Relationships between *in vivo* and *a priori* themes

Emergent <i>in vivo</i> themes	Related <i>a priori</i> themes from literature review
1. Concerns about direct interaction with end-consumers	ARA framework; activity links; organisational resources
2. Power conflicts with dyadic partners	Dyadic and network effects; power; conflict
3. Product quality and liabilities	4R model; technology resources; products and facilities
4. Concerns with financial issues	None clearly identified
5. Logistics investments	4R model; technology resources; facilities Dyadic adaptation of logistic facilities for particular partner(s)

FINDINGS

THEME 1: THE DIFFICULTY AND CONCERN IN INTERACTING DIRECTLY WITH CONSUMERS (B2B TO B2C CONVERSION)

Two manufacturers we interviewed can see advantages in dealing directly with consumers. They think that this would enable them to get a better understanding of consumers, and possibly enhance the relationship.

“...we may be in a better position to have a constant contact with somebody who has one of our products, a parent who has a product from [a brand], so they may feel that the type of feedback they’re prepared to give to us is of more value to us and they’re open to listening to our messages about childcare and the brand” (Baby product manufacturer)
“...in order for us to become better at what we’re doing, in order to be developing the best products to fit the right needs, by loaning things out and getting them back, we can learn a lot from somebody using that intensely for two weeks” (Integrated retailer)

The arrangement would also enable cross- selling products. Our data however suggests that suppliers of baby care products, which currently interact with retailers and wholesalers, would generally be concerned about interacting with consumers direct. This concern is motivated by changes in activities this direct route to business would require, which would have resource and skills implications, requiring either investment or partnership with other companies.

An industry expert from a trade association feels that small suppliers would not be able to deal direct with customers, and larger ones could be intimidated by having to break the status quo of the current distribution networks. These companies rely entirely on these large, powerful retail chains which includes the likes of *Mothercare*, *Mamas & Papas* and *Kiddycare*.

Switching to direct sales would entail a considerable time of transition fraught with risk. One of the participants, a supplier of reusable nappies, is a medium size company and feels they would not have the resources to make the transition. One of the concerns is financial management of a lease model direct to consumers:

"We can't be having contracts with hundreds, potentially thousands of people trying to, getting £10 in, because it's not just about, I mean if it's all being collected on time, there is a cost, as a company, of receiving all those things..."

Therefore they feel that this would require an intermediary – e.g. a financial company – managing the customer interface of the scheme. A major adaptation would be necessary in terms of legal aspects: in the UK leasing is regulated by the Consumer Credit Act 1974, which means that suppliers operating such a scheme would need to acquire a licence under such a scheme.

The notion of operating a leasing system directly to consumers, in conclusion, would require new activities with specific resource requirements, establishment of new relationships with new types of actors, would have dyadic effects and call for Government influence in the form of legislation. The change would involve a period of transition:

And then the other biggest one is obviously us dealing direct (with consumers), that's quite a big transition (Reusable nappies supplier).

We therefore note that the activities connected with direct interaction with consumers would need to address regulatory pressures and resources connected with managing the interaction, including learning new skills and the establishment of relationships with new actors.

THEME 2: POWER CONFLICT WITH DYADIC PARTNERS

Manufacturers of baby products are mostly business to business companies that get to market in the UK through powerful intermediaries such as those listed in Theme 1, some being large retailers with manufacturing capabilities. The notion of direct leasing is seen by participants as very attractive, as an opportunity to reduce the influence of partners which can exert considerable power on their business. Manufacturers however expressed anxieties on the adoption of PSS provided directly to consumers, as this could jeopardize dyadic relationships because of that power retailers have. The decoupling with traditional retailers is seen as a dangerous route because of the possibility of retaliation by these, e.g. black listing. Retailers also have skills that manufacturers would need to acquire if they stopped relying on them.

Thus a lease program which goes around the traditional distribution network made of retailers and wholesalers could destabilize established dyads and bring about conflicts of power, requiring therefore environmental adaptation. The analysis therefore suggests that the adoption would call for investment in resources and skilful relationship management.

THEME 3: PRODUCT QUALITY AND LIABILITIES

The rental scheme in our study consists of renting products which are rented multiple times by consumers. Concerns arise therefore from possible liabilities the renters might incur in the case said products were to fail. Some baby products are safety related products, e.g. car seats, and pre-used products could have been damaged for no fault of the supplier.

The need to extract more cycles of use from products would entail a significant increase in technical operations linked with production of spare parts, cleaning and taking the products apart, as well as inspection and certification of fitness for purpose, which would entail investment in resources or partnering with other - possibly localized - organizations.

We'd have to work with some sort of facilitator to adapt or recondition the products. We'd have to incur additional testing, of course, to make sure the product is compliant with all the safety regs. (Baby product manufacturer)

Another possible risk factor is that of obsolescence - keeping products in use for a longer time by more people might challenge the interest of consumers in what they consider obsolete products, with risk of stock becoming unsaleable. Obsolescence could be precipitated by fashion as well as changes in legislation.

One of the challenging - and risky - aspects would be the liability connected with tough legislation in matter of health and safety. This for example could require a review of insurance practices. The liability would be associated with quality concerns, some products can be easily seen as reusable, and with others the risk is greater and would make a company liable. This would create the pressure cited above to set up activities connected with repair, testing and certification. The problem with products such as pushchairs is that consumers use these intensively, says an industry expert from a trade association. The possibilities are many, from structural damage following a car accident (car seats) to bacterial infestation, this would create considerable risk.

"Because they may have been dropped or damaged, the car might have had a bit of a bump and that really can affect safety aspects of certain products, including car seats." (pushchair manufacturer)

Most players in the industry express uncertainty on the legislation which applies:

"...there would be constraints because if it has been used by somebody else, I don't know the legalities around it, but there would be, you know, we talked about health and safety concerns, it would have to go through certain tests..." (Integrated baby products retailer)

Potential conflicts could arise because of consumers' needs to customize products to accommodate them. Some of this "personalization" and customization of product would be in contrast with a PSS because of the non- acquisition of ownership rights by the customers. Furthermore, one of the issues of this industry is that the products are needed consistently; service or product failures stop consumers from traveling with their child, so there is pressure for suppliers to replace products swiftly.

"...when you've got a baby and you've got a pushchair, if there's something wrong with it, the resolution has to be instant" (integrated retailer).

This would put suppliers under pressure to readily replace failing products.

Our analysis of the data through our framework reveals that participants are concerned with new activities including product refurbishment. For this they may have to establish relationships with new type of dyadic actors; they will need to abide to Governmental power in the guise of liability legislation and considerable investment in resources including skills.

THEME 4: FINANCIAL ISSUES

In spite of beneficial aspects to a relationship based on leasing or renting, where suppliers could hope for regular payments for products which would aid cash flow, participants had several concerns with financial issues.

One of these concerns is that because of an uncertain return of investment and payback period, which would be dependent on the number of cycles that is possible to extract from specific

products, companies would need to allocate considerable capital reserves in order to operate such a system. In other words in spite of a reduced number of products required by the market, individual suppliers might need to invest in a greater volume of products.

“....it will affect our cash flow in terms of we buy the product from our supplier, from our factories, we get it into stock and we normally then just sell it on and then we get the money for it” (Reusable nappies manufacturer)

“...it would impact on our cash flow because instead of (selling) a [product type] for £1200, we would only get, say, £300 or £400. So it costs us money, we still have to pay our suppliers to manufacture it, so it would be, you know, it would take 3 or 4 years to get the same money that you’re (investing), so it’s cash negative, so that would be a problem.” (Pram manufacturer)

Concern also exists with the financial management of collection from consumers, and they see an intermediary as a necessity to manage this interface. The change could require therefore the establishment of a relationship with a new type of partners, e.g. a financial company.

“... (we would need to have) an intermediary, somebody who actually is chasing that money for us, so we are guaranteed (it), so our contract is with the company in the middle. I mean in an ideal world, you’d want a finance house, who yes, you have to discount to but the finance house actually does all the deal with the end consumer, we just deliver the product and we get paid with a discount for the financing and we get paid up front” (Reusable nappy manufacturer)

The adoption of PSS might present financial challenges calling for the establishment of relationships with new actors, the acquisition of credit licensing, investment in financial resources and learning.

THEME 5: LOGISTICS INVESTMENTS

Another problem is linked to the recovery of the products and delivery to a remanufacturing or refurbishing facility. This recovery of pre-used products would require heavy investment in direct and reverse logistics facilities, including for example those to repackaging the products to be re-issued.

“Logistics cost would be a big thing I think because obviously you’ve got the cost of actually doing any work on it, the cost of the parts (and of) storing the parts so knowing what parts you might need, keeping track of those so that you’ve actually got the right ones to be able to refurbish....” (integrated retailer)

In alternative manufacturers and other product suppliers would need to partner with suitable logistic companies:

“... that could perhaps do the servicing of products, possibly technical services, maybe test houses because if you’re going to send something back out that’s already been used, is it safe?” (Integrated retailer)

There would be costs that would need to be met, and these would have to be built in the rental fees charged to the final consumer. There is also a need for responsiveness - consumers might not like to be on a waiting list for products that are in transit for a given time. An integrated retailer of baby products says that they would be inclined to train consumers to perform some of the repairs themselves to keep the logistic operation manageable. Consumers, as they are renting products, might demand their replacement as soon as a problem arises with them.

Our analysis of the interview data has revealed that the perceived development needs for the adoption of PSS by baby product manufacturers, includes relationship management with existing and new actors, activities of direct interaction with consumers, considerable learning and adaptation, financial management and investment in logistics resources. This might give, in line with (Cook, Bhamra et al. 2006), considerable advantages to companies that are already service oriented and have access to sources of knowledge underpinning PSS.

DISCUSSION

Our investigation of managers' perceptions of the difficulties of PSS implementation uncovered considerable concerns for the challenges involved. These include financial concerns and logistic costs, but also more strategic concerns such as brand reputation and products' safety.

One of the key implementation issues of the PSS model appears to be the issue of shouldering the costs involved in the necessary large-scale organisational and system restructuring. The shift to a PSS model would be more painful for big companies due to the need for new organisational structures that can accommodate the emerging requirements as well as the need of new investments. Existing organisational rigidities coupled with current lock-in investments represent a significant barrier to change in large incumbents. Hence it is likely that the switch to PSS will materialise gradually, allowing companies to recuperate their existing investments and accumulate sufficient cash to provide support for the new systems. In addition, organisational culture is typically more pervasive in large companies and tends to form layers of strong resistance to change.

While companies are concerned that lack of punctuality, substandard provision and wider accessibility may cause brand damage, they are also keen to be seen as 'doing the right thing'. Improved brand image, improved communication, close interactions with customers and better understanding of their needs, as well as enhanced brand image and reduced number of 'middle men' are seen as additional attractions to the new market, product and service opportunities, and ecological benefits offered by the model. These benefits are expected to offset to a great extent the anticipated reduction in production volumes and economies of scale.

The findings highlight the critical importance of collaborative mindset and ability to develop and manage relationships for the implementation of the PSS model. The latter requires by definition close involvement of numerous different stakeholders which would enrich businesses' social capital. Both upstream and downstream relationships must be tightened. Innovation on the supply side is likely to be facilitated by more intense relationships with other organisations and relevant institutions as well as by interactive learning relationships with consumers.

A growing stream of research in recent years has recognised the important role of consumers in innovation (e.g. Von Hippel and Von Krogh, 2003, among others). Our findings strongly indicate that consumers must be closely integrated into the company systems for without their contribution and support it is unlikely that the PSS model will flourish. In the light of previous research, this conclusion suggests that the ability of companies to establish, manage and exploit 'porous' boundaries has become a key company competence. However, it could be expected that companies will encounter the full range of challenges associated with networking and collaboration in general, and extensively reflected in the relevant research streams.

Nevertheless, while relationship development and management certainly is resource-intensive, the combination of different types of innovation, i.e. new/reused products and services offerings, use of new materials, organisational and strategic innovation, as well as productive collaboration, and customer retention are seen as having the potential to secure stable economic returns in the long run. Yet, few companies can specify the steps that they intend to follow in adopting and developing the PSS model.

The full impact of the implementation of the PSS model on the economic performance of companies is difficult to assess on the basis of the existing evidence. For instance, a wide-scale research of consumers' perceptions would be extremely helpful in identifying what steps must be undertaken to incentivise and support consumers not only in accepting the PSS model but also in actively participating and contributing to its development. A purposeful effort is required to persuade a wider range of customers that the virtues of the model are not just desirable advantages but necessary changes that must happen if we are to build a new sustainable economy. The benefits that the adoption of the model can potentially generate for consumers, producers ecology, and for the economy as a whole need to be thoroughly examined and evaluated against the risks and costs involved.

However, current performance indicators are not adequate for assessing the wider impact of the PSS model due to their focus on short-term performance. The use of current measurements would paint a misleading picture of what is to be expected. The adoption and implementation of the model require sufficient time for all mechanisms to start working to their full potential and deliver benefits. Hence appropriate measurements that capture long-term performance need to be developed as well as business models that can reduce the risks and costs involved while increasing the benefits for all parties involved.

CONCLUSION

This paper explores the adoption and implementation of a new and little studied business model for sustainable innovation - Product Service Systems (PSS). More specifically, we examine the challenges and benefits that businesses encounter in adopting and implementing the model, and reshaping the existing systems. Our paper contributes to the little existing understanding of why businesses resist the PSS model and what could be done to overcome the resistance. Wide-ranging organisational innovation is needed for the successful implementation of the PSS business model. Willing managers must begin gearing for the adoption of the model by developing concrete plans, appropriate business models, and focusing on the 'how' question and step-by-step implementation guidance. Most importantly, they must start developing close

relationships with suppliers, consumers and other relevant organisations, and collaborate with them in developing plans and business models. A 'go-it-alone' approach cannot work; or, to reprise a well-worn IMP theme: 'no business is an island'.

The adoption of the PSS business model calls for a holistic approach to innovation whereby actors from different industries join efforts in collaboration for innovation and sustainability. Wider stakeholders' involvement and support, including from government and various financial and knowledge-generating institutions, are critical if the PSS model should work. Our findings confirm that businesses, institutions and policy makers must work together for the successful implementation of the PSS model. New business models and innovation ecosystems need to be supported by appropriate accommodating regulations and legislation. The latter will play a key role in the design of the new structures through assigning responsibilities and respectively costs to be born.

Cooperation for innovation holds the promise of environmental and social benefits as well as costs savings through reducing the needs for increasingly scarce resources and the dependence on raw materials. The large scale innovation model discussed in this paper has implications for decision making and suggests that the management of innovation for sustainability needs to be built on an integrative system along the innovation processes rather than on isolated players. A collaborative mind-set and organisational culture are key ingredients in the development of the new system and a major requirement for all players.

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