

# **INNOVATIVE MANAGEMENT MODELS: PRODUCT-SERVICE SYSTEMS**

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### **1 INTRODUCTION**

Manufacturing has changed over time, from craftwork with basic mechanised hand tools to the current manufacturing situation which represents the culmination of technological, economical and social development.

The industrial revolution in the mid 1800s made the transition from craftwork to large factories, mechanisation and, later, to automation of production processes. It was the industrial revolution which led to major changes in the way we manufacture and gave rise to a new management model: scientific management (or Taylorism). Taylorism was based on the detailed division of work, with clear differentiation between planning and execution, and replacement of rule-of-thumb work methods with a system based on the scientific study of the task (de Souza, 1999). It had, as its main objectives, the development of the business and obtaining good financial results, as well as benefits for the workers (such as higher wages and more secure employment). It was the basis of the concept known today as industrial engineering (Gregory, 1995). Taylorism is often mentioned alongside Fordism, a model based on mass production (Winanti, 2007). Ford's idea was to combine mass production with mass consumption in order to obtain sustained economic growth. The result was the production of large volumes of the same product, at low prices for the customer.

Another milestone in manufacturing history was computerisation and automation in the 1960s which brought automated and, later on, integrated production. Ever since, due to technological development and increasing innovative capacity of companies, manufacturing is faced with growing demand for customised products, shortened product life cycles and market saturation. New management systems and philosophies have emerged (such as Total

Quality Management, Lean, Six Sigma, Business Process Re-engineering) to enhance business performance.

Currently we are living in the post-mass production age (Goggin, 1998) when the product/service mix is moving from a resource-based production system to a knowledge-based system called Product-Service System (PSS). Many manufacturing businesses, particularly the Irish ones, cannot compete on low cost or quality anymore. They have to move to a new business system, such as the PSS, to achieve competitive advantage. In this paper the authors introduce PSS as an innovative business concept, which has the potential to deliver economic benefits, while simultaneously reducing the adverse environmental impact of manufacturing. Examples are used to support the authors' arguments.

## 2 MANAGEMENT SYSTEMS AND PHILOSOPHIES TO ENHANCE BUSINESS PERFORMANCE

As competition has grown fiercer, new management systems and philosophies have emerged to help enhance business performance and create competitive advantage. Some of them, which are used on a larger scale in industry, are briefly summarised in Table 1 (Currie, 1999), (University of Strythclyde, 2009) under a number of key dimensions: principles, enabling tools and methods, and business benefits.

Table 1. Management systems and philosophies to enhance business performance

			Product differentiation	Operational excellence	Customer intimacy
<b>Total Quality Management (TQM)</b>	Continuous improvement, focus on customer and processes, teamwork, top management commitment	Benchmarking, Quality Function Deployment (DFQ), Pareto analysis, Plan-Do-Check-Act (PDCA), Statistical Process Control (SPC), team building	Quality improvement, zero defects	Better communication, cost reduction, culture change	Customer satisfaction
<b>Business Process Re-engineering (BPR)</b>	Competitive pressure, eliminate business processes, cross-functionality, automate or liquidate, outsourcing	Strategic vision, top-down process analysis, Management Information Systems (MIS), customer perception		Eliminate non-core business processes, achieve functional integration, greater worker	

<b>Lean</b>	Product /process development, supply management, customer relations, quality improvement	Just-In-Time (JIT), Visual management, Lean methodology (specify, identify, flow, pull, and perfect), Kanban, audits, Value Stream mapping (VSM)	High quality and fewer defects	Reduced waste, reduced machine downtime, reduced cost, reduced human effort	
<b>Six Sigma</b>	Eliminate variability, defects and waste	Define-Measure-Analyse-Design-Verify (DMAIC), Standardisation, QFD, Failure Mode and Effects Analysis (FMEA), Statistics and probabilities, Supply chain matrix, Kano model	Improved quality, defect reduction	Improve process capability, decrease process variation, higher profits, better employee morale	Customer loyalty

All these approaches can help to reduce cost, enhance quality, eliminate non-value activities/processes or increase customer satisfaction. However, competition on the basis of price, time, quality or flexibility has become insufficient for the success of a company. New innovative models are necessary at strategic management level to enhance competitive advantage and to contribute more to customer intimacy. One such model is the set called *product-service system (PSS)*, which will be described in the next section.

### 3 AN INNOVATIVE MANAGEMENT MODEL: PRODUCT SERVICE SYSTEM

Product Service System (PSS) is an innovative concept because it takes a more holistic view of competitiveness on the basis of time, cost, quality, flexibility and environment, achieving more effective use of resources and lower environmental burden, and delivering higher performance than traditional products.

Although the PSS concept has been used mainly in the sustainability-oriented literature, it can be seen as a *business model* that supports ‘servicisation’ of products: ‘*a system of products, services, supporting networks and infrastructure that is designed to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models*’ (Mont, 2002). In the authors’ view, PSS is a specific business model that focuses primarily on

customers' demands and is meant to provide customers with all the benefits (functionality, utility, self-esteem) of the product without necessary ownership of the product, at the same time being less harmful to the environment.

### 3.1 Types of PSSs

A classification of PSSs agreed by many authors (Tukker & Tischner, 2006), (Yang, Moore, Pu, & Wong, 2008), (Brezet, Bijma, Ehrenfeld, & Silvester, 2001) gathers all the types of PSSs under three headings (see Figure 1):

- *Product-oriented services* – the product is owned by the customer; some extra services are added such as planning, financing, installation or maintenance, consultancy
- *Use-oriented services* – the product is owned by the manufacturer who sells the product's usage. This category includes product-sharing, renting, leasing, pooling, pay-per-service unit
- *Result-oriented services* – the product is substituted by a service. Outsourcing, as well as provision of various functional results, is included in this category (e.g. delivery of cold air instead of a refrigeration unit, delivery of warmth instead of a heating device).



Figure 1. Categories of product-service systems, after (Tukker & Tischner, 2006)

This classification of PSS is comprehensive and represents very clearly the transition from product to services and the transfer of product property.

### 3.2 Benefits of PSSs for the Environment

The PSS concept was first mentioned in sustainability-related literature as it was considered that PSSs have the potential to reduce the environmental impact (see Figure 2).

Benefits of PSS to the environment			
<p><b>Increased resource productivity</b></p> <p>By using new technologies and/or new organisational models, PSSs contribute to dematerialisation (Aurich, et al., 2007), (Heiskanen, et al., 2000), (van Halen, et al., 2005)</p>	<p><b>Product life extension and closed loop manufacturing</b></p> <p>It is obtained by preventive maintenance and upgrade services (Roy, 2000), (Takata, et al., 2004)</p>	<p><b>Waste reduction</b></p> <p>Lower level of material use in lease/reuse systems contributes to waste reduction (Tasaki, et al., 2006)</p>	<p><b>Re-orient current unsustainable trends in consumption practices</b></p> <p>Lease/rent systems mean longer product life (Manzini, et al., 2002)</p>

Figure 2. Benefits of PSS for the environment

Many authors, however, doubt that PSSs are more sustainable than physical products. The argument brought by these authors is the ‘rebound effect’ – total consumption increases faster than the environmental efficiency (Tasaki, Hashimoto, & Moriguchi, 2006) (e.g. when energy management services reduce the cost of energy due to more energy efficiency, customers respond by having higher standards of warmth and, therefore, increased energy consumption). Some other authors suggest that the sustainability potential of PSS should be analysed by types of PSS (see Figure 1) or even on a case-by-case basis (Tukker & Tischner, 2006), (Roy, 2000) as various types of PSSs may have different impacts on the environment. The authors believe that PSSs have the *potential* to reduce the environmental impact by stimulating creativity and innovation in the way of doing business and encouraging companies to find solutions for environmental improvements while gaining economic benefits. Companies who offer the product-service have the incentive to produce or use efficient product-services (as they are paid by the result) and to extend product’s lifetime (when they remain the product’s owner).

For example, a company which offers machine washing services would use reliable and energy-efficient washing machines as it is interested in using them for a long time and in having as low usage costs as possible. The use of laundry services involves other benefits for the environment as well, such as the reduction in the stock of washing machines needed to satisfy demand and, therefore, a reduction in the amount of materials consumed in manufacturing, as well as the energy consumed during the delivery and disposal of the washing machines.

### 3.3 Contribution of PSSs to Business Competitiveness

In the current competitive environment, research has shown that innovations in competitive strategy have life cycles of ten to fifteen years (Stalk Jr. & Hout, 2003), (Jagdev, Brennan, & Browne, 2004). This is due to the fact that, in general, as soon as an organisation has found a competitive advantage, its competitors struggle to understand the nature of this advantage and eventually emulate it, so that the competitive advantage soon becomes obsolete and a new innovation must be found. PSS is an innovation that contributes not only to reducing the impact on the environment, but also to increasing business competitiveness because of the reasons presented in Figure 3.

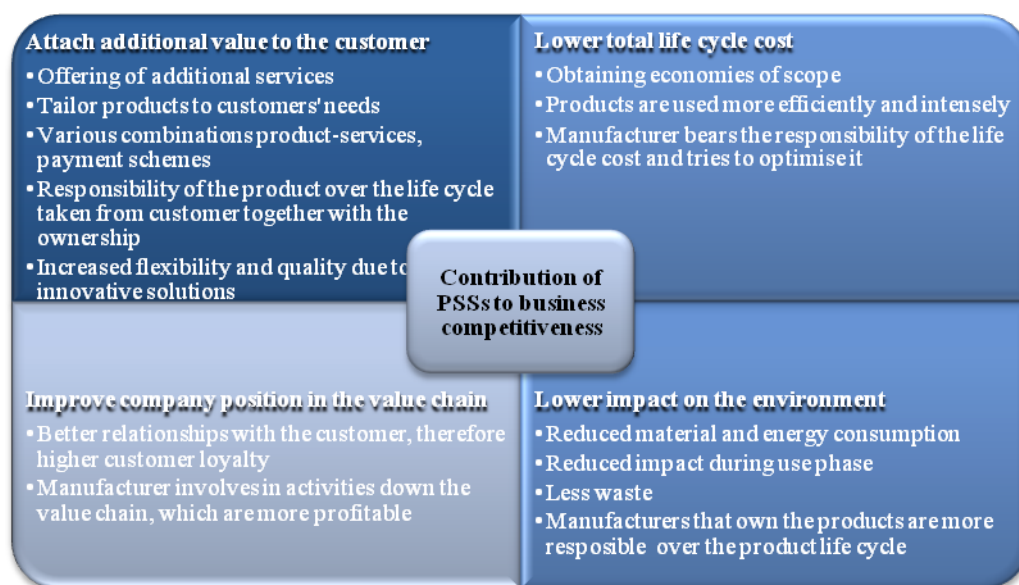
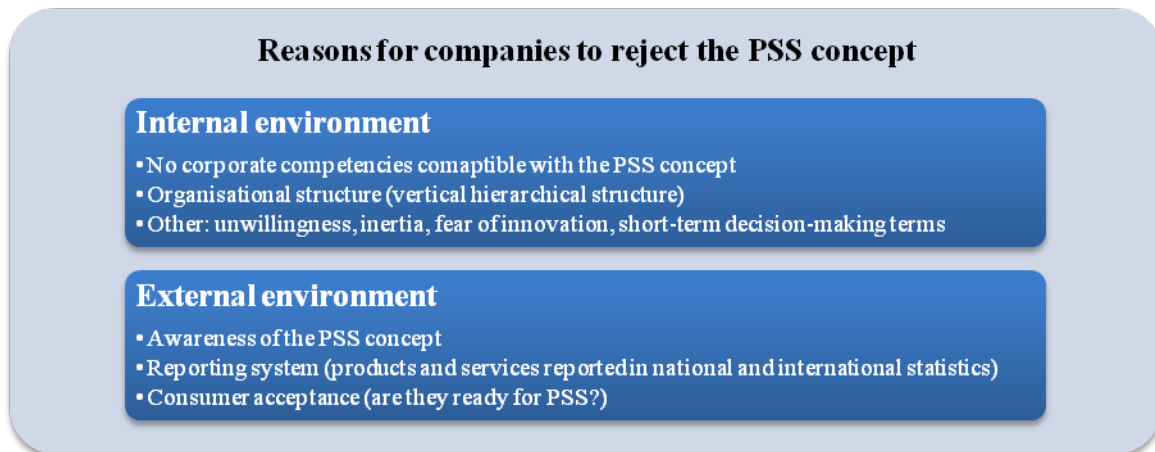


Figure 3. Contribution of PSSs to business competitiveness

### 3.4 Barriers to PSSs

It has already been suggested that the concept of PSS can contribute to reducing the adverse impact on environment of manufacturing processes and products, and it can be a source of competitive advantage. However, many companies are not receptive to PSS for various reasons related to the internal or the external environment of the organisation – see Figure 4.



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Figure 4. Barriers to PSS

### 3.5 Examples of Current PSSs

Some businesses are based on the concept of PSS (such as those in the mobile phone industry), others have adopted new business models based on PSS, as shown by the examples presented below:

- Xerox (Xerox Corporation, 2008) is a well-known company which has lease and ‘pay-per copy’ programmes, as well as toner cartridge collection, take-back, remanufacturing and recycling programmes.
- Toshiba offers for rental a package of four household appliances (automatic washing machine, fridge-freezer, flat screen TV and a cooking oven-range) on a pay-per-use basis. The targeted market is students or other people living alone for a short period. Toshiba covers all the costs related to delivery, installation, repairs, end-of-life recycling within the rental agreement (Tukker & Tischner, 2006).



- The IKEA concept (IKEA, 2008) is based on offering a wide range of low price well designed home furnishing products, combined with cash-and-carry formula, stores at easy to reach locations and parking spaces, children playgrounds and family restaurants. IKEA uses simple cost-cutting solutions that don't affect product quality – efficient packing, storing and transporting – and also has introduced eco-design.
- Douwe Egberts in Netherlands enlarged their activity from supplying only coffee ingredients to offering total solutions for the out-of-home market: development, production, distribution and maintenance of coffee systems (Goedkoop, van Halen, te Riele, & Rommens, 1999). The company aimed at fulfilling needs rather than selling a product or a service.
- Mobility CarSharing (Mobility CarSharing, 2008) provides mobility services in Switzerland, based on economical, technological and ecological efficiency. The company's offer meets the customers' need – mobility – with an integrated package: car plus all associated services (maintenance, insurance, petrol, parking fees).

These are only a few examples of the PSS concept application to successful businesses. They show that PSSs can offer the value of use instead of physical products (e.g. mobility versus car, clean clothes versus washing machine). At the same time PSSs can be more sustainable than physical products as companies own the product and are interested in making the product efficient, reusable and recyclable.

#### **4 CONCLUSIONS**

The authors' research found that the term Product Service System is new to the business literature. It has been used mainly in the sustainability-oriented literature and was linked especially to its potential benefits to the environment.

However, as highlighted in this paper, the contribution of PSS to business competitiveness cannot be neglected. That is why the authors want to introduce the PSS concept to the

business world as an innovative solution for manufacturers, Irish manufacturers in particular, which are under huge pressure coming from the market and from the environment. PSS can be viewed as a business model as it is a system of products, services, supporting networks and infrastructure which is meant to enhance company competitiveness and focus mainly on customers' demand. At the same time, it has the potential to reduce the harmful impact of the company's activity on the environment.

Many companies are not familiar with the PSS concept or may be reluctant to adopt it due to various internal factors, such as unwillingness, inertia or lack of internal competencies to deal with PSS. However, the PSS has proved its applicability and contribution to sustained economic performance in the companies which were open to the concept and have adopted it as their new business model.

The PSS business model presented in this paper is intended to be promoted to Irish and European SMEs during the 'FutureSME' Framework 7 European Project as a method to support competitive advantage. Further research will be carried out to advise SMEs on how to best apply the PSS concept in order to maximise their competitiveness, as well as their environmental performance.

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