TRANSITIONING PRODUCT EDUCATION TO PRODUCT SERVICE EDUCATION

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ABSTRACT
The defining lines between product and service are becoming increasingly blurred. The importance of services is increasing within manufacturing companies and trends are moving towards a more product service approach to business, where both are combined together to provide high customer value. This has resulted in services now accounting for a greater share of profits then manufacturing operations in many 'manufacturing' firms. As a result, designers must now be capable of designing integrated product and services systems (PSS). However, product-orientated design students can struggle to account for the inherent differences between goods and services, and integrate the two effectively. Therefore, a tailored approach to design education is required in order to move with industry demand and convert product-orientated design students to product-service design students. This paper discusses methodologies, tools and approaches used to convert product-orientated design students to product-service design students, providing a structure through which a successful conversion can occur.

Keywords: Product, service, product service systems

1   INTRODUCTION

Globalisation, emerging new technologies, increasing competition, deregulation and economic instability has led to a shifting of Western society from an emphasis on production of goods, to production of services. Companies traditionally focused on the production of products are increasingly required to provide service components in their value offering (see Figure 1 for the process of servitisation within manufacturing companies). Companies seeking to meet customer expectations and requirements with personalized and comprehensive solutions must convert their product strategies into Product/ Service Strategies (PSS). PSS has been described as 'an innovation strategy, shifting business focus from designing (and selling) physical products only, to designing (and selling) a system of products and services which are jointly capable of fulfilling specific client demands' [1]. As a result, companies are demanding designers capable of undertaking both product and service design activities and integrating them into a single cohesive system. However, due to the significant differences in the fundamental characteristics of goods and services [2], many product-orientated students struggle to integrate the two effectively.
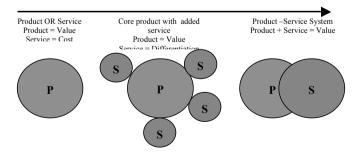

Figure 1. The servitisation of manufacturing [3]

In order to capably design a PSS, students must have the skills and knowledge to understand and implement a broad range of both product and service skills. This paper discusses methodologies, tools and approaches used to convert product-orientated design students to product-service design students. Tools and methodologies developed through a combination of literature review and application within a traditional product-orientated design course will be discussed. To facilitate the discussion, the fundamental differences in products and services will first be examined.

2   PRODUCT VERSUS SERVICE

Some of the main differences between product and service concern the specific characteristics of service development, provision and use (see Table 1 for an overview of these differences). The 'real-time' production of services allows modification of the delivery process at the point of delivery. This interaction between service development and service delivery is higher than that of new product development and production in product manufacturing [4]. Unlike products, which are produced independently from the consumer, service operations are co-created with the customers i.e. a degree of customer input is required in order to complete service provision. Thus, customer misuse can directly affect the service outcome. Production and consumption of services are simultaneous [5]. Due to their intangibility, services cannot be inspected prior to purchase, but must be examined during delivery or post-purchase. Despite these differences, there are similarities in methodologies, tools and approaches in product and service development.

Table 1. Common differences between Manufacturing and Service

Product	Service
1. Object	1. Deed, act or performance.
2. Tangible.	2. Intangible.
3. Produced, distributed & consumed separately.	3. Produced, distributed & consumed simultaneously.
4. High repeatability.	
5. Low customer participation.	4. Low repeatability.
6. Pre-purchase inspection.	5. High customer participation.
	6. Surrogate inspection e.g. Word-of-mouth, brand, personnel.
7. Created by manufacturer.	
8. Low effect of consumer error.	7. Co-created by consumer & provider.
9. High industry standards.	8. High effect of consumer error.
10. No emotional demand on supplier.	9. Looser industry standards.
11. High satisfaction rates.	10. High emotional demand on provider.
12. Product features.	11. Low satisfaction rates.
13. Storable.	12. Service experience.
14. Ownership can be transferred.	13. Cannot be stored.
15. 'Back room' operations.	14. Ownership cannot be transferred.
16. Long change times.	15. 'Front room' operations.
	16. Short change times.

For example, due to their tangible nature, products have clear development boundaries. As a result, he formal design process models are often used in design education. Design process models assist student learning through the provision of a structured approach to industrial design problem solving. In addition they provide a tool for the planning and management of design projects by breaking down the whole process into subordinate processes to which resources can be allocated and whose tangible outputs can be monitored [7]. Although the role of design in service organizations is more difficult to define, a structured design process can also be used to develop service products. Ma *et al.* [6] make services 'tangible' through the use of consolidated architectural elements. These elements provide an understanding of what a service product is, its components and their inter-relationships, which define the service product. Students operating under formal product design models can adapt to include and account for service elements.

User-centred design represents a general philosophy toward design that brings the users or consumers into the design process. The primary aim is to gain insight into the needs of the user which can be both explicit and tacit. This approach is commonly used in both product and service design. Tools such as persons, scenarios, customer journey mapping are commonly used to place the user at the

centre of product and service development processes[8]. Product based user-centred design typically has a narrower focus, for example the interaction between the user and the product, and the context in which the product is being used. Service based user-centred design takes a broader view, for example the service being used, the context of use, the drivers of use and interactions beyond the scope of the service.

Designers are encouraged to consider environmental accountability in their work [9]. For example Design for Environment (DfE), which includes design for remanufacturing, design disassembly and for recycling, is often used to reduce the environmental impact of proposed products [10]. Similarly, sustainable development has occupied a vital position in the field of service design. The service approach taken in relation to sustainability often divides into two main categories, product focused (i.e. reducing raw materials from products and extending their life spans) and socially focused (i.e. appropriate policies or strategies, altering habits or norms) [11]. In particular, a key driver of a PSS approach is the potential of producing synergies among profit, competitiveness, and environmental benefits [12].

As can be seen product and service design are not exclusive. This illustrates that current product design educational practices can be adapted to account for both product and service design requirements.

3 TRANSITIONING TO A PSS MINDSET

As discussed, companies are demanding designers capable of effectively integrating product and service processes into a single cohesive PSS. However, product-orientated design students can underestimate or ignore the potential gain offered by a service within the PSS structure. Therefore, an adaption of their mindset, skills and knowledge is required in order to recognize, develop and account for service components. The following section discusses approaches to converting a product-orientated mindset to a product-service mindset, through the altering of service knowledge, skills and perceptions. This approach draws from a secondary research, focused on all product, service and PSS development; and primary information, application within a third level product design course.

3.1 Broaden the value proposition

Product-orientated students often believe that companies succeed by creating superior products, enhancing the features of existing products, product innovation, product line extensions and new product features [13]. In contrast, students often view services as add-ons whose primary role is to support the functionality of the product i.e. maintenance, repair, distribution. However, within PSS, value is made possible through value co-creation, shifting from the means of production to the means of utilization. The provider role shifts more towards that of a resource integrator, and value is determined by the customer as value-in-use, whether in direct interaction with the provider or in indirect interaction through goods/ services in use [14]. Therefore, product-orientated students must be made aware that services within a PSS offering can provide a high level of customization and flexibility, capable of adapting to the customer's changing requirements, needs and conditions [15]. For example, a single mobile phone can be customised for a wide range of customers through the service offering. Integration of both product and service is key, as offered solutions should provide more value than the sum of the individual parts [16].

3.2 Define the strategy

Product-orientated students are familiar with product development processes and strategies. They have the appropriate knowledge and skills to determine the required stages and resources to bring the product to completion. However, although product-orientated students have a clearly defined product strategy, they often lack the experience, knowledge and skill to define a service strategy. Clarity of strategy within PSS is essential as the type and extent of services offered influences the ability to augment the core product offering [17]. To successfully launch a PSS, students must first decide whether the primary focus should be to support and develop an existing product or product range, or to grow a new and independent platform. They must discern the source of competitive advantage in the service market in which they chose to compete. This provides a base on which to build a systematically coordinated and transparent procedure which can support the development of new services. Due to the combination of numerous components, both new and familiar, it is essential students ensure their strategy emphasizes the smooth integration of product and service factors into a

comprehensive customer solution [18, 19]. Students must learn to take into consideration the additional resources required for increased levels of customer interaction and co-creation as required in a PSS strategy.

3.3 Establish the importance of customer relationships

Product-orientated students utilize customers within the product development processes to generate new ideas, test finished products and gather feedback for continuous product improvement [20, 21]. This interaction can be carried out at specific stages of development as the actual production of the product can be done independently of the customer. In contrast, services are co-created with the customers i.e. a degree of customer input is required in order to complete service provision, and customer misuse can directly affect the service outcome. In PSS, the ultimate aim is to assist customers in their value-creation processes and create long-term relationships [22]. Product-orientated students must learn to apply a holistic perspective on value creation and customer relationships and not view all product and service sales as separate and static. Products, services and customer relationships must integrate together to provide a coherent, cohesive and adaptable package. Shifting perspectives from static offerings to customer activity cycles can help students quantify the level of customer interaction and co-creation required for a proposed PSS and identify opportunities for providing additional value.

3.4 Involve the user

In contrast to product development and manufacture, service provision has a high level of variability. As discussed, due to their co-creative nature, customer can directly affect the service outcome. Therefore, in order to develop a coherent PSS offering, it is essential that students involve the user in the development process. This provides direct insight into potential customer reactions to the value offering and help in predicting the responses of the target market. These insights can be used in the creation of personas and scenarios. Personas are fictitious abstractions of groups of real consumers who share common characteristics and needs [23]. They allow students to consider their Value Proposition from the perspective of their current and potential Customer Segments, to determine customers' main motivation for using their product or service, and to help predict future potential needs and demands. Students can then place these personas in scenarios representing the proposed PSS. Scenarios describe everyday tasks in plain language [24]. Using PSS scenarios allows the student to place the user in the proposed PSS context, discuss the customer's reaction and predict the wider markets potential response.

3.5 Make the intangible tangible

Product-orientated students are familiar with tangible products and can often struggle to visualize intangible services. As discussed, visual representation of a service provides a clear picture of the service structure, and a tangible component to which the student can relate. For example, customer journey mapping can be used to gain a better understanding of customers and greater customer insight by seeing things from the customer's point of view. It describes their experience, but more importantly their feelings and perceptions as they progress through the service. This provides key insights into the potential PSS solution. Similarly, service blueprinting provides a picture of the service system. Like process flow diagrams, blueprints document all the processing steps required but separate activities that can be seen or experienced by the customer (known as front-office activities) from those that cannot (known as back-office activities) [25]. This can be achieved through the use of post-it notes, each representing an activity within the service, which can then simply and quickly ordered and reordered as variations of the service is tested. Once the processes involved have been identified and diagrammed, blueprints are used to isolate potential failure points in the system and to build in processes to correct service failures. By clearly mapping the service process, students can pinpoint the interactions between the product and service and facilitate their integration into a cohesive PSS.

3.6 Measure the success

Product-orientated students often measure success in terms of product revenues and product profitability as it provides objective quantifiable information. In contrast, the intangible and co-creative nature of services makes quantifying resources and results a challenging and complex task.

However, in order to gauge the effectiveness of a PSS, students must consider both objective product information and subjective service information. When designing a service component, students must establish processes and systems to capture the subjective information generated during the service delivery e.g. feedback forms, customer reports, staff reports. In the absence of objective measures, students must rely on the user's perceptions of service quality to identify their strengths and/or weaknesses, and design appropriate strategies [26]. For a PSS in which services can be quantified, it is critical to define value metrics jointly with the user and to measure them systematically [14]. To achieve this, the student must be aware of the balance of product and service within the PSS being offered. In a PSS in which the majority of the value is provided by the product offering, known as product dominant PSS, objective information is of a higher priority e.g. number of units produced, unit cost, product life duration. In a PSS in which the majority of the value is provided by the service offering, known as service dominant PSS, subjective information is of a higher priority i.e. perceived value of offering, customer satisfaction rates, establishment and maintenance of customer relationships. Being aware of objective product information and subjective service information will allow the student to gain a comprehensive view of the entire PSS performance.

4   CONCLUSIONS

Manufacturing companies are increasingly introducing service components into their value offering. This combination of products and services into a singular offering is known as a Product Service System (PSS). There are significant potential benefits associated with a PSS strategy, such as increased revenue, provision of stable and countercyclical revenue source, competitive advantage through customized products and services and higher shareholder value [27]. To meet this trend, designers must be capable of designing processes which account for both product and service requirements. Product-orientated students often struggle to develop and integrate the service component of a PSS due to differences in the inherent characteristics of products and services. Therefore, this paper suggests that a new approach to design education must be taken to enable students to account and design for the differing requirements of both products and services. In order to achieve this, it is suggested that the following are taught to design students in relation to PSS design:

- To recognize the value of services through the customization and flexibility of the PSS offering to meet a broad range of customer requirements, needs and conditions.
- To define the intended source of competitive advantage and develop a clear strategy to either support and develop an existing product or product range, or grow a new and independent platform.
- To approach products, services and customer interactions as a single, integrated and dynamic system.
- To be aware of the customer's role within the PSS and involve them in the development process.
- To visualize services components through tangible blueprinting and service mapping, so the PSS structure and product interaction is clear and unambiguous.
- To account for objective (product based) and subjective (service based) information to provide cohesive feedback on the PSS as a whole.

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