Rethinking Service Design: A Socio-Technical Approach to the Development of Business Models

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Abstract

This chapter introduces socio-technical systems thinking as a tool for the concurrent development of organizational business models and associated service offerings that deliver value provided to customers and suppliers. As organizations offer integrated products and services, interactions and relationships between customer and supplier have assumed greater importance. Traditionally, importance was placed on the customer need and requirements for a physical product. Socio-technical thinking advocates a holistic perspective of complex work systems, ensuring the consideration of both technical and social aspects of a system. Product-service systems are becoming increasingly utilized within organizations and this is illustrated through the three case studies in this chapter. The first discusses the growing trend for manufacturing organizations to move from traditional transactional business models, with a focus on the delivery of physical products, to the inclusion of service delivery. The second case study provides details on manufacturing supply networks and the associated changing business models needed to support the development of supplier capability. The third case study considers changing business models and service delivery in the emerging context of technology-intensive healthcare services in the UK. Finally, a socio-technical framework is proposed as a tool to aid in the development of business models and service delivery using these case studies as examples.

Keywords

- Socio-technical
- Business models
- Product-service system
- Supply networks
- Telehealth

1. Introduction

Business models are the means by which organizations generate value for customers. They are closely tied with the organization's product and service offerings, which act as vehicles for the delivery of value [26, 37, 43, 63]. Current thinking argues for the concurrent development of product and service offerings and the business models through which value will be realized. In this chapter, we introduce three case studies. The first, based on a recent review of UK-based manufacturing, discusses the growing trend for manufacturing to focus on service delivery in addition to the traditional focus on physical products. This is followed by a second case study that provides more detailed service perspectives on engineering design and manufacturing supply networks where changing business models (from make-to-print to design-and-make) are driving an increased focus on service delivery and supplier capability through entire supply networks. A third case study, based in the emerging telehealth sector, considers how this new business model is influencing the design and development of technology-intensive healthcare services in the UK. The chapter concludes by drawing on learning from these three case studies to support the use of socio-technical systems thinking as a tool for the concurrent development of service offerings and associated business models.

Identifying and creating something of value to the customer lies at the core of designing a new product or service [35]. This, in turn, demands an understanding of what potential users might need and want. Unlike the development of a product, the development of a service relies heavily on understanding the interactions between customers and the agents of service delivery, such as employees of both supplier and customer organizations, in order to understand customer experience and value [42]. Many theories and models of service development provide frameworks for gaining insights into what customers and/or end-users might want and need. For example, business management researchers have provided service blueprinting as a technique used to map the processes and interactions between the customer and the service, enabling the identification of value improvement areas [38]. Other techniques include role playing, whereby the role of customer and employee is acted out in a dramaturgical approach designed to highlight the complex interplays of relationships involved in the customer experience [9]. More recently, engineering researchers, whose focus lies in the transition from product to product-service system delivery, have begun to provide tools that engineers might use to understand service stakeholder needs early in product-service system development processes, for example [41, 52], which are intended to accommodate the complex technology-intensive products that are typically parts of product-service systems.

While many service development techniques center themselves on understanding end-user perspectives, with a view to improving understanding of customer value, they have different strengths. For example, blueprinting focuses on defining service processes (which are key components of engineered systems), whereas role playing focuses on the interactions between people (key components of social systems). In reality, both processes and people are just parts of the complex and interacting work systems needed to realize business models that achieve both value for the customer and sources of revenue for the supplier organization [10]. Service designers can benefit from tools and techniques that allow the holistic and simultaneous examination of both social and engineered work system features. Without this holistic approach there is a risk of developing service components in isolation, leading to poor design choices and increasing the likelihood of encountering unforeseen barriers to operation.

2. Case Study One: The Transition to Product-Service Systems Within Manufacturing Industry

Digitalization, globalization, and the use of value-adding networks are widespread in manufacturing industry. As a result, support for downstream engineering processes such as service and maintenance are becoming extremely important in sustaining manufacturing productivity and customer satisfaction. This has led to a strong trend for manufacturing organizations to evolve toward the delivery of product-service systems [32] where margins between manufacturing and service industries are becoming increasingly blurred. A recent study, initiated by the UK Government Office for Science, examined trends and factors that are shaping the UK "Factory of the Future", with the aim of providing a focus for manufacturing research roadmaps [59]. Manufacturing organizations that previously viewed themselves as production-oriented, are now viewing themselves as service providers, with more importance placed upon the nonmaterial aspects of service. It has been reported that a large number of employees working within traditional manufacturing industries are performing increasing amounts of service-related tasks such as the provision of maintenance and support services [50].

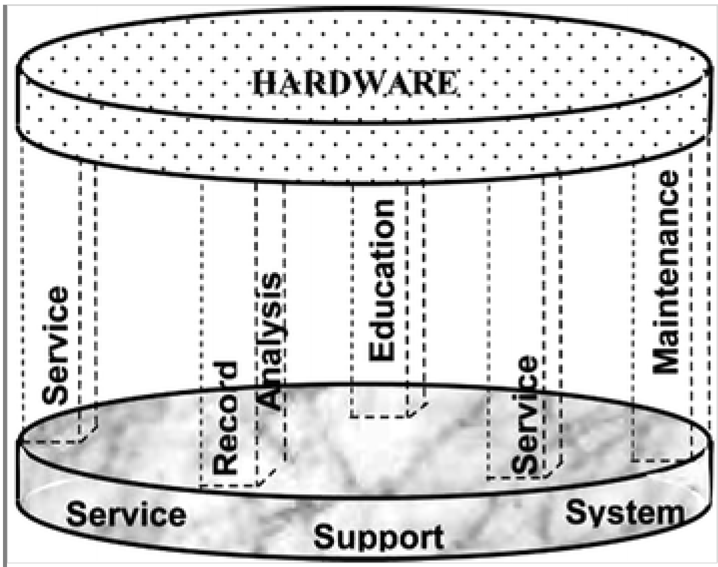
Traditionally manufacturing organizations have operated priced-based business models revolving around the transactional sale of products, with no contractual involvement thereafter. Product-service systems (sometimes referred to as "Total-Care Packages") have been introduced by a number of established international companies including Rolls-Royce, Alstom, Xerox, and Toyota [32]. This case study uses the example of "power-by-the-hour" from Rolls-Royce (http://en.wikipedia.org/wiki/Power_by_the_Hour) to describe the adoption of a service model by a traditional manufacturing organization [7]. Delivering this new kind of offering demands new ways of thinking, which focus around the user and customer requirements for product functionalities rather than the physical products themselves. Isaksson et al. [32] argue that core components of functional product development processes include a focus on finding solutions to customer needs; a high degree of customer involvement (which goes further than being customer-centric); being networked; being global; development with customers, partners, and suppliers; and modeling and simulation support for product-service systems, especially in early phases of the development process.

2.1. Rolls-Royce: "Power-by-the-Hour"

Rolls-Royce, a multinational engineering organization, traditionally sold aero engines to airlines, and would then service those engines under a separate contract. This provided two separate sources of income, but it meant that the customer bore the variable cost of servicing the engines. Rolls-Royce now operates a Total-Care Package business model referred to as "power-by-the-hour". Under this arrangement, Rolls-Royce sell the power of the engine and retain responsibility for maintenance, i.e., they sell the use of the product instead of the product itself. The product, or hardware, is now supported by a service system and its related core functions, such as service, education, and through-life maintenance (see Fig. 1).

Fig. 1

Hardware (product such as an aero engine) is integrated with service support system ('Concept of the Total Care Product: service system supporting the hardware' [5] of all five of Berry



From a customer perspective, they will now pay an agreed sum to cover the hours of power that are supplied by Rolls-Royce, and therefore know the cost of that power over the lifetime of their engine(s). The customer is paying for the use of the product with fewer risks, responsibilities, and costs, as well as the reassurance that the engine will always be in working condition. This new business model is designed to better satisfy the needs of the customer, providing them with more controllable and predictable spend.

So what does this shift to a service-oriented system mean for manufacturing organizations? Solutions now need to target customers whose needs and demands are changing. A vital step in the development of product-service systems is concerned with understanding customer needs [6], and translating them into design requirements [3]. Manufacturing organizations now need to focus more on the quality of their products and services to ensure they address the needs and requirements of customers, i.e., moving from a technical-product focus, to a service-customer focus. A key process that is often overlooked is to identify end-user requirements and establish an effective partnership with the customer [19].

The design of such services impacts organizational structures and working relationships with customers, which are likely to extend more deeply into both organizations, going beyond traditional sales and purchasing-related activities [50, 70]. Improved information flows related to customers' preferences and customer satisfaction are also likely to increase and improve opportunities for relationships with the organization identified. Such interactions with the customer can be viewed as "front office" (i.e., what the customer sees) [47], as opposed to the "back office" activities (which are more concerned with support processes that the customer does not need to see). When changing a business model, "back office" issues also need to be addressed to ensure that customer value is maintained and increased. As well as a difference in the contractual arrangements, a change in mindset is required to enable advancement in line with the new business model. Business models cannot be developed in isolation from the design of the service itself and the needs of key stakeholders such as service users must be considered as part of the same socio-technical process. Business models are becoming more important for organizations, for example, Apple introduced both new and attractive technological products (e.g., the iPod®) and a new business model focusing on a service (i.e., easy digital download via iTunes®), resulting in growth and profit for the company [34]. With a socio-technical systems approach being adopted, the methods and tools used to develop products, as well as the user and organizational aspects can be considered.

From an organizational perspective, manufacturing teams become more closely linked to life cycle cost and service teams, integrating their responsibilities and altering traditional organizational structures. Service/maintenance has an increased impact on, and potentially drives, design and manufacturing changes. This creates more networks and opens up communication channels across the organization. In the case of manufacturing companies for whom a significant proportion of their order book now involves services, such technologies provide opportunities to create new social networks between design communities in one part of the world with service communities spread around the globe [59].

To price their packages accordingly, manufacturers need more knowledge of the whole life-cycle costs of their engines for timescales that extend beyond the life of the support contract, which can be 10 years or more. In essence, what was once "nice to know" has now become an essential part of their operation under the new business model. This now means a higher degree of responsibility for the product's full life cycle coupled with pressure to reduce the total life-cycle cost of the product. Among other things, this means that design communities in manufacturing companies need new tools that enable them to predict life-cycle costs, new roles that include consideration of life-cycle costs, and new relationships with service engineers, that allow them to understand, analyze, and reduce life-cycle costs. If life cycle-costs are estimated incorrectly, the new business model is at risk of failure and the organization will begin to deliver services at a loss. In other words, the new business model has necessitated changes to service design, both in terms of the product and/or service that is accessed by the customer, and also in the way that service is designed and delivered, for instance, to accommodate requirements for different roles and working practices.

2.2. The Importance of People in the Development of Product-Service Systems

When moving to a service-based business model, manufacturing organizations cannot focus solely on their technological capabilities; cultural changes occur, and the change process needs to be user-centric. For example, as the main focus of the product-service system is now on the customer need and design requirement, it is likely that there are a number of inter-organizational changes e.g., outsourcing and links to other companies in the product chain may create the demand for intermediates, and decision-making structures become decentralized [50]. There is currently a lack of holistic methodologies for the design of product-service systems within manufacturing industries [7, 51]. Designers are used to designing products, but now face the challenge of designing these product-service systems and new associated business models. Adopting a socio-technical systems approach ensures that all aspects of the manufacturing system fit together and are integrated, in order to be effective. Complex problems, such as changing the orientation of a business, can be addressed through the use of a socio-technical approach [17, 22] to help the organization understand these different facets, such as people, users, environments, and services.

The role of people within manufacturing has been reported to be of great importance [59]. The need for talented, creative, innovative, flexible individuals, working in multi-disciplinary teams allows the integration of knowledge and expertise when moving to a service-oriented business. Socio-technical systems thinking helps to identify those "softer" issues that are concerned with the operational and organizational aspects of manufacturing, rather than with hard technologies. Although this is the era of information technology, manufacturing organizations should not let technological advances be dominant in designing a service model. That is not to say that technology will not play an important part in the development and utilization of product-service systems. For example, through their new business model, companies can now remotely monitor the condition of their aero engines, collecting useful data on product performance and use [7]. Such information can allow them to improve the product performance and utilization, maintenance service, and productivity, as well as reducing life-cycle cost and providing a reliable service.

The benefits of systems thinking have been highlighted in the literature [5, 44, 50], yet currently, there are few examples of service models being developed using this approach [7, 50], not least a socio-technical approach within the manufacturing industry. Mont [50] argues that system-based solutions should facilitate the move from separate systems of producing and consuming, to a product–service system, where the design of products, services, infrastructure, and networks are integrated to provide a certain quality to customers, as well as minimize the environmental impacts of the system. Environmental sustainability has been seen as a key advantage of adopting a systems approach to product–service systems for manufacturing organizations in addition to the commercial advantage. By improving resource and functional efficiency (e.g., reuse or recycling of materials after a product's life-cycle), companies can subsequently increase productivity and dematerialization, as well as have a lower environmental impact [7, 45, 49]. The green agenda is seen as greatly important to manufacturing organizations with companies such as Rolls-Royce and Toyota investing considerable effort in this regard within their services. The socio-technical framework described in this chapter can be used to provide a methodological basis for the development, practical implementation, and evaluation of the design of product–service systems within manufacturing organizations.

2.3. Key Summary Points

- The need to maintain global competitiveness is driving manufacturing industry to become increasingly service-oriented with the introduction of innovative product–service systems, as opposed to the traditional product–oriented systems.

- This move toward servitization requires new business models and changed mindsets within manufacturing organizations where customer requirements and satisfaction are of increasing importance.

- New user-centric business models are being introduced where the nature of relationships with customers and suppliers are more partnership-like and less adversarial.

3. Case Study Two: Engineering Supply Networks

Traditional supply networks are collections of organizations, which transform raw materials into physical products that are delivered to end customers. Supplier organizations use their specialist competencies and capabilities to produce parts, which are then used to create more complex parts. Success of a given supplier is measured by inspecting the parts it delivers to the customer, and confirming they are within tolerances specified on an engineering drawing. Much effort has been devoted to ensuring that engineering drawings (and, more recently, digital product definitions) define required parts fully and unambiguously, and national and international standards (such as, BS8888 and ISO10303 [12, 33] are in place to support this. More recently, practitioners and researchers have begun to consider how success of whole networks might be measured: in part because, as Fine [27] argues, the ability of a given organization to deliver products to customers depends on the ability of its supply network to deliver products at the right quality, on time and to cost. The pressure to consider whole supply networks has also grown as demands from end customers have changed. For example, the change in aerospace networks where companies such as Rolls-Royce now offer the "power-by-the-hour" service (*see Case Study One)* means that manufacturers need to change from supplying products, to delivering products and product-related services, the aforementioned "Product-Service Systems".

In parallel, as engineering companies focus more on their core capabilities, design outsourcing has become increasingly prevalent [56]. The transition from "make-to-print" to "design-and-make" supplier networks is one example of design outsourcing. A key difference between the "design-and-make" and "make-to-print" model is that the customer provides the supplier with design requirements and the supplier designs and manufactures parts (or subsystems) that satisfy the requirements. This makes the measurement of quality more challenging, primarily because the well-established quality control systems used in "make-to-print" networks are no longer applicable when the customer does not provide the supplier with an engineering drawing. As a result, Supplier Management Systems are being developed to support the control of quality in supplier networks where design as well as production is outsourced; examples include the Rolls-Royce SABRe system [60], the Airbus supply base optimization system [4] and the Graham Packaging Company's supplier quality management system [54]. A key goal of these systems relates to achieving continuous improvements in the supply base, which, given the investment involved, encourages the development and maintenance of long-term supplier–customer relationships. The management of quality using supplier management systems tends to rely on the auditing of suppliers against agreed supplier requirements [40, 48]. SABRe has two core areas of requirements, one related to compliance (with Rolls-Royce and regulatory requirements) and the other related to capability. The Airbus system has similar categories with the same focus on compliance ("focusing on the WHAT') and capability ("focusing on the HOW"). Supplier management and the inherent move away from partnerships, demand integration of engineering and purchasing functions. Van Poucke and Mattyssens [67] refer to this as "purchasing maturity". From an engineering perspective, this demands a change in focus from the delivery of products to the delivery of services through the entire supply network.

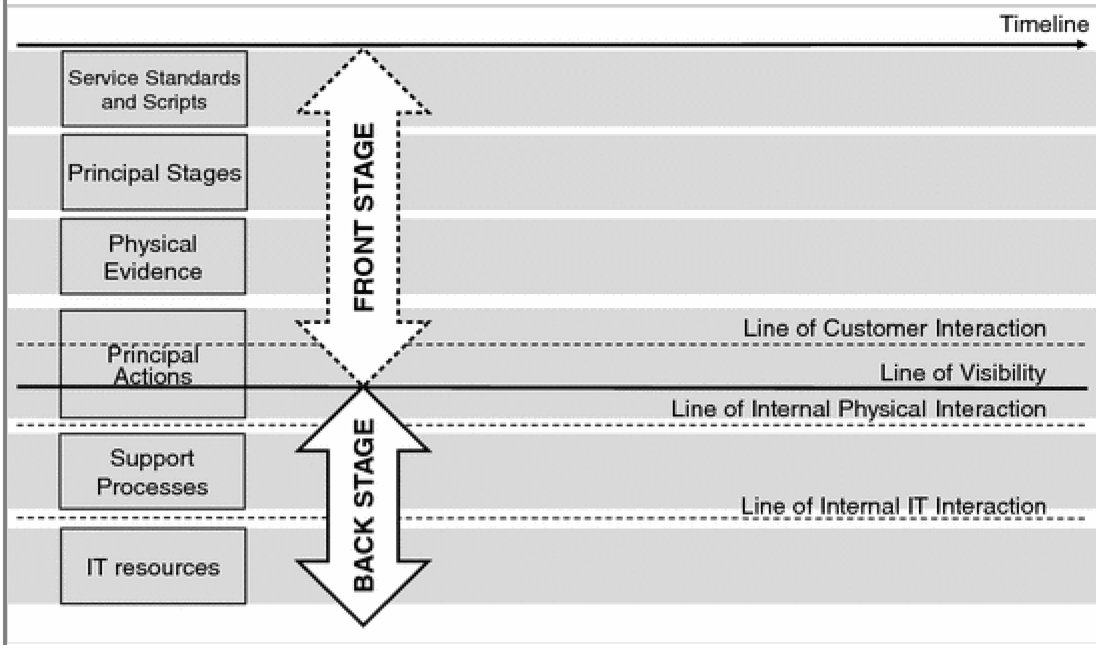
In achieving compliance, suppliers define processes and procedures as parts of their quality management systems that satisfy the requirements of the customer's quality management system. Supplier audits are used to confirm that the supplier is operating these processes and procedures and, through this mechanism, are compliant with the customer's quality management system. Given compliance, a further opportunity for customers to improve the performance of their product development and realization processes and for suppliers to improve their value to the supply network, lies in improving the performance of the supply network as a whole. In highly regulated supply networks, where quality is a given, performance improvements typically include more reliability in on-time delivery and increased levels of responsiveness and innovation through the supply network. Ensuring the continued delivery of these kinds of improvements demands the development of supplier and customer capabilities. In turn, development programs require effective measurement systems if progress is to be monitored effectively. Capability is recognized as being difficult or impossible to measure. For example, in their work on the measurement of business process capability, Vermeulen et al. [68] identify 11 critical factors (including business strategy, organizational structure, and process improvement) that need to be taken into account, none of which are straight forward to quantify and measure. A common response to the problem of measuring supplier capability is to focus on business process optimization. While this may yield desirable results in the short term, the effectiveness of optimization processes depends on, and is limited by, the design and structure of the process being optimized.

One way to overcome the challenges of measuring capabilities and move beyond the optimization of processes is to change the way in which supplier–customer relationships are viewed. In this section, benefits of taking a service perspective are considered. Taking a service perspective changes the focus from optimizing processes to delighting customers [71]. Zeithaml et al. [8, 72] provide an integrated view of quality failures that may occur in service delivery and highlight fives dimensions through which customers judge service quality: tangibles, reliability, responsiveness, assurance, and empathy. These can be applied in engineering supply network contexts where service is being delivered from people in one organization to people in another. An example of good practice is the ABB Full Service® offering where the service development process is itself a stage-gated service process, which takes account of all five of Berry et al. [8] service dimensions.

The schematic of a service blueprint given in Fig. 2 (showing a service blueprint as a collection of swim-lanes) is a useful framework for considering what such a shift to a service focus might entail. The arrows labeled “front stage” and “back stage” are discussed in the first case study. Starting with a definition of a process, process steps can be categorized into the three process-related swim-lanes (Principal Stages, Principal Actions, and Support Processes); the categorization of relationships between process steps is governed by the positioning of the process steps they connect, but could highlight discussion points, for example, when process flows span lines of interaction and visibility. Measures of process performance are not typically captured in process definitions although, for process optimization, they need to be known and quantifiable; these would be positioned in the Service Standards and Scripts. Depending on how the original process was defined, there may be a need to augment the process definition in the blueprint, for example, with the addition of principal stages that may be straight forward to elicit from a structured process definition such as IDEF0, but less so in a flat process definition such as a flowchart.

Fig. 2

A schematic of a service blueprint



On this foundation, issues in the delivery of Berry et al. [8] five perspectives can be considered. “Tangibles” would become explicit in the blueprint, sitting in the physical evidence swim-lane; some tangibles are likely to be associated with process flows, and a key consideration is likely to surround whether all (and if not which) Principal Stages would benefit from physical evidence being associated with them. For example, work with the ABB Full Service® team [2] has highlighted the importance of improving the tangibility of the service, especially in the early stages, which could lead to decisions to introduce new forms of physical evidence. “Reliability” and “Responsiveness” are important requirements of supplier–customer relationships and would be embedded within the Service Standards and Scripts swim-lane. “Assurance” is likely to be improved with explicit acknowledgement of lines of visibility and interaction, which could also contribute to the delivery of “Empathy,” for example, by ensuring the staff know where they are in the service, and selecting/training appropriate staff for customer-facing activities.

It can be seen that moving from process thinking to service thinking inevitably demands more engagement with the socio-sphere. The definition of the Service Standards and Scripts swim-lanes could connect directly with the socio-technical framework (see Sect. 5) where the hexagon would be applied to supply network relationships. In this way, Service Standards and Scripts could be derived from socio-technical perspectives of both supplier and customer organizations, and the goals of the relationships between them.

3.1. Key Summary Points

- Traditional make-to-print manufacturing supply networks are built around formally defined engineering drawings and, more recently, digital product definitions.
- Emerging design-and-make supply networks cannot be based on engineering drawings because the supply process begins with customer requirements, which cannot be specified in this way.
- Supplier Management Systems are used to support the control of quality in design-and-make supply networks where design, as well as production, is outsourced.
- These systems assess both compliance (with customer and regulatory requirements) and capability (to perform as required) ultimately to deliver customer satisfaction.
- Delivering customer satisfaction demands more than the optimization of processes; taking a service perspective allows suppliers to gain insights into barriers, enablers, and improvement opportunities.

4. Case Study Three: Telehealth Business Models

The world is facing a new challenge in providing healthcare resulting from improvements in standards of living coupled with medical advancements, meaning more people are living for longer [28, 61]. In the UK, there are currently 10 million people aged over 65, with this number predicted to increase by a further 5.5 million in the next 20 years; by 2050 predictions see the number of people aged over 65 rise to over 19 million [21]. These changing population demographics mean there is an increasing demand for healthcare services as an aging population develop and live longer with chronic long-term health conditions, such as diabetes, chronic obstructive pulmonary disease, and chronic heart failure [58]. It is predicted that current healthcare services in the UK will reach a crisis point, where traditional models of care (such as in-person appointments and attendance at emergency departments) will no longer be able to cope with the increasing strains being placed upon them [36]. In order to maintain services into the future, healthcare providers and commissioners are beginning to consider new ways of delivering healthcare services that harness technological advancements to improve efficiency and quality by treating people in their own homes; for example, the use of teleconferencing for patient consultations, smart phone apps to deliver healthcare information, and in-home equipment for the monitoring of patient vital signs. There are many examples of how the use of telehealth equipment can not only improve the health of the patient and the quality of the care they receive, but also improve the efficiency and the capacity of existing services [62]. For example, for the UK prison service, some local hospitals have developed the capability to offer hospital outpatient appointments to prisoners remotely through the use of video conferencing, meaning prisoners can access care without the costly need to leave the prison environment NHS [53]. Furthermore in the United States, telehealth is used widely to support veterans with a range of long-term health conditions in their own homes, reducing the need for health practitioners and patients alike to travel to more traditional appointments [24]. While new technologies open up the possibilities for new healthcare products and services there has been limited uptake within the medical profession, particularly within the UK [29]. This means that the potential benefits of telehealth, such as its ability to reduce hospital admissions [62] and improve quality of life for patients [69] are not being realized at a large enough scale to generate the benefits that promise to bridge the gap between available health resources and user demand.

While individual customers can purchase telehealth for personal use, large scale deployment lies in the context of healthcare providers, such as hospitals and clinics, where national and global health policy seeks to influence the adoption of telehealth into public services [20]. The authors' recent investigations into UK telehealth services reveal that, in the past, these organizations have commissioned telehealth using a transactional business model where monies are exchanged for physical telehealth products. These products often come with add-on services that are essential in realizing the value of the telehealth equipment, e.g., connection to telehealth operating software that allows access to, and use of, patient data. In these circumstances the customer (i.e., the healthcare provider) owns the equipment and therefore the risk of costly repairs and the eventual obsolescence of the technology. The use of such business models, therefore, contributes to the limited uptake of telehealth among the medical profession, as they are unable to respond to changing customer needs and fail to guarantee the customer access to working equipment at a predictable cost [11]. A second barrier to the uptake of telehealth is the integration of the equipment into the clinical care pathway for patients. Often the customer, a large complex organization offering multiple healthcare services within an existing infrastructure of care pathways, is required to operationalize the delivery of telehealth services. They often lack the training, expertise, and resource needed to carry out the necessary day-to-day operations [11]; as such many customers choose to outsource aspects of work, such as equipment installation and monitoring, to businesses that offer ready-made services in the form of installation teams or dedicated telehealth monitoring call centers. The authors' recent research into the telehealth sector reveals that this piecemeal approach to the operationalization of telehealth services is suboptimal, with healthcare providers designing services based on the availability of existing "off the rack" products and services rather than being central to the formation of service offerings. As such, many telehealth services fail to realize the value that would warrant further investment from healthcare providers and commissioners, which would see telehealth services grow from pilots and small scale deployments to large scale mainstreaming in the public sector. It can be argued that large scale deployment of telehealth is dependent upon the creation of new and attractive telehealth service offerings and associated business models that better add value for suppliers and customers.

The trend toward services sees new partnerships between supplier and customer organizations called for, whose combined capabilities have the potential to deliver services with a value greater than its component parts [57]. For this reason, the move to service demands stronger relationships than those needed for the successful deployment of telehealth equipment. The formation and development of effective partnerships is regarded as a significant enabler in the design of new telehealth service offering [57]. The successful creation of partnerships presents challenges for suppliers and customers alike, particularly in England, where the National Health Service (NHS) is widely criticized for its disconnected approach to users during the design of services. For example, lessons can be learned from the failure of past technology projects within the UK's publicly funded NHS. A notable recent example is the 10 years National Programme for IT (NPfIT) change project. NPfIT had the vision of delivering better care to patients by equipping staff with a suite of new information technologies, ensuring that they would have ready access to the latest patient information. The project was later abandoned when it was announced that it would fail to deliver the modern IT services the NHS needed [46]. The failure of NPfIT has been attributed to a techno-centric approach that imposed top-down change into an existing work system without adequate end-user engagement [23]. The result was a suite of software services that did not take into account the local needs of different users [46]. In reality, technology is just one part of a complex socio-technical work system that contains both technology and people. For this reason, in order to achieve optimal design, both aspects need to be jointly understood and designed together [17, 22]. Failure to consider wider work systems is attributed to the limited uptake and failure of many technology projects [19]. The introduction of new technology often leads to unforeseen changes in work processes and the characteristics of users themselves can influence the adoption of technology [1, 25]. For example, Touré et al. [64] found that the age of clinicians was a substantial factor in uptake of telehealth, with younger workers displaying more confidence and willingness to engage. The development and implementation of new technology projects in the sphere of healthcare therefore requires a holistic approach that can give equal weighting to both social and technical aspects of the system, which together make up the complex work environment in which telehealth is delivered.

The move to service, and resulting integration of value chains between business partners, requires new tools that enable the co-design of value across these extended enterprises. One such tool is the System Scenarios Tool (SST), which can provide multiple stakeholders across organizational boundaries with a framework to holistically consider the implications of different design choices [31]. The SST is a flexible method of scenario planning underpinned by socio-technical principles, in which the impact of different design choices can be considered across the entirety of the work system. The changes modeled can be at any level or organizational remit however large or small the change. Applying this approach can mean barriers to the adoption of the modeled change can be more readily identified and resolved. The SST is therefore a tool, which can assist in the design of new service offering and business models in the telehealth sector, through the co-design of value across the various interacting business partners and stakeholder groups.

5. Key Summary Points

- Telehealth equipment and services offer opportunities for bridging the future gap between available health resources and demand created by an increase in life expectancy.

- Current use of telehealth is limited by inadequate business models and service designs that fail to generate successful partnerships and value for customers and suppliers.

- Traditionally, healthcare providers have taken a techno-centric approach to the implementation of new technologies, which often results in unforeseen barriers to success.

- Design and implementation of new services can benefit from a socio-technical approach, which gives equal consideration to both social and technical aspects of a complex system.

- Co-creation of value requires new tools such as the System Scenarios Tool (SST), which provides stakeholders with a holistic framework to help model the implications of service offering and business model choices.

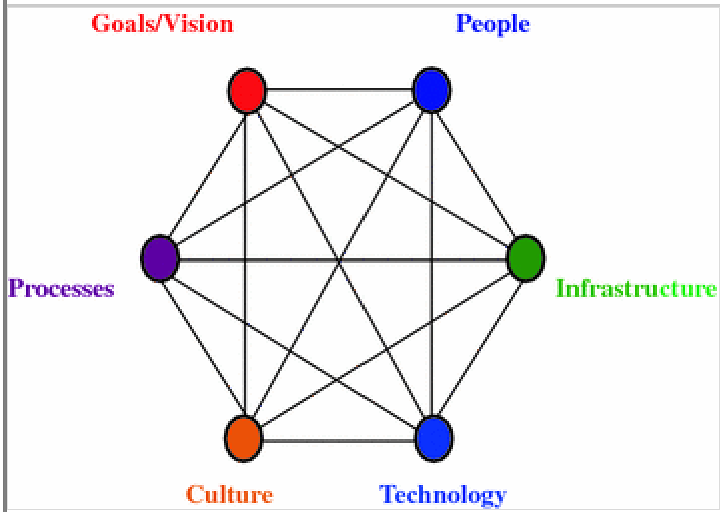
6. Discussion: A Socio-Technical Approach to the Development of Services and Associated Business Models

The three case studies detailed in this chapter together highlight different aspects of changing product and service offerings with connected business models across various contexts. The increasing importance of service thinking and connection to physical technology-based products in the manufacturing sector was highlighted in the first case study and extended to supply networks in the second. In both cases, the importance of service thinking and the possible role of service blueprinting as a means of defining services was highlighted. In the third case study, current trends in the emerging telehealth sector and the role of systems scenario planning in the development of telehealth services and business models were reported. Together, the case studies highlight a shift in focus, from traditional product delivery to service delivery, which requires the concurrent design of service and business models. Effective service design and business model development requires a socio-technical approach, to ensure designers give equal consideration to both social and technical aspects of the complex systems into which they are to be deployed.

The merits of socio-technical approaches to the design of work systems are well documented [15–17, 65]. The approach operates on the principle that any work system designed to deliver a product or service is comprised of both a social system (i.e., people, culture, goals, and working practices) and an engineered system (i.e., technology and equipment, which supports working practices). These two systems are interdependent and interacting, and in order to achieve successful design outcomes (i.e., delivery of the product or service in the desired way) all aspects of the system need to be understood, designed, and improved jointly. Figure 3 provides a visual representation of the components within a social-technical system. This framework has been applied successfully in a number of contexts, to bring a clear and holistic understanding to complex system design [14, 18, 22].

Fig. 3

A visual representation of the socio-technical framework (adapted from [22])



In order to apply this framework, Clegg [17] offers a set of socio-technical principles to guide such systems design. These principles extend Cherns' original socio-technical principles to provide a more integrated approach to design and to address changes in industrial and commercial environments, with the domination of new information and communication technologies providing alternative working arrangements and practices. Clegg splits these principles into three interrelated types: principles concerned with the overall orientation of design (in the form of meta-principles), content (content-principles), and process (process-principles). They are not intended to be applied mechanistically; rather, they provide inputs to individuals engaged collaboratively in design. In particular, these principles have helped guide designers on the potential roles of system users and on the integration of new technology existing (and planned) social systems [39].

While a socio-technical approach can help designers take a holistic view to the design of systems, through the consideration of the wider work system in which services operate, socio-technical approaches are not enough to define and operationalize services. Many authors propose processes for engineering design [13, 55, 66]; a common feature of all of these processes lies in an early focus on the problem to be addressed and the formulation of design requirements [3]. More recently, product-service system researchers have begun to propose similar processes for product-service system design. For example, Hinz et al. [31] provide a generic framework for product-service system development and evaluate current approaches with respect to it. Little attention is paid in these models to means of formulating product-service system requirements. Early research by the authors indicates that, in addition to supporting the design of new solutions, socio-technical systems approaches are useful tools for the evaluation of problem situations and the formulation of design requirements.

6.1. Key Summary Points

- In increasingly complex environments where customers and suppliers co-create value, organizations require approaches to help them understand and design services in parallel with the associated business models through, which stakeholder value will be delivered.
- For successful delivery, service development should also take into account how proposed new services might be integrated into existing and new work systems and systems of use.
- The socio-technical approach states that any work system has both social and technical components that need to be understood, designed, and improved jointly, as a single integrated system.
- The socio-technical approach offers a framework for understanding wider work systems that can be used to improve the development of new service and business models, taking into account both technological and social dimensions.

7. Conclusions

This chapter has explored issues around the transition from physical products to service delivery and the impact this is having on the development of the business models needed to ensure that all stakeholders can realize value from new service innovations. A number of open research issues emerge.

First, services typically form parts of multiple work systems that feature both aspects of people and technology across multiple organizations. Added complication lies in the organizational structures of the stakeholders within each individual organization. A socio-technical approach provides opportunities to take a viewpoint, which gives equal weighting to the social and technical aspects of the design problem, using a framework that gives consideration to the impact of organizational features, such as the structure of system stakeholders, during the design process.

Another research issue that emerges relates to the nature of inter-plays between organizational structures and the business models being used to deliver value; as organizations move toward the delivery of services, extended enterprises are created, where services are essentially delivered by multiple organizations working dependently together. This presents challenges for the creation of new, attractive, and profitable business models, as measuring and attributing value to any one provider becomes more difficult.

A further set of questions relate to the exploration of stakeholder relationships and their dynamics, which must now move from being purely transactional to being an active partnership. Socio-technical approaches, as well as service viewpoints, have long called for the marrying together of perspectives in order to better design services that add value for both customers and suppliers. However, more work is needed to provide developed examples of these partnership working in practice in different contexts.

New developments in technology and information sharing are opening up possibilities for new markets, services, and business models. Organizations and supply chains now stretch across the world. Emerging technologies are affecting both the services and products people buy and the ways in which people and organizations deliver and generate value from them. Designing services and business models to operate in these interconnected and global systems requires new perspectives, ones that enable organizations to consider holistically the networks of people, technologies, and contexts which impact on service delivery. One such perspective is offered by socio-technical thinking. This chapter has introduced a socio-technical framework that has been applied to case studies in three different design contexts: manufacturing organizations, manufacturing supply chains, and the healthcare sector.

However, the transition to service design also demands new roles and working practices internally, and new customer relationships externally. Most fundamentally, a cultural shift is now necessary to ensure that business model development embraces a socio-technical mindset, and is not just driven by technical capability.

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References

1. Aas, IHM (2001) A qualitative study of the organizational consequences of telemedicine. Journal of Telemedicine and Telecare 7:18–26. doi: 10.1258/1357633011936093 .

2. ABB (2011) ABB explains Full Service® strategy [Online]. Available: http://www05.abb.com/global/scot/scot288.nsf/veritydisplay/1c85adcbe8b434a9c1257922001b7ec8/$file/ABB%20Explains%20Full%20Service%20Strategy.pdf Accessed 10 December 2013.

3. Agouridas, V, McKay, A, Winand, H, De Pennington, A (2008) Advanced product planning: a comprehensive process for systemic definition of new product requirements. Requirements Engineering 13:19–48. doi: 10.1007/s00766-007-0055-z .

4. Airbus (2013) Airbus supply base optimisation system [Online]. Available: www.tescra.com/white%20paper/Supplier%20Base%20Optimization%20White%20Paper.PDF and http://freedownloadb.org/ppt/powerpoint-presentation-327168.html Accessed 20 August 2013.

5. Alonso-Rasgado, T, Thompson, G (2006) A rapid design process for Total Care Product creation. Journal of Engineering Design 17: 509–531. doi: 10.1080/09544820600750579 .

6. Alonso-Rasgado, T, Thompson, G, Elfström, BO (2004) The design of functional (total care) products. Journal of Engineering Design 15: 515–540. doi: 10.1080/09544820412331271176 .

7. Baines, TS, Lightfoot, HW, Evans, S, Neely, A, Greenough, R, Peppard, J, Roy, R, Shehab, E, Braganza, A, Tiwari, A, Alcock, JR, Angus, JP, Bastl, M, Cousens, A, Irving, P, Johnson, M, Kingston, J, Lockett, H, Martinez, V, Michele, P, Tranfield, D, Walton, IM, Wilson, H (2007) State-of-the-art in product-service systems. Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture 221: 1543–1552. doi: 10.1243/09544054jem858 .

8. Berry, L, Zeithaml, V, Parasuraman, A (1990) Five imperatives for improving service quality. Sloan Management Review 31: 29–38.

9. Bitner, MJ (1990) Evaluating service encounters: the effects of physical surroundings and employee responses. Journal of Marketing 54:69–82.

10. Bouwman, H, De Vos, H, Haaker, T (2008) Mobile service innovation and business models. Berlin, Springer.

11. Broens, THF, Huis In't Veld, RMHA, Vollenbroek-Hutton, MMR, Hermens, HJ, Van Halteren, AT, Nieuwenhusis, LJM (2007) Determinants of successful telemedicine implementation. Journal of Telemedicine and Telecare 13:303–309.

12. BSI (2011) BS8888:2011 Technical product documentation and specification.

13. Cagan, J, Shimada, K, Yin, S (2002) A survey of computational approached to three-dimensional layout problems. Computer-Aided Design 34:597–611. doi: http://0-dx.doi.org.wam.leeds.ac.uk /10.1016/S0010-4485(01)00109-9 .

14. Challenger, R, Clegg, CW, Robinson, MA (2010) Understanding crowd behaviours: Practical guidance and lessons identified. London, The Stationery Office.

15. Cherns, A (1976) The principles of sociotechnical design. Human Relations 29: 783–792. doi: 10.1177/001872677602900806

16. Cherns, A (1987) Principles of sociotechnical design revisited. Human Relations 40: 153–161. doi: 10.1177/001872678704000303

17. Clegg, CW (2000) Sociotechnical principles for system design. Applied Ergonomics 31: 463–477. doi: 10.1016/s0003-6870(00)00009-0

18. Clegg, C, Shepherd, C (2007) The biggest computer programme in the world… Ever!: Time for a change of mindset? Journal of Information Technology 22: 212–221.

19. Clegg, CW, Older-Gray, M, Waterson, PE (2000) The "Charge of the Byte Brigade" and a socio-technical response. International Journal of Human-Computer Studies 52: 235–251. doi: 10.1006/ijhc.1999.0287 .

20. Coyte, PC, Goodwin, N, Laporte, A (2008) Policy brief: How can the settings used to provide care to older people be balanced? Denmark: WHO Regional Office for Europe.

21. Cracknell, R (2010) The aging population: key issues for the New Parliament 2010. Commons Briefing Paper [online]. Available: http://www.parliament.uk/documents/commons/lib/research /key_issues/Key%20Issues%20The%20ageing%20population2007.pdf Accessed 11 December 2013.

22. Davis, MC, Challenger, R, Jayewardene, DNW, Clegg, CW (2013) Advancing socio-technical systems thinking: a call for bravery. Applied Ergonomics (in press).

23. Department Of Health (2011) Dismantling the NHS National Programme for IT. Department of Health press release [online]. Available: https://www.gov.uk/government/news/dismantling-the-nhs-national-programme-for-it Accessed 12 December 2013.

24. Department Of Veterans Affairs (2013) United States Department of Veterans Affairs website [online]. Available: http://www.telehealth.va.gov/ccht/index.asp Assessed 9 December 2013.

25. Dinesen, B, Seeman, J, Gustafssan, J (2011) Development of a programme for telehealth-

rehabilitation of COPD patients across sectors: co-innovation in a network. International Journal of Integrated Care 11:1–12.

26. Eckhardt, JT (2013) Opportunities in business model research. Strategic Organization 11: 412–417.

27. Fine, C (1999) Clock speed: winning industry control in the age of temporary advantage. Perseus Books.

28. Fries, JF (2002) Aging, natural death and the compression of morbidity. Bulletin of the World Health Organization 80:130–135.

29. Goodwin, N (2010) The state of telehealth and telecare in the UK: prospects for integrated care. Journal of Integrated Care 8:3–10. doi: 10.5042/jic.2010.0646 .

30. Hinz, H, Bey, N, Mcaloone, T (2013) Timing and targeting of PSS methods and tools: an empirical study amongst academic contributors. In: Meir, H. (ed.) Product-Service Integration for Sustainable Solutions. Springer Berlin Heidelberg.

31. Hughes, HPN, Bolton, L, Clegg, CW, Beaumont, LC (2014) Systems scenarios: A tool for facilitating the socio-technical of work system. In preparation.

32. Isaksson, O, Larsson, TC, Öhrwall Rönnbäck, A (2009) Development of product-service systems: challenges and opportunities for the manufacturing firm. Journal of Engineering Design 20: 329–348.

33. ISO (1994) BS ISO 10303-1:1994. Industrial automation systems and integration. Product data representation and exchange overview and fundamental principles.

34. Johnson, MW, Christensen, CM, Kagermann, H (2008) Reinventing your business model. Harvard Business Review 86: 57–68.

35. Kasper, HPVH, Gabbott, M (2006) Services marketing management: a strategic perspective. John Wiley & Sons Ltd., UK.

36. Keogh, B (2013) Review into the quality of care and treatment provided by 14 hospital trusts in England: overview report. NHS for England, London, UK.

37. Kijl, B, Nieuwenhuis, LJM, Huis In ‘t Veld, RMHA, Hermens, HJ, Vollenbroek-Hutten, MMR (2010) Deployment of e-health services - a business model engineering strategy. Journal of Telemedicine and Telecare 16: 344–353.

38. Kingman-Brundage, J (2007) To be added. In: Lovelock, CWJ (ed.) Services marketing: people, technology, strategy. Prentice Hall, Upper Saddle River, NJ, USA.

39. Klein, WR, Lankhuizen, M, Gilsing, V (2005) A system failure framework for innovation policy design. Technovation 25: 609–619.

40. Kundu, S, Mckay, A, Baker, R, De Pennington, A, Thorpe, R (2012) Co-creating value across supply networks: towards an agenda for supply chain design engineering capability development. Cambridge International Manufacturing Symposium: Capturing Value in International Manufacturing and Supply Networks - new models for a changing world. Møller Centre, Cambridge, UK.

41. Laurischkat, K (2013) Computer-aided service design for the development of product-service systems – motivation and benefits. In: Meier, H (ed.) Proceedings of the 5th CIRP International Conference on Industrial Product-Service Systems. Product-Service Integration for Sustainable Solutions. Springer-Verlag Berlin Heidelberg, Bochum, Germany.

42. Lovelock, CWJ (2007) Services marketing: people, technology, strategy. Prentice Hall, Upper Saddle River, NJ, USA.

43. Maglio, PP, Spohrer, J (2013) A service science perspective on business model innovation. Industrial Marketing Management 42: 665–670.

44. Manzini, E, Vezzoli, C (2003) A strategic design approach to develop sustainable product service systems: examples taken from the 'environmentally friendly innovation'. Italian prize. Journal of Cleaner Production 11: 851–857.

45. Manzini, E, Vezzoli, C, Clark, G (2001) Product service-systems: using an existing concept as a new approach to sustainability. Journal of Design Research, 1.doi: http://dx.doi.org/10.1016/S0959-6526(02)00153-1 .

46. Maude, F (2011) Major Projects Authority Programme Assessment Review of the National Programme for IT [online]. Available https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/62256/mpa-review-nhs-it.pdf Accessed 12 December 2013.

47. Maussang, N, Zwolinski, P, Brissaud, D (2009) Product-service system design methodology: from the PSS architecture design to the products specifications. Journal of Engineering Design 20: 349–366.

48. Mckay, A, Baker, R, Kundu, S, De Pennington, A, Thorpe, R (2013) Realising design engineering capability across distributed enterprise networks. The Ninth International Symposium on Global Manufacturing and China. Zhejiang, China.

49. Michelini, RC, Razzoli, RP (2004) Product-service for environmental safeguard: a metrics to sustainability. Resources, Conservation and Recycling 42: 83–98.

50. Mont, OK (2002) Clarifying the concept of product–service system. Journal of Cleaner Production 10: 237–245. http://dx.doi.org/10.1016/S0959-6526(01)00039-7 .

51. Morelli, N (2006) Developing new product service systems (PSS): methodologies and operational tools. Journal of Cleaner Production 14: 1495–1501. http://dx.doi.org/10.1016/j.jclepro.2006.01.023 .

52. Nemoto, Y, Akasaka, F, Shimomura, Y (2013) Knowledge-based design support system for conceptual design of product-service systems. In: Meier, H (ed.) Proceedings of the 5th CIRP International Conference on Industrial Product-Service Systems. Product-Service Integration for Sustainable Solutions. Springer-Verlag Berlin Heidelberg: Bochum, Germany.

53. NHS Airedale (2013) Airedale NHS Foundation Trust website [online]. Available: http://www.airedale-trust.nhs.uk/services/telemedicine/case-studies/help-for-prisoners/ Accessed 9 December 2013.

54. Packaging, G (2013) Graham Packaging Company's supplier quality management system [Online]. Available: http://www.grahampackaging.com/images/QualityMgmtSystem_Manual.pdf Accessed 20

August 2013.

55. Pahl, G, Beitz, W, Feldhusen, J, Grote, KH (2007) Engineering design: a systematic approach (3rd ed.). Springer-Verlag: London.

56. Palm, IVWJ, Whitney, ED (2013) Prioritizing the Many Measures of Success in Outsourced Design. ASME 2013 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, IDETC/CIE 2013. Portland, Oregon, USA.

57. Papazoglou, MP, Ribber, P, Tsalgatidou, A (2000) Integrated value chains and their implications from a business and technology standpoint. Decision Support Systems 29:323–342.

58. Poots, E (2012) Living with long term health conditions. Department of Health, Social Services and Public Safety policy framework [online]. Available http://www.dhsspsni.gov.uk/living-longterm-conditions.pdf Accessed 13 December 2013.

59. Ridgway, K, Clegg, CW, Williams, DJ (2013) The factory of the future. Technical report for UK Government Office for Science.

60. Rolls-Royce (2013). Global Supplier Portal [Online]. Available: https://suppliers.rolls-royce.com/ Accessed 20 August 2013.

61. Rowland, DT (2012) Population aging the transformation of societies. Springer: Dordrecht, Netherlands.

62. Steventon, A, Bardsley, M, Billings, J, Dixon, J, Doll, H, Hirani, S, Cartwright, M, Rixon, L, Knapp, M, Henderson, C, Rogers, A, Fitzpartrick, R, Hendy J, Newman, S (2012) Effect of telehealth on use of secondary care and mortality: findings from the whole system demonstrator cluster randomised trial. British Medical Journal 344: e3874. doi: 10.1136/bmj.e3874 .

63. Storbacka, K (2011) A solution business model: capabilities and management practices for integrated solutions. Industrial Marketing Management 40:699–711.

64. Touré, M, Poissant, BR, Swaine, BR (2012) Assessement of organizational readiness for e-health in a rehabilitation centre. Disability & Rehabilitation 34: 167–173.

65. Trist, EL, Bamforth, KW (1951) Some social and psychological consequences of the longwall method of coal-getting: An examination of the psychological situation and defences of a work group. Human Relations 4:3–38.

66. Ulrich, KT, Shane, SA (2004) Technological innovation, product development, and entrepreneurship in management science. Management Science 50:133-144.

67. Van Poucke, E, Mattyssens, P (2013) The development of purchasing maturity and its impact on internal service quality and supplier satisfaction. Work-in-progress paper [Online]. Available: http://www.impgroup.org/uploads/papers/7874.pdf Accessed 20 August 2013.

68. Vermeulen, A, Pretorius, JHC, Kruger, D (2012) Business processes capability and performance: A South African perspective. Technology Management for Emerging Technologies (PICMET), 2012 Proceedings of PICMET’12. IEEE, 547–559.

69. While, A, Kirk, F (2009) Chronic heart failure: Promoting quality of life. British Journal of Community Nursing 14:54–59.

70. Williams, A (2007) Product service systems in the automobile industry: contribution to system innovation. Journal of Cleaner Production 15:1093–1103. doi: http://dx.doi.org/10.1016/j.jclepro.2006.05.034 .

71. Wilson, A, Zeithaml, VA, Bitner, MJ, Gremler, DD (2012) Services marketing: integrating customer focus across the firm. McGraw-Hill, UK.

72. Zeithaml, V, Parasuraman, A, Berry, L (1990) Delivering quality service: balancing customer perceptions and expectations. Free Press, New York, USA.