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Redefining Healthcare Infrastructure: Moving Toward Integrated Solutions

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***Abstract***

Currently in the United Kingdom there is a trend to broaden the scope of service provision in the healthcare sector. Not only are new healthcare-related services being provided to the community, but also there is increasing concern for providing services to extend the life cycle of built facilities. This trend is similar to what has been observed in manufacturing, where different approaches are used to combine products and services, generating high-value integrated solutions.

This article analyzes integrated-solution approaches that have been adopted in the manufacturing sector and compares them to trends that are emerging in the healthcare sector. The practical implications of these trends in the UK healthcare sector are also pointed out. This study discusses how to improve value generation by combining products and services; it also addresses the need for a value-creating system that is capable of developing and sustaining new healthcare infrastructures.

Some of the major changes needed to achieve fully integrated solutions in healthcare—such as supporting policies for innovation and stakeholder engagement—are pointed out. However, understanding the theoretical concept behind such approaches (and thus how value can be generated) and the challenges associated with introducing them into practice seem to be the first steps toward achieving integrated solutions in the healthcare context.

## ***Introduction***

Transformation and change for a better healthcare delivery system have been the driving forces behind the United Kingdom's government initiatives and investments in the health sector (Sapountzis, Harris, & Kagioglou, 2008). Considering the definition of healthcare infrastructure design as services and the physical environment that supports their provision, there are two major expectations for this reform that have a direct impact on the design of new healthcare infrastructure. These are improving services for patients and thus the supporting physical environment (Darzi, 2008); and improving the performance of built facilities throughout their life cycle (Barlow & Köberle-Gaiser, 2008a).

Delivering better services for patients has been the priority of this program of reform (Darzi, 2008). The government is introducing major organizational changes, such as decentralization and involvement of the private sector, to improve quality and also to provide new services to the community (Department of Health [DoH], 2009). The importance of appropriate infrastructure in which healthcare can be delivered has been widely recognized (Evans & McCoy, 1998; Ulrich, Quan, Zimring, Joseph, & Choudhary, 2004). Design can be a catalyst for change, encouraging fresh approaches to both the organization of healthcare and the design of the environments in which it takes place (Commission for Architecture and the Built Environment [CABE], 2002). Infrastructure design can support new ways of working, contributing to redesigning care around patients and delivering patient-focused environments (Francis, 2002).

In addition, the need to increase facility performance throughout its life cycle has been discussed in the literature (Barlow & Köberle-Gaiser, 2008a). The government has introduced new methods of procurement, in which the private sector becomes responsible for developing, building, and maintaining the built infrastructure throughout long contractual periods. Dainty (2007) and Leringer, Green, and Raja (2007) argue that this is an innovative idea in which the building's clients receive an integrated solution of product plus services and are able to use the asset without the risks of ownership. Such an arrangement has been observed in both the manufacturing and capital industries in which, increasingly, physical products have been combined with intangible services to deliver high-value solutions to customers (Davies, 2004). Here, the concept of value can be understood as the perception of benefits achieved from acquiring a product in relation to the sacrifices associated with its acquisition (Monroe, 1990). Thus, generating or adding value refers to the effort of increasing the perceived benefits of a product or service when measured against the sacrifices associated with its purchase.

Healthcare infrastructure development faces two challenges related to integration: The first is to consider innovative and integrated ways to provide health services to the community; the second is to achieve high performance throughout the entire facility life cycle by better integrating services with the built environment. However, these two issues have been discussed separately in the literature. Some authors have focused on the trend of integrating different and new healthcare services (e.g., Simoens & Scott, 1999); others discuss the introduction of integrated solutions as a way to improve the performance of a building throughout its life cycle (e.g. Leringer et al., 2007).

Similar issues have been discussed in manufacturing. Davies (2004) argues that, in manufacturing, a movement toward the provision of innovative combinations of products and services tailored to customer needs has increased levels of customer satisfaction. The value in the use of products is enhanced as additional services extend their traditional functionality (Baines et al., 2007). By using such an integrated approach, the focus shifts from the “sale of the product” to the “sale of use.” Consequently, manufacturers increase their competitiveness, because such solutions may be clearly differentiated from product-based offerings (Baines et al., 2007). In fact, there is a wide range of integration approaches described in the literature, which emphasize different aspects of value, such as increasing the scope of solutions (e.g., Normann & Ramirez, 1993), extending life cycle (e.g., Oliva & Kallenberg, 2003), and generating value not only for the final customer but to the entire supply chain (e.g., Manzini & Vezzoli, 2002).

Therefore, this article analyzes a set of product development approaches that put forward integrated solutions, which have been adopted in the manufacturing sector, and compares them to trends that are emerging in the healthcare sector. Some practical implications of these trends in the UK healthcare sector are also discussed. The aim of this article is to discuss how to improve value generation by combining products and services; necessary changes in the supply chain that are instrumental in the provision of a new healthcare infrastructure are also addressed.

Initially, this article examines different approaches to integrated solutions in the manufacturing sector. Then, similar concepts that have been adopted in the context of healthcare infrastructure

and their practical implications are analyzed. The article concludes by proposing a framework that illustrates different dimensions of value generation for healthcare through integrated solutions and making recommendations for further research.

### ***Integrated Solutions in Manufacturing: Approaches Described in the Literature***

The idea of generating greater value by moving beyond the delivery of physical assets has been discussed for a long time. Porter (1985) proposed the concept of *bundled products*, in which manufacturers of capital products would offer convenient packages of components (products plus services) at fixed prices. In such offerings, certain features that would be a responsibility for customers in normal situations are passed on to suppliers. One example Porter cites is the approach adopted by Cessna, a business aircraft manufacturer, in which corporate customers were offered a bundle at a set price that included a plane, maintenance, pilots, a hangar, office space, and landing fees (Porter, 1985).

Normann and Ramirez (1993) pointed out that some companies changed their focus to *value-creating systems*, within which different economic actors work together to coproduce solutions. Thus, by reconfiguring roles and relationships among actors, it is possible to mobilize new forms of value creation by new players. Normann and Ramirez mentioned IKEA as an example: key tasks, such as assembling and transporting, are passed on to customers so the company can focus on differentiation and low prices. In addition, IKEA stores provide coffee shops, restaurants, and day-care facilities to provide a better experience for their customers while they shop. Thus, by

combining different offers (products and services), customers can generate their own value (Normann & Ramirez, 1993).

IT IS IMPORTANT TO UNDERSTAND VALUE-CREATING SYSTEMS CLEARLY IN TERMS OF THE INTERACTION BETWEEN PRODUCTS AND SERVICES AND THE RELATIONSHIPS AMONG STAKEHOLDERS (Goedkoop, Van Haler, Te Riele, & Rommers, 1999; Normann & Ramirez, 1993). Novel types of interactions and innovative partnerships are necessary among customers, suppliers, public bodies, and not-for-profit organizations (Manzini & Vezzoli, 2002). As a result, producers and service providers extend their interests beyond their usual boundaries in terms of both product life-cycle phases (preproduction, production, distribution, use, and end-of-life) and connections with other products and services, which are necessary to provide integrated solutions for the customer. This requires providers to develop new capabilities as they shift from being product- or service-centric to customer-centric (Brady, Davies, & Gann, 2005).

Similarly, Thoben, Eschebächer, and Harinder (2001) presented the concept of *extended products*, which is a new way of developing products that some companies have adopted to survive in a competitive global market place. It consists of developing a combination of products and services, which makes the sale more attractive to customers. According to the same authors, customers no longer look for physical products; rather, they focus on the benefit enabled by a value-added service. Thus, by shifting into the provision of benefits rather than simply manufacturing products, companies might become more competitive. In addition, such a strategy can address environmental concerns related to product life cycle and disposability, e.g., the concept of purchasing mobility versus owning a car (Thoben et al., 2001). Therefore, according

to Morelli (2002), several companies are facing the challenge of aligning their production systems with an emerging complex demand. The same author argues that there must be an understanding of customers' needs to enable the provision of knowledge-intensive systemic solutions.

Baines et al. (2007) define a *product-service system* (PSS) as a service-led competitive strategy that addresses the issues of environmental sustainability and has been adopted to differentiate its adopters from competitors who simply offer lower-priced products. According to Baines and colleagues, by considering a product's life cycle, companies increase value for customers by assuming the risks, responsibilities, and costs traditionally associated with ownership while retaining the benefits of enhanced utilization, reliability, design, and protection. This shift to the provision of services throughout the product life cycle is usually associated with three factors (Oliva & Kallenberg, 2003): (1) substantial revenues associated with the maintenance and upgrading of the installed base of a product (rather than its sale alone); (2) higher product margins for services; and (3) greater stability of income streams. Moving the focus from products to the delivery of a function affords the opportunity to break the link between value delivered to the customer and the amount of physical material needed to create that value, referred to as *dematerialization* (Manzini & Vezzoli, 2003).

According to Heiskanen and Jalas (2000), a shift from producing and consuming products to producing and consuming services is central to a sustainable economy; this is presented as one means to reach dematerialization. Cleveland and Ruth (1999) indicate that different definitions have been used for this term, such as a reduction in materials used per product, or a reduction in

the materials intensity of economic activities. The overarching idea, though, is that the use of less material would have a positive environmental impact, among other positive consequences (Cleveland & Ruth, 1999). Goedkoop et al. (1999) argue that such initiatives can be either business driven or eco-driven. However, by redefining the value-creating system, new patterns of consumption and production may emerge.

The importance of considering all stages of a product's life cycle, as well as the connections with other products and services, has led to the emergence of the "through-life management" concept (Koskela, Siriwardena, & Rooke, 2008). Through-life management encompasses designing and producing artefacts, producing services through those artefacts, and planning for deconstruction (or disposal) of those artefacts. Koskela et al. (2008) also state that the central idea of introducing through-life management is to create an understanding of all these stages as one unit of analysis and one integral object of management.

## ***Discussion***

Based on the literature, it is possible to identify that different approaches for integrated solutions have some common aspects: (a) an emphasis on innovation and creativity to solve problems; (b) an emphasis on quality or differentiation rather than volume of production; and (c) an emphasis on decreasing material consumption by combining tangible and intangible assets.

Along with these similarities, these approaches improve value generation in three different ways (see Figure 1):

- (a) *Increasing product scope:* A wide range of customer needs is considered, beyond basic and spoken needs. This makes a product more attractive, which can be a competitive advantage. However, making the product more attractive does not necessarily imply the addition of time-related services—for instance, IKEA stores have multiple functionalities, providing a better shopping experience for customers (Normann & Ramirez, 1993).
- (b) *Considering product life cycle:* Value for customers is enhanced by providing life cycle-related services. This approach also benefits companies, which can increase revenue associated with services while maintaining product ownership (Baines et al., 2007). This also represents an opportunity to address environmental issues related to product disposal.
- (c) *Configuring a value-creating system:* Value is generated by relocating actors in the supply chain (Normann & Ramirez, 1993). The value-creating system should define the interaction between services and products and show how value will be generated for the different groups of stakeholders, such as suppliers, customers, society, and public bodies (Manzini & Vezzoli, 2002). Thus, the focus of value generation is not only on the final users, but also on other groups of stakeholders, e.g., society.

**Figure 1.** Different dimensions of value generation.

[Figure 1 about here.]

The literature on integrated solutions in manufacturing covers from extending product scope to better satisfying user needs; extending services throughout the lifetime of a product; and finally, creating a robust system capable of generating value for final customers, intermediate clients,

other actors in the supply chain, and to society. Therefore, value generation is not simply focused on the end user; it also takes into account a wide variety of actors.

### **From Built Facilities to Integrated Healthcare Solutions**

Similar to what has been observed in manufacturing, THE SCOPE OF HEALTHCARE PROVISION HAS EXPERIENCED MAJOR CHANGES. IT IS BROADENING AND BECOMING MORE PLURALISTIC, CUSTOMIZED, AND DECENTRALIZED. In addition, the system in which healthcare infrastructure is developed is becoming more complex, as a larger number of stakeholders become involved.

In the United Kingdom, a framework for reform devised by the National Health Service (NHS) provides the context, establishing different implications for the development of healthcare infrastructure (DoH, 2005): (a) the provision of a greater selection of services; (b) flexible and innovative patterns of provision; and (c) a closer relationship between commissioners and providers based on transparency and high performance. Such a transformation implies a change in the way the healthcare sector is organized: more hospital services are being provided in local health centers, community hospitals, and even in patients' homes.

One example of a project that is shifting the traditional way care is delivered is the use of 'telecare', which involves information and communication technologies to provide support for vulnerable individuals living in the community. One of the goals of telecare is to increase older people's independence and quality of life by enabling them to live at home whenever possible

(Barlow, Bayer, & Curry, 2005).

Along with those initiatives, new healthcare facilities are providing innovative ways of collocating services. Polyclinics, for instance, are offering a comprehensive range of complementary diagnostic and therapeutic services (CABE, 2009). Such services include medical and surgical out-patient clinics, X-rays and ultra sound, physiotherapy, pain management, hearing tests, health advisers for older people and etc. Also, new primary care facilities are offering community services, such as leisure, IT (information technology) and art based activities for local communities (National Audit Office [NAO], 2005).

The drivers of this reform are somehow established by capturing the requirements of public opinion (DoH, 2006):

- need for less variation in the provision of new services, as well as in the quality of available services ;
- need for more personalized services;
- need for better information about both health and social care;
- need for improved communication both between service users and professionals and between services to ensure consistent, safe, and effective care;
- need for more services to be free at the point of care;
- need for overall improvement of health and social services in inner cities and rural areas and support for older people and vulnerable groups.

Furthermore, for the next 2 decades, a greater focus on preventive healthcare is expected, as well as a shift toward home-based and community care strongly supported by advances in informatics (Department of Trade and Industry, 2000).

To create incentives to develop these modern, responsive community services at a consistently high standard, the government has recently established a Transforming Community Services Programme, in which the commissioning of services will be oriented through a World Class Commissioning (WCC). This will enable new patterns of provision supported by the separation of commissioning and provider functions and through the introduction of new organizations (DoH, 2009).

This means a transformation not only of the characteristics of new built infrastructure, but also of the system in which it is developed, because of the introduction of new stakeholders. Consequently, healthcare infrastructure development must consider: (a) a shift from large built infrastructures to smaller, more decentralized facilities; (b) an emerging focus on community and preventive services, as well as the introduction of new providers through WCC; and (c) a greater reliance on information and communication technology, which emphasizes the importance of developing intangible assets.

The life cycle of healthcare facilities has been considered mainly through the introduction of new approaches to development, such as procurement methods like *public-private partnerships* (PPPs). These approaches include a greater involvement of the private sector, which acts as a

codeveloper of healthcare infrastructure, shares funding for renewing facilities, and takes responsibility for facility maintenance over the lifetime of a contract (Barlow & Köberle-Gaiser, 2008b). According to the same authors, PPPs are expected to: (a) renew the healthcare built infrastructure faster than conventional public funding models; (b) reduce the need for facility replacement caused by underinvestment of the public sector; and (c) introduce innovation through the injection of new ideas from the private sector. In addition, government policy regarding the introduction of PPP also suggests that private-sector partners can widen the range and quality of built environment solutions, as well as strengthen the quality and capacity of management skills to develop them (Devereux, 2008).

PPPs are also expected to be a way to consider the changing patterns of demand and use of healthcare services, which have a direct impact on the type and amount of built and technical infrastructure required to support them (Barlow & Köberle-Gaiser, 2008b). Hayward (2005) argues that because the functional level of buildings is very complex, services need to be delivered jointly and the service mix and methods of operation are varied and, in most cases, unknown at the outset. Consequently, the challenges are how to deal with the uncertainty regarding changes in operational needs over time and how such changes should be considered when planning a healthcare facility.

### **Challenges Shift From Facilities to Integrated Solutions in the Healthcare Context**

PPPs have played an important role in initiatives to transform the UK healthcare system. Two main types of PPPs that have been used in the United Kingdom are the Private Finance Initiative

(PFI) and the NHS Local Improvement Finance Trust (NHS LIFT) (DoH, 2009). Under PFI arrangements, the private sector provides the required asset by designing, building, and financing it; it also operates the facility for long contractual periods. Such services must be provided to the agreed-upon standard required by the consortium. If requirements are met, the NHS trust, which is responsible for providing clinical care to patients, makes regular payments to the private consortium over the term of the concession period (Lee, 2007).

Similarly, NHS LIFTs are PPPs for community-based services. LIFTs are formed by local stakeholders, who will own and develop fully maintained property for primary, community, and social care users (MaST LIFT NHS, 2002). In LIFTs, the priority for investment is in those parts of the country where primary care centres are in most need of improvement (MaST LIFT NHS, 2002). Consequently, these programs are also expected to contribute to the regeneration of deprived urban areas.

It has been observed that the establishment of a single point of responsibility for an entire project from its inception through financing, design, construction, and operation of assets creates a strong incentive to think about the implications that a design or construction decision will have on the operating effectiveness and costs of maintaining a facility during its operational life (Leiringer et al., 2007; Ng & Loosemore, 2007). However, Tzortzopoulos, Cooper, Chan, and Kagioglou (2006) point out issues related to poor requirements management. In LIFT plans, Primary Care Trusts (PCTs) are responsible for redesigning primary healthcare services and are also the “clients” of the new facilities being produced. Thus, they are responsible for a number of activities, including identifying stakeholders, capturing requirements, and informing designers.

However, PCTs have little or no previous experience or skills in design and construction. Accordingly, such issues lead to deficient communication with designers, poor requirements management, increased redesign, and consequently, poor design quality.

Moreover, contractual arrangements in PFI plans and the manner by which risks are allocated can hinder innovation (PriceWaterhouseCoopers, 2008). Because the private sector consortium responsible for the plan bears the majority of project risk, there is a need to ensure certainty as early as possible in the procurement, design, and construction process. Thus, requirements must be specified very precisely and well in advance to eliminate as much uncertainty as possible. Little room is left for negotiating further considerations that can improve facility operational performance, sometimes leading to the development of suboptimal solutions (Barlow & Köberle-Gaiser, 2008b).

In addition, Leiringer et al. (2007) have identified poor collaboration between maintenance providers and infrastructure developers in large organizations responsible for developing an integrated solution of built infrastructure and operational services (e.g., maintenance). The same author suggests that this problem is associated with the degree of importance assigned to issues such as long-term commitment and service provision. This determination was found to be very distinct within and between the operating units while developing a facility under the PFI arrangement and has led to poor consideration during the design phase of operational requirements that maintenance providers perceived as important.

In summary, DESPITE THE INCENTIVES FOR INNOVATION AND FOR DEVELOPING INTEGRATED SOLUTIONS IN THE HEALTHCARE SECTOR, A NUMBER OF POTENTIAL ISSUES THAT HINDER THIS ACHIEVEMENT HAVE BEEN IDENTIFIED:

- poor requirements management
- unsuitable contractual arrangements and risk allocation
- lack of collaboration among different stakeholders

Such findings suggest that not only must the combination of products and services be considered, but also the value-creating system, which should develop, provide, maintain, and deconstruct the infrastructure. Consequently, there is a need to configure and continuously improve this system, identifying key stakeholders as well as defining policies that encourage innovation, high performance, and collaborative work. Moreover, in this context of transformation and organizational rearrangement, the capacity to learn and to continuously improve value-creating systems should also be taken into consideration.

### **Conclusions and Recommendations for future Studies**

This study has identified the strategies that have been proposed for generating a high-value healthcare infrastructure, based on the analysis of a set of approaches for integrated solutions adopted in the manufacturing sector. Similar to manufacturing, in the healthcare context there is a trend toward increasing the scope of service provision and extending the life cycle of built facilities to improve value generation. There is also a shift from generating value to end

customers into the provision of benefits to providing value for different actors in the supply chain.

A wider scope of healthcare solutions is being pursued in the context of the increasing importance of intangible assets through advances in informatics and the decentralization of hospital services (Bosanquet, Haldenby, & Zoete, 2006; Department of Trade and Industry, 2000). Moreover, facilities are expected not only to tackle health issues, but also to promote better well-being, focus on preventive care, and contribute to urban regeneration (DoH, 2006), thus broadening the scope of services to end users. This shift may increase the attractiveness of a building, fulfilling a wider range of needs. Moreover, PPPs have supported attempts to better consider the life cycle of facilities, improving operational services, changing requirements, and maintenance (Barlow & Köberle-Gaiser, 2008b).

Underpinning these changes is a value-creating system that should enable the development and sustainability of such solutions. Figure 2 presents a conceptual framework for understanding the shift to integrated solutions in healthcare infrastructure. The widening scope, the consideration of life cycle, as well as a supporting value-creating system are fundamental elements to achieve innovative and high-performance healthcare infrastructure.

[Figure 2 about here]

**Figure 2.** Conceptual framework of integrated solutions in healthcare.

Such value-creating systems should enable the generation of value for different groups of stakeholders involved in the supply chain. In the context of organizational change, where new patterns of provision are emerging (Bosanquet et al., 2006), not only are new groups of stakeholders being involved, but new roles are also being performed (Tzortzopoulos et al., 2006). Thus, IT IS IMPORTANT TO CONSIDER HOW THIS SYSTEM WILL BE CONFIGURED AND WHAT POLICIES CAN BE INTRODUCED TO SUPPORT SUCH INNOVATION AND HIGH PERFORMANCE.

Although a long path remains to achieve an improved value-creating system and provide integrated solutions in the health sector, it is important to understand fully how value can be generated, who the relevant stakeholders are, and the implications for developing such systems, e.g., the new roles of stakeholders and supporting policies. However, further studies are necessary to identify how to engage different groups of stakeholders effectively to provide such solutions, as well as ways to incentivise and sustain value-creating systems. Achieving a clearer vision of the value that can be generated for each stakeholder may be a form of encouraging stakeholder engagement and collaboration. Another emerging topic of study is how to introduce such changes in a systematic way, enabling learning and continuous improvement.

Successful examples of integrated solutions in the manufacturing industry also could be further explored. Despite the contextual differences, good lessons could be drawn from such experiences. Further studies should focus on the main implications for the healthcare sector and on the way the construction industry and service provision are organized in this setting.

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