VALUE CREATION OF A HOSPITAL IN USE

Abstract

This paper applies the Resource Interaction Approach, utilizing the 4Rs model and the three settings of developing-producing-using to address how to create value of hospitals in use. With starting point in a new cancer treatment facility this case study shows that in the developing and producing settings, little attention is given to the central resources that decides upon the value of the hospital facility when in use.

INTRODUCTION

Hospitals are large and complex buildings that fulfil many different functions in a healthcare system. They are research facilities, educational institutions and not the least producers of healthcare services. To construct such complex buildings requires substantial initial investments, nevertheless even *in use*, the hospital sector alone uptakes an estimated 50% of the total public healthcare expenditures (Rechel el al., 2009). Given hospitals' central function in the healthcare system and the considerable costs associated with constructing and running hospitals, urge better understanding of the mechanisms behind their value creation in relation to other crucial healthcare resources. In this paper we apply *a product development* perspective on hospitals, hence the hospital is developed as a unique product that shall provide specific functions in the larger healthcare system. Applying product development perspective implies that how hospitals are planned for, designed and produced will necessarily affect the hospital's possibilities to fulfill its expected functions and value when the 'product' is ready to use as a healthcare facility.

The paper presents a case study of the development of a new hospital, the Skandion clinic. The hospital is the only clinic in Sweden providing cancer treatment using proton therapy. Its coordinating role as central treatment node in the Swedish healthcare system renders importance to its value. During the planning of Skandion it was estimated that around 1500 patients would receive treatment at the clinic on a yearly basis, whereas the estimated need in the Swedish population amounted to over 2000 patients. Nevertheless, well in use the hospital only treats around 300 patients annually and the clinic have shown large deficits each year (Glimelius et al. 2006, UNT 180221).

This paper explores the gap between the planned product, the needs it was set out to fulfill and the product in use, by investigating the Skandion clinic as a product development process through the phases of development, production and use. Prior studies (c.f. Håkansson & Waluszewski, 2007) have shown that new solutions to a large degree is affected by the empirical context in which the new product have been developed, produced as well as being used (Håkansson & Waluszewski, 2007). In the developing setting the building and its future services are configured, in the producing setting the building is constructed, hence the physical features which set the boundaries for future processes in use are settled. While in the using setting the production of healthcare services are realized and the clinic becomes a treatment facility in the Swedish healthcare system. The case is investigated from a Resource Interaction perspective (Håkansson & Waluszewski 2002; Baraldi, Gressetvold & Harrisson 2012) as to grasp the resource interfaces (i.e. where resources are coupled and interact). More specifically the research question to be answered is: Which are the main factors deciding on the value of a hospital building in use?

THEORY

The Resource Interaction Approach

Resource heterogeneity indicates that the value of resources is highly context-dependent (Håkansson & Snehota, 1995; Snehota, 1990). This means that any resources' value is determined by other resources to which it is coupled. Likewise, it is the interconnected resources that defines a specific resource's area of use. Resources are assumed to have an infinite number of features and can potentially be utilized in an endless number of ways, which specific features of a resource that are activated is decided through its current interactions (Waluszewski, 1990). The very same resource can thus create different outcomes depending on the resource constellations surrounding it.

The value creation of resources is a matter of understanding its current interaction patterns, since no resource has an intrinsic value (Håkansson & Waluszewski, 2002; Baraldi et al., 2012). Therefore, the value of any given resource is based upon its ability to add value to other resources (Baraldi et al., 2012). In interaction processes there is an assumed continuous adaptation taking place between resources, the interaction patterns then unveil not only the subjective value created in each context, but brings forth that value never is static but will change over time (Håkansson & Waluszewski, 2002). This means that as the interactions underpinning a resource *change*, the new interaction patterns will alter the value of the focal resource (Håkansson & Waluszewski, 2002). A longer time perspective offers a picture where resources at the same time are path dependent as well as under continuous change. The *path dependency,* derives from resources' history of earlier interactions and investments in place.

The 4R model have been used in several studies investigating new product development and innovation processes (Håkansson & Walusewski, 2002; Håkansson & Waluszewski, 2007; Håkansson et al. 2009; Baraldi et al. 2012). The model conceptualizes resources into four types: *Products* and *Facilities* which are physical resources. The first refers to artefacts that are created and shaped during interaction and the latter refers to place bound production facilities (Håkansson & Waluszewski, 2002). The social resources are *Organizational Units* and *Organizational relationships.* An organizational unit includes aspects such as organizational structure, competence and the knowledge and skills embedded in the persons of an organization. An *organizational relationship* is regarded as a resource per se, something which is developed over time and that contains bot material and immaterial resources (Håkansson & Waluszewski, 2002). The resource *interface* is the focal point of analysis and the very key function of the 4R model. The interface is central to any resource analysis since it is the 'contact points' of resources where the actual effects of interaction are exposed and can be traced back to specific interactions with specific resources (Håkansson & Waluszewski 2002).

Developing, Producing and Using of New Solutions

There are three empirically derived settings, representing different economic logics for organizations to engage in the value creation of a specific solution (Rosenberg, 1994; Håkansson & Waluszewski; 2007). In this paper we will utilize these settings to capture the product development process of a new hospital. *The developing setting* is associated with high insecurity related to large investments without insurance of future returns. What triggers an organization to engage in development of a new product is related to the specific resource, where a radically new resource will require large adaptations in established structures and thus involves higher costs (Håkansson & Waluszewski, 2007). Capital investments in hospitals is related to highly uncertain as there is little knowledge available to guide decisionmakers of a good way to structure and organize the ways in which hospitals operate in practice (Healy & McKee 2002). *The producing setting's* most important task is to understand whether or not a new resource can generate value for potential users, as future users bring revenues that can motivate production (Håkansson & Waluszewski, 2007). The fundamental aspect a producer has to consider is thus if the investments made in a new resource will exceed the costs of producing it with regard to the users and the production structure (Ibid). *The using setting* relates to finding users seeing the new solution as valuable. In a public healthcare setting it is for example never a question of earning profits, nevertheless economic use of resources needs to be carefully considered as public tax money is used to pay for treatment. The using setting may well use a new resource to diminish costs in already existing processes, or it can change the existing way of doing things by replacing it with something new (Ibid).

METHOD

The investigation is based on a case study approach, which is appropriate when studying the relation between a phenomenon and its context (Dubois & Gadde, 2002). In this case the phenomena is the value of a hospital in use, i.e. constructing an effective health care facility satisfying a complexity of healthcare needs. The case was selected for being a unique health care facility in the Nordic countries requiring specialized solutions related to needs in a healthcare context.

The data of this case has been collected during two different periods in time. The first data was collected in 2012- 2013 with the aim to investigate the very construction project and the interactions undertaken to realize the building (designing, planning and construction). The second part of the data collection was undertaken in 2019, as a follow-up study with the aim to investigate the hospital in use. In the first data collection phase semi-structured interviews (Hesse-Biber & Leavy, 2011) were performed with the client/developer, main contractor, the tenant/user organization, several subcontractors, the architect, the planning coordinator and the med-tech supplier. The second phase of data collection included the head of the clinic, the director of the organization governing the clinic and former project members of the owner of the building. During the data collection the interview guide used was focused on resources and inter- organizational collaboration in tracing the use and development of material and immaterial resources across firm boundaries within and beyond the boundaries of the specific project – across time and space. The interviews also aimed at capturing the different perspectives of the resources and the specialized solutions that evolved during the development, production and use of the new hospital building. In total 23 interviews were performed, 20 interviews during the first data collection phase, and 3 follow- up interviews in 2019. To complement the data regarding the hospital in use additional secondary data was collected between 2018 and 2019, including firm documents, economic statements and newspaper articles reporting on the outcomes of the treatment operations related to the new hospital facility.

SKANDION - CREATING A NEW CANCER TREATMENT NODE IN SWEDEN

The Skandion clinic is a cancer radiotherapy clinic located in Uppsala, Sweden. It provides cancer treatment with *proton* radiation, a therapy that causes less damage to surrounding non-tumour containing tissue than the conventional *photon* radiotherapy[1]. The following case

[1] One third of all Swedes will suffer from cancer at some point during their lifetime, in turn approximately 50% of all cancer patients in Sweden receives some kind of radiation therapy (Cancerfonden 2019, SBU 2003).

description departs from main resource interfaces directing the development, production and use of the Skandion clinic.

The Developing Setting of Skandion

Interface: Treatment knowledge and treatment capacity

The triggering factor for initiating the development of Skandion was a review of Swedish cancer treatment in 1996, it revealed that radiotherapy was at a significantly lower level than international standards (SBU, 1996). The Swedish healthcare system lacked capacity for radiotherapy treatment of cancer patients in need. When proton therapy was a suggested alternative to enhance that capacity another investigation showed that approximately 2200-2500 patients annually could be eligible for proton therapy if available in the Swedish healthcare system (Glimelius et al. 2007).

Interface: Traditional photon therapy and proton therapy

The investment in proton therapy was based on the overall assessment that it would still be superior to the traditional photon radiation therapy as it created less damage on surrounding tissue, despite the potential technological advances ahead in photon therapy (Zackrisson, 2019). Hence, the interface between the two types of technologies changed in favour of introducing proton therapy in Sweden. As a consequence, a decision to build Skandion as a solution for delivering proton therapy was taken in 2003.

Interface: KAS and proton therapy

In 2006 a new organization, *Kommunförbundet avancerad strålbehandling (KAS)*, was established as an independent organization, based on a joint collaboration between the seven county councils with university hospitals and thus specialized radiotherapy competence. KAS would establish and run Skandion and the investment and operational costs should be divided among all the 21 countries across Sweden, since Skandion was to be utilized as a joint resource in the healthcare system as a whole. The organization constructed a medical board consisting of oncologists and hospital physicists from all seven counties. The idea was that all patients had to pass through this medical board to ensure that the patients with most need got access to proton treatment, hence the ‘right patients’. Treatment was thus planned according to ’distributed competence’ where patients would be evaluated on national on-line video conferences on a weekly basis. Hence an important interface between KAS and the treatment procedure of the new technology was established. When planning for the new clinic KAS only consisted of two people; the manager and the chief physicist. In the planning phase the main interest of KAS was to create an efficient patient flow *inside the building*, rather than focusing on national coordination, and thus create economies of scale in relation to the expensive medical equipment. As a result, it was estimated that the clinic would have capacity of treating up to 1500 patients annually.

Interface: KAS and the equipment supplier

KAS signed a contract with a Belgian firm, *IBA*, specialized in supplying cyclotrons for proton radiotherapy to clinics world-wide. As a consequence, an important social interface between KAS and IBA was established and the demands from the equipment supplier to a large extent directed the design & planning of the new building. IBAs requirements were summarized in an Integrated Building Document (IBD) providing measurements and details of the treatment rooms and the IBD was a formal appendix to the procurement contract signed between KAS and IBA.

Interface: KAS and main project organization

In 2010, KAS decided to appoint *Akademiska Hus* (AH) as developer and property owner. AH were prior to Skandion specialized in higher education buildings and not hospitals. Nevertheless, Ah entered a partnering collaboration with *NCC Construction,* while KAS would be the future tenant. AH and NCC together with the planning organization established a main project organization to design and build the new clinic. A social interface was thus established, where KAS needed to decide on the design of the clinical area. In turn, KAS had few individuals in place and no prior experience of building processes, the project organization viewed KAS as 'weak' counterpart.

The Producing Setting of Skandion

Interface: Project organization and equipment supplier

The project organization was in charge of coordinating the construction of Skandion and of translating the requirements, especially from the equipment supplier. Production drawings that would fit the production organization, especially since the production and the planning was taking place in parallel. The social interface between the project organization and the equipment supplier was facilitated by site visits to IBA-facilities world-wide, where the project organization could understand how the equipment was connected to healthcare treatment procedures in practice.

Interface: Project organization and partnering agreement

The partnering contract as a new physical product in coordinating construction facilitated the work by the project organization as it created an arena for constant feed-back. Both partnering units express their satisfaction to work with partnering and make use of each other's competences. This also caused spill-over effects to other actors including IBA and subcontractors. The transparent dialogue enabled by the partnering contract opened up for new possibilities to use art with the aim to create a 'healing environment' as well as the use of digital software (BIM) which diminished 'faults' on site in the production.

The Using Setting of Skandion

Interface: Photon therapy and proton therapy

When KAS was established to develop Skandion in 2006 traditional photon radiotherapy was inferior to proton therapy. Since then the physical interface between the two technologies have changed as photon therapy has undergone large improvements and is 'closing in' on proton therapy. Today photon therapy is a well-established treatment procedure and it is available at all regional hospitals (Zackrisson, 2019). Moreover, photon therapy is a cheaper cancer treatment than proton therapy and is included in the basic care program. Unlike photon therapy, proton therapy has not been subject to any technological development since it was introduced in Sweden. The estimated 2200-2500 patients eligible for proton therapy was based on a broad group of patients, while in reality mainly two groups of patients are remitted to Skandion; children and patients with brain tumours.

Interface: KAS and patient flow

In practice, an average of 300 patients are remitted to Skandion yearly (UNT 180221). The interface between KAS and the new treatment technology have changed as the planned remittance and treatment procedure has proven to be both complex and difficult. At a first stage, it is physicians at regional hospitals that refer patients as 'potentially viable for proton therapy' thereafter 'distributed competence', i.e. the medical evaluation board evaluate each individual patient. If the patient gets accepted for proton therapy a preparation procedure starts at their home clinic[2]. Each patient is allocated both a responsible oncologist at their home clinic and at Skandion. While at Skandion, the patient has to go through the same preparation procedure to confirm the accuracy of the data from the home clinic. When the treatment period is over, the patient returns to their home clinic for aftercare and check-ups[3].

Interface: R&D and Patient flow

The distributed competence also has negative effects on research and development since physicians have to share their time between Skandion and their home clinics. The lack of R&D also impacts the possibilities of broadening the patient group eligible for proton therapy. The lack of patient flow is the largest challenge for Skandion, a broader range of cancer patients could potentially enhance the number of patients at the clinic. However, in order to establish standard procedures and opening up for other patient groups more evidence-based studies are required.

Interface: KAS and the regions

Looking at the social interface between KAS and the different regions remitting patients to Skandion it is evident that the geographical sourcing of patients is biased. Until 2017, 145 patients were remitted from the Uppsala region, to be compared with 19 patients from Linköping and Örebro (UNT, 20180221). Thus, the Uppsala region is an important provider of patients to Skandion. An interesting aspect is that the proton technology has been available in Uppsala since the 1950s, then at the The Swedberg laboratory[4]. The knowledge about the method and its effects are thus well embedded in this specific region and user environment.

Interface: KAS and reimbursement systems

The cost of conventional photon radiotherapy is carried by each region through basic care programmes. For proton therapy the physical reimbursement system is different since KAS is an interdependent ’stand alone’ entity, charging other counties. Hence, the interface between KAS and the reimbursement system is more complex and difficult. The initial agreement between the counties was based on a fixed yearly fee covering 50% of the total costs to run the clinic and then the counties were charged per treatment, the cost per treatment is expensive and paid by the single clinic. Also, the fixed costs for running the clinic are very high (constantly running of the cyclotron and rent) and the variable costs per treatment is low, resulting in the difficulty to cut costs. From January 2019 the fixed fee from each county should cover 70% of Skandion’s total costs. In order to help with its deficit, KAS need to increase its intake of patients, while the remittance of patients is in the hands of regional physicians.

Interface: KAS and administrative systems

KAS as an organisational form entails self-governance, as a consequence KAS have to establish physical administrative systems such as it-systems, digital patient records, financial and payroll monitoring and procurement competence by themselves. These systems are normally handled by large administrative units within each county. It turned out to be difficult for Skandion to settle administrative systems for information sharing and coordination of

[2] One of the seven university clinics. The preparation procedure at the home clinic take around two weeks.

[3] Comparing the treatment procedure at Skandion to other similar proton radiation clinics abroad reveal that most clinics have a cohesive treatment procedure in the sense that all preparations, treatments and aftercare are handled at the same clinic.

[4] The Svedberg laboratory was closed when Skandion was established.

treatment procedures between the involved caregivers. In 2019 the main administrative systems used belonged to Uppsala county.

Interface: KAS and the equipment supplier

KAS still has a close relationship and strong interface with the cyclotron supplier in the using setting. The supplier has a maintenance team on site to monitor the equipment at all times working in close cooperation with the rest of the personnel at KAS. A cyclotron has to be active at all times, hence it cannot be switched off. Overnight the maintenance team tests and calibrates the equipment. Regarding the technological development of the equipment Skandion follow the continuous developments undertaken by IBA. The cyclotron cannot be replaced as such, rather it is a question of continuous upgrades in software or changing specific components.

Interface: KAS and the property owner

The social interface between KAS and AH still remains but the set up is unusual for a hospital where the property owner normally is the county. AH is a state-owned company with its core business in educational buildings. They have a long experience in complex building projects with high functional requirements, while Skandion is thus a unique building even in this context and does not really "fit in" to the core business. AH is a profit-driven organization with the goal to generate a profit, which means it has a different economic logic than non-profit public healthcare. In 2019 a discussion of KAS taking over as property owners have been initiated which gives KAS more freedom to make needed changes in the direction of their current activities.

CONCLUDING DISCUSSION

The interfaces displayed here above points to the imbalanced assessment of the hospitals value creation in the different settings. In the developing setting interfaces were mainly focused on estimation of future prevalence of cancer including a broad set of cancer patients, also the consequences of rapid technology development of conventional photon therapy was not taken into account. At the same time the treatment and patient flow was mainly focused on the patients within the future hospital walls without consideration of how to actually remit patients from the healthcare system as a whole. The production setting's focus was on establishing the physical set up of the clinic including an efficient use of the cyclotron in-side the clinic, at the same time the tenant and healthcare organization responsible for treatment was considered as both weak and immature. The using setting is far more complex than anticipated and planned for in the development and production of the new hospital. For instance, the planned 'distributed competence' resulted in both lack of R&D in proton therapy which in turn affected the possibility to enhance the patient flow and thereby broaden the patient groups being remitted to Skandion. Moreover, it also caused a very complex and time consuming remittance procedure while in use, hence few patients could be remitted as the 'power' of remitting patients was in the hands of regional physicians, hence outside the power of KAS. Also, the preparation procedures included double work. The role of KAS as a new organizational form impacted the use of the new hospital as KAS themselves had to establish new administrative systems and develop new reimbursement systems, which has not been considered as problematic and costly in the design and production of the actual hospital. Altogether these aspects hindered the establishment of Skandion as a valuable new solution in the national healthcare system in Sweden. What can be noted is that proton therapy has high fixed cost that do not vary in relation to patient flow. Yet, the patient flow is the central resource necessary in order to increase the value of the hospital in use. Strongly related to the in-flow of patients are *firstly* R&D in relation to protons as to include a broader category of patients. *Secondly* easier remittance procedures and an integrated preparation procedure of patients as to avoid double work. However, that would require an alteration of the premises – a new building.

The most important factors to decide on the value of this building in use are related to a broader understanding of the organization of healthcare processes, how they are coordinated - from diagnosis to after treatment - research and development in the cancer treatment area, reimbursement procedures and coordination of activities in the system at large. The medical needs in terms of statistics, the performance of the specific technology and the internal processes of the single building - the most prominent features in the developing and producing setting - are of less importance for the building to create value in the system. Yet these features, settled in the developing and producing settings, sets the boundaries for the clinic's possibilities to adapt to central resources in the system as they change over time.

It could be possible that the value of hospitals to a large degree are taken for granted given their central position in the system. To evaluate a hospital's function from the perspective of the larger system, where they fulfil specific functions in relation to other central resources could potentially enhance the capacity of the system and aid the public sector to harvest the value of investments in very expensive healthcare resources as hospital buildings.

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