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Strategies for optimization of value in hospital buildings

Peter Johann Hareide[a]*, Svein Bjørberg[b], Marit Støre-Valen[c], Amin Haddadi[d] and Jardar Lohne[e]

[a]*M.Sc. Student, Department of Civil and Transport Engineering, NTNU, Høgskoleringen 7A, Trondheim 7491, Norway*
[b]*Professor II, Department of Civil and Transport Engineering, NTNU/Multiconsult, PB Skøyen, Oslo 0213, Norway*
[c]*Associate Professor, Department of Civil and Transport Engineering, NTNU, Høgskoleringen 7A, Trondheim 7491, Norway*
[d]*Ph.D. Candidate, Department of Civil and Transport Engineering, NTNU, Høgskoleringen 7A, Trondheim 7491, Norway*
[e]*Research scientist, dr. art., Department of Civil and Transport Engineering, NTNU, Høgskoleringen 7A, Trondheim 7491, Norway*

Abstract

Nearly half of the Norwegian hospital buildings are reported inadequate for today's procedures, causing an estimated upgrading cost of NOK 35-45 billion. Sykehusbygg HF (SBHF), a late-2014-established nationwide trust, aims to contribute enhancing pre-design stages in hospital building projects. This paper investigates how value is created in hospital buildings through pre-design. Furthermore, it assesses which strategies that ought to be present to add value in future hospital buildings.

This paper is based on case studies involving four Norwegian hospital buildings, with completion dates spanning from 2000 to 2015, and pre-design starting 12-15 years earlier. A literature review, document studies and semi-structured interviews with key personnel from the four hospitals and SBHF were conducted and constitute the main source of information. The results focus on current routines in pre-design of hospital buildings, and strategies for adding value in future hospitals.

The research reveals that a valuable hospital building is *a building creating optimal conditions for effective delivery of the healthcare services.* As of today, an awareness of strategies for optimizing value exists among actors from strategic levels, but these are not necessarily utilized as intended. A reported usability condition and a backlog of maintenance, development, and operational services support this statement. In brief, value within hospital buildings is added by focusing on adaptability, life cycle costs, and strategic involvement of facilities management.

This paper identifies possible measures for value adding in pre-design, contributing to enhanced future planning of hospital buildings.

Keywords: hospital buildings, value, pre-design stage, life cycle planning, facilities management

1. Introduction

There are high costs related to a highly developed healthcare system, but without investments, an unhealthy population in working age will contribute to large annual expenses (Nedin, 2013). Larssen (2011) claims that hospital buildings only serve one purpose: assisting the healthcare services to be as functional as possible. The healthcare sector in Norway occupies more space than any other public sector with a total building stock of 4.9 million m^2. Estimated monetary value of hospital buildings was in 2013 NOK 76.7 billion (Norwegian Ministry of Health and Care Services, 2013). The Association of Consulting Engineers in Norway (RIF) reports an annual downgrading of maintenance, development and operational costs within hospital budgets, consequently leading to a backlog with nearly half of the hospital buildings reported as unacceptable for use (RIF, 2015). Apparently, a common approach of planning hospital buildings on a national level seems lacking, with several new hospital buildings holding different solutions of future development. The healthcare system in Norway is divided into four regional health authorities, and much competence and experience stay within each region authority, however with few routines on how to exchange this. As an initiative to improve the hospital buildings, the Ministry of Health and Care Services introduced the trust Sykehusbygg HF (SBHF) late 2014. SBHF's purpose is to aid the health region authorities in planning and

* Corresponding author. Tel.: +47 95780114.
E-mail peterjh@stud.ntnu.no

construction of new hospital buildings, as well as development of the facilities management (FM) of existing hospital buildings (SBHF, 2015).

This paper explores the understanding of value in hospitals and search to identify the value proposition of hospital buildings. Accordingly, the purpose is to look for *Strategies for Optimization of Value in Norwegian Hospital Buildings, and how the building can add value.* In order to address the statement, answering three research questions respectively composes the assessment:

1. *What is value in a building context?*
2. *What creates value within hospital buildings?*
3. *Which strategies are required for future development of hospital buildings?*

2. Research methodology

This paper presents the results of a research involving a comprehensive literature review as well as examination of five cases, thus applying the triangulation methodology in qualitative research (Yin, 2013). The literature review aims to create a theoretical framework within the topic and the research questions. When searching for relevant literature, the stated keywords *hospital buildings, added value, pre-design stage, life cycle costs, adaptability, and facilities management* respectively composed the foundation of the review. Internet queries through library databases, as well as curriculum literature from previous courses attended, constitute the main source of information in the theoretical framework.

A total of five cases were investigated, involving four Norwegian hospitals and the recent established health trust SBHF. The hospitals were selected on basis of their completion dates, spanning from 2000 to 2015 with pre-design starting 12-15 years earlier, thus enabling an analysis of how planning of hospital buildings has evolved. The studies consist of document readings, and at three of the hospitals and SBHF, open-ended semi-structured interviews were conducted. At the fourth hospital, the authors led a workshop with four employees from the FM-department. The interviewees had background from design and project management, FM-services and pre-design projects, respectively.

The reviewed hospital buildings were from merely two of the four health region authorities in Norway. In hindsight, cases from the remaining two regions could have been studied to achieve an improved generalization of the findings in the paper. Moreover, key personnel from the administration of the health region authorities, Ministry of Health and Care Services and SBHF could have been interviewed to attain additional material regarding upcoming strategies of development of hospital buildings in Norway.

3. Theory

3.1. The concept of value in a building context

As there are several definitions of *value*, it is challenging to describe the notion with one single definition. The simplest description of the notion is to express value as subjective, with an interpretation differing from each individual conducting the assessment (Ashworth & Hogg, 2000). Another, more common approach of defining value in mathematical terms, is to assess the relationship between needs, functions, costs and used resources (Kelly et al., 2008; Institute of Value Management, 2015). To evaluate value in a building context, Dewulf and Wright (2009) argues that value should be defined by in which degree a building is flexible and supportive of the core business activities in the operational phase. Blanc-Brude et al. (2006) and Smit and Dewulf (2002) present comparable definitions, stating that inexpensive solutions to provide a prompt and low-cost construction will decrease the life time value of a building. This can certainly be related to hospitals, which are buildings that demand frequent refurbishment and upgrading and having short Service Life Periods (Bjørberg & Verveij, 2009). The inexpensive solutions can lead to challenging refurbishment or upgrading when required, decreasing the usability of the building.

Added value is said to be a contribution from a process of developing products. In other words, a thorough analysis with a focus on how to satisfy the client in best way possible can add value to a product (Ashworth & Hogg, 2000). Added value should then be explained as the satisfaction from the client using the product, not the producer. *Intrinsic*

and *extrinsic* value of buildings are two notions that can be related to added value. Kelly et al. (2015) define the two notions respectively as expectations to the new building before completion, and satisfaction with the building after completion. Intrinsic value can also be a driver through the pre-design stage, participating in decisions on how the building should appear. Extrinsic value is obtained from a completed building's aesthetics or smart solutions adding value to owners, users and neighbours, independent of the ownership of the building. The expectations from intrinsic value are realized with *instrumental value,* which depends on how the building has attained its intended functions according to the goals made in pre-design stages (Hartman, 2011; Perry, 1914; Wagner, 1999; Zimmerman, 2001).

Value management is a process that creates adequate functions to the most inexpensive achievable cost (Kelly et al., 2008). The process is an organized analysis method with the aim of identifying and eliminating unnecessary cost without compromising the functions. Value management provides a holistic evaluation of the different phases of a building: from pre-design stage to operational phase. Through a strategic function analysis, a project's purpose and object is examined. By identifying and creating a breakdown structure, ranking the functions from *higher order needs* to *lower order wants*, it is possible to eliminate the functions not contributing in attaining the project's purpose. The breakdown structure is established through asking *how* and *why*. This method is called *value improvement,* where the first step should be requirement definition, identifying and classifying functions through workshops. After requirement definition phase, the next steps are to evaluate and optimize the specifications (Kelly et al., 2015).

3.2. What creates value within hospital buildings?

The Norwegian healthcare sector was in 2002 divided into four regional health authorities, subdivided into 25 regional health trusts. Each authority has the responsibility of offering necessary healthcare services to their belonging population as well as strategic guidelines for future development. The health region trusts are the hospital-building owners, with all the responsibility associated with the ownership (Norwegian Ministry of Health and Care Services, 2013; Norwegian Government, 2014). Previously, the 19 county authorities in Norway was the owner of the hospitals, but with the dividing in 2002, the Norwegian Government was granted the ownership. Consequently, much FM knowledge remained with the county authorities, and the new health region authorities organisations had to start acquiring their own knowledge, experience and competence (Larssen, 2011). Norwegian hospital buildings are reported to be of an average age of 45 years, according to *State of the Nation* by RIF (2015). Annual budgets for the hospitals are approximately NOK 25.000 /m^2; where 1 % *should* be used for maintenance, keeping up with technical functionality, and replacements. In reality, only 1/3rd of the 1 % is actually being used. As a trend going on for years, the result is a backlog in the hospital building's overall standard. RIF claims that merely half of the buildings contain good or acceptable standard, and the cost of upgrading the technical and building standard to today's requirements is estimated to be of 35-45 billion NOK. In addition, the hospital buildings are not designed for today's procedures, as the structures do not possess adequate adaptability. Hence, RIF states that the health authorities have to deal with unnecessary costs related to low efficiency, logistics, and ineffective space use. Most of the hospitals referred to were constructed in the 1950s and 1970s. In recent decades, the sector has developed into regarding the patient as a customer of the healthcare services, causing an increased focus on how physical environment in hospital buildings affects the patients (Støre-Valen et al., 2014). The authors of this paper believe that these needs will increase according to demographic trends, as it is expected a larger amount of 60 year-olds than 15 year-olds in 2050 (Nedin, 2013).

The Norwegian Directorate of Health has published a pre-design guideline, addressing the importance of developing a healthcare activities plan and a building design plan for the new hospital buildings before designing. The building design plan is intended to contribute in development of the healthcare activities, providing a holistic future planning of the new building (Norwegian Directorate of Health, 2011). However, as the healthcare sector is under continuous development, it is challenging for a guideline to provide standard tools or instructions on how to accomplish the plans.

An effective, qualitative and functional healthcare service is crucial to the society. To maintain this in the future, hospital buildings must withstand the requirements and technology of today as well as the future's. Adaptability will possibly generate a building ready for changing requirements in a sustainable way (Larssen & Valen, 2008; Nedin, 2013; Støre-Valen et al., 2014). Adaptable buildings possess three key abilities: *flexibility, generality,* and *elasticity*

(F, G, E) (Bjørberg & Verveij, 2009). Adaptability can maximize the efficiency of core business in a building over the whole life cycle (Glenville & Nedin, 2009). To enable this ability in hospital buildings, planners need to possess in-depth insight of what services the future hospital buildings will need. Norwegian hospital buildings erected the last decades possess decent adaptable abilities, but the possibilities of expansion or rearrangement of areas are not being utilized as intended (Letting, 2013).

Life cycle costing (LCC) is a tool to estimate costs over the lifespan of a product. According to the Plan and Building Act in Norway, LCC is recommended utilized in decision-making in building projects (Bjørberg et al., 2007). Even though LCC is a recognized approach in project management, few incentives have been present for project groups to utilize the tool. Consequently, initial costs have been the main decision maker when designing hospital buildings in Europe over decades (Bjørberg & Verveij, 2009). As the inexpensive and promptest solutions have had priority, many new hospital buildings are already experiencing difficulties in the operational phase. Støre-Valen et al. (2014) claims that LCC and initial cost should be considered as one total sum, as the operational costs normally already exceeds the initial costs two to three years after completion. By designing the building after a comprehensive life-cycle analysis, the building costs normally increase with 6-12 %, but the costs over the life span of the building will be reduced (Rechel et al., 2009).

FM can be the link between the hospital building and the healthcare services, contributing to value adding and creation (Larssen, 2011). Recent years, there has been an increasing awareness in FM services in the healthcare sector. The competence in FM departments in several Norwegian hospitals is reported to be decent, but not evenly distributed over the country (RIF, 2015). Nonetheless, short time planning and a lack of communication between FM departments and the core activities in the hospital, render the strategic development of the building challenging, and almost not existing (Støre-Valen et al., 2014).

3.3. Strategies for future hospital development

A more strategic life cycle planning, involving both adaptability and LCC, need to be a part of hospital building projects of the future. The focus needs to change from evaluating hospital buildings after completion time, cost, and quality, to assessment of life-span qualities such as low operational costs, adaptability, long-lasting materials and on how the hospital building supports the healthcare services over time (Bjørberg & Verveij, 2009; Nedin, 2013). The Norwegian Minister of Health and Care Services highlights the issue of poor development of the hospital buildings, as there will be capacity problems if no actions are rendered (Høie, 2015).

In current pre-design stages of hospital buildings the FM department is not adequately involved. As an effort to improve life cycle planning, and to be prepared for future needs, theory suggests to embody the FM in the hospital boardroom with a more strategic role (Støre-Valen et al., 2014). Another measure to ensure utilization of adaptability in hospital buildings is to educate the FM personnel. Digitalization of the building stock could be a tool for strategic development of hospital buildings, as Building Information Modelling (BIM) introduces a great potential for utilization in the operational phase. BIM is a well-established tool in design and construction, utilized in most recent construction projects of hospital buildings, but is still not as much exploited in the operational phase (South-Eastern Norway Regional Health Authority, 2014).

SBHF was established late 2014, but is still not fully operating. SBHF is an initiative recommended by the Minister of Health and Care Services, and is supposed to contribute in design, construction, standardizing, and experience transfer at a national level. The trust aims to contribute in forming the healthcare sector of Norway to a more efficient and improved sector (Høie, 2015). One expected result of the coordination from SBHF is a strategic national development plan (RIF, 2015).

4. Findings and discussion

4.1. Value propositions in hospital buildings

All interviewees and workshop attendants were asked about value propositions within hospital buildings and the replies were fairly harmonized, as everyone stated approximately the same, verifying one of the theory's definitions:

Value is a hospital building that creates optimal conditions for effective delivery of healthcare services. One respondent portrayed the hospital building as an exterior shell, with the sole purpose to serve the healthcare services in best achievable manner. When asked which fundamental parameters are required to achieve this value, the respondents mentioned four parameters: *logistics*, *functionality*, *effective operative services* and *environmentally consciousness.*

While the theory describes value as the relationship between function and cost, the findings from the case studies do not indicate any particular usage of this approach. However, a larger awareness on connecting investment and life cycle costs is advised by the respondents as a mean to achieve more valuable buildings in the future. Additionally, the case studies imply that there is a correlation between more effort and cost in the investments, and less life cycle costs. One of the hospitals, Akershus University Hospital, completed in 2008, reduced investments during the design stage. The reductions enabled a more comprehensive analysis of the new hospital building, causing a postponing of the process, but correspondingly providing a better building than first intended. This partly supports the theory on giving more efforts in the pre-design phase, as better solutions were experienced after a more comprehensive analysis. However, the Akershus University Hospital already experiences problems with capacity, due to an unexpected extension in the hospital catchment area.

The mathematical approach of defining added value is a challenging procedure, and may be problematic to relate to. Hence, it could be better to relate added value to expectations. How does the building fit the expectations of users, owners or clients before completion? Does the new hospital building fulfil needs in a better way than the prior? From the case studies, respondents explained that a new hospital building could offer some of the added values presented in table 1. Table 1 shows factors that certainly can be related to expectations as well as consequences of what the new hospital building actually offers. Data from owner or management's perspective were not assessed, and could not be illustrated in table 1.

Table 1. Identified key factors for added value

Healthcare services	*Workplace environment*	*Competence development*	*Sense of belonging*
Users	*Appealing, light and airy*	*Holistic impression – fundamental for good health*	*Attractive building*

Added value is in the theoretical framework described as the contribution from a process to a product. In hospital buildings, this can be conducted through evaluations of the requirements. The findings advise a comprehensive analysis resulting in objectives describing how to enable the hospital building to add value to the healthcare services. This is a recommended approach according to the research done by the authors, even though it might be challenging. By creating correct specifications and criteria for the hospital building, the process can contribute to add value. From the case studies, we found three useful questions to acquire correct specifications, presented in table 2.

Table 2. Questions to acquire correct specifications

1	*How do the healthcare services desire to develop competence, capacity and reputation in the future?*
2	*How can the hospital building serve the healthcare services to realize these objectives?*
3	*What are the hospital building's most crucial requirements to realize future needs?*

The questions points to strategic and tactical aspects of pre-design planning, giving a holistic view of the process of developing the services for the future. By conducting analyses of question three, the planners define what should be the foundation of the hospital building. The approach can be related to the process *Value Management* as previously described in chapter 3.1 through Kelly et al. (2015). Arranging a workshop where the objective is identifying, classifying, evaluating, and optimizing functions through asking the questions *how* and *why* could be a supplementary approach when addressing the three stated questions.

4.2. Value creation within hospital buildings

The pre-design stage in hospital building projects is and has been a time-consuming process. The theoretical framework emphasizes more cooperation and a better arrangement between the healthcare services and the building

itself in the planning. However, document studies imply that there is awareness about the latter, contributing to life cycle planning and cooperation between services and building.

From the case studies there seem to be a variable and apparently casual use of the terms *Flexibility, Generality, and Elasticity (F, G, E)*. Results from the document studies imply nevertheless that adaptability is a dominant part in the pre-design stage within recent hospital building projects. In particular, analyses of the latest project New Østfold Hospital reveals in-depth descriptions of the terms *F, G, E,* though vastly weighted on elasticity, as there are opportunities connected to future expansion on the surrounding site. However, the project manager was concerned that the FM department would not know enough about these designed opportunities. The oldest case studied, Rikshospitalet, soon 15 years old, has already spent most of its elasticity. The St. Olavs Hospital experienced capacity problems in somatic services quickly after completion, when an estimated trend occurred quicker than expected. When asked about possibilities of restructuring usage or moving service areas to other floors, the respondent at St. Olavs Hospital replied that this was possible in theory, but complex to accomplish in reality. Questions that immediately arise are:

- *For how long was the adaptability designed to last?*
- *Why spend money on adaptable hospital buildings if the potential is not going to be utilized?*

Every case study had pre-design documents labelling LCC vital to realize long-term solutions, thus applying LCC as the foundation of decision making throughout the building project and operational phase. However, three out of the four case studies admit that LCC was not given adequate priority throughout the processes, causing problems in the operational phases such as high cost and ineffective solutions. At Rikshospitalet, LCC was by Bergsland et al. (2001) reported as inadequately utilized, mostly due to the ownership of the project. The report states that a project designed, built and operated by the same owner may lead to a larger focus on LCC and planning. Through the design and construction processes, delivering on estimated time, cost, and quality are often the main objectives, and accordingly LCC is becoming less important.

The respondents express concerns regarding shortage of allocation of funds for adequate FM services, which verifies the report from RIF (2015). FM has insufficient priority in the budgets, causing a backlog of maintenance, operations and development. This is a contrast to what is stated in the pre-design documents of the four hospitals, where there is an objective for the new buildings to achieve annual operational cost profits. By downgrading operational budgets, the usability of the hospital buildings will decrease over time. Consequently, larger investments and efforts in refurbishment of the buildings will arise sooner or later. However, some of the respondents defend this priority, saying that the daily healthcare services have to be of uppermost importance. This argument is reasonable, but nonetheless a short-term manner of thinking that will cause problems for future hospital buildings.

4.3. Measures for added value in future hospital buildings

Both the theoretical framework and the case studies indicate that life cycle planning, adaptability and FM involvement are important strategies of being prepared for future development, as illustrated in Figure 1. Life cycle planning including adaptability and LCC are technical strategies that can add value for hospital buildings. In order to utilize these, a shift in paradigm is demanded within planning of hospital buildings, involving enhanced focus on healthcare services and hospital buildings as depended elements. Figure 1 also illustrates a focus on including FM services in strategic planning of development of the hospital as a strategy for value adding in hospital buildings. Utilizing modern FM technology is process oriented, and demands leadership on strategic levels, according to Larssen (2011) and Støre-Valen et al. (2014). The interviewees support BIM as a tool, and its awareness in the sector is increasing. However, at present there is not adequate knowledge or will in the health region trusts to utilize the potential of the tool in the operational phase of hospital buildings. The interviewees are nonetheless positive to development and usage of the tools in FM services as well as design and construction.

SBHF is by the Government and Minister of Health and Care Services suggested as the measure for an increased focus on learning, experience transfer and standardization in and between the health region authorities on a national level. The interviewees reveal various expectations to SBHF, but all believe that the trust can contribute in making the sector develop in a positive direction. At present, it is not certain how much influence SBHF will have on the health region authorities, but through interview with key personnel from SBHF we found that the trust aims to be a knowledge bank to contribute in planning and leading projects of a certain size (above 500 million NOK (RIF, 2015)). Creating a standard is considered challenging, as the sector is rapidly changing from every new project. It would however be interesting to acquire a framework based on data from experience and research to simplify the requirement definition and pre-design stage. In this way, hospital-building projects will be able to move towards the best practice. SBHF can also contribute in introducing LCC, adaptability, BIM and strategic FM involvement to the health region authorities by demanding utilization of these Strategies in future projects. SBHF as a leader of FM in hospital buildings could be a demanding objective, according to findings from interviews and case studies. As long as SBHF does not have any ownership of the hospital buildings, it might be difficult to create a standardized way of conducting FM throughout the country.

Fig. 1 Key strategies identified for adding value.

5. Conclusion

Both literature and case studies imply that a definition of value in hospital buildings is *a hospital building that creates optimal conditions for effective delivery of healthcare services.* With reports revealing a massive backlog of maintenance, operations, and development in hospital buildings, there seems to be ample room for improving hospital buildings in order to add value. The notion *added value* is typically understood in light of expectations and subjective perceptions of actors. Results from interviews show that logistics, functionality, effective operative services, and environmentally consciousness are parameters judged essential to achieve a valuable hospital building. Furthermore, the paper assesses how this can be accomplished. Results indicate that evaluations of requirements with enhanced assessments and larger investments must be made in the pre-design stage of hospital buildings. Table 2 illustrates three main approaches to achieve correct specifications and criterions for hospital building projects.

This paper identifies key strategies for value adding in hospital buildings, illustrated in figure 1: enhanced utilization of LCC and adaptability as well as strategic involvement of FM services in hospital boardrooms. Today's hospital building projects are aware of both life cycle planning and strategic involvement of FM, according to interviews and theory. Adaptability and LCC are known strategies in the sector, but inadequately utilized. Involvement of FM services in boardrooms is also not a common strategy at present, even though the awareness is increasing. Though at an early stage, the authors of this paper think SBHF is able to influence the sector to apply these parameters and generate well-prepared hospital buildings for future healthcare services. As the interviews indicate various expectations to the trust, SBHF's main challenge is to assemble the whole sector to create valuable hospital buildings for the whole life cycle.

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