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FM and clinical employees' involvement in the design of eight Norwegian hospital projects

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Abstract

Purpose – This paper aims to gain insight in how the involvement of facilities management (FM) and clinical employees are practiced in new Norwegian hospital projects and to study the benefits and lessons learned from the involvement.

Design/methodology/approach – This study is conducted by cross-sectional case studies of eight hospital projects by using a literature review, interviews and document studies of FM and clinical employees and project leaders (PLs) among Sykehusbygg.

Findings – The service design approach with a structured interaction between the PL's of Sykehusbygg, and the different disciplines of clinical employees and FM specialist was rewarding and efficient. The facilitator role of Sykehusbygg is essential to manage such a broad and complex involvement process using a wide range of various techniques at the different stages of the projects (dialogue meetings, review meetings, workshops, post-it notes, 2-D drawings, mock-up and 3-D models, as well as virtual reality (VR) and Building Information Modeling technology). The clinical employees' framework is stronger and much more structured than the involvement of FM competences through the different stages of the projects. The property management competences were involved at the early concept phase and design phase, whereas the Operation and Maintenance (O&M) competences were getting involved through the construction and commissioning phase. The value of FM involvement in all stages of the project is seen beneficial, particularly when the FM specialist become a part of the design team and located physically at the same place. The main reported benefits of early FM involvement are cost-effective technical solutions and installations, less design flaws and improved functionality, as well as a stronger ownership and mutual respect between the clinical and FM disciplines. However, not all hospital organizations see the benefits of the FM involvement of all stages, as they are driven by reducing capital cost. In one of the new projects, other ways of involving the FM competences were tested. Additionally, particularly for the O&M competences, a dialogue meeting with a clear focus of sharing experiences with different technical solution was found rewarding in terms of cost benefits.

Research limitations/implications – This study does not consider the social impact of the choices made in the design phase. The findings also indicated a certain development of the FM involvement. This is not studied in two of the newest projects where they are still in the design phase and the FM role was not interviewed.

Practical implications – The PL role is important as a facilitator role of the involvement process.



Social implications – A dialogue meeting with a group of O&M people was found rewarding and valuable for knowledge sharing. This methodology can be further developed and tested, as this group of stakeholders is not always available for giving input in the project.

Originality/value – The value of this study is the description of the interaction between the PLs and the hospital organization in the eight projects and lessons learned by the involvement of FM competences and clinical employees.

Keywords Design and development, User involvement, FM involvement, Health-care FM, Hospital buildings, Project leader role

Paper type Research paper

1. Introduction

Hospitals are complex and technologically advanced, with many complicated structures and sub-functions (Marmo *et al.*, 2020).

The health-care facilities management (FM) is different from other sectors, as they serve the clinical employees, the patients as well as the visitors of the hospital. The clinical employees are recognized as the expertise of producing health-care services and the health-care FM is one of the key elements for a successful delivery of health-care services (Gelnay, 2002) in Lavy and Fernandez-Solis (2010).

Performance evaluation is essential for ensuring the effective operation of facilities (Lai and Yuen, 2020) and is particularly relevant for improvement measures. Finding relevant key performance indicators (KPI's) are debated among the researcher and are reported relevant for monitoring and assessing the quality of the FM services (Amos *et al.*, 2020).

Rodríguez-Labajos *et al.* (2018) looked at how performance measurements are practiced as a tool for informing decisions at a strategic level in four English speaking countries. They found that performance measurement tools are adopted by governments where the health-care property competencies are centralized.

In 2016–2019, the Norwegian Government required that the regional health trusts presented a long-term development plan (to 2035) that reports an overall plan for their future development of the health trust activities and buildings [White paper: Meld. St. 11 (2015/2016)]. The development plans contain KPI's at a strategic level, used space and capacity, technical condition, usability and adaptability of the existing building stock, as well as site and property development capacity.

However, as mentioned by several researchers, relevant KPI's at the operative level are about not only technical measures relevant for the maintenance planning and predicting annual operational costs but also service measures as well like responsiveness, professionalism and competence (Amos *et al.*, 2020; Lai and Yuen, 2020; Lai and Man, 2018; Lavy *et al.*, 2014).

Boge and Salaj (2017) describe the benchmarking process of the FM department of one Norwegian hospital. The FM department participates in a national benchmarking process run by the Real Estate and Facilities Management network (Nfn). The participants can meet annually to compare results and look for possible improvement of their services. As this is not a required practice of the government, not all Norwegian hospitals are participating in the survey. This is not the focus of this study but is an interesting topic for further research.

1.1 Facilities management role in new Norwegian hospitals

In Norway, the FM practice in hospitals is often called “hospital services”, divided into a property management (PM) department, an Operation and Maintenance (O&M) department and an internal service department, with disciplinary sections underneath. In addition, the FM organization has access to some supportive functions like economic, human resources and consultancy functions [information and communication technology (ICT) and other

service suppliers]. In general, the way the FM practice is organized can simply be illustrated as shown in [Figure 1](#).

The hospital service organization serves the hospitals belonging to the regional health trust, meaning that they serve the somatic, as well as the psychiatric hospitals and clinics, located at several sites in the following regions: Helse Vest, Helse Sør-Øst, Helse Midt and Helse Nord.

[Shohet and Lavy \(2004a\)](#) clustered the FM topics into six main groups: Maintenance management, Performance management, Risk management, Development, Supply Service management and ICT, in which the ICT function integrates all the other domains.

Today, many of the FM tasks are automatized by Building Automation Systems (BAS) or FM tools, so the ICT function is not a separate function, but instead integrated into all FM functions. However, the maintenance, performance and risk management function are still relevant today, though there is less focus on manual work with audits and checklists, a trend using a digital Web platform that communicates with the interfaces and units. This task is organized into the O&M department, while Development is handled by the PM department. [Shohet and Lavy \(2004a, 2004b\)](#) cluster the Supply Service management into a group, similar to the “internal services” in Norwegian hospitals ([Figure 1](#)).

1.2 Project leader role of Sykehusbygg

In 2014, Sykehusbygg was established by the government, owned by the four regional health trusts, to contribute to a future-oriented development of the construction of hospitals in Norway. As Norwegian hospitals are primarily public funder, Sykehusbygg was given the role of ensuring coordination, learning from newly completed projects through innovation and experience, and competence transfer. They are responsible for organizing

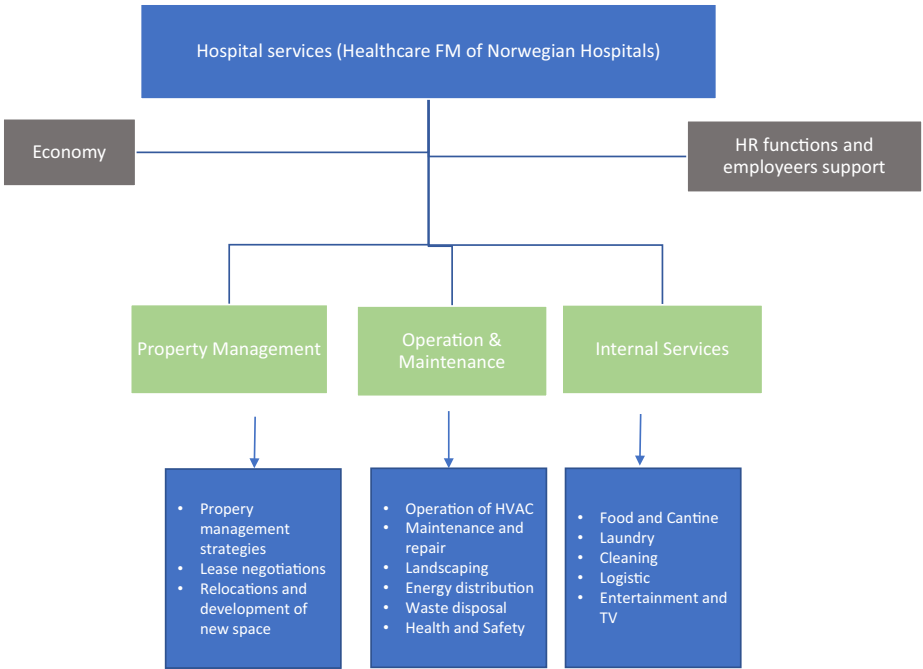


Figure 1.
FM practice of
Norwegian
hospitals –
organizational chart

both the building project and the planning and defining of the main function programme in the concept phase. In the design and construction phase, they enter a lead role in project management and work closely together with the project organization on the one hand, and the hospital organization on the other.

The role of Sykehusbygg is well-recognized among the hospital sector and act as a neutral part, thereby helping to facilitate the process between the client and the project organization. They also facilitate and coordinate the input from the ongoing parallel process between the hospital's own organization development process (OD process) and the construction project.

Over the years, they have gathered expertise and experiences as project leaders (PL's) of several hospital projects. Based on this experience, Sykehusbygg developed a guideline for a structured end-user involvement process to help facilitating the clinical employees to communicate the big picture and overall goal of the project, as well as ensuring engagement and ownership of the project. They experienced from an earlier project that persons involved in such processes may need some education and training to understand their role in the process, in addition to their realistic empowerment of how they can influence the decision-making. This framework is developed based on a service design approach (Sykehusbygg, 2017), and will be further described in the findings chapter.

1.3 Research design

This paper presents a study of how the early FM involvement in the design and construction phase of new hospital projects is practiced. The involvement process is compared with the way of practicing the end-user involvement of clinical employees.

This has driven the author to gain more insight into the complex manner of such user participation. Therefore, the approach to this study is done by looking at the current practices of eight Norwegian hospital projects, to acquire an understanding of the nature of FM and clinical employees' involvement.

The aim of this research is to shed light on the involvement process of FM representatives and clinical employees, and to study the role of the PL's of Sykehusbygg as facilitators of the involvement process. It is also a goal to enhance the benefits and lessons learned of the FM organization and the clinical employees. This is approached through a multiple case study of eight new Norwegian hospital projects. The following research questions are raised:

- RQ1. How to explore the actual framework of user involvement of building design in hospital projects?
- RQ2. What are the benefits of involvement of FM and clinical employees in new hospital projects?

A literature review of selected sources and documents are carried out to acquire a better understanding of the framework of the involvement of facilities management representatives and clinical employees. To obtain insight of the practice of FM and clinical employees, an embedded multiple case study of eight Norwegian new hospital projects has been conducted. The aim of the case studies was to get in-depth qualitative insights into how the clinical employees and FM organization are involved in the design, construction and commission process of the projects.

The paper is organized, first with an introduction of the scope of this work, followed by a theoretical background of selected topics explored in scientific sources and documents. The methodology chapter then follows, describing the way of pursuing the aim of this research.

Next, the multiple case studies are presented, followed by a findings and discussion chapter. Finally, the conclusion chapter sums up the main findings.

2. Theoretical background

The framework for the end-user involvement and benefits of involving FM and clinical personnel in the building design of hospital projects is reviewed, as well as other relevant topics of FM in the health-care sector.

The chapter discusses how researchers and practices recognize the values and benefits of involving end-users in complex projects.

2.1 Framework of facilities management and clinical employees' involvement

2.1.1 Legislation. In Norway, The Act of Health Authority says that the regional health authorities shall include end-user involvement in new hospital projects. This is patient rights as declared in the Norwegian Act of the patient and user rights (1999, § 3–1), both the right to be involved as a quality assurance of the services delivered by the hospitals, in addition to participating in- and receiving information of the development of the new hospital.

The Norwegian [Planning and Building Act \(2008\)](#), § 5, states that stakeholders have the right to be involved in building projects. This is a bit vague when it comes to how this should be practiced.

2.1.2 Performance indicators and POE of hospital facilities management. Performance evaluation is essential for ensuring effective operation of facilities ([Lai and Yuen, 2020](#)). According to [Woono et al. \(2014\)](#), Vischer emphasizes that the value of a POE is proven to be more important than the data collected itself, indicating that it is more about how the FM department follows up on the findings than it is rather a temperature measure of how the staff are satisfied with the services, and how they are following up to improve the measure. However, [Woono et al. \(2014\)](#) emphasize that critical success criteria in the POE of hospitals is lacking, as well as the fact that decision-makers are not using POE information in strategic planning and in future real estate decision-making.

[Liyana and Egbu \(2008\)](#) and [Nkala \(2015\)](#) suggest using a performance measurement framework of involving FM in hospitals. However, they recommend using key performance indicators toward FM services and do not specifically describe the practice of how to involve the FM or the clinical role.

[Van der Voordt and Jensen \(2020\)](#) looked at what parameters are most relevant in the benchmarking of workplaces. In the hospital sector, they found that cost and productivity rank highest and satisfaction at third place.

[Lai and Yuen \(2020\)](#) and [Lai and Man \(2018\)](#) reviewed the relevance of more than 70 indicators and came up with a short list of 18 hospital performance indicators relevant for FM personnel, sorted into the four aspects: *physical, safety, environmental and financial*. [Lai and Yuen \(2020\)](#) researched how to develop an analytic FM performance evaluation method suitable for hospital buildings. A recent study shows a performance measurement model, developed for waste management services, based upon a Balance Score Card approach among public hospitals in Ghana ([Amos et al., 2020](#)).

Earlier studies agree on that KPI indicators are a valuable and useful way of measuring building performance ([Shohet and Lavy, 2004a](#); [Lavy and Shohet, 2009](#); [Ikediashi and Ekanem, 2015](#); [Pitt et al., 2016](#)). [Lavy and Shohet \(2009\)](#) use a maintenance efficiency indicator that is further developed by [Marmo et al. \(2020\)](#) to a Building Performance and maintenance information based on an international foundation class scheme.

Amankwah *et al.* (2019a, 2019b) looked at the FM service quality on patient satisfaction of hospitals in Ghana. They found that the quality of the FM services directly affects the patient satisfaction and confirms that the FM service quality has a positive influence on the patient satisfaction. This is in line with the findings from Pitt *et al.* (2016), that examined the relationship between customer satisfaction and facilities and service quality. They found that the customer complaints are important information for the improvement of the service quality as they found that quick responses to complaint is directly affecting the patient satisfaction. The following quality measures are identified by Amos *et al.* (2020) as relevant improvement measure of FM: *responsiveness, service reliability, professionalism and competences*.

So, the researchers are clear about the relevance of using a performance measurement framework of a tool for improving the service quality and to reach a predetermined goal (Amos *et al.*, 2020) involving FM in hospitals. Nonetheless, this is not related to the involvement of building design, and not practically ascribed in how to do this.

2.1.3 Outsourcing of facilities management services. Others also looked at how organizing FM services either outsourced or in-sourced services. Hashim *et al.* (2016) investigated the challenges for the delivery of FM under the public private management (PPP) of HC services in Malaysia. They state that the PPP can provide value and provide a positive impact on the service quality and corporate image of the HC sector, which is of relevance to the O&M services. They identified several challenges but highlighted an inadequate specific PPP risk management model and difficulty in reaching agreements and project complexity as the most important.

Ikediashi and Ekanem (2015) embrace outsourcing as a way for providing public services in the health sector, and pinpoint the following benefits, such as improved performance, cost savings and an increased focus on the core business, as well as an improved quality of services. They looked at the practice of public hospitals in Nigeria and found that there is a low level for the outsourcing of FM in Nigerian hospitals.

Hashim *et al.* (2016) also commented that there are different cultures and traditions for the outsourcing of FM services in Scandinavia. Norway has a long tradition of having in-house FM services in hospitals as an integrated approach, as the FM leader is a part of the top management team equal to the clinical CEOs (Boge and Salaj, 2017), whereas in Sweden FM services are outsourced to a professional FM company. In Norway, there are some services that are outsourced, particularly cleaning and food and catering services.

2.1.4 Digitalization of facilities management. Effective and easy use of technology should enable innovation in the health-care industry (Thakur *et al.*, 2012). The digitalization of FM due to Building Information Modeling (BIM) technology has long been expected to innovate FM services in the health-care sector. Several researchers expect that BIM has the potential to advance and transform facilities by providing a platform for facility managers to retrieve, analyze and process building information in a digitalized 3-D environment (Gao and Pishdad-Bozorgi, 2019; Ilter and Ergen, 2015; Liu and Issa, 2014; Dixit *et al.*, 2019; Marmo *et al.*, 2020). However, several barriers, like interoperability and a lack of competence, are reported as issues. Dixit *et al.* (2019) explored key issues that hinder the BIM-FM integration, and found that the most important issue hindering BIM-FM is the lack of FM professionals' involvement in the design and construction phase, which leads to a mismatch between information needed by the FM team and information delivered by the design and construction team. Due to rapid technology development, this gives new possibilities to increased interaction between users and planners in the future.

2.1.5 Level of user involvement. How the early involvement is practiced varies, depending on the type of building and the organization and maturity of both the FM

organization and the client (Store-Valen *et al.*, 2014; Edum-Fotwe *et al.*, 2003). Edum-Fotwe *et al.* (2003) present findings from a case project of a hospital in the UK, where the early FM involvement was applied at the design and construction stage. They found that the *involvement of FM Operators and FM services* was beneficial in terms of an increased ownership and a clearer demand of documentation for operational and maintenance manuals. They also referred to *review meetings* through the design phase as beneficial, giving key managers from different departments the possibility to be involved, and to ensure a proper input for the concerns of their respective departments. The third element that they found beneficial was using a *sample mock-up* in order to present the designers intention, thereby allowing the FM operator to inspect the designed solution according to the agreed upon FM criteria.

Atkin and Bildsten (2017) underpin that there is a need to focus on drivers for space into the future and the facilities/assets that will have to be provided. They emphasize that the strategic perspective of space management is underdeveloped and needs to be higher up on top management's business agenda.

Fatayer *et al.* (2019) recommend the need for FM involvement at an early design stage regarding the need for maintainability considerations at an early stage, as well as the need for FM to become familiar with the decisions done at the design stage.

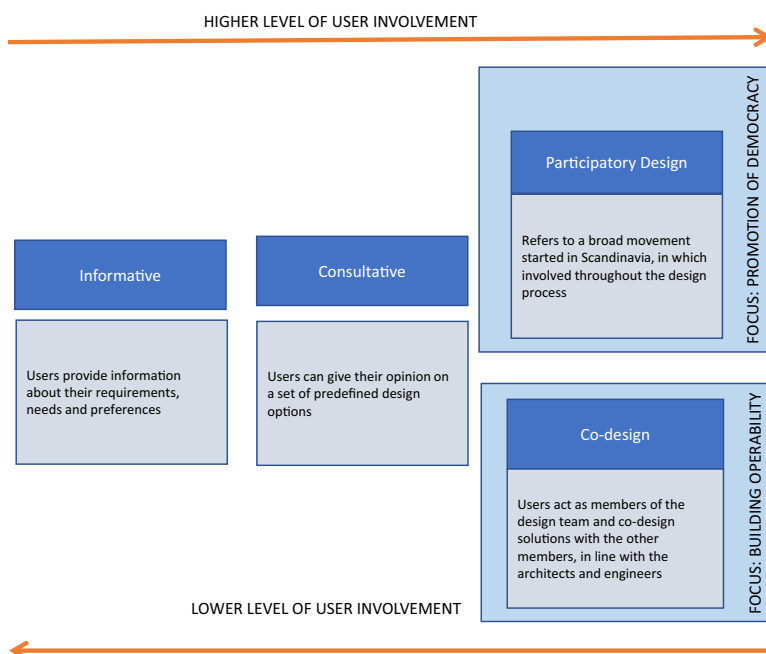
Several terms are related to end-user involvement developed over the past few years, given as a participatory approach, co-design or co-creation. In a participatory approach, the end-user has an active role in the design of the product, as well as being involved in the decision-making. In hospital projects, there are different levels of involvement and an understanding of what it means in terms of the decision-making. Bueno *et al.* (2019) present a literature review of 37 relevant articles, describing user involvement in building design. They refer to the level of user involvement as within a range of *being informative, consultative or participative/co-designing*, as shown in Figure 2. When using a participative or co-creative design, the level of involvement is high and more likely to have real power and take part in the decision-making (Bueno *et al.*, 2019). A lower level of user involvement, as more of the involvement has an informative character, has been widely practiced in building design. When the end-user is given an informal role, they experience less engagement and less dialogue with the design team and the client.

A clear definition of end-user involvement is lacking (Bueno *et al.*, 2019; Kujala, 2003). According to Bueno *et al.* (2019), the level of involvement is one of the key dimensions for understanding the user involvement, as shown in Figure 2.

Dewulf and Van der Meel (2002) describe the end-user involvement level at the design phase of office building. They categorize the involvement into three levels:

- (1) informing the users;
- (2) participation of users; and
- (3) co-decision or co-design of users

At Level 1, when the users are informed, they do not have any formal role in the project. The users can come with viewpoints and suggestions, but their viewpoint is not necessarily heard, even though the suggestions reach the decision-makers. At Level 2, the users are participating in the process, and are given a realistic room for influencing and approving suggestions, and solutions are also discussed. This is called a participatory approach, but not as strong as a co-design, as they are not designing the technical solutions of the building but instead are more into solutions that affect their workday. One example of this is where to place the sink at the patient room, or where to locate the ward office related to other ward



Source: Adapted from Bueno *et al.* (2019)

Figure 2.
Key dimensions of
health-care end-user
involvement

functions. This level does not have any formal power to make decisions but gives a strong expertise advisory voice to the design team. At Level 3, the users take part of the co-design, participate in the development, and make decisions regarding the product.

Bueno *et al.* (2019) do not distinguish participatory design or co-design in terms of the level of involvement, while Dewulf and Van der Meel (2002) put the participatory approach in the middle of high and low involvement. They add a new category called a consultative approach and describe the level of involvement as going from being more informative, to consultative towards either being participatory or a co-design as the highest level.

2.1.6 Service design. Service design is another approach of user involvement, with origins from Scandinavia. Service design is widely described by the research body and has gained a lot of attention over the recent years (Fry, 2019). It has a systematic and holistic approach, including end-users and stakeholders in the innovation process, and is an interdisciplinary approach that draws upon user-centric methods to improve innovation (Fry, 2019; Stickdorn and Schneider, 2011).

It is a way of thinking how to involve end-users and stakeholders in the innovation of new services, which are particularly relevant for innovating new services and health-care concepts in the hospital and health-care sector (Bessant and Maher, 2009; Junginger and Sangiorgi, 2011; Razzouk and Shute, 2012; Pfannstiel and Rasche, 2019).

Design thinking is generally defined as an analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback and redesign (Razzouk and Shute, 2012).

The method includes many creative ways of involvement like dialogue, creative workshops, discussions, process mapping and so on (Razzouk and Shute, 2012). Service design is found to be beneficial in the ability to realistically enhance the involvement of the employees, as well as the relatives to the patients (Pfannstiel and Rasche, 2019), with positive effects reported, both in the health-care and hospital sectors. Eines *et al.* (2020) found that service design has resulted in good discussions, reflections and involvement through a structured process run by a project leader or a facilitator team. In the Norwegian hospital sector, Sykehusbygg has developed a method of a structured end-user involvement also involving the FM role in the hospital project, based on the service design approach through their experience from previous hospital projects (Sykehusbygg, 2017). They combine a mix of methods to communicate and facilitate the information flow using workshops, visualization techniques and 2-D drawings in the early phase, and then changing to 2-D models in the design phase, as well as virtual reality (VR) methods to engage the clinical employees to understand the design of a standardized patient room or a ward. Figure 4 shows one way this can be organized, as a structured involvement process facilitated by Sykehusbygg (Sykehusbygg, 2019).

2.2 Benefits of facilities management and clinical involvement of building design

The research literature is clear about the benefits of involving FM in the building design. This has gradually been recognized by practitioners and researchers (Meng, 2013), as it provides both better technical solutions and a stronger ownership (Dewulf and Van der Meel, 2002; Kujala, 2003; Edum-Fotwe *et al.*, 2003; Meng, 2013; Lavy and Fernandez-Solis, 2010; Meng, 2013; Støre-Valen *et al.*, 2014; Fatayer *et al.*, 2019; Bueno *et al.*, 2019). Other reported benefits are a reduced O&M cost due to more efficient and effective facilities or improved functions, identification and the avoidance of architectural, structural, plumbing and heat, ventilation and air-condition (HVAC) design defects, in addition to a choice of materials and technical solutions that gives lower life cycle costs and an increased collaboration with the client and the designer team (Bueno *et al.*, 2019; Fatayer *et al.*, 2019; Meng, 2013; Støre-Valen and Lohne, 2016; Edum-Fotwe *et al.*, 2003; Kujala, 2003).

However, as several researchers has pinpointed, it is not a question of involving FM, but rather how and what competencies to involve at various stages of the project (Edum-Fotwe *et al.*, 2003; Meng, 2013; Nkala, 2015).

Meng (2013) reports the following barriers among the clients, the designer team, and the FM organization for the early involvement of FM in building design. Based on findings from more than 30 expert interviews of FM practitioners, he states that the client's focus is on the capital cost to get the most value for money, as well as a lack of awareness of the experiences and knowledge of what the FM role can add to the project. The barriers of the design team seem to be underestimating the FM organization, and that there are benefits to involving the FM role, in addition to acquiring an understanding of the differences in building design and facilities design. According to Meng (2013), the design team gives a low priority to performance and practicability, with the FM organizations reporting a lack of knowledge and expertise or blame allocation.

Meng (2013) also discusses ways to overcome these barriers, and pinpoints that to communicate the benefits of the involvement to clients and design team is one way. The other way is to professionalize the FM role and increase their competence and awareness of their own role to enhance the quality of the building by being involved.

3. Methodology

This research has been conducted by a qualitative approach combining information from a literature review, a cross-section analysis of multiple embedded case studies of eight new hospital projects by documentation analysis and semi-structured in-depth interviews of FM personnel, clinical employees and PLs of Sykehusbygg, in addition to expertise interviews and on-site visits. The research methodology is presented in a flow chart in [Figure 3](#).

3.1 Case studies

This study is a multiple case design with embedded areas of analysis reviewed for the involvement of FM and clinical employees in new hospital projects.

Several new hospital projects in Norway are under planning and construction, with some even completed or about to be completed. Information about the ongoing hospital project was found at the web portal of Sykehusbygg (www.sykehusbygg.no). Moreover, the project leaders from Sykehusbygg were contacted and asked if they wanted to be a part of this study. The case strategy was to select projects that were either completed or under planning within the period from 2015 to 2025. The cases were selected based on a mix of somatic and psychiatric hospitals, as well as large and small projects and their willingness to share information and knowledge to this research study. Facts about the case studies (location,

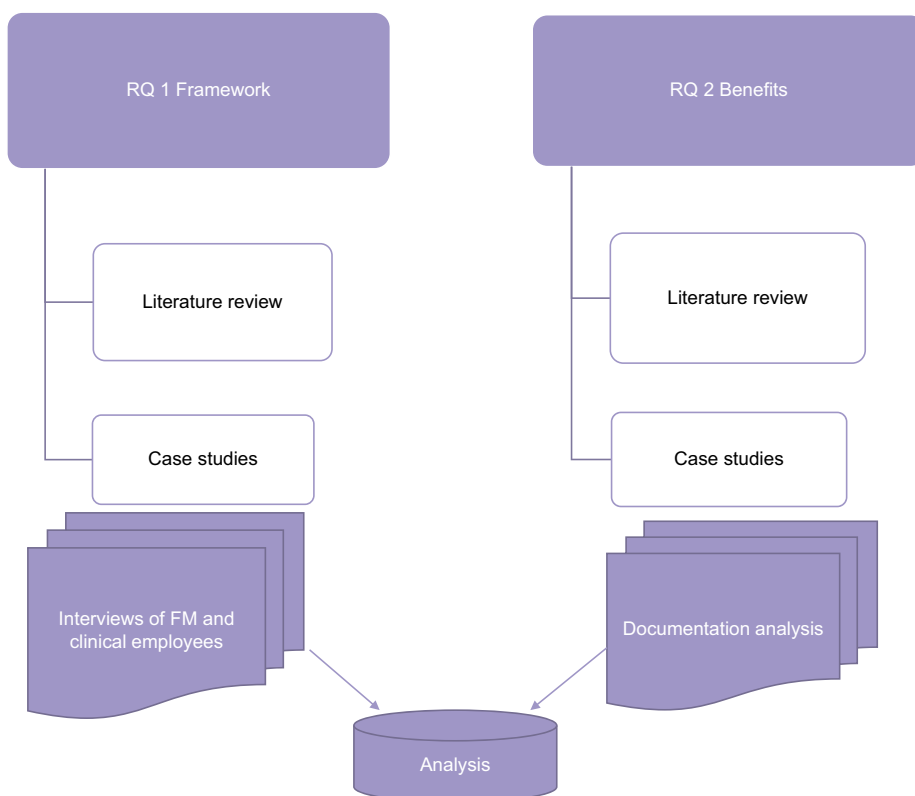


Figure 3.
Research
methodology

size, stage of the project and type of project, whether refurbishment, extension or new) are presented in [Table 1](#) as follows.

The hospital projects are a mix of somatic and psychiatric hospitals. There is a trend in Norway to relocate several psychiatric institutions and hospitals to the same site, due to more efficient treatments and interaction between the hospitals. The FM organization is normally responsible for operating both types of hospitals and should be involved in the design of both, even though psychiatric hospitals are less technically complicated than somatic hospitals. However, psychiatric hospitals have other issues of importance to be considered, such as robustness and security issues.

In many of the cases they had to cut the opex costs at one point, which normally means downsizing the floor area. This is always a negotiation between different interests. For example, in Case 3, the floor area was reduced by removing the planned basement to cut costs. This affected the operation in the way that several technical rooms planned in the basement were reduced in size and moved to the first floor instead. The technical rooms were placed behind an office/meeting room, so when the O&M staff needed to enter the technical room, they would have to interfere with the clinical employees who were using the room. This was reported as inconvenient and annoying. One of the case studies was used as a single pilot case study with five expertise interviews to gain knowledge of the execution model of this project, as it was one of the first complex projects in Norway using Integrated Project Delivery. These interviews were conducted in March 2017 and published in a master's thesis ([Schatvet et al., 2017](#)), in addition to a PhD work that looked at what creates value for owners and users in construction projects ([Haddadi, 2019](#)).

3.1.1 Interviews. The three focus areas and information searched by semi-structured interviews of informants with the following affiliation are presented in [Table 2](#). The informants were asked a set of questions regarding:

- how the framework and structure of user involvement is practiced regarding the involvement of expertise, decision-making and the information flow of the different stages of the project;
- their motivation for being in this role;
- the recognition of the impact and value of their influences; and
- the benefits and value added of being involved at the various stages. The benefits and lessons learned will be briefly discussed.

The number of interviews, and the affiliation of the interviewees at the stage of the project when the interview was conducted, is presented in [Table 3](#).

The author conducted 22 face-to-face, semi-structured interviews of the informants based on their role and involvement in the project ([Yin, 2018](#)). Three different interview guides were prepared, according to the informant role (FM employee, clinical employee or project leader [PL] of Sykehusbygg). The interview guide was sent to the informants in advance, with the interview lasting from 60 to 90 min. The interview was audio recorded, transcribed and sent to the informants for their approval and clarification. Some information, documents and follow-up questions were gathered by e-mail correspondence. The interviews and the information collection were conducted between January 2019 and December 2019. The cross-section analysis and main findings are presented in [Table 4](#).

3.1.2 Document studies. The document study contained a study of project reports, project presentations, minutes and notes from board meetings of the Health Authority Boards.

Stage of the project (phase)	Case 1		Case 2		Case 3		Case 4		Case 5		Case 6		Case 7		Case 8	
	Accomplished (year)	Operation	Design and construction	Operation	Design	Design	Design	Design	Design	Design	Design	Design	Design	Design	Design	Design
Health authority (HF) and region	2015	HF Sør-Øst	HF Sør-Øst	2018	HF Midt	2023	2024	2023	2025	2024	2023	2024	2023	2024	2023	2023
No of inhabitants in region	317 000		230 000	137 000	130 000	300 000	500 500	300 000	500 500	300 000	500 500	300 000	500 500	300 000	500 500	470 000
New somatic or psychiatric hospital	Both		Both	Psychiatric	Both	Psychiatric	Both	Psychiatric	Both	Psychiatric	Both	Psychiatric	Both	Psychiatric	Both	Somatic
Type of project:	New		Extension, refurbishment and new addition	Extension and refurbishment	New	New	New	New	New	New	New	New	New	New	New	New
New location, extension or addition																
Size (BTA m2)	92000		11 300 + 33 000	600 + 2000	60 000	10 760	122 000	10 760	122 000	43 000	100 000	43 000	100 000	43 000	100 000	100 000
No. of patient beds (psych. + somatic)	712		50 + 176	60	39 + 197	80	167 + 378	80	167 + 378	153	640	153	640	153	640	640
No. of m2/beds	129		192	43.3	254	134.3	224	134.3	224	215	156	215	156	215	156	156
Construction + refurbishment cost (2016 cost, MRD NOK)	6,1		2,7	0,4**	4,6***	0,87**	8,2	0,87**	8,2	3,06 + 1,71 *	9,2**	3,06 + 1,71 *	9,2**	3,06 + 1,71 *	9,2**	9,2**

Note: *2018, **2019 level, ***2020 levels
Source: www.sykehusbygg.no

Table 1.
Choice of case
hospital projects,
their location, type of
project, stage of the
project as well as
size, no. of patient
beds and estimated
construction cost

3.1.3 *Site visits.* Two of the projects were completed in 2017 and 2018. They were revisited in October 2019, allowing a walk-through study and informal talk with some of the clinical employees. This was done with the purpose of seeing whether they confirmed the benefits and values reported after the hospital had been in use for some period.

3.2 *Analysis*

The topics selected to be analysed and described for each case were the framework and structure of the end-user involvement, the available resources and competencies involved in the project, the meaning of co-working and co-location of the design team and the reported benefits and lessons learned of being involved in the project.

4. *Case studies*

The main findings from the document analysis and cross-section analysis of the multiple case studies are presented in Table 4. *RQ1* is presented in rows 1 – 3 and *RQ2* in Row 4. The findings are based on an interpretation from the interviews and analysis according to how the FM involvement and clinical employees were practiced, whether there were dedicated resources and the competencies of FM and clinical employees, and what benefits were seen as being involved at various stages. The benefits and lessons learned are based upon how the interviewees experienced their participation, and what they saw as valuable at the organizational level.

4.1 *Involvement of facilities management and clinical employees*

The level of involvement of the FM organization varied in the eight hospital projects. In four of the cases, both the PM and the O&M roles were involved in the design phase. Here, they

Table 2.

The role of the informants of the FM employees, clinical employees and the hospital planners of Sykehusbygg (PL = project leader)

	FM employees	Clinical employees	PL, Sykehusbygg
Role of Informants	PM O&M Internal services	User coordinators Clinical leaders Main safety representatives	PL, Technique PL, Interaction between planners and clinical employees PL, Design team

Table 3.

Role and number of informants, affiliation and stage of the project at the time the interview was conducted. The interviews were conducted between January 2019 and December 2019

Role of informants	Affiliation	Design	Construction	Operation
Clinical employees	PL Org. Development (OD)			1
	End-user coordinator		1	2
	Safety representative	1	1	
FM personnel (PM, O&M and internal services)	Property Manager		1	2
	Operation Manager	1	1	2
	Internal services	1		1
Hospital planners (facilitator role of Sykehusbygg)	PL Design	4		
	PL technique	3		1
	PL user participation	2		
Other expertise	Architect	1		
	Consultants	1		

Topics	FM employees	Clinical employees	The PL role of Sykehusbygg
Framework of user involvement	Less structured – regular meeting plan FM/PM is involved in the early concept phase, and to some extent in the design phase. O&M is more involved in the last part of the design phase and the commissioning phase.	Dedicated PL representing the clinical employees coordinating the group leaders for each discipline Structured meetings – regular meeting plan for six months ahead Fixed agenda Information flow – one week before the meeting Focus groups raising specific topics 100% dedicated PLs of health-care personnel with medical expertise Group leaders recruited from the clinics	The PL of clinical interaction – Coordinates the clinical working groups and facilitates the process of clinical employees. PL of technical issues – Plans and facilitates the involvement of the different technical disciplines Planned decision-making and time for closing the decision gates The PLs (technique and clinical interaction) are 100% dedicated to the project. Experienced PL and expertise on facilitation and involvement processes, planning and design of hospitals The PL of clinical interaction and the PL of technique are coordinating the co-working. Physically co-located two to three days a week Working closely with the architects, contractors, planners and consultants
Available resources and competencies	PM is 100% in some projects and partly in others (50–70%). O&M is normally not 100% available. Some participate in meetings, while others are 100% available as a part of the design team. In four of the cases, both the PM and the O&M role are involved in the design stage. In two of the cases, the PM is involved, but not the O&M. In two of the cases this is wanted by Sykehusbygg, but not prioritized. Increased understanding among FM employees of the value of engaging external expertise Improved communication internally and between FM and clinical employees Increased professionalism of FM in hospitals Digital VR platform useful for training and preparation of running a new hospital	The PL of clinical interaction is part of the design team, and coordinates the information and input from the disciplinary groups. Ownership and engagement of clinical employees in the Org. and Dev. process Increased productivity Efficiency in terms of <i>“improved work days for the employees”</i> New ways of working at the wards Visualization of patient rooms and corridors Efficient Digital Training platform with VR	Saving costs due to knowledge transfer between O&M and PM from other hospital projects Smart technology and digital tools are beneficial in visualizing and engaging the users. It is sometimes difficult to engage O&M staff when needed
Interaction and co-working (physically) between the design team and client organization			
Benefits and lessons learned			

Table 4.
Main findings from the eight case hospital projects – the FM employees, the clinical employees and the project leaders (PL) of Sykehusbygg

were given a significant role that participated in the meetings at an equal level, with the clinical employees as a part of the design team of Sykehusbygg.

In many cases, there are first and foremost the PM competencies involved in the conceptual and detailed design phases, while the O&M competencies are involved at a later stage of the detailed design phase, particularly when considering the technical details of HVAC systems and energy efficiency matters. The level of involvement varies. The informants describe this as varying from being 100% dedicated and having an active role in the design team, to be more in the periphery as only participating in formal meetings or corresponding to e-mails and answering questions in matters of choice of solutions at a detailed technical level. In some cases, the O&M personnel are not involved at all, saying that this is because their role is not recognized by the hospital organization. Others say that the hospital organization argues that there are no resources to support a such dedicated FM involvement. One of the PM informants who was involved said that there is a communication barrier between the PLs and O&M staff, as O&M personnel are occupied with the daily routine of operation and find it hard to prioritize meetings and taking the time to discuss issues of future solutions. The PM even described them as having a hard time imagining future solutions or being innovative in finding new ways of working as well.

The size of the hospital projects and whether there is a new location, or an extension of existing buildings, affects the way the FM role is involved. A new location gives the opportunity to develop the FM organization, and add new competencies in a way that enhances the health-care services in the new hospital. Here, the FM employees are highly relevant to give input to the hospital organizational development that happens in parallel to the building project. Increasing professionalism is highly relevant and is made possible through new funding and the need for change.

In one case, the O&M organization was rebuilt and developed due to a generational shift. To merge several hospital buildings into a new building provides an opportunity to develop new ways of working and emphasizes how FM can help support the health services. Many of the FM staff reports this as a positive change that follows when building a new hospital. In one case, this happened a bit late in the design phase since the PM department was only involved in the design phase. However, one of the FM informants said that this was a challenge, as they at the same time should ensure that the existing facilities were operating in a satisfying way:

We were first involved in the design phase and the construction phase, and not in the concept phase. This was because we had to sell existing buildings, and at the same time ensure enough space for the existing hospital during the construction of the new hospital. Retrospectively, we see that this could be handled differently, as we now do not always understand the reason for the decisions made.

The clinical personnel are recognized for their expertise in their field, though in the involvement process of a new hospital there are many functions and clinical programmes that need to be considered. The Sykehusbygg engages in structuring the process. The hospital organization uses dedicated clinical personnel suited to lead the process of involving clinical personnel, with one of the PLs for the involvement of clinical employees describing the role as follows:

My job is to prepare the staff to think how to run the hospital when it is finished. I participate in the planning process, as well preparing some contractual documents and helping to prepare the hospital organization to start using the new hospital. The client has one organization that mirrors the project organization. The involvement of the clinical employees is organized in the same way with user coordinators and thematic focus groups. The user coordinators work together with the

architects, as well as the hospital representatives from O&M, in a structured meeting plan with the PLs.

Sykehusbygg organizes the clinical employees in groups according to their discipline and topics. The clinical employees are represented with clinical leaders for each discipline. The hospital organization has already worked closely together with Sykehusbygg in the concept phase when defining the main function programme. This is an advantage when entering the detailed design phase, and for the evolvement of the detailed functions and design solutions, as they have already established trust between the parties. The evolvement of the OD project is led by a clinical leader who is 100% dedicated to this job. Among the FM functions, the leader of the O&M section is not necessarily involved during the design stage. The leader of the FM department is normally more likely to be a part of the project team. It is not clear in what way the FM people participate in the OD project, as the internal service functions are integrated as part of a focus group.

Each discipline is usually divided into groups and with a PL of the clinical leaders. The meetings are then structured and planned six months ahead in three meetings.

4.2 Project leader's role of Sykehusbygg

Since it was established, Sykehusbygg has gained a lot of experience from developing and managing several large, unique and complex hospital projects. The PLs are involved as early as from the early stage of the conceptual phase and follow up the process with defining the functional programme of the hospital. Their role works as process leader, as they work in teams to facilitate the clinical interaction and help the hospital to define the primary functional programme.

This way of working is developed through years of experiences of planners and project leaders experienced in structuring processes and projects, as well as involving expertise and new technology when making decisions. Their practice is inspired by the service design approach illustrated in [Figure 4](#). The PL from Sykehusbygg says that it is motivating to work together with the staff from the clinics, because they are all highly motivated to share knowledge and contribute in a way that will yield the best possible hospital.

One of the PLs of technique says that:

The clinical employees are organized in groups according to clinics and administrative functions. The user coordinator has regularly met with each group and is responsible for communicating correct information to the groups.

The PL leader prepares the clinical employees for the process in terms of giving them needed information and processes that must be accomplished before the decision-making is closed in the building project. These meetings are facilitated and led by the PL of Sykehusbygg, using structured meetings with the different groups with a fixed agenda every other week. They also scheduled some focus group meetings with specific topics, like the design of hand washers or showers, or topics such as a soft or hard floor covering. A structured meeting plan for the next coming six months is presented. However, there are some challenges to be overcome as reported by a PL of interaction:

We must educate the persons involved before we start, as many of them have never been involved in such complex project before. It is a large communicative challenge to get the organization and the people involved at different levels to understand what they are going to participate in. For many, this is maybe the first and last time they participate in such a large construction project.

In the beginning they have many questions. We need to inform them of what information is needed, and at what time the different decisions are closed in the building project.

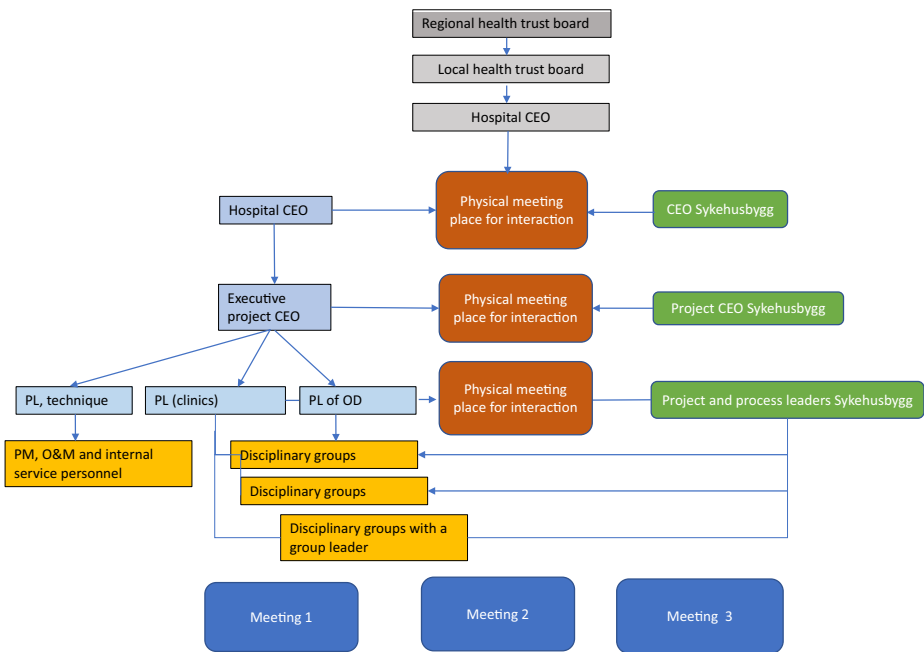


Figure 4.
Flow chart of the
interaction between
PL's of Sykehusbygg
and the Hospital
organization

The PLs of Sykehusbygg recognize the value of involving FM employees in the design phase, but says it is not always easy to get them engaged or involved due to a lack of prioritizations. In talking about technique, one of the PLs Sykehusbygg said that:

It has a very great potential in talking together across disciplines. For example: We arranged a half day meeting with O&M people from four different hospitals and offered to pay their travelling costs to give them time to share their knowledge. The consultant presented a technical solution suggested at the new SNR project and asked for their opinion. They were enthusiastic to share their experience, and by inviting them to a dialogue we got a professional discussion and a lot of improvement to the solution. After the meeting they felt appreciated and valued for their competences, and we found that we saved the project 50 Mill NOK just by talking together!

In this way they got to meet the O&M staff face to face, with an amazing effect of saving costs and improving better solutions. They recognized the competencies of the O&M people, and in return they felt appreciated and valued. This type of experience transfer through an informal or formal network does not seem to be the daily practice of the FM departments. Even so, this is the role of Sykehusbygg in the coming years, to develop arenas and meeting points to gather expertise and harvest the operational experiences of the FM employees.

In the eight hospital projects, we see that there is a strong tradition for involving clinical employees, and to some extent also the FM role. Therefore, there is a strong acceptance that they participate in their own OD process, as well as contributing with input to the main functional programme in the conceptual phase, in addition to the next step in the details of room functions and equipment projects. The FM role does not have the same strong tradition to be involved, also seen that the grade of participation varies among the eight projects. However, their role and the value of their contribution are recognized among the PLs of Sykehusbygg. The mandate of Sykehusbygg is also to make a space for sharing knowledge and transfer the experiences from one hospital project

to the next. The PL emphasized the value of bringing the O&M staff together and to listen to their knowledge sharing.

To sum up, the author emphasize the value of the interaction between the PL's of Sykehusbygg, the clinical employees and the health-care FM specialists. The involvement of the clinical employees are done by a structured approach using Sykehusbygg as a facilitator for the process among different disciplinary groups. The benefit of the involvement of the FM specialists are clear. Main benefits is the cost-effective aspects in terms of finding better technical solutions as well as benefits related to the social sustainability like productivity and increased functionality as well as the quality of the FM services. However, the research indicates that the recognition of the FM role varies among the hospital organizations. In this way the PL's of Sykehusbygg become highly relevant in order to pursue the involvement of the FM specialists at the different stages of the project.

4.3 Benefits and lessons learned from the involvement of facilities management and clinical employees in hospital projects

One of the PLs says of technique:

The client's user coordinator is physically located three days a week and sits together with us in the design team. That is an important key for success in this project. In this way, the design team has direct access to valuable information and knowledge sharing. It would not be the same if we only had met in formal meetings every week. Now the dialogue is based on trust and openness.

Talking about technique, the PL further says:

We wanted the same possibility to interact with some personnel from the PM and O&M department as well, but that wasn't prioritized here. Here we meet people from PM and O&M in the meetings, and the sense of trust and engagement is not the same. This is a strategic decision from the client organization, as value for money is often the argument. In another hospital project where I was involved as a PL, the O&M was 100% dedicated to the project. There was a big difference in engagement and ability to have a holistic view of the design. We are depending on a resource that can respond to questions, as well as have the time to get acquainted with the current issues. This is a strategic question where resources to O&M are not prioritized to participate in the project, even though earlier projects have pinpointed the positive effects of an early FM involvement. Engaged people who can respond to questions during the different stages of the project is the most important.

Many of the PMs involved in both the conceptual phase and the detailed design phase say that they have learned a lot from this process. One of the PMs involved said:

It opened my mind in understanding the process of developing the terms of the value of involving external expertise in the project, referring to involving expertise from developing BIM for the user phase.

One lesson emphasized the need for developing the strategic FM role that attends space management. Two of the hospital projects have defined and employed a PM department, and professionalized the O&M role. This has also been recognized by the hospital organization.

In the case studies, the KPI benchmarking process was done at the FM department, by an annual survey from the hospital network, collecting data about costs and other technical KPIs, FM service quality and user satisfaction. The FM department presented this in a dialogue meeting with the clinical leaders and discussed possible improvements to be considered. One particular KPI that was improved, was the response time of the FM department. From the time the users sent a request, they had now seen that the satisfaction

had improved since they promptly responded with information about the expected time before the request will be handled. The benefits of doing performance measurements on a regularly basis, as stated by [Amos et al. \(2020\)](#) as well as [Lavy et al. \(2014\)](#), are confirmed by the FM departments in this research.

One of the PL of Sykehusbygg said that they wanted the PM to be a part of the design team, but this is not always prioritized by the hospital organization. When asking the PM and O&M leader about why it is difficult to prioritize FM resources to become more involved, their opinion was that this had to do with the fact that the doctors and hospital staff have a strong tradition to recruit leaders from their own staff, while the FM department does not.

PM, Psych. Hospital:

It depends on how we organize ourselves according to new projects and learn how to utilize competencies and expertise from outside of the organization. We are learning from the Psyk project. I talked with the boys of the O&M every day. When it comes to technique I must be fed with a teaspoon, and they are very helpful. It helps the communication in both ways that we have been through such a process in this project. We have improved a lot at this point.

Some of the case studies indicated that there was a challenge to engage the O&M personnel in the design process. From the interviews, the one PL's of Sykehusbygg from one of the ongoing projects, reported great benefits of inviting the O&M personnel from different regions to an informal dialogue meeting to exchange experiences and share knowledge. This was a low-cost initiative that had great benefits in terms of cost reduction of the design and in technical installations. This model can be further developed and researched in the future. The authors impression was that this initiative was highly valued and perceived as inspirational by the O&M staff as they were able to share and receive knowledge among other colleagues across the regions.

5. Discussion

5.1 Framework of facilities management and clinical involvement in hospital projects

The Act of patient and end-users' rights (1999, § 3–1) gives the end-user the right to be involved in the process of designing a new hospital. Such an involvement has a strong tradition in hospitals and is well recognized among the hospital organizations ([Store-Valen et al., 2014](#)). The involvement of the FM role is not likely emphasized in the regulation, as it is only mentioned in the [Planning and Building Act \(2008, § 5\)](#). This is also seen in practice, as the FM role is not always prioritized to be involved by the hospital organizations, even though this is wanted by the PLs of Sykehusbygg. This study shows a strong indication of the benefits of involving the FM competencies, as well as providing a valuable contribution to the project.

In the eight Norwegian hospital projects, both an awareness of the FM role and the professionalization of the role has been raised. The benefits of being involved are recognized by the FM department, as well as among the PLs of Sykehusbygg, so several barriers are overcome as suggested by [Meng \(2013\)](#). In the case studies, the awareness of the benefits of involving the FM role has developed from 2015 until now. At this point, the PLs want the FM role to be actively engaged in the design process, and not only having an informative role. This is seen as a key to a successful cost-effectiveness and the quality of the project among some PL's.

In the case studies, the review meetings practiced are reported as being beneficial. One of the largest hospital projects still in the detailed design phase is also using a sample mock-up as a good tool to communicate and visualize solutions to both the FM and clinical employees.

Several of the hospital projects added a property management role in the FM organization as they became aware of the need to professionalize the task of handling space

management. This is in line with the researchers, thereby also underpinning the need to focus on the space management as a strategic resource in hospitals (Prugsiganont and Jensen, 2019; Atkin and Bildsten, 2017; Store-Valen *et al.*, 2014; Dewulf and Wright, 2009).

A service design approach is found to be beneficial for structuring the involvement of FM and clinical employees in hospital design processes. The role of Sykehusbygg is essential to achieve a good process, as they have experience and the proper competence to lead the process. They know when to push and when to pull the decision processes and share information about the next step in the decision process. Compared to the scale of involvement by Bueno *et al.* (2019), this service design process is a participatory approach at Level 3.

Sykehusbygg is also responsible for sharing information and ensuring knowledge transfer between hospital projects. They experienced that the FM staff highly appreciates being invited to a workshop to share their knowledge. They found that a better technical solution could be developed by the O&M experts being given the possibility to share their practical opinions about certain matters. Some of the PLs indicated that the O&M people sometimes need to be taken out of their daily routine to make them engage in such matters. This also underpins that there is a need for a stronger integration of early FM in hospital projects, as indicated by the research literature (Meng, 2013; Edum-Fotwe *et al.*, 2003; Nkala, 2015).

Yet, the engagement of the FM role in the hospital project is more unclear in terms of being dedicated and having available resources. The engagement of the FM role is wanted by the PLs of Sykehusbygg, though in some of the case studies this was not recognized in the hospital organization.

5.2 Benefits and lessons learned

New hospital projects can be a driver for a change in the FM organization, which shall operate the existing hospital facilities, as well as being involved in the design of the new hospital project. This sometimes means that the organization must rescale according to new working tasks and technology. In these cases, it is seen that the FM organization adapting to the new hospitals gives motivation to professionalize and reorganize the FM organization. One of the case projects accomplished in 2015 reported that they were able to redefine a new O&M department and professionalize the FM organization, as they added new competencies and restructuring to the FM organization. Others added the PM role to the FM team as the strategic role of handling space management issues and the relocation of clinical functions.

Several benefits are found from involving FM and clinical employees in the detailed design and construction phase, and not only the obvious reduction of O&M, architectural or structural defects, as reported by Fatayer *et al.* (2019) and Meng (2013). From the case studies, both the PL of Sykehusbygg and the FM personnel interviewed emphasized a raised awareness of their own FM competence, as the involvement had an educating and developing effect. Others recognize the benefits of inviting external expertise in using 3D-models and VR technology to visualize different solutions, in addition to the fact that it eased the communication barriers between disciplines and helped to better understand their point of view in certain matters.

The theory indicates that BIM in FM is expected to be a future solution that can improve FM services, particularly in storing information more easily. This has yet to be implemented in the case studies. Even though there was a goal to prepare the FM department to handing over the BIM used in the design and construction phase to the operational phase, several issues around operability was seen as tricky. Another benefit reported of using VR and gaming technology is using the BIM model to train the staff to operate in new facilities before they could move in.

6. Conclusion

This study confirms that a structured framework of a service design approach is beneficial when involving FM and clinical employees in the design of new hospitals. Sykehusbygg uses an experienced facilitator as the key role in leading the involvement process. The benefit of involving FM competencies and clinical employees are clearly reported as:

Cost-effective technical solutions and reduced architectural design flaws, productivity and functionality issues in terms of choice of materials and design of social functions, mutual respects between disciplines and increased focus on the quality of the FM services as responsiveness were highlighted as a relevant issue that affected the customer satisfaction.

This research also indicated that the FM discipline have developed and matured over the last years from the first case project of 2015 until newest project that yet is seen to be accomplished in 2024, with a focus on professionalism and competences. Performance measurement among the FM departments were found beneficial for internal purposes. This should be further researched at a regional and national scale. Sykehusbygg reports that they are developing methodology for evaluation of accomplished projects to ensure knowledge transfer between projects. This should be done at different levels, from the clinical and FM perspective to the patient perspective. Sykehusbygg is expected to be a vehicle for developing new practices and standards for building evaluation in the future.

References

- Amankwah, O., Choong, W.-W. and Mohammed, A.H. (2019a), "Modelling the influence of healthcare facilities management service quality on patient's satisfaction", *Journal of Facilities Management*, Vol. 17 No. 3, pp. 267-283.
- Amankwah, O., Choong, W.-W. and Mohammed, A.H. (2019b), "Modelling the mediating effect of health care healing environment on core health care delivery and patient satisfaction in Ghana", *Environmental Health Insight*, Vol. 13, pp. 1-14.
- Amos, D., Musa, Z.N. and Au-Yong, C.P. (2020), "Modelling the performance of waste management services in Ghana's public hospitals", *Facilities*, Vol. 38 Nos 9/10, pp. 715-738.
- Atkin, B. and Bildsten, L. (2017), "A future for facility management", *Construction Innovation*, Vol. 17 No. 2, pp. 116-124.
- Bessant, J. and Maher, L. (2009), "Developing radical service innovations in healthcare – the role of service design methods", *International Journal of Innovation Management*, Vol. 13 No. 4, pp. 555-568.
- Boge, K. and Salaj, A.T. (2017), "Practice vs theory: short-term financials trumps long-term value creation", *Journal of Corporate Real Estate*, Vol. 19 No. 3, pp. 186-204.
- Bueno, M.C., Caixeta, M., Tzortzopoulos, P. and Fabricio, M. (2019), "User involvement in building design – a state-of-the-art review", *Pós. Revista Do Programa de Pós-Graduação em Arquitetura e Urbanismo da FAUUSP*, Vol. 26 No. 48, available at: www.revistas.usp.br/posfau/article/view/151752 (accessed 6 March 2020).
- Dewulf, G. and Van der Meel, J. (2002), "User participation and the role of information and communication technology", *Journal of Corporate Real Estate*, Vol. 4 No. 3, pp. 237-247.
- Dewulf, G. and Wright, S. (2009), "Capital financing models, procurement strategies and decision-making", *Chapt. 16 in Investing in Hospitals of the Future*, p. 123.
- Dixit, M.K., Venkatraj, V., Ostadalimakhmalbaf, M., Pariafsai, F. and Lavy, S. (2019), "Integration of facility management and building information modeling (BIM)", *Facilities*, Vol. 37 Nos 7/8, pp. 455-483.
- Edum-Fotwe, F.T., Egbu, C. and Gibb, A. (2003), "Designing facilities management needs into infrastructure projects: case from a major hospital", *Journal of Performance of Constructed Facilities*, Vol. 17 No. 1, pp. 43-50.

- Eines, T.F., Løfaldli, B.B. and Ødegård, A. (2020), "Helseinnovasjonssenteret : et kommunesamarbeid om forskning, tjenesteutvikling og innovasjon", Oslo, Universitetsforlaget (In Norw.), pp. 131-145.
- Fatayer, F., Hassanain, M., Abdallah, A. and Al-Hammad, A. (2019), "Investigation of facilities management practices for providing feedback during the design development and review stages", *International Journal of Building Pathology and Adaptation*, Vol. 37 No. 5, pp. 597-614.
- Fry, K.R. (2019), "Why hospitals need service design", in Pfannstiel, M. and Rasche, C. (Eds), *Service Design and Service Thinking in Healthcare and Hospital Management*, Springer, Cham, doi: [10.1007/978-3-030-00749-2_2](https://doi.org/10.1007/978-3-030-00749-2_2)
- Gao, X. and Pishdad-Bozorgi, P. (2019), "BIM-enabled facilities operation and maintenance: a review", *Advanced Engineering Informatics*, Vol. 39 No. 1, pp. 227-247.
- Gelnay, B. (2002), "Facility management and the design of victoria public hospitals", *Proceedings of the CIB Working Commission 70: Facilities Management and Maintenance Global Symposium 2002, Glasgow*, pp. 525-545.
- Haddadi, D.A. (2019), "Value creation as a means to success – creating value for owners and users in construction projects", Doctoral thesis, Norwegian University of Science and Technology, Trondheim.
- Hashim, H.A., Sapri, M. and Low, S. (2016), "Public private partnership (PPP) facilities management for healthcare services in Malaysia", *Journal of Facilities Management*, Vol. 14 No. 4, pp. 350-362.
- Ikediashi, D. and Ekanem, A.M. (2015), "Outsourcing of facilities management (FM) services in public hospitals. A study of Nigeria's perspective", *Journal of Facilities Management*, Vol. 13 No. 1, pp. 85-102.
- Ilter, D. and Ergen, E. (2015), "BIM for building refurbishment and maintenance: current status and research directions", *Structural Survey*, Vol. 33 No. 3, pp. 228-256.
- Junginger, S. and Sangiorgi, D. (2011), "Public policy and public management: contextualizing service design in the public sector", in Cooper, R., Lockwood, T. and Junginger, S. (Eds), *The Handbook of Design Management*, Berg, Oxford.
- Kujala, S. (2003), "User involvement: a review of the benefits and challenges", *Behaviour and Information Technology*, Vol. 22 No. 1, pp. 1-16.
- Lai, J.H. and Man, C.S. (2018), "Performance indicators for facilities operation and maintenance (part 2)", *Facilities*, Vol. 36 Nos 9/10, pp. 495-509.
- Lai, J. and Yuen, P.L. (2020), "Identification, classification and shortlisting of performance indicators for hospital facilities management", *Facilities*, Vol. 39 Nos 1/2.
- Lavy, S. and Fernandez-Solis, J. (2010), "Complex healthcare facilities and lean construction", *Herd: Health Environments Research and Design Journal*, Vol. 3 No. 2, pp. 3-6.
- Lavy, S. and Shohet, I.M. (2009), "Integrated healthcare facilities maintenance management model: case studies", *Facilities*, Vol. 27 Nos 3/4, pp. 107-119.
- Lavy, S., Garcia, J.A. and Dixit, M.K. (2014), "KPIs for facility's performance assessment, part I: identification and categorization of core indicators", *Facilities*, Vol. 32 Nos 5/6, pp. 256-274.
- Liu, R. and Issa, R.A. (2014), "Design for maintenance accessibility using BIM tools", *Facilities*, Vol. 32 Nos 3/4, pp. 153-159.
- Liyanage, C. and Egbu, C. (2008), "A performance management framework for healthcare facilities management", *Journal of Facilities Management*, Vol. 6 No. 1, pp. 23-36.
- Marmo, R., Polverino, F., Nicoletta, M. and Tibaut, A. (2020), "Building performance and maintenance information model based on IFC schema", *Automation in Construction*, Vol. 118, p. 103275.
- Meld. St. 11 (2015/2016), "Nasjonal helse- og sykehusplan (2016-2019)", (In Norw.), White Paper, available at: www.regjeringen.no/no/dokumenter/meld.-st.-11-20152016/id2462047/?q=utviklingsplan&ch=2#match_2 (accessed 28 February 2021).
- Meng, X. (2013), "Involvement of facilities management specialists in building design: United Kingdom experience", *Journal of Performance of Constructed Facilities*, Vol. 27 No. 5, pp. 500-507.

- Nkala, S.M. (2015), "Defining early facilities management involvement using the concepts of performance management", Master thesis, University of the Witwatersrand, Johannesburg.
- Pfannstiel, M. A. and Rasche, C. (Eds) (2019), *Service Design and Service Thinking in Healthcare and Hospital Management: Theory, Concepts, Practice*, Springer International Publishing.
- Pitt, M., Chotipanich, S., Issarasak, S., Mulholland, K. and Panupattanapong, P. (2016), "An examination of facility management, customer satisfaction and service relationship in the Bangkok healthcare system", *Indoor and Built Environment*, Vol. 25 No. 3, pp. 442-458.
- Planning and Building Act (2008), available at: [www.lovdata.no](http://www lovdata.no) (accessed 6 March 2020).
- Prugsiganont, S. and Jensen, P.A. (2019), "Identification of space management problems in public hospitals", *Facilities*, Vol. 37 Nos 7/8, pp. 435-454.
- Razzouk, R. and Shute, V. (2012), "What is design thinking and why is it important?", *Review of Educational Research*, Vol. 82 No. 3, pp. 330-348.
- Rodríguez-Labajos, L., Thomson, C. and O'Brien, G. (2018), "Performance measurement for the strategic management of health-care estates", *Journal of Facilities Management*, Vol. 16 No. 2, pp. 217-232.
- Schatvet, M.V., Støre-Valen, M. and Haddadi, A. (2017), "Viability: a fundamental aspect of value creation in hospital projects", *12th International Scientific and Technical Conference on Computer Sciences and Information Technologies (CSIT), Lviv*, pp. 240-245.
- Shohet, I.M. and Lavy, S. (2004a), "Healthcare facilities management: state of the art review", *Facilities*, Vol. 22 Nos 7/8, pp. 210-220.
- Shohet, I.M. and Lavy, S. (2004b), "Development of an integrated healthcare facilities management model", *Facilities*, Vol. 22 Nos 5/6, pp. 129-140.
- Stickdorn, M. and Schneider, J. (2011), *This is Service Design Thinking, Basics-Tools-Cases*, BIS Publishers, Amsterdam.
- Støre-Valen, M. and Lohne, J. (2016), "Analysis of assessment methodologies suitable for building performance", *Facilities*, Vol. 34 Nos 13/14, pp. 726-747.
- Støre-Valen, M., Larssen, A.K. and Bjørberg, S. (2014), "Buildings' impact on effective hospital services: the means of the property management role in Norwegian hospitals", *Journal of Health Organization and Management*, Vol. 28 No. 3, pp. 386-404.
- Sykehusbygg (2017), "Veileder for tidligfasen i sykehusbyggprosjekter", (In Norwegian), Sykehusbygg, available at: <http://sykehusbygg.no/Documents/Veiledere/Veileder-for-tidligfasen-i-sykehusbygg-prosjekter.pdf> (accessed September 2020).
- Sykehusbygg (2019), *Presentation of Nordmøre og Romsdal's Hospital Project*, Sykehusbygg.
- Thakur, R., Hsu, S.H.Y. and Fontenot, G. (2012), "Innovation in healthcare: issues and future trends", *Journal of Business Research*, Elsevier, Vol. 65 No. 4, pp. 562-569.
- Van der Voordt, T.J.M. and Jensen, P.A. (2020), "Typology of value adding FM and CREM interventions", *Journal of Corporate Real Estate*, Vol. 22 No. 3, pp. 197-214.
- Woon, N.B., Mohammad, I.S., Babac, M., Mei, J., Zainole, N.N. and Nazri, A.Q. (2014), "Critical success factors for post occupancy evaluation of hospital building performance", *Jurnal Teknologi*, Vol. 71 No. 4, pp. 161-166.
- Yin, R.K. (2018), *Case Study Research and Applications. Design and Methods*, Sage Publication Inc, London.

Further reading

- Act of Patient and user-right's (2020), "Act of patient and user-right's (1999, § 3-1) (pasient- og brukerrettighetsloven, § 3-1)", available at: www.lovdata.no/LOV-1999-07-02-63 (accessed 6 March 2020).
- Amos, D., Musa, Z.N. and Au-Yong, C.P. (2019), "A review of facilities management performance measurement", *Property Management*, Vol. 37 No. 4, pp. 490-511.

- Haddadi, A., Johansen, A. and Andersen, B. (2016), "A conceptual framework to enhance value creation in construction projects", *Procedia Computer Science*, Vol. 100, pp. 565-573.
- HF Sør-Øst (2018), "Delstrategi for eiendomsvirksomheten i helse Sør-Øst", sak 080-18, godkjent i styret HSØ, 13. September 2018 (in Norw.), available at: www.helse-sorost.no/Documents/Styret/Styrem%C3%B8ter/2018/20180913/080-2018%20Saksframlegg%20-%20Delstrategi%20for%20eiendomsvirksomhet%20en.pdf (accessed 6 March 2020).
- Kaya, S. (2004), "Relating building attributes to end user's needs", *Facilities*, Vol. 22 Nos 9/10, pp. 247-252.
- Kim, T.W., Cha, S.H. and Kim, Y. (2016), "A framework for evaluating user involvement methods in architectural, engineering, and construction projects", *Architectural Science Review*, Vol. 59 No. 2, pp. 136-147.
- Nardelli, G. and Scupola, A. (2014), "Tools for stakeholder involvement in facility management service design", *Proceedings, Presented at the CIB Facilities Management Conference 2014, May, Copenhagen*.
- Shamayleh, A., Awad, M. and Abdulla, A.O. (2019), "Criticality-based reliability-centered maintenance for healthcare", *Journal of Quality in Maintenance Engineering*, Vol. 26 No. 2, pp. 311-334.
- Shohet, I.M. and Nobili, L. (2016), "Enterprise resource planning system for performance-based-maintenance of clinics", *Automation in Construction*, Vol. 65, pp. 33-41.
- Shohet, I.M. and Nobili, L. (2017), "Application of key performance indicators for maintenance management of clinics facilities", *International Journal of Strategic Property Management*, Vol. 21 No. 1, pp. 58-71.
- Yousefli, Z., Nasiri, F. and Moselhi, O. (2017), "Healthcare facilities maintenance management: a literature review", *Journal of Facilities Management*, Vol. 15 No. 4, pp. 352-375.

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