SECTION 5

DEVELOPMENT PAPERS

Consistent with overall EuroFM objectives to advance knowledge in Facilities Management, the research network wish to encourage members to present research work at different stages of development for discussion. This includes work in progress, postgraduate research and emerging research findings.

Papers that have been submitted for review which are not accepted for publication as a full Paper, can be considered for publication as development papers to enable ideas, preliminary findings and early conclusion to benefit from feedback and discussion in a supportive research environment.

Rikke Brinkø
Shared space - between vision and reality. The case of Lyngby Idrætsby.

Franziska Honegger and Susanne Hofer.
An approach to professionalising FM services in a Swiss Hospital

Nicole Gerber and Susanne Hofer
Role Model for Chief Facility Managing Officers (CFMOs) based on the Service Allocation Model for Service Companies (SAMoS)

Thomas Leiblein.
Outlining the project L-I-F-E (Legionella In Facilities and associated Environments)

Olayinka Olaniyi and Andrew Smith.
The impact of facilities management in achieving sustainable buildings
Shared space in a municipal sports facility
The case of Lyngby Idraetsby
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ABSTRACT

Purpose. The concept ‘shared space’, where different users use the same space, is expected to be a way towards a more environmental, economic and social sustainable build environment. This paper presents important aspects of establishing a shared space in a real-world context by studying Lyngby Idraetsby (‘sports city’) in Denmark, with the purpose of increasing the understanding of shared space as a strategy towards a more sustainable space- and portfolio management.

Theory. Shared space in the form of coworking and hot-desking are well described in literature. The case in this paper is a public real-estate complex within sports, and the theory used will be centred on usability, user involvement and space management.

Design/methodology/approach. The paper is based on a study of a specific case; Lyngby Idraetsby. The approach is inductive, and the information gathered via interviews with planners, facilitators and users, with additional information collected via documents and observations at planning and user meetings.

Findings. The project shows how shared space is relevant for the users and the project as a whole, and sheds light on key challenges regarding user involvement and facilitation that have to be handled when establishing a shared space.

Originality/value. Shared space is receiving increasing attention, as part of the topics of the ‘sharing economy’ etc. These themes illustrate trends in society, but there is little empirically material available when it comes to FM. This paper intends to fill part of this knowledge gap with an in-depth case study.

KEYWORDS shared space, facilities management, sustainable fm, public fm

1 INTRODUCTION

Shared space is a term that for many different people can mean just as many different things. In this paper shared space is understood as ‘multiple individuals, groups, or businesses making use of the same space, either simultaneously or at different times’. Spaces is understood as anything from offices, laboratories and canteens to reception, workshop space and anything one can think of.

But why is shared space interesting? When we share we use one of the under-utilized tools we have to create value and consistency in our daily lives and in our businesses. We already share much more than we may realize, but when considering sharing most people often think about the typical aspects of sharing, such as sharing a car, a summer home, bicycles and much more. Therefore, we rarely consider the opportunity to share on a broader scale, although it may be a golden opportunity for many to not only utilize their resources better, but also in terms of what
can be gained by entering into partnerships with others. Because sharing is not confined to office space; there may be opportunities to share a myriad of different rooms and many other aspects of a business. This paves the way for intensification of use, allowing different types of users and different uses over time. Such intensification might improve the liveliness of neighbourhoods, increase sustainability, and strengthen the ties between different actors.

2 THEORY

The field of shared space is part of the larger topics of The Share Economy, Collaborative consumption and not least Collaborative Urbanism, all describing the same overall phenomenon (Botsman & Rogers, 2010; Owyang, Tran, & Silva, 2013; Silver, 2013). The connection and relevance to the build environment has been described by (Brinkø, Nielsen, & Meel, accepted for publishing in 2015), and looking towards more established fields, there is theory describing shared space in office environments. Here one can find literature, also from a facilities management (FM) perspective, on for example co-working, hot-desking, designing and managing open space offices (Becker & Steele, 1995; Duffy & Powell, 1997). Since the case in question is a municipal complex, another set of theories also comes in to play; public FM and user involvement (Fronczek-munter, 2011; Jensen, Alexander, & Fronczek-Munter, 2011; Nardelli, Nielsen, & Jensen, 2015). The paper by (Nardelli et al., 2015) presents the following figure, Error! Reference source not found., illustrating an analytical framework with a complex relationship between actors, that is also used to guide the study in this paper. The figure illustrates the complex situation that must be handled by the ‘internal FM unit’; which in Lyngby idraetsby is the project group/municipality. Furthermore it illustrates the importance of considering both users and clients in relation to the public buildings, and it is exactly the usability and user involvement that have been the key focus in this study.

3 LYNGBY IDRAETSBY, A CASE DESCRIPTION

The case investigated, Lyngby Idrætsby, is a non-profit municipal sports facility in Lyngby, Denmark, approximately 12 km outside of the Danish Capital of Copenhagen. The project is a large renovation and construction project involving many stakeholders. The complex was completed in 1948 with a swimming pool added in 1976 and the total complex consists of approximately 13700 m² (DGI projekt- og udviklingsværksted, 2012), not counting the outdoor areas. In 2010 mould was discovered during the initial phases of renovating a club’s facilities, and an investigation to determine the extent of the problem found the mould to have spread throughout the building (DGI...
projekt- og udviklingsværksted, 2012). Renovating the building was estimated to be too expensive, and it was decided to replace them with new. Due to the entire complex being of an older date, a total renovation and updating of the complex into “Lyngby Idraetsby” was initiated.

3.1 Previous configuration: Single purpose strategy
The existing complex of Lyngby stadium can be seen in Picture 1. The stadium offer facilities for indoor and outdoor sports, among which are

- show stadium for football as well as practice fields
- fitness, sports hall and athletics stadium
- swimming pool, diving pool and baby pool
- archery ranges and space for other sports associations.

Besides these, the stadium also houses a café, lounge area and private clubrooms. The layout means that not much interaction is taking place between users, and the majority of facilities are single-purpose spaces not necessarily suitable for other uses.

3.2 New configuration: Multi-purpose strategy
Lyngby Idraetsby, the new complex, will consist of approximately 11800 new m² (DGI projekt- og udviklingsværksted, 2012) in addition to the existing 13700 m² of which 2420 will be torn down, giving a combined total for the new complex of 23080 m², not counting the outdoor areas. One of the proposed designs can be seen in Picture 2. The plan includes in addition to the existing facilities an area reserved for the business community, a physical education day-care and the Lyngby-Taarbæk Youth School (Lyngby-Taarbæk kommune, 2012a, 2012b). The facilities for recreational sports are meant to be shared, and are planned with multi-purpose use in mind. One of the main differences from the existing to the new complex is a plan to centre the sports associations around an “association zone”. This means that no associations will have their own club rooms and no space should be usable for only one function. The association zone will be built as a specific area in connection with the sports facilities, and consist of a number of rooms the associations must share and can use to meet and gather when needed.

The vision is for Lyngby Idraetsby to be an area characterized by activity in as many hours of the day as possible, for as many different users as possible; “Throughout the planning process there
has been focused on the development of space that promotes community and interaction between different groups, and strengthen new forms of activity” (Lyngby-Taarbæk kommune, 2012, p.4). This is backed up by the project manager; “You could say the vision for the sports city lies in that [...] there must be activities around the clock in order to attract many different types of users. [...]And this is how we have worked throughout the project – we have always planned for multi-function”. [Project manager]

3.4 User involvement

The user involvement process established as part of the process is an essential part of the project in relation to this study, and in the spring of 2012 a process was initiated to involve the stakeholders and collaborative partners in the process. Representatives of the sports associations as well as neighbours etc. have throughout the process been closely involved in the development of the project as illustrated in Figure 1

Figure 1: Adapted from The building design phases presented by RIBA (Royal Institute of British Architects, 2013) with illustrations of user involvement during the project period

From the project’s beginning in 2012 until now, the user involvement have included the initiatives marked on. “DGI Faciliteter og Lokaludvikling” (DGI Facilities and local development), a Danish organisation working in collaboration with the Danish sports association DGI, were hired to facilitate the initial user involvement process. They were chosen based on their ‘association-based’ profile, as it was thought that users of Lyngby Idraetsby might connect better with another association instead of the municipality [Project manager]. DGI Faciliteter og Lokaludvikling were in charge of hosting the first information meeting, individual meetings offered to all associations, a workshop with architects and users, as well as to provide drawings to form the base for the project. After these initial phases the user-followgroup was established and the responsibility for user involvement instead lies with the municipal project team.

4 METHODOLOGY AND APPROACH

This paper is based on a case study of Lyngby Idraetsby in Denmark; a choice of study type that has been chosen based on its special characteristics as described by Robert Yin; "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context.” (Yin, 2009) and also Bent Flyvbjerg; “For researchers, the closeness of the case study to real-life situations and its multiple wealth of details are important” (Flyvbjerg, 2006).

Case study research as described by Yin can embrace many different epistemological orientations (Yin, 2009, p. 17). The study of Lyngby Idraetsby lies closest to philosophy of the critical realist as described by (Saunders, Lewis, & Thornhill, 2009, p. 140), and has been conducted with a mainly inductive approach. It is an exploratory study with the aim of identifying aspects of the project process that have played a significant role in relation to the outcome, both positive
and negative. The purpose is increasing the knowledge of shared space within FM, and forming a hypothesis that can be tested in additional case studies and further research.

The design is a longitudinal study of processes involved in the establishment of a shared space in a municipal leisure facility context, with special focus on the interaction between users and planners. The majority of the information used for this study has been gathered via observations at meetings and interviews with a wide variety of parties involved in the project. In addition, secondary information has been gathered via documents related to the project, to gain another perspective. The overall process is illustrated in Figure 2.

**Figure 2: Methodology and approach**

In the following, the different methods used during the information gathering and analysis process are described.

### 4.1 Observations

Observations were made by the author at user-involvement initiatives marked by a circle on Figure 1 as well as at an internal meeting in the planning group during the construction period, in total at the following three situations, during the period of May 2014 and August 2014:

- Observations at mini-seminar for users and stakeholders
- Observations at a planning group meeting
- Observations at meeting with the follow group of users

The observations have been made with inspiration from the method of participatory observations described by (Saunders et al., 2009) and as “The researcher attempts to participate fully in the lives and activities of subjects and thus becomes a member of their group, organisation or community. This enables researchers to share their experiences by not merely observing what is happening but also feeling it” by (Gill & Johnson, 2002)

### 4.2 Interviews

In order to gain first hand insights into different aspects and experiences during the process of planning, designing and constructing, representatives from users, architects and the municipal project group were interviewed, resulting in 5 interviews in total.

The interviews have all been conducted as semi-structured qualitative interviews based on the works of (Kvale, 2002); a type of interview that was selected based on the ability to deliver insights into a concrete topic, and ensuring the interviewer the possibility of obtaining non-anticipated information while at the same time ensuring answers to predetermined key questions. The focus of the interviews has been to gain insights in to different aspects of the project process seen from the perspective of different stakeholders, in order to understand which aspect of the project plays the biggest role from their point of view.
Users
Interviews have been conducted with representatives from 3 different user groups; the Gun association, the Handball association and the Popular Education Association (FOF). These three have been chosen based on a two main reasons. First they are three of the largest stakeholders and will be greatly impacted by the project. Second, they have been closely involved in the user involvement process, and can therefore provide insights in to how this has been experienced from a user perspective.

Architect/facilitator
An interview has also been made with a representative from the architect/facilitator organisation DGI Faciliteter og Lokaludvikling. The purpose of this interview was to learn about the user involvement process from the facilitator point of view.

Municipality
An interview with the project manager from the municipality as well as ongoing communication regarding the project, development and additional info have also been an important source of information during the gathering of empirical material for this study, in order to learn about the project from the planner and owner perspective.

4.3 Document analysis
In addition to the primary data collected via interviews and observations, additional information has been used to further illustrate the case. These are:
- Confidential meeting summaries from steering committee meetings
- Public meeting summaries from political discussion meetings
- Architectural drawings on the overall project as well as specific user projects
- Newsletters send out by the municipality regarding the project and official press material
- Local district plans made for the development of the area

These documents have been used and analysed based on the guidelines presented in (Saunders et al., 2009).

4.4 Analysing the empirical data
The methods for analysing the gathered data according to the process illustrated in Figure 2 are mainly open and axial coding as described in Grounded Theory (Bolsen, n.d.). Open coding has as mentioned been used for the initial analysis and mapping of themes, after which axial coding has been used for identifying possible connections between the previous identified themes. The purpose with doing this type of coding is to “to develop theoretical explanations of social interactions and processes in a wide range of contexts” (Saunders et al., 2009, p. 185). Coding helps secure a rigorous analysis process that can be displayed and controlled, and the program used to perform and manage the coding in this study is NVivo 10.

5 FINDINGS
The findings from the case, illustrates some of the challenges that must be taken in to consideration and handled when establishing a shared space in a public leisure facility context. During the open coding and analysis of the empirical information, a number of aspects appeared. These were connected via axial coding, and reduced to just three aspects, illustrated in the three boxes below; territoriality, logistics, and involvement (see Figure 3, Figure 4 and Figure 5). The three aspects are located in the centre of the coloured circle, surrounded firstly by some of the aspects the specific term symbolises, and secondly by quotes from interviews that led to identifying the different aspects.
Territoriality seems to play an extremely important role when asking about a person’s/groups attitude towards sharing in general. Control, individuality, personalisation, fear of losing rights etc. has been mentioned in many different forms during the interviews, and is without a doubt an aspect that is necessary to be aware of when establishing a shared space.

Logistics
Logistics was mentioned many times as important during both the construction/renovation phase but also in the period after the space is put into use. Information and planning in regards to how “daily life” will run during construction as well as after, and also the importance of managing the different activates that must share space, so they do not interfere with each other. Not necessarily in time but in space. An example was, ‘do not put fitness or Zumba right next to the yoga class unless you have good sound insulation’.

Involvement
Involvement was the third key aspect that was considered extremely important among users. Being heard and taken serious as well as being kept informed about the process and how it would affect a specific group was highlighted as one of the best parts of the process in this case, and also as one of the main reasons for why most had chosen to accept having to share.

The three aspects illustrates key features that through the analysis process is recognised as being of significant importance for the successful process of establishing a shared space in this context, with special focus on managing the practical aspects of working with the users and satisfying user needs.
They aspects are not blank slates within existing theory, and have been described to varying degrees within fields such as FM, architecture and psychology. So the new knowledge resulting from this study is not necessarily the three aspects in themselves, but the fact that they have been identified in this specific context. This means that a lot can be learned from existing theory but with the knowledge combined in new ways and in relation to a new strategic target; ensuring the best possible chance of creating a successful shared space. Combined this can lead to an increased understanding of how to manage the complex process illustrated in the case.

6 DISCUSSION AND FUTURE PERSPECTIVES
The case investigated in this study is as mentioned a municipal sports and recreation centre in Denmark. It is therefore focused on sports associations and athletes, both professionally and amateurs, so what can be learned from the results outside this framework?
Well none of the three aspects identified are uniquely linked with sports facilities, but are as mentioned also of more general interest individually, within several different fields of research. Second, shared space and how to work with it in general is receiving increasing interest as part of the greater topic of ‘the sharing economy’ as described in section 2. This is also happening within FM, for example within the office environment. The results are also interesting when looking beyond this single case in a leisure setting, since it by the municipality is being considered a pilot project. The experience gained from this project is to be incorporated in other real-estate projects in the municipality, outside the world of sports, as for example regarding public housing complexes etc. The results can therefore play a role in many different types of shared space situations where the complex user/internal FM unit/client relationship as illustrated in Error! Reference source not found. is present and interaction with users is key. The knowledge and experiences gained therefore have a possibility for playing a role in relation to for example schools, kindergartens, nursing homes etc. More research though, will have to be done, to understand fully how to best handle the three aspects presented in section 5, for example by studying what has already been written on the subjects within for example architecture, phycology and existing FM research. In addition, further studies of different types of cases from outside the leisure setting represented here, would help to support and uncover settings, in which the aspects presented here can be of importance, thereby strengthening the relevance of the results presented in this study. Studies such as these are planned for the near future. The final result of this research is expected to be a set of guidelines and a tool to guide interested organisations or municipalities in establishing and working with a shared space in practice, thereby increasing the understanding of the concept as a way to a more optimised and sustainable space- and portfolio management.

7 CONCLUSION
The purpose of this cases study was to gain empirical insights in to some of the processes involved in establishing a shared space in a real-world municipal context, in order to increase the understanding of how to work with shared space. By identifying the aspects of Territoriality, Logistics and Involvement, presented in section 5, the goal is that organisations and groups interested in working in or with a shared space can better navigate the process, and have a better chance at securing a good result. In this way it can be a step towards creating guidelines for FM management practice on how to work with shared spaces, first of all in leisure setting, but perhaps also in the greater field of Public FM. In this way it can help to begin and fill part of the knowledge gap that exists regarding shared space and FM as a field.
ACKNOWLEDGMENTS
A vital part of the case study behind this paper is the valuable insights provided by a number of people in different organisations and associations, and the study would not have been possible without this assistance. Many thanks are extended to:
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SKL, Representative from gun association, (02.09.2014), personal interview
LHK, Representative from handball association, (03.09.14), personal interview
FOF, Representative from the Popular Education Association, (30.06.2014), personal interview
DGI, Representative from DGI Faciliteter og Lokaludvikling, (11.08.14), personal interview
An approach to professionalising FM services in a Swiss Hospital
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ABSTRACT
Purpose. This research sets out to explore non-nursing activities in a hospital, looking at when and whom performs them and how the quality of these non-nursing activities is controlled. The results were developed into a strategy paper to guide a major reorganisation process with the aim of professionalising Facility Management (FM) services. Hence this research focuses very much on the people who work in FM.
Theory. FM in hospitals enables the core activities of medicine and nursing to operate. Skills-oriented allocation of work is essential. Defining the non-nursing activities, which can be carried out by staff reporting to the FM department, instead of by nursing staff, is one way of addressing nursing shortages.
Design/methodology/approach. The research is based on a case study. Data collection methods included document research, structured non-participant observation on six specifically selected hospital wards, semi-structured expert interviews with nursing management from these wards, and expert discussions with representatives from both the nursing and the FM departments.
Findings. The results show that FM tasks are performed differently in different wards. Because many processes and the responsibilities for performing the tasks involved in these processes are not defined, the quality of service depends on the people performing the tasks rather than any pre-defined standards. The issues highlighted by this research are addressed in a resultant strategy paper.
Originality/value. The findings of this research provide a set of valuable arguments for professionalising FM services.

KEYWORDS HOSPITAL, HEALTHCARE, FACILITY MANAGEMENT, WARD SERVICES

1 INTRODUCTION
Switzerland’s total health expenditure, expressed as a percentage of GDP, is, according to the OECD, one of the highest in the world, with the United States having the highest total expenditure (OECD, 2011). However, in contrast to the US and other countries where healthcare costs are already economically driven, the Swiss healthcare sector has benefited from a laissez-faire attitude to costs where hospitals used to be paid retrospectively for their services and bills were rarely challenged (Fetter, 1991). However, this system, which was advantageous for hospitals, has recently been changed by the implementation of the SwissDRG system, which requires hospital costs to be paid in advance, based on a diagnosis-related group system. This change to hospital financing affects the way processes are delivered (Brügger, 2010) and the provision of hospital support services. The change is designed to ensure hospitals are run more efficiently than previously (Oggier, 2012). Hence, a main and highly proclaimed benefit of this system is that it forces hospitals and health care providers in general to focus on higher process transparency as a precondition for being cost-oriented (Balmer, 2011; Cording, 2007; Hurlebaus, 2004; Mathauer & Wittenbecher, 2012; Oggier, 2012; SwissDRG, 2011). Despite the introduction of the new
system in 2012, many hospitals are still just starting to implement the necessary efficiency measures in their core and support processes.

2 BACKGROUND THEORY
Following sections highlight the main theoretical threads reasoning the research of this paper. They provide the necessary background theory by presenting the most relevant literature.
The introduction of afore mentioned change to hospital funding means that hospitals need to address certain challenges. Not only do they need to deal with reduced financial resources but they also need to manage the rising expectations of patients and other stakeholders. In order to stay competitive, the introduction of qualitative services is inevitable. Besides processes that focus on a hospital’s core functions of treatment and care, support processes are also affected by this move to provide effective and efficient services that are tailored to their recipients. These support processes can be put under the remit of facility management (FM), a practice that is defined as the “integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of its primary activities” (CEN, 2006, p. 5). The importance of the support processes is evident, since while approximately 60-75% of hospital costs relate to core activities (treatment and care), a further 25-40% (Abel & Lennerts, 2006; Jensen, 2008) are incurred by support processes.
A further aspect referring to the importance of support processes is, that the quality of medical treatment is no longer the only criteria for patients when choosing a hospital. So called “hotel services”, sometimes also referred to as “housekeeping services”, are increasingly important for attracting patients and also play an important role in patient satisfaction (Haseborg & Zastrau, 2005; Weilnhammer, 2005) Something which private hospitals realised long ago is now also becoming more relevant for public hospitals.
Another reason underpinning this papers research is the fact that there is an increasing shortage of skilled labour in healthcare institutions in most European countries (Hasselhorn, Tackenberg, & Müller, 2003; Simoens, Villeneuve, & Hurst, 2005; Vernooij-Dasssen et al., 2009) including Switzerland (anon., 2014). This shortage is particularly evident in core services professions, such as doctors and nurses. Hence it is also essential for Swiss hospitals to ensure that “the right people, with the right skills, are in the right place at the right time” (NHS National Quality Board, 2013). Because of these labour shortages, there is an ongoing trend in Swiss hospitals towards removing responsibility for domestic / housekeeping services (such as food ordering, service and clearing away; flower care or errands) from the remit of nursing staff and putting them under the responsibility of staff assigned to the FM department (ZHAW/IFM, 2012). In Switzerland these tasks are often assigned to a sub division of the FM department referred to as “Room-Service” or another name indicating non-nursing activities. In this paper the term room-service is used. In the UK these tasks are often carried out by ward housekeepers who run hospital wards for the benefit of patients and their visitors (NHS Careers, 2014a, 2014b). Studies conclude that the room-service concept is beneficial for hospitals because it both increases patient satisfaction and reduces costs (Aase, 2012; Buzalka, 2004; Elan, 2008; Mahoney, Zulli, & Walton, 2009; Stanga et al., 2003). In terms of patient satisfaction, these studies state that an important positive influence is the fact that room-service staff are more focused on the quality of food service delivery than the nursing staff. In contrast to nursing staff, staff assigned to the FM department consider these tasks to be their primary focus, resulting in improvements in the patients’ service experience. Furthermore, the shift of non-nursing activities to the FM department means that FM has total process responsibility for the services. To provide an example: Food is not handed over to nursing staff after it is delivered to the wards, instead the process ends when the patients have re-
ceived their food. Because the FM department now has direct managerial authority over its own staff it is much easier to professionalise the service than when using nursing staff who the FM department usually has no direct authority over. According to Sheehan-Smith (2006) room-service best practices in hospitals includes timely delivery of food after advising the patients and taking their orders, a suitable menu, and distinguishable occupational clothing for the service staff. The same author further stresses that the successful implementation of these best practices requires a service oriented corporate culture. Not only does room-service encourage the professionalization of the service for the benefit of patients, but it also has the ability to reduce costs by optimising processes, which can, for example, lead to less food waste (Aase, 2012; Mahoney, et al., 2009). A further and extremely important argument for room-service in hospitals is that it frees skilled nursing staff from non-nursing duties and enables them to focus on their core tasks of providing medical care. Paeger (2009) states that these non-nursing tasks take up between 20 – 30% of a nurse’s time. Hence, moving tasks from nursing to FM staff is one way of stemming the shortage of nurses, and at the same time enables the professionalization of FM services. The research this paper represents was carried out in light of above contents. It is about a Swiss hospital that realised the potential of a room-service concept and as a result and took the decision to plan and subsequently implement such a concept. In order to set this organisational change in motion, evidence-based data representing the current situation was needed, and it was this data that was developed in this research.

3 METHODOLOGY

3.1 Research Aim and Questions

Based on above background, the aim of the research was to investigate how non-nursing tasks were conducted in this hospital, in order to provide an evidential basis for future changes to the provision of such tasks. Guiding research questions were:

- When are non-nursing activities performed and who performs them?
- Are non-nursing activities standardised?

The answers to the two research questions enabled the derivation of predominant areas that need to be addressed when planning the professionalization of services by the introduction of room-service. The results were developed into a strategy paper to make the case for and guide a major reorganisation process aiming to professionalise FM services by introducing room-service.

3.2 Qualitative Case Study Design

To achieve the aim, a case study design with a qualitative approach was conducted. Various definitions of case study designs exist. For this research the following definition was used: “Case study research in business uses empirical evidence from one or more organisations where an attempt is made to study the subject matter in context. Multiple sources of evidence are used, although most of the evidence comes from interviews and documents” (Myers, 2011, p. 76). The findings of this research are derived from a single case study, on the subject of non-nursing activities on hospital wards in a single hospital.

3.3 Case Access / Sampling

This research was undertaken on the request of the hospital itself. It is a public hospital which has more than 500 beds. It treats both general and privately insured patients. Due to available resources it was not feasible to collect data on all the hospital wards. Therefore six wards, representative of all the different types of wards in the hospital, were selected by applying a purposive non-probability sampling technique. The wards to be studied were chosen based on the patients’ insurance status, and whether special patient needs meant that activities that would otherwise be
defined as non-nursing ones became nursing activities. This choice was led by the assumption that non-nursing activities are influenced by patients’ insurance status and special needs. Table 1 provides an overview of the six wards:

<table>
<thead>
<tr>
<th>Ward</th>
<th>Characteristic</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
<td></td>
<td></td>
<td>Privately insured Patients</td>
<td>Privately insured Patients</td>
<td>Out Patients</td>
<td>Both general and privately insured patients</td>
<td>Special ward: Intermediate care unit</td>
<td>Special ward: Long stay patients</td>
</tr>
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3.4 Data Collection and Analysis

In line with a qualitative case study research design, data collection was performed using a multimethod approach for qualitative studies (Saunders, Lewis, & Thornhill, 2007), which included semi-structured interviews, expert discussions, document research and structured non-participant observations.

For the observations, a recording sheet was developed. This enabled the times and duration of non-nursing activities to be collected in a structured way, with an indication of who performed each task. Information from the literature was used to create a list of common non-nursing activities. Data was collected in wards 1-5 on two days, between 7am and 7/9 pm, the times when non-nursing activities predominantly take place. Due to the nature of the patients in ward six, the non-nursing tasks were highly individual and formed part of their treatment; therefore observations were not carried out for this ward. Semi-structured expert interviews were conducted with nursing management on the six wards in order to verify observed data and to gain additional knowledge about current non-nursing activities. The interview guidelines were divided into two sections: one section that was specific to each ward and one section that examined all the wards. Detailed document research, focusing on available process and service descriptions, enabled information that supported and enriched the observation and interview data to be gathered. The research project was supported by a steering committee consisting of representatives from both the nursing and FM departments. To process the collected data and its results, expert discussions were conducted with this group of people.

The data collected by interview and observation focused on how non-nursing activities are carried out in the six wards and was analysed and compared. For this purpose a coding strategy was applied using codes to represent a thematic structure that serves to compare and describe settings (Flick, 2009). The codes used were iteratively derived from the data, focusing on the activities and opinions in a majority of the six wards. Examples for such codes are: “Meal task”, “Laundry task”, “Information Exchange”, “Errand”. Firstly, the recorded interviews were transcribed. The codes then made it easy to see what the principal non-nursing tasks were in a condensed form, which then served as a basis for developing the strategy paper.

4 FINDINGS

To address the question when non-nursing activities are performed, the data was displayed as a schematic representation of the non-nursing activities performed on a daily basis, as seen in figure 1. The three main meals serve as structuring tasks, between which logistics activities, such as placing orders, and dish washing, take place. These activities are interrupted by spontaneous, unplanned activities, such as responding to patient calls, transporting patients or running errands to the laboratory.
To clearly state where the condensed form of daily non-nursing activities, as seen in figure 1 is derived from, an extract from the observation recording sheet displaying data is shown in figure 2. It shows on one hand the observed non-nursing activities including their nature and duration and indicates by whom they are conducted.

Regarding who is performing these non-nursing activities, data shows that these are mostly carried out by nursing assistants; however, on wards with privately insured patients some of these tasks are already to some extent performed by staff with a hotel service background. It is important to note that the members of staff carrying out non-nursing activities work under the authority of the nursing department. Data regarding the typical daily routine of these staff further shows that non-nursing activities are already to a high degree carried out by nursing assistants and staff with a hotel service background. This indicates that the main challenge to professionalising the performance of these tasks is not so much the defining of non-nursing activities, but rather the transfer of the entire responsibility for these tasks from the nursing department to the FM department.

With regard to the second research question about whether non-nursing activities are standardised, the data shows that non-nursing activities are performed very differently across the wards. Workflow records were not available for all of the wards. The ones that exist list activities and establish time frames for carrying out the various activities, but they are not used on a daily basis. The majority of the documents are also not current, indicating that processes are not being
assessed and verified on a regular basis. Checklists describing the qualitative nature of the non-nursing activities were not available from the sample wards. From this it can be derived that service quality depends on individuals and the structures that have evolved in each ward rather than on set standards.

The findings of the interviews not only verified the observation data, but also indicated that focusing on the professionalisation of service was viewed positively by the nursing managers questioned. Nursing management from the sample wards especially stressed that the involvement of the FM department in non-nursing activities is welcomed and is not seen as an intrusion. It was acknowledged by the nursing managers that were interviewed that non-nursing activities are not actually part of their remit.

It is important to mention that the nursing managers’ view of non-nursing activities at the time of data collection was not judged to be negative. The findings are the result of structures that were developed over time and, under the given circumstances, the non-nursing activities were carried out appropriately. The data provided substantial evidence to indicate there is great potential to professionalise these activities under the remit of the FM department. The main points that need to be addressed in order to reach the goal of professionalising non-nursing activities are stated in the conclusion.

5 CONCLUSION

This research set out to provide an evidential basis for future changes to the provision of non-nursing activities in the considered hospital. The results show that non-nursing activities are conducted differently between wards and depend on individuals rather than set standards, because the processes and responsibilities for the tasks are not thoroughly defined.

In order to overcome these evidence-based challenges, five core principles were derived from the expert discussions with the research steering committee. These five principles serve as a set of measures for professionalising FM services. Each of it is reasoned by the results of this research. The principles are defined below in order to ensure a joint understanding and to answer the third research question, about the predominant areas that need to be addressed when planning the introduction of room-service:

- **Standards**: Standardisation of non-nursing tasks and processes in order to ensure reliable, constant and professional service delivery that benefits the patients’ needs to be introduced.
- **Process-Controlling**: Total process responsibility including managerial authority should be introduced.
- **Consistency**: Measures designed to professionalise non-nursing activities must be implemented in spite of any positive / negative effects that are associated with change processes.
- **Commitment**: A top-down commitment to plan, introduce and establish service professionalisation through a room-service concept is vital.
- **Professional Skills**: Assigning resources with the appropriate professional knowledge, skills and interest to the appropriate tasks serves as a leading principle in the professionalisation process.

These results were developed into a strategy paper to initiate and guide a major reorganisation process with the aim of professionalising FM services. The main findings of this paper justify the establishment of a detailed project to plan a hospital wide introduction of room-service and to move non-nursing activities from the nursing department to the FM department. This is a precondition for professionalising non-nursing services as part of the FM support services. Based on the findings from this paper, a decision was taken by the hospital board to start planning such a project.
5.1 Relevance of Findings
The findings of this research provide a set of valuable arguments for professionalising FM services. They are of particular interest for the hospital involved in this research and are also limited to that. The findings cannot be claimed as representative for other hospitals. In order to profoundly generalize the findings for other hospitals other realities would need to be analysed, using the established methods of this research. Still the existing findings are useful for other hospitals aspiring to professionalise their services by introducing a room-service concept by providing them a basis of argumentation to start the analysis of their own realities, as a basis for the concepts introduction. Nevertheless, in light of the previously mentioned challenges that Swiss hospitals are facing, these findings are of great value. However the findings and especially the therein contained positive attitude of the nursing management towards the involvement of the FM department were made at a time when the FM department had not yet started to take over any responsibility for non-nursing tasks. Further research needs to evaluate whether this attitude outlasts a real shift of non-nursing tasks and allocated staff resources from the nursing to the FM department.

5.2 Outlook
Subsequent to this research, the hospital completed a planning project, which led to a large reorganisation project. Non-nursing activities are gradually being moved from the nursing to the FM department. A hospital wide introduction of professionalised ward FM services will be completed by 2015. This will be followed by a thorough validation of the reorganisation project, which will be used to further extend this research. Then also the actual room service concept can be validated for its value and findings will not be limited to the status quo, as addressed by the present study.

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Role Model for Chief Facility Managing Officers (CFMOs) based on the Service Allocation Model for Service Companies (SAMoS)  
A Theoretical Reflection and Basis for Discussion
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ABSTRACT
The profile of a Chief Operating Officer (COO) mostly defines the role of the manager responsible for daily business operations, reporting to the Chief Executive Officer (CEO). For service companies or institutions with no industrial production but instead a high ratio of hospitality aspects, no adequate profile in terms of leading support processes has so far been discussed on a broad level. The setup of the Service Allocation Model for Non-Medical Support Services in Hospitals (LemoS) has revealed that the coordination of resources and data between the different FM areas defined in the norm SN EN 15221-4 (2011) means a new discipline and role, by means of which FM will be able to prove its importance in controlling and developing service companies. For this purpose, LemoS was adapted to general service companies such as airports, ground transportation companies, hotels, food service providers, event management businesses, safety & security providers, logistics & procurement firms and postal services, where FM plays an even more important role than the classical management support services. The result is the Service Allocation Model for Service Companies (SAMoS). On this basis, the differences between the tasks of Chief Operating Officers (COOs) and Chief Facility Managing Officers (CFMOs) can be discussed systematically, as well as the (future) profile and role of the latter.

KEYWORDS Facility Management, Chief Facility Managing Officer CFMO, Chief Operating COO, Resource Management, Service Companies, SN EN 15221-4

1 INTRODUCTION
In classical business administration, the role of managing the daily operational business has so far been defined as Chief Operating Officer (Lüth & Leicht, 2008; Miles & Bennet, 2006; Investopedia), or in brief COO. What this function includes is usually the conduct, control and organisation of (production) processes, including the reporting of production quotas. For service companies or institutions without industrial production but instead with a high ratio of hospitality aspects as well as the processes related to the buildings - e.g. airports, ground transportation companies, hotels, food service providers, event management businesses, safety & security providers, logistics & procurement firms and postal services - no adequate profile has so far been specifically discussed. When working in the FM context it becomes clear that it is necessary to promote such a new role and most probably in addition to the classic COO tasks, taking into consideration the specific FM needs of service companies, and at the same time to grasp the opportunity to position FM at the board level.
2 SERVICE ALLOCATION MODEL FOR NON-MEDICAL SUPPORT SERVICES IN HOSPITALS (LEMOs)

According to Hofer and Gerber (2013) and Gerber and Läuppi (2014) and their Service Allocation Model for Non-Medical Support Services in Hospitals (LemoS - Leistungszuordnungsmodell für nicht-medizinische Supportleistungen in Spitälern), in the hospital industry, the service levels can be distinguished between Strategic Management Services and their Support Services, Medical Core Services and their Support Services and Non-Medical Support Services (see Figure 1). Focusing on the Non-Medical Support Services, the authors describe the different FM services in hospitals (see Figure 2) with the goal to create a basis for a common understanding and in order to be able to set up clear key performance indicators. The methodology for setting up LemoS were iterative rounds of expert interviews and focus groups, with both norm and hospital FM experts from all different levels and various specializations, using semi-standardised guideline-based interviews.

Figure 1: Overview of Service Levels in Hospitals

3 RESOURCE MANAGEMENT

In a qualitative survey conducting expert interviews Gerber (2014) found out that the specific aspect of resource management covering the complex network of FM services is of great importance (see also Klaus, 2012), but currently not specifically described in the norm SN EN 15221-4 D (2011) / SN EN 15221-4 E (2011). In addition, it became clear that there are hardly any software applications linking all the different FM factors. As a consequence, expert interviews with people from finance/controlling, IT as well as of the operational FM levels were conducted to find possible approaches for IT-supported FM applications to achieve more specific resource management in hospitals (Gerber, 2014). The author points out that the partial results

Source: Gerber & Läuppi (2015)
showed three main findings: first of all, there are very rarely people whose function is to take care of resource management spanning all the different FM disciplines. This means that different profiles are specified in FM sub-disciplines, but there is no key person with a hub function representing the organization’s official management level also called the C-level due to the fact that its representatives are mostly called Chief … Officer. Secondly, the different units therefore very often operate in their own area without harmonising resources with other FM areas. This is thirdly also the case because the software applications implemented are not (fully) interlinked and therefore cannot support the FM staff in planning for different resource scenarios.

Figure 2: Service Allocation Model for Non-Medical Support Services in Hospitals

4 SERVICE ALLOCATION MODEL FOR SERVICE COMPANIES (SAMOS)
Transferring the findings from LemoS and the survey on Resource Management to the context of service companies in general, it becomes apparent that even when the specific hospital content is removed, the situation concerning resource management and coordination of the FM sub-tasks in service companies remains similar. This leads to the setup of the Service Allocation Model for Service Companies (SamoS) illustrated in Figure 3, describing all the different tasks on the three service levels, without the specifications of the healthcare context. The model is also based on SN EN 15221-4 E (2011) but the services are clustered in a more systematic manner, according to the findings of the LemoS project (Hofer & Gerber, 2013).
The goal of the model is to have a basis for discussion for future research of different interactions between the specific strategic, tactical and operational services in service companies as well as to develop clear empirically founded guidelines to enable future Chief Facility Managing Officers (see following chapter).

Figure 3: Service Allocation Model for Service Companies (SamoS)
5 DISCUSSION: CHIEF FACILITY MANAGING OFFICER (CFMO) OR CHIEF OPERATING OFFICER (COO)?

It has become clear that, especially with the growing need for sustainable resource use and the increasing importance of FM, the role of combining resources and FM, as well as being represented on the C-level management board, implementing the role of Chief Facility Managing Officer - CFMO – has to be discussed on a broad level. A CFMO should at least have three main objectives: firstly to align the different aspects on the strategic level with each other, with the focus on FM. Secondly, to coordinate and adjust the FM services and their resources on an operational/tactical level. Thirdly, to handle the alignment between the strategic and the operation-
al/tactical levels. Figure 4 illustrates the above mentioned interlinks within the Strategic Management Service level, the Support Services for Core Business level as well as between the two levels. These ideas lead to the discussion on how the role of COOs and CFMOs differ and under which circumstances it would be advisable to appoint which role. As a result, it will have to be considered to adjust the illustration in Figure 5. The Service Allocation Model for Service Companies (SamoS) is supposed to provide a systematic basis in this discussion process. Figure 5: Example of an organisational model based on the FM-model where the primary activities and the support activities are organised on an even level and the FM organisation is incorporated on board level. The line between Internal and External represents the flexibility in outsourcing.

Source: SN EN 15221-4 2011, p. 62

6 OUTLOOK
In general it can be said that current research reveals that FM specialists will in the future most likely be even more interdisciplinary than nowadays, speaking the language of both the strategic and the operational levels. Furthermore, suitably designed FM-Software will play a major role in establishing FM on the C-level. The cooperation between IT and FM specialists is therefore vital, as is looking at FM in a very holistic way. Should the role of CFMO as a representative of the FM discipline on the strategic level be promoted, further studies will have to be conducted. For example, the different interactions between the specific strategic, tactical and operational services have to be researched and a framework with practical checklists to support CFMOs will have to be developed, both in the hospital as well as the general service company context. In order to develop the FM software development, one possibility would be the exploration of information systems and application mappings to enhance scenario planning in FM. It is hoped that through these systematic applied research projects, FM will soon reach the position in the business world it deserves - on the strategic level, represented by CFMOs.

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**Legionella in FM – Detection of Legionella pneumophila in waterlines of dental surgeries in the canton of Zurich, Switzerland**

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**ABSTRACT**

Facility management (FM) is present in healthcare. According to the International Facility Management Association (IFMA) guidelines, an organisation is obliged to take precautions to enable continuous business operation and reduce hazards. As FM organizations or facilities services are sometimes responsible for water systems, and hence in the reduction of hazards in this area, the FM’s role is vital for maintaining hygiene. Being healthcare providers, dental surgeries are subject to strict hygienic criteria. During treatment patients are consigned to the care of dentists. The instruments of a dental chair unit (DCU) operate with drinking water from a source. In the process of an implemented hygienic concept in the dental surgeries the care instruments get disinfected systematically. But the water system of the building itself allows limited access, and its hygienic status is not always documented well. As can be seen by this example, hygiene concepts potentially contain blind spots. As a result, not only patients but also medical staff might be exposed to hygienic hazards, which are meant to be reduced to a minimum. Contaminated water lines may cause certain diseases (e.g. Legionnaire’s Disease). Inevitably, the personnel responsible have to manage the facilities appropriately to reduce the risks of a contamination. Literature on Legionella suggests an urgent need to address the issue of Legionella in dental surgeries. This paper will highlight the issue of Legionella in dental surgeries and aims to detect potential hazards from the built environments’ hygiene with a focus on water lines. It will further draw attention to additional criteria relevant for FM and duty holders. During the case study, data was collected on Legionella contamination in dental surgeries' waterlines. Building and water lines of the DCUs were tested as well, in compliance with the Swiss drinking water ordinance. Appreciating the fact, that there was no pathogen Legionella pneumophila detected in all samples of the DCUs, the questions arises on the incident of a potential contamination of the facilities (building) water line system itself as well as on the duties of the stakeholders involved.

**Keywords** Healthcare, Facility Management, Legionella, Contamination, Dental Surgery

6 **INTRODUCTION**

6.1 **Occurrence of Legionella**

The genus *Legionella* is a pathogenic group of gram-negative bacteria, which includes the species *Legionella pneumophila*, causing Legionellosis. *Legionella* contaminated water systems in facilities are a serious problem and an issue which needs to be addressed. Besides the threat of economic losses or damage to image, a risk to the public is undeniable. Potentially affected are people being exposed to open water systems or the apertures of water systems (i.e. all varieties of water outlets). Hazards arise from contaminated small-size water droplets, termed aerosols, in which *Legionella* exist. Especially in facilities management (FM) contexts, where managers (i.e.
operators or any duty holders) can be responsible for building associated facilities such as water systems, awareness of the potential contamination risks needs to be addressed. Understanding the context is the first step towards precisely defining actions against hazards such as Legionella. Prominent cases of contaminated water systems or water-bearing facilities, which document the hazardous potential of contamination with Legionella, can be found worldwide. The surveillance report from the European Centre for Disease Prevention and Control (ECDC) states, that 5,852 cases of Legionnaires’ disease were reported by EU member states, Iceland and Norway. Of the 29 countries involved, six countries accounted for 84% of all notified cases. Interestingly these countries have a high level of awareness and run reporting systems on Legionella. 69% of the reported cases were community-acquired, 20% were travel associated and 8% were linked to healthcare facilities (ECDC, 2014). Healthcare facilities are usually visited by immunocompromised people or people who need a medical operation. Thus they constitute a risk group whose environment should meet stipulated requirements of hygiene.

The ECDC’s report states two main reasons why Legionnaires’ disease is thought to be underreported: (a) insufficient diagnosis by clinicians, and (b) failure to notify health authorities, although the disease can be registered in all European Union (EU) and European Economic Area (EEA) countries. Switzerland is not mentioned in the ECDC report.

6.2 Legionella in the context of FM

Water systems, including all related facilities, are in the range of duties FM organizations or facilities services (e.g. property operators) sometimes are responsible for. The IFMA guidelines define the competencies of FM. In 2013 the chapters “Emergency Preparedness and Business Continuity” and “Environmental Stewardship and Sustainability” were added to these guidelines. Thus the management competencies of FM now include hazard prevention requirements. Hazards might, for example, arise from microbiological contamination with species of Legionella (Legionella spp.). The facultative pathogen Legionella pneumophila (Heesemann J., 2012), a species of Legionella, accounts for 85-98% of confirmed cases, depending on the testing method used (ECDC, 2014). In community and in healthcare organisations, the potential consequences of a case of Legionella are particularly profound. In healthcare not only the health of patients and staff might be affected (working people such as doctors, care personnel, cleaning personnel, and service personnel), but also the performance of and confidence in the organisation.

The former draft of ASHRAE-Standard 188P entitled “Legionellosis: Risk Management for Building Water Systems” puts forward criteria to help facility managers understand building water systems with respect to avoiding amplification and dissemination of Legionella. With respect to the design and operation of the building water systems, the upcoming standard will provide practical guidance to control exposure. It will include design, maintenance and operational procedures throughout the life-cycle of the building (Martin D., 2012; Scott J., 2014).

One tragic example of a Legionella outbreak, which is associated with a particular FM service provider, is a case in Germany in 2009. The city of Ulm recorded over 65 cases and several deaths (von Baum H. et al., 2010). The outbreak was caused by Legionella infected aerosols from a cooling tower of a thermal block-type power station. Several years of litigation ensued before prosecution stopped the investigation procedure (Mayer C., 2013).

To counteract potential threats caused by Legionella contamination, organisations should consider a mandatory scope statement as part of their risk management. However, the legal framework or potential threats are not always identified sufficiently. Duty holders may fail to determine appropriate strategies to counteract Legionella (Gollnisch A. et al., 2003). Considering parameters specific to the organisation is an essential part of risk assessment. An infected water system is a
defect of a building and reduces the value of a facility. Professionals with operator’s duties must bear that in mind. Probably derived from demands like these the UK HSE guidance ‘Legionnaires’ disease: Technical guidance’ was compiled (HSE, 2014).

6.3 Drinking water and Legionella in Switzerland
A report from the Swiss Federal Office of Public Health (FOPH, 2008) concluded that the incidence of Legionnaires’ disease in Switzerland is relatively high compared with other countries in Europe. FOPH’s ongoing statistics on the number of cases registered, document an increasing number of deaths caused by Legionnaires’ disease. The numbers represent all cases reported to the FOPH. During the past 52 weeks the number of cases has increased to 296 (FOPH, 2015). Statistics are listed consecutively due to the fact that in Switzerland Legionnaires’ disease has been a reportable disease since 1988. In a module-based document the Swiss authority reports on different perspectives on Legionella and prevention strategies. Special cases are seen in hospitals and care units (FOPH, 2009). The Swiss regulations on drinking water – including Foodstuffs and Consumer Goods Regulations, Hygiene Regulations and Regulations on Drinking Water, Spring Water and Natural Mineral Water – make no mention of Legionella. Nevertheless pathogens are tolerated up to a limit to 300 microbes per ml (millilitre).

6.4 Legionella aerosols in healthcare facilities
Legionnaires’ disease is transmitted by air through inhalation of contaminated aerosols or aspiration of contaminated water (Heesemann J., 2012). Aerosols occur both inside and outside buildings, and are often associated with the water systems of cooling towers, heat exchange systems, showers, swimming pools, thermal spas or similar (Laganà P. et al., 2014). Facilities of this kind promote the creation and distribution of aerosols. A large proportion of people present in a healthcare facility are there because they suffer from poor health and are thus vulnerable to infection. As a result of this, indoor environments should be subjected to high standards of hygiene and prevention control (Haupt T.E. et al., 2012). In many cases a relatively high level of hygiene is achieved for the proximity (working environment). However, ‘non-obvious’ risks, such as water-bearing facilities, might be neglected. Even in healthcare, a field of high-level hygienic risk control, this phenomenon is present (Fragou K. et al., 2012; Spagnolo A.M. et al., 2013). In dentistry we find situations where (a) aerosols might be emitted by the water-associated instruments of dental chair units (DCUs), (b) aerosols potentially contain Legionella arising from the dental unit waterlines (DWULs), and (c) patients and working personnel are exposed to aerosols.

7 CONTEXTUAL FRAME AND AIM OF THE STUDY
The Commission of Hospital Hygiene and Infection Prevention (KRINKO) compiled guidelines for the prevention of nosocomial infections and for operational-organisational and constructional-functional hygiene measures in hospitals and other medical facilities. The guidelines are published by the Robert Koch-Institute (RKI) with respect to the latest epidemiology results, and are considered best practice in many places (Simon A. and Christiansen B., 2012). As outlined in the introduction section, risk management and control strategies for hygienic risks of processes in healthcare require and involve FM activities. In that context this research affects facilities of buildings and water lines in the context of Legionella. The purpose of the present work is to outline needs of duty holders and relevant activities in healthcare associated facilities (here: dentistry).

This study is currently at the stage of performing and analyzing a case study to obtain evidence on water lines in dental surgeries in the canton of Zurich. Previously a literature review was carried out to get an impression of the potential level of a contamination by Legionella in dental
surgeries. Findings from the literature review as well as an up-to-date evaluation of the case study will be presented in this paper. In addition to the usual water lines in the buildings, attention is paid to the DCUs, which are supplied by water of drinking water quality (Barben J. et al., 2009). Depending on the technical level of the facility the water is processed before final usage. The ‘raw material’ is the water coming from the source of the local water provider to the building’s operator. As soon as the water gets into the facility it is the building operator’s duty to ascertain the quality level of the water according to regulatory.

In Switzerland, the FOPH has published guidelines for testing of Legionella for several types of facilities. The limits for concentration of Legionella pneumophila in the water line system obtained from these guidelines are used for orientation. With respect to Legionnaires’ disease, the FOPH does not give particular modules for dental surgeries. In module 13, “Special case hospitals and care homes”, limits for Legionella in the water lines of hospitals are laid down. Dental surgeries, as part of healthcare, will be evaluated according to the limits described in module 13. It is an aim of this research to assess the risk arising from potentially contaminated water in dental surgeries.

Further aims are:
- Outlining the relevance of the issue of Legionella in FM
- Bringing attention to and showing the need for ongoing research on Legionella in the context of FM and water lines.
- Encouraging a framework for appropriate hygiene monitoring as part of the risk management in FM for prevention and steering measures, including the crucial players.
- Generating data during a field study in the canton of Zurich to evaluate the presence and relevance of the Legionella issue in dental surgeries (facilities in healthcare).
- Gaining an impression of the technical level and age of DCUs in dental surgeries in the canton of Zurich.

8 RISK ASSESSMENT AND HYGIENE MANAGEMENT IN DENTAL SURGERIES

This paper deals with the issue of Legionella contamination risk in healthcare facilities, which can be part of an FM activities’ portfolio. A special hotspot of facilities’ risk in healthcare is seen in dental surgeries, where Legionella might be released during dental treatment. A pilot study identified the transmission of pathogens to patients during dental treatments (Exner M. et al., 1981). Studies in Liverpool and London have also shown the significance of bacterial contamination with Legionella in dental surgeries (Martin M.V., 1987; Oppenheim B.A. et al., 1987). The guidelines for infection prevention in dentistry, issued by the KRINKO at the RKI, list the following factors as being most relevant to risk potential with regard to Legionnaires’ disease risk in dental surgeries (KRINKO, 2006):

- Age of DCU
- Presence of a hygiene concept regarding prevention of Legionella (cleaning/disinfection)
- Hazard analysis in case of a positively tested case
- Continuous monitoring of defined check points (CPs) within an existing hygiene concept
- Source of contamination (technical system or main waterlines of the building installation)
- Raising awareness of a potential contamination scenario (training)

An analysis of a survey carried out in 2009 (Hübner N.O. et al., 2012) identified deficiencies in the hygiene management of dental surgeries. However, Hübner et al. also stated that hygiene management and hygiene equipment in dental surgeries have improved considerably compared to a previous survey in 2002/2003. The 2006 KRINKO guidelines for dental practices were as-
signed to this effect. The study focused mainly on DCUs and to a lesser extent considered facility water lines, which are also relevant to facilities duty holders.

A prevalence of between 10% and 50% for *Legionella pneumophila* in DCUs has been reported in the literature (Lück P.C. *et al.*, 1992; Oppenheim B.A. *et al.*, 1987; Reinthaler F.F. *et al.*, 1988). In Switzerland, one study from Berne showed that only 10% of DCUs complied with existing criteria required for drinking water. It documented that for *Legionella* the tolerated margin of 1,000 microbes per litre was frequently exceeded (Tonetti-Eberle B. *et al.*, 2001). In a study, conducted by Barben *et al.* in 2009 (Barben J. *et al.*, 2009) in St. Gallen, Switzerland, the water quality in 76 DCUs was tested. Microbial contamination was detected by evaluating the prevalence of *Pseudomonas aeruginosa, Legionella* and heterotrophic bacteria as ‘markers of pollution in water’. Among others, water samples for quality testing were taken from the 3-in-1 air water syringe. *Legionella* were found in 20% of the DCUs tested, indicating the 3-in-1 air water syringe being one of the sampling locations with bacterial count. The study also showed a significantly higher risk of contamination associated with older DCUs. Furthermore, the study showed that the water quality of 60% of the DCUs tested neither complied with Swiss drinking water standards nor with the recommendations of the American Centres for Disease Control and Prevention (CDC).

To investigate incidences that were discussed above, but considered from a different perspective, we conducted our own case study research with a specific link to facilities duty holders in the canton of Zurich.

9  **CASE STUDY DENTAL SURGERIES IN THE CANTON OF ZURICH**

9.1  **Design and Methodology**

During the case study quantitative data was collected on *Legionella* contamination. The case study research was design mixed method. The qualitative part was realized by a survey which was divided into three categories (technical, structural and organizational). It contained in-depth questions about the facility, the facilities’ waterlines, the technical specifications of the DCUs, and on the characteristics of an existing hygiene concept. The case study involved five dental surgeries, randomly selected in the canton of Zurich. Within this sample the presence of *Legionella* was tested by taking water samples from different waterlines. Both the buildings’ and the DCUs’ waterlines were tested. The sample covered 11 waterlines from the building, each including warm and cold tap water. The points of water sampling included taps at the sink in the laboratory, taps at the sink in the break room and hand basins in the customers’ toilet. Furthermore, the testing scenario covered 14 DCUs. Here the points of water sampling included the 3-in-1 air water syringe and the taps to fill the tooth mug. The water samples were taken according to DIN EN ISO 19458. According to this norm the sampling procedures can be assigned to ‘aim c for orientation’. This category was selected as worst-case-testing scenario for the waterlines as it tests the waterline system on the present conditions in use. Divergent to the norm, it must be mentioned for the sampling procedure for facility waterlines, that there was no sampling at either the water circulation return or the outlet of the hot-water boiler. Furthermore, we applied a 1 minute interval water rinse to receive water from regions deeper in the water line system. All water samples were subjected to microbiological tests according to Swiss norm SN EN ISO 11731-2:2008-05.
9.2 Findings

- There was no evidence of the presence of *Legionella pneumophila* or *Legionella spp.* in waterlines in the DCUs. Hence there was no observed impact of the age of the DCUs on the *Legionella* contamination result.
- There was evidence for the presence of *Legionella pneumophila* and *Legionella spp.* in waterlines in the facility where the dental surgeries are located.
- In 4 out of the 11 hot water lines of the building there were samples which tested positive to *Legionella pneumophila* and *Legionella spp.* In 3 of them the values exceeded the threshold of 1,000 microbes per litre (FOPH, 2009), indicating a potential contamination of the hot water line.
- In 7 out of 10 cases the water temperature measured at the opening of the hot water taps was not greater than 55°C, and so not in accordance with the recommendations of the FOPH. The temperature ranged from 46.9°C to 53.9°C. The fact that the temperature falls below this value is a commonly known and discussed subject amongst technicians and plumbers regarding drinking water hot water lines. This issue is also in line with known discussion on biofilms in waterlines.
- In cases, the dentists did not have in-depth knowledge about their facilities’ water lines, the treatment of the water of their DCUs and the microbiological quality of the water lines in the building in which the surgery located.

10 CONCLUSION

To maintain continuously high hygienic safety and to minimize the risks of contamination by *Legionella*, appropriate hygiene monitoring (qualitative and quantitative) is essential for risk management, which includes prevention measures. It involves national legislation, guidelines, limiting values, and consulting subject-specific professionals to consider generally recognised codes of practice. Preliminary results of this case study suggest that less risk results from water in DCUs, from which aerosols might be released into the indoor environment. Cases of *Legionella* associated with dental treatment are documented in the literature. But *Legionella* infection risks occur in different types of healthcare facilities, not limited to dental surgeries. Risks of *Legionella* contamination potentially occur in public buildings as well as in private institutions. The question remains, as postulated by ECDC, whether all cases of Legionnaires’ disease are notified to health authorities and whether dental surgeries represent a potentially more hazardous environment compared with other healthcare facilities. National legislation differs from country to country, but the risk of *Legionella* is common to all. To reduce the risk of damage to health, the World Health Organisation’s guidelines for drinking water quality recommend that health care facilities adopt a water safety plan (WHO, 2011) to practice it as a substantial part of their risk management. The use and provision of microbiologically clean water also complies with the generally accepted principles of preventing infection.

In means of our case study, not only assessing potential hazards (e.g. age of DCU, implemented hygiene concept including CPs and hygiene monitoring) is crucial for *Legionella* prevention as it was outlined by KRINKO 2006. Also the raising awareness for potential sources of contamination, the source of contamination itself, the water lines (of the DCUs and of the facility) as well as the knowledge about the latter should be considered by duty holders.

We found evidence for the presence of *Legionella pneumophila* and *Legionella spp.* in waterlines in the facility in which the dental surgeries are located. It leaves open the question ‘Where are
the water lines in dental surgeries assigned to? For facility water lines (sanitation in private household) in Switzerland there are different thresholds regarding the assessment of a potential contamination compared to those determined for hospitals and other health care facilities, according to the report of FOPH (FOPH, 2009). Appreciating the fact that there was no single pathogen *Legionella pneumophila* detected in all samples of the DCUs, the questions arises about the potential for contamination of the facilities (building) water line system itself.

FM needs to keep an eye on the topic of *Legionella* and water systems of facilities. In FM contexts *Legionella* is a serious and present issue and needs more investigation. Systemic approaches and legal authorities must be considered for identifying the sources, to launch protection strategies and to fulfil long-term responsibilities towards people and the preservation of facilities.

**ACKNOWLEDGMENTS**

We wish to thank the dentists in the canton of Zurich who participated and thus contributed to the case study “*Legionella in FM*” for dental surgeries in the canton of Zurich.

**REFERENCES**


Impact of facilities management in achieving sustainable buildings

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ABSTRACT
The aim of this paper is to determine FM functions in relation to sustainable building (SB) throughout the phases of the building life-cycle. A sustainable environment is the primary focus of many building designers, and even building users in order to attain high level of satisfaction of occupants’ safety and comfort and to meet the sustainable development (SD) agenda requirements. Facilities management (FM) has an important part to play in creating this sustainable environment and has been defined by many. However, does this integrative role help in achieving SB? There is limited research in FM view in relation to SB. The research methodology adopted is the review of existing literature sources on SBs and the documents produced by BREEAM, LEED and ISO. The research methodology also involves a review of the competencies of FM as stated in FM professional standards. The paper evaluates the role of FM in relation to identified SB constituents at the design, construction and operations phases of the building life-cycle. The findings of the research reveal SB constituents in accordance with BREEAM, LEED and ISO and FM functions in relation to the SB constituents. These FM functions are found to be operative mostly at the design and operations phase. This paper helps FM practitioners to be aware of their role in SBs. There is need for FM practitioners to function at the construction phase.

KEYWORDS Sustainable building, Sustainable development, Facilities management,

1.0 INTRODUCTION
The creation of sustainable living and workplace environment is the key focus of building designers, contractors and even building users in order to achieve high level of satisfaction of occupants’ safety, health and comfort and to meet the SD agenda requirements. FM in its multi-tasking role has an important part to play in creating these sustainable environments and has been defined by many (Becker, 1990; Pearson, 2003; Armstrong, 2002; Alexander, 2003). This FM multi-disciplinary role involves activities within the built environment, which includes maintaining, improving and adapting buildings and assets through time, in the most cost effective way (BIFM, 2008) and is mostly related to buildings of all types (residential, commercial, healthcare, industrial, government, educational, agricultural, religious, and so on). In these buildings FM measures customer satisfaction to improve its services reflecting on the extent to which a building meets the needs of its users; addressing such issues as occupant performance, worker satisfaction and productivity (British Council for Offices, 2007; Preiser and Vischer, 2005). FM deals with all aspects of indoor environmental quality (Chan et al, 2008; Smith and Pitt, 2011); space management and plays an essential role in healthcare, with the provision of a well-designed and well-maintained good quality environment in hospitals, in order to improve overall healthcare quality (Richardson, 2001). Though FM has contributed immensely to the productivity and profitability of organisations and to the health and well-being of building users, its role in creating SBs is yet to be determined.
2.0 THE CONCEPT OF SUSTAINABLE BUILDING
The SB concept can be integrated into buildings of all types whether commercial, residential, healthcare, sports etc. A SB is a building that minimises the use of resources such as energy and water, unwanted outputs such as greenhouse gas, and maximises the health and wellbeing of users (Eley, 2011). John et al., (2005) describes it as the thoughtful integration of architecture with electrical, mechanical and structural engineering resources, considering the whole life of the building and taking environmental quality, functional quality and future values into account. Buildings are responsible for the consumption of major amounts of energy, water and land usage and are therefore responsible for a great part of the world's environmental problems (Anink et al., 1996). A high percentage of non-renewable resources consumed across the world are used in the construction industry, making it one of the least sustainable industries in the world (Edwards, 2010). The built environment has a significant impact on the SD agenda as it accounts for nearly 40% of natural resources consumed, and 40% of waste and greenhouse gases generated (CIOB, 2004). Buildings use as much as 45% of generated energy to produce power for air-conditioning and heating (Wood, 2005; Reed et al., 2011). Buildings also account for one sixth of the world’s fresh water withdrawals, one quarter of wood harvested and two fifths of all material and energy flows (Emmanuel, 2004). The need for SBs arose as a result of the negative impact of the construction industry on the environment. Though the construction industry has a history of negative impact on the environment such as being responsible for the consumption of major amounts of energy, water and land usage, yet it has a vital contribution towards achieving SD (Gibberd, 2002; Anink et al, 1996). It addresses basic human needs in terms of provision of housing and social infrastructure (Sinha et al., 2013). It also determines the quality of housing and access to services and recreation, promoting healthy living and socially cohesive communities (Shah, 2007). It is increasingly becoming a key consideration for building practitioners in the construction industry to achieve the aim of increasing economic efficiency, protect, and restore ecological systems and at the same time, improve human well-being with the development of SBs (Sinha et al., 2013). This according to BIFM (2014), RICS (2014), IFMA (2014) and FMMA (2012) is the sole aim of the FM practice. However, in order for FM practitioners to support the SB concept, there is need to understand the FM function in the phases of the building life-cycle.

3.0 FACILITIES MANAGEMENT AND PHASES OF THE BUILDING LIFE-CYCLE
According to Hodges (2005), facilities managers are specialised in the knowledge of the entire life-cycle of a building and manage the different phases as shown in Figure 5.1 in order to derive optimum value of the building at the most economical cost over its life-cycle (Then and Hee, 2013).

The building life-cycle from a facilities manager’s view does not start at the building handover but at the design phase and in particular, the initial briefing (Shah, 2007). At the design phase, according to Erdener, (2003) the early engagement of FM can contribute to reducing major repairs and alterations that will otherwise occur at the operational phase. However, few efforts have been made in the construction industry to involve FM in the design phase (Nutt and McLennan, 2000). To ensure from the very beginning that building facilities meet the objective of supporting core business and to reduce cost of major repairs and alterations, the facilities manager has to be involved in the entire design process (Kelly et al, 2005). According to Preiser (1995), facilities managers when consulted in the design phase of a project, are able to highlight problems early and provide valuable information on building performance and operating costs.
At the operations phase FM deals with the management of built assets and incorporates controlling services necessary for successful business operations of an organisation and for the ultimate satisfaction of the building users (Lavy et al., 2010). These built assets start to age from the moment they are completed and put in use and consequently needing maintenance throughout the life time of the building in order to achieve its effective and economical usage (Fakhrudin et al., 2011). This paper sets out to determine FM functions in creating SBs. However, in order to determine this, there is need to identify SB constituents and then determine if FM carries out its functions in line with these constituents.

Figure 1: FM Role and the Building Life-Cycle. FMA Australia (2012) as cited in Shiem-Shin and Hee, (2013).

4.0 RESEARCH METHODOLOGY
The research methodology used in this study involves an in-depth study and review of existing literature sources on SBs and the documents produced by the Building Research Establishment Environmental Assessment Method (BREEAM), the Leadership in Energy & Environmental Design (LEED) and the International Organization for Standardization (ISO). According to Yuhui (2013) BREEAM and LEED are the two most representative building sustainability assessment organizations in the world due to the wide coverage of building types, and environmental, social and economic issues.

The International Organization for Standardization (ISO) identifies and establishes general principles for SD in building construction. These international standards are set by technical committees made up of governmental and non-governmental international organisations in the UK. Draft international standards adopted by these technical committees are circulated to the member bodies for voting. National standards are set for publication when at least 75% of the member bodies have casted a vote on it. These international standards contribute to the achievement of SD either directly, where they specifically address SD issues, or indirectly, where they relate to testing, products, procedures, services, terminology, management systems or auditing (BSI, 2013).

The documents produced by these organisations are building assessment standards used in assessing a building’s sustainable qualities, and these include; BREEAM New Construction UK, LEED New Construction US and the Sustainability in Buildings and Civil Engineering Works — Guidelines on the Application of the General Principles in ISO 15392. These documents address buildings at the design phase on the basis that a building can only be truly sustainable if designed having put sustainable measures into consideration. Through the years, they have contributed to the increase in awareness about the criteria and objectives of SD in buildings and have become a
framework of reference to assess the sustainability of buildings. Though they present their assessment of what a SB is in different ways, yet they share a common framework. Therefore the justification in this research as documents that can be used to determine the constituents of SB. The research also includes an in-depth study and review of the competencies of FM as stated in FM professional standards which include Skills in Facilities Management Investigation into Industry Education (FMAA) 2012; the IFMA Complete List of Competencies as defined in the Global Job Task Analysis (GJTA) 2009 defining 11 core FM competencies including responses from facility managers in 62 countries; the BIFM Facilities Management Professional Standards Handbook 2014; and the RICS Assessment of Professional Competence Facilities Management Pathway Guide 2014.

These documents were selected on the basis that; they are produced by the British Institute of Facilities Management (BIFM), the International Facility Management Association (IFMA); and the Royal Institute of Chartered Surveyors Facilities Management Group (RICS FM group) established within the Royal Institution of Chartered Surveyors (RICS) respectively. These associations are globally accepted as bodies that deal with the FM profession and are the leading FM associations in the world. They define what FM is, explicate the scope of FM and elucidate the knowledge, skills, abilities and behaviours needed to perform FM tasks (Awang et al, 2011).

These documents are set as standards for facility managers and are relevant to the research study. Hence, the justification for using them to determine FM functions. The documents were studied and the FM functions as stated in each document were identified and examined. The various processes and activities involved in the design, construction and operations phases of the building life-cycle were also examined, in order to map identified FM functions in relation to SB at each phase. This was carried out in order to determine FM function in relation to SB.

5.0 FINDINGS

5.1 Sustainable Building Constituents

A review of BREEAM-NC, LEED-NC and Sustainability in Buildings and Civil Engineering Works — Guidelines on the Application of the General Principles in ISO 15392 and of existing literature sources on SBs, has identified 25 constituents common to both literature on SB and the above mentioned documents. The SB constituents include: Under the environmental aspect – building material use, energy use (local energy generation from renewable sources and reducing operational GHG emissions), energy use (solar), land use efficiency - previously developed sites, land use efficiency – ecological value of land, land use efficiency – biodiversity, air pollution, water and land pollution, light pollution and waste management; under the social aspect - adhering to ethical standards, adaptability for different uses, conserving local heritage and culture, accessibility, visual comfort, indoor environmental quality, thermal control, acoustic control, water quality and safe access; and under the economic aspect – building life-cycle cost, energy efficiency and management, water efficiency and management, material efficiency, and maintenance and management.

5.2 Facilities Management Functions in Sustainable Buildings

An examination of the FM professional standards as stated in Section 4.0 was carried out using key word search of FM functions that are common to at least two of the documents selected above and these were compared to the identified SB constituents. FM functions were found to relate to 14 of the SB constituents as shown in Table 1 and these include under the environmental aspect: building material use, energy use (local energy generation from renewable sources and reducing operational GHG emissions), land use efficiency – ecological value of land, land use
efficiency - biodiversity and waste management; under the social aspect: visual comfort, indoor environmental quality, thermal control and acoustic control; under the economic aspect: building life-cycle cost, energy efficiency and management, water efficiency and management, material efficiency, and maintenance and management. This is supported by studies carried out on FM and have shown FM to include supporting organisations to become more environmentally sound and provide environment and energy related services (Hodges, 2005; Roper and Beard, 2006; Wood, 2006; Junnila, 2007; Nousiainen and Junnila, 2008).

6 FM IN SUSTAINABLE BUILDING

6.1 FM in Sustainable Building at the Design Phase
In relation to FM functions in SB, the facilities manager at the design phase has the competence to advise designers and developers on building material use. He creates specification of construction materials with low environmental impact and responsibly sourced materials. He ensures that the designers specify these materials and the developer or the contractor complies with the specified materials. (IFMA, 2014; RICS, 2014).

The facilities manager advises on energy use and efficiency, minimising operational energy consumption through good design, monitoring by sub-metering, use of energy display devices and use of energy efficient light fittings and equipment (IFMA, 2014; RICS, 2014; FMAA, 2012; BIFM 2014). He is in a position to advise on the use of water efficient components and equipment, installation of water recycling systems, water consumption monitoring systems, water leak detection and prevention systems that help to reduce consumption of portable water for sanitary and occupants use from all sources (IFMA, 2014; FMAA, 2012; BIFM 2014). He is also in a position to recommend an appropriate waste management system; provision for reuse of recycled materials; and operational related recyclable waste facilities (IFMA, 2014; RICS, 2014; FMAA, 2012; BIFM 2014).

The facilities manager can give guidance on indoor environmental quality. He ensures a healthy internal environment through the specification of appropriate heating, ventilation and air-conditioning equipment and finishes (FMAA, 2012; BIFM, 2014). He recommends on issues that deal with daylighting, artificial lighting and occupant controls using the client requirement brief at the design stage to ensure best visual performance and comfort for building occupants (FMAA, 2012; BIFM, 2014). The facilities manager using the client requirement brief advises on appropriate thermal comfort levels to be implemented at the design phase and monitors installation of controls to maintain a thermally comfortable environment for occupants within the building (FMAA, 2012; BIFM, 2014). He can also advise on acoustic control, that is, the building's acoustic performance including sound insulation meeting the appropriate standards for the health and safety of occupants (BIFM, 2014; RICS, 2014).

At the design phase of the building life-cycle, the facilities manager carries out building life-cycle cost exercises in order to provide economic value of the building overtime and financial affordability for beneficiaries (IFMA, 2014; RICS, 2014). Though the facilities manager has the competence and ability to carry out the above named functions, he is hardly ever involved in the early stages of the design process (Nutt and McLennan, 2000).
### Table 1. FM Functions in Relation to SB Constituents

<table>
<thead>
<tr>
<th>Constituents of Sustainable Building</th>
<th>FMAA</th>
<th>IFMA</th>
<th>BIFM</th>
<th>RICS</th>
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</thead>
<tbody>
<tr>
<td><strong>Environmental Aspect</strong></td>
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<tr>
<td>1 Building material use - The facilities manager advises, establishes and maintains specification of construction materials with low environmental impact and responsibly sourced materials.</td>
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<tr>
<td>2 Energy - The facilities manager influences appropriate use of renewable energy sources, reduction of operational GHG emissions resulting from refrigeration systems energy use, reduction of co2 emissions from refrigeration systems, and energy efficient transportation systems in buildings (lifts, elevators, escalators or moving walks);</td>
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<td>3 Energy - Maximum use of solar energy.</td>
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<td>4 Land use efficiency - Use of previously developed sites and/or contaminated land, and Non-use of virgin land;</td>
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<tr>
<td>5 Land use efficiency - The facilities manager develops, implements and reviews procedures that protect the ecological value of land during site preparation and completion of construction works.</td>
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<tr>
<td>6 Land use efficiency - The facilities manager introduces processes that encourage preservation and enhancement of biodiversity.</td>
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<tr>
<td>7 Pollution - Use of systems that reduce GHG emissions, ozone depleting gas emissions, and NOx emissions;</td>
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<tr>
<td>8 Pollution - Use of rainwater collection systems to reduce water pollution and land;</td>
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<tr>
<td>9 Pollution - Reduction of night light pollution.</td>
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<tr>
<td>10 Waste management - The facilities manager introduces, encourages and implements effective and appropriate management of waste; Reuse of recycled materials; and Provision of operational related recyclable waste facilities.</td>
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<tr>
<td><strong>Social Aspect</strong></td>
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<tr>
<td>11 Adhering to ethical standards.</td>
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<tr>
<td>12 Adaptable for different uses - Providing a place that meets needs with a mix of tenure types and ensuring flexibility wherever possible.</td>
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<tr>
<td>13 Conserving local heritage and culture - A building that contributes to social and cultural attractiveness of the neighbourhood leading to users and neighbours satisfaction.</td>
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<tr>
<td>14 Accessibility to good public transport network and local infrastructure and services and alternative modes of transportation for occupants to reduce transport related pollution and congestion.</td>
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<tr>
<td>15 Visual comfort - The facilities manager using the client requirement brief advises on daylighting, artificial lighting and occupant controls at the design stage to ensure best visual performance and comfort for building occupants.</td>
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<tr>
<td><strong>Economic Aspect</strong></td>
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<tr>
<td>16 Indoor environmental quality - The facilities manager ensures a healthy internal environment through the specification and monitoring installation and maintenance of appropriate heating, ventilation and air-conditioning equipment and finishes.</td>
<td>✓</td>
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<tr>
<td>17 Thermal control - The facilities manager using the client requirement brief advises on appropriate thermal levels to be implemented at the design phase and monitors installation of controls to maintain a thermally comfortable environment for occupants within the building.</td>
<td>✓</td>
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<tr>
<td>18 Acoustic control - The facilities manager using the client requirement brief advises on the building's acoustic performance including sound insulation meeting the appropriate standards.</td>
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<tr>
<td>19 Water quality - Minimising risk of water contamination in building services through design, implementation, maintenance of relevant equipment and the provision of clean and fresh drinking water for building occupants.</td>
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<td>20 Safe access - Effective design measures that promote safe access to and from the building.</td>
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<tr>
<td>21 Building life-cycle cost - The facilities manager carries out life-cycle cost exercises in order to provide economic value of the building, durability and financial affordability for beneficiaries.</td>
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<tr>
<td>22 Energy efficiency and management - The facilities manager acquires knowledge and advises on energy efficiency principles, advises on minimising operational energy consumption through good design, monitoring by sub-metering, use of energy display devices and use of energy efficient light fittings and equipment.</td>
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<tr>
<td>23 Water efficiency and management - The facilities manager influences the use of water efficient components and equipment, installation of water recycling system, water consumption monitoring system, water leak detection and prevention systems to reduce consumption of portable water for sanitary and occupants use from all sources.</td>
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<tr>
<td>24 Material efficiency - The facilities manager advises on maximising building material optimisation and minimising the frequency of material replacement and use of recycled materials.</td>
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</tr>
<tr>
<td>25 Maintenance and management - The facilities manager processes that involve the maintenance of the building and its services and minor works and repairs which ensures the durability and economic value.</td>
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</tbody>
</table>
6.2 FM in Sustainable Building at the Construction Phase
The facilities manager in relation to SB constituents has the skill to develop, implement and re-view procedures that protect the ecological value of land and introduces processes that encourage preservation and enhancement of biodiversity during site preparation and up until completion of the construction works (IFMA, 2014; BIFM, 2014). He also has the ability to identify and advise on suppliers of electrical and mechanical systems with low energy consumption and low CO2 emissions during installation works in preparation for the operations phase of the building (FMAA, 2012).

6.3 FM in Sustainable Building at the Operations Phase
At the operations phase, the facilities manager in relation to SB has the ability to maintain and manage processes that involve the maintenance of the building and its services and minor works and repairs which ensures the durability and economic value of the building (FMAA, 2012; RICS, 2014). He can advise on thermal control and monitor installation of controls to maintain a thermally comfortable environment for occupants within the building (FMAA, 2012; BIFM, 2014). The facilities manager monitors installation and maintenance of appropriate heating, ventilation and air-conditioning equipment and finishes, thereby ensuring indoor environmental quality (FMAA, 2012; BIFM, 2014).

7.0 CONCLUSION
In creating SBs, the facilities manager at the design phase has the competence to advise the design team on sustainable measures that can be incorporated into the design of the building and adopted at the construction phase in order to target the sustainable operability of the building at the operations phase. At the design phase, he advises on issues such as building material use, energy use and efficiency, water use and efficiency, indoor air quality, thermal and acoustic comfort, and carries out building life-cycle cost exercises in order to provide economic value of the building. The facilities manager monitors the installation works of the various services equipment at the construction phase, in preparation for the operations phase. At the operations phase he maintains and manages the building which he has practically created as a result of his recommendations.

REFERENCES


