Backlog of Maintenance in Public Sector a Huge Challenge for FM

Svein Bjørberg, Norwegian University of Science and Technology/Multiconsult, Norway
Alenka Temeljotov-Salaj, European Faculty of Law in Nova Gorica, Slovenia

Abstract

Backlog of maintenance in public sector is well known in most countries and to some extent documented. The sector is costly and buildings, property and localization, are important factors for the delivery of the primary services. Resources for maintenance often loose in the budget process because of the high value of core business activities. The objective of this paper is to show how bad technical condition affects social and environmental condition for the core business and to show how strategic level of FM can collect, organize, visualize and communicate data as means for strategic planning and budgeting. The methodology and tools, including questionnaire, so far is a result of research and development projects and PhD studies in Norway and Slovenia. Mapping methodology has been developed and tested empirically on approx. 40 million m^2. Presentation of complex data using new technology such as 3D BIM tool and Google maps has proved to be of high value in communication with stakeholders and decision makers.

Keywords: condition, maintenance, strategic planning

1. Introduction

Public sector is costly in all nations. Buildings, property and localization, are important factors for the delivery of the primary services. Healthcare and school buildings together represent more than 50 % of the gross building area in public sector. Maintenance of these buildings has been more or less neglected for a long period of time. In 1997 Oslo City Council (Oslo is the largest municipality in Norway) asked for an estimate of upgrading costs and value of their total building portfolio of approximately 4 mill. m^2. Due to short time for the assessment of technical condition and the size of the portfolio the MultiMap method was developed.

The Norwegian Association of Local and Regional Authorities initiated a research project named "Maintenance in the Municipality Sector" (KS, 2008). Totally approximately 12 million m^2 of 10.000 buildings were mapped. These represent approximately 40 % of the total

of municipality buildings in Norway. For the quantitative assessment the project defined four objectives:

1. Documentation of area, age, building types and technical condition
2. Cost calculation for technical upgrading based on a defined level of ambition on how the buildings appear.
3. Estimate a norm figure as annual cost per m^2 which should be sufficient for value keeping maintenance
4. Point out guidelines for maintenance strategies based on the level of ambition

In addition to the technical condition there has been an increasing focus on how buildings affect the core business effectiveness over time. Changes and new needs in the core business, especially in the hospital sector, will lead to new performance requirements. Buildings are a deciding factor for continuous efficient operation of the core business.

A four years long research project, managed by Multiconsult, with the title "Buildings and Property as Strategic Means for Effective Health Services" (Bjørberg et al., 2005-2010) supported by the Norwegian Research Council was finished in 2010. An aggregate summary of the Specialist Health Care Service status (building stock, current practice of asset management) in Norway was for the first time established in this project. A strong demand for technical and structural upgrading is documented, plus a significant need to transform facilities in order to customize the locations for future health service packages (Larssen, 2011). The Specialist Health Care Service is facing a substantial need for investments, also in buildings, while the economic resources in general are limited.

Backlog of maintenance is well known and documented. It has a significant influence on the environment, both indoor as well as outdoor, which will affect the users of the buildings regarding health, safety and environment. Totally approximately 30 million m^2 has been mapped up to 2012. The Norwegian Labour Inspection Authority has over a period of three years inspected schools and some hospitals and a number of public building owners have received notice to upgrade the buildings so the health and safety requirements at work act can be fulfilled.

In Slovenia a research project taking other aspects than level of maintenance and economy into consideration, namely social and environmental, has been carried out (Temeljotov, 2004).

One important question of the research is the interaction between the individual and the environment, more exactly between the individual and its immediate physical environment, or with some of its components. The models describing the interaction between the individual and the environment are gathering on analyses of social variables (individual and group, personality, culture, part, organization, social-economic characteristics) considering the influence of physical facts and variable's analyses of nature and shaped environment (characteristics of architecture and landscape, characteristics of environmental processing, sphere and frequencies of the processes) (Rus, 1997). The results of these researches show that the characteristics of physical microenvironment, especially the residential and working environment can significantly influence the quality of our life.

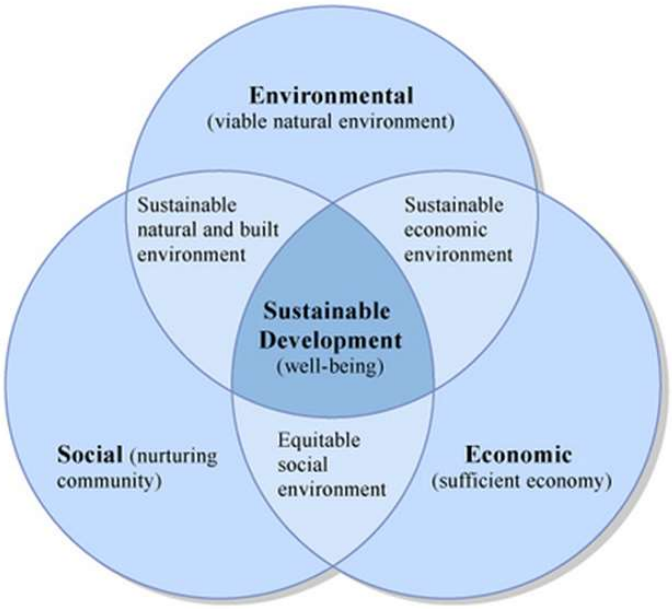

Figure 1: The concept of Sustainable Development (Ref.: MIT)

Building maintenance is often cut in the budget process because of the high value of core business activities. Documentation of needs for maintenance and upgrading is important in promoting and communicating the building's needs, and is a real challenge for the Facility Management (FM) organisation, and it is important to use models that cover all aspects which have impact on the core business effectiveness. FM organisations are normally divided into three levels (strategic, tactical and operative) as shown in Figure 2. The big challenge is to communicate adequate information between different levels and stakeholders which we want to strengthen with methods and knowledge described in this paper.

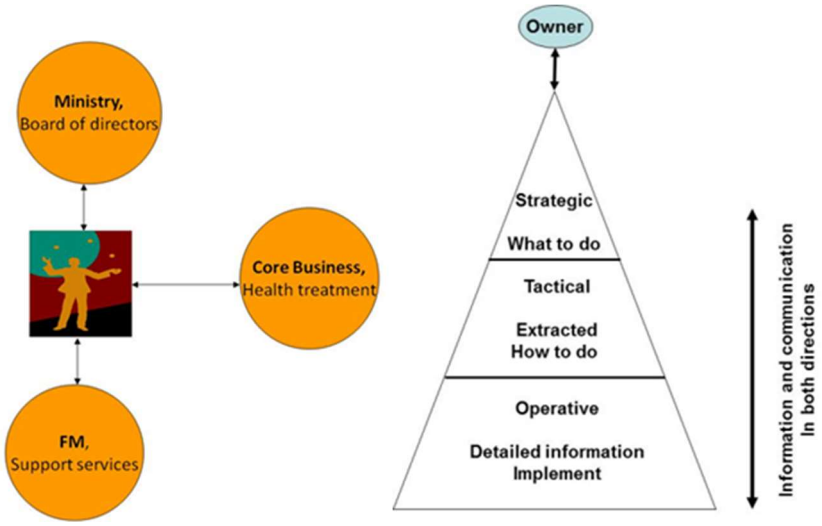

Figure 2: Interaction between different stakeholders and level of FM (Ref.: Multiconsult)

Between Slovenia and Norway there is an ongoing project aiming to implement experiences from respective projects into a whole. Up to now the focus has been on the hospital sector in order to support a benchmarking platform for FM decision making and strategic planning. The experience so far is that the methods and tools are relevant and useful for strategic planning and early stages of feasibility studies. Developed methods and knowledge described will be the base for further cooperation projects between Slovenia and Norway.

2. Methodology/Approach

The tools, so far, are results of research and development projects and through PhD studies in Norway and Slovenia. Development of the methodology and tools, called MultiMap, in Norway has involved a large number of participants from the public sector, both from property and FM units and representatives from core business. Workshops, interviews, focus groups and several large scale case studies and real life projects.

Basic modules for mapping different performance values have been tested, from the start in 1997 and up to 2012, resulting in an extensive amount of empirical data. Totally approximately 30 million m^2 gross areas of buildings are included. Data structure is based on the Norwegian Standards classification system (Norwegian Standards, NS, with elements such as NS 3424 “Condition Assessment of Construction Works” (1995), NS 3451 “Table of Building Elements” (2009), NS 3454 “Life Cycle Costs for Building and Civil Engineering Work” (2000) and NS 3457 “Table for Building categories” (1995). NS 3424, “Condition Assessment of Construction Works”, is the most central. It uses condition grading between 0

and 3. Condition grade 0 is equivalent to the best grade (new building), and condition grade 3 corresponds to the lowest rating. Table 1 gives a general description of the condition grades in the standard.

Condition grade	Description
0	No symptoms
1	Slight symptoms
2	Medium-strong sympt.
3	Strong symptoms

Table 1: Condition grades due to Norwegian Standard NS 3424

To get information about such large number of buildings the approach has been to optimize the relationship between detailing and the use of resources. This has led to the following basic principles for the mapping procedure:

The use of existing knowledge

Mapping of building information should, as far as possible, be based on existing knowledge in the organization, i.e. from administrators and users. They work in the buildings and are familiar with history and modifications, the current problem areas, maintenance situation, user opinion, etc.

Forms and explanatory matrices

To systematize information and to establish an objective point of view, matrixes / forms for the assessment, including guidance, are developed. The definition of reference levels through descriptive explanatory matrixes is an essential basis for the registration. An example of a descriptive explanatory matrix is shown in Table 2.

FUNCTIONALITY - INTERNAL LOGISTICS				
Parameters	Grade 0	Grade 1	Grade 2	Grade 3
Functions	The facilties contains the functions the organisation (user) needs, now and in the known future. No complaints from users.	The facilties contains to a high extent all necessary functions the users need in todays situation.. Only small amount of functions located in other facilties/building.	The facilties lack some essential functions, resulting in regularly use of other fasilties/buildings.	The facilities does not give room for necessary functions. Large amount of essential functions located in other facilties/buildings. High amount of complaints/dissatisfaction from users.
Area/space	Suffisient area (m2) to support necessary functions satisfactorily, now and in the known future.	Suffisient area for todays functions.	Amount of space (m2) is little. The spaces is small and well suited for the different functions. Low space/area efficiensy.	Acute need of more space in order to perform necessary functions.
Design and shape	Design and technical solutions is a very good support to the core activity, today and in the known future. The internal logistics is good and the core activity can operate effectively.	Design and technical solutions is a good support to todays core activity. The internal logistics is good and does not hinder effective operation for the core activity.	Design, shape and technical solulons is inexpedient. Essential functions is ineffecively located.	Design and technical solutions is inexpedient. Internal logistics is bad and results in ineffective operation of the core activity.

Table 2: Example on an explanatory matrix, part of the Usability matrix (Ref.: Multiconsult)

In addition several interviews have been carried out regarding FM organizations, communication lines from operative to strategic level and then into a decision process by the owners. Main conclusions from this are lack of strategies and goals, lack of attention to FM in the core business strategy and information.

In the Slovenian research one of the main interests was if the different perceptions of the built environment, like urban place, residential place and working place are connected with the social and value orientations, like preferences or realization of the value and evaluation of the life style. Method for this part was mostly workshops and questionnaire.

3. Findings

In the project "Maintenance in the Municipality Sector" (KS, 2008), all data collection was organized according the Norwegian standards listed above. As mentioned approximately 10.000 buildings covering approximately 12 million m^2 gross areas were assessed. Totally there are 430 municipalities in Norway and the data collection covered 127 municipalities. Distribution of these municipalities covers all regions and also small (up to 5.000 inhabitants), medium (between 5.000 and 25.000 inhabitants) and large ones (more than 25.000 inhabitants). From the data key figures about the amount of buildings is shown in Figure 3.

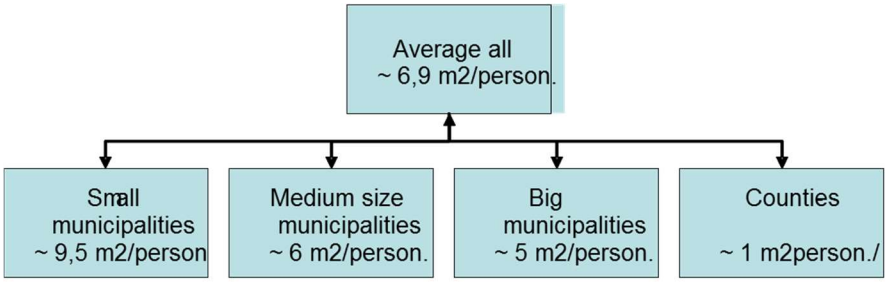

Figure 3: Key figures on area depending on municipality size

For each building 16 elements were assessed, totally approximately 160.000 condition degrees. Input of data was done on WEB by people who have the competence about the building in the FM organization. Upfront these people got training through a workshop program. To communicate the results those 16 elements were weighted up to one degree for each building depending on value or cost for upgrade to level of ambition. For a total overview a further aggregation was done and grouped by year of construction, see Figure 4.

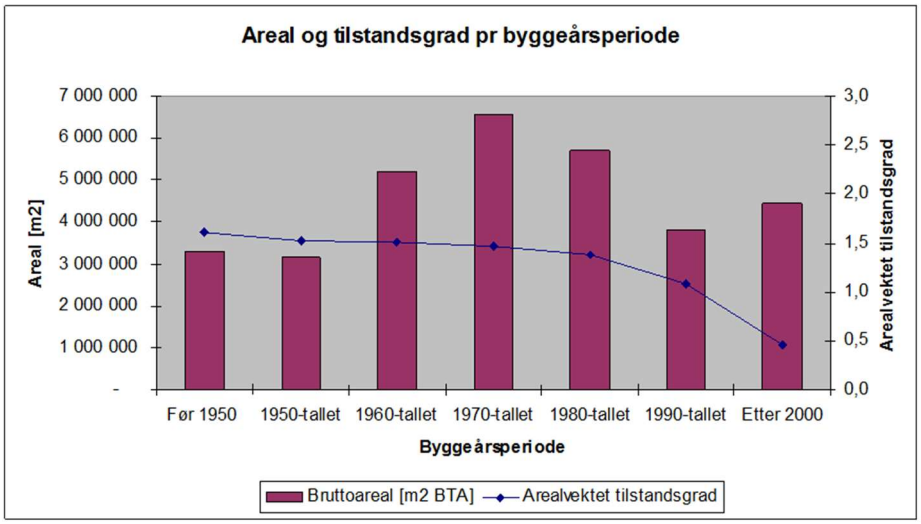

Figure 4: Weighted condition for the total portfolio

This condition assessment has shown that the building portfolio within Norwegian municipalities can be divided into three categories:

- one third of buildings are in good or satisfactory condition
- one third is partly satisfactory and need corrective maintenance
- the last third is in bad condition and are in need of heavy technical upgrading.

The total upgrading costs were calculated to:

- Ambition level A: 60 billion NOK (8 billion EUR) within 5 years and 82 billion NOK (11 billion EUR) for the next period of 5 years.
- Ambition level B: same as level A for first period and 34 billion NOK (4,6 billion EUR) for the second.

Results from the interviews showed that the FM organizations have challenge to communicate the needs and especially put forward the consequences if budgets become too low and further backlog will occur. None of them had a strategic plan for the maintenance and therefore no reference for maintenance activities. This, together with the fact that maintenance costs are the easiest costs to cut when budgets are balanced, leads to accumulated backlog. To help this situation it is necessary to establish agreed strategies, goals and plans that can serve as a platform for improvements. A maintenance strategy can be related to the condition degree and measurable requirements related to the levels of ambition:

- Ambition A: No building component / element shall have degree 2 or 3
- Ambition B: No building component / element shall have degree 3, some may have 2

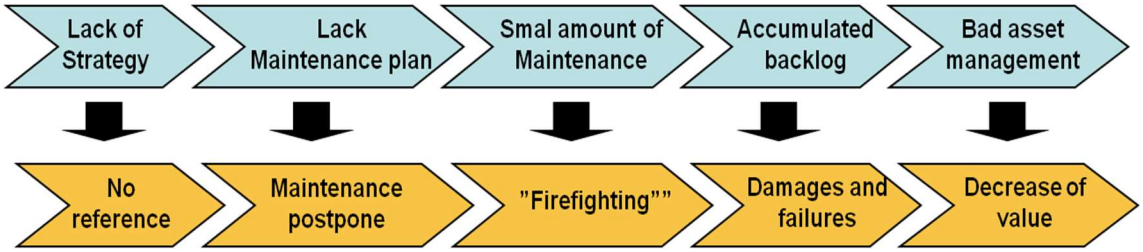

Figure 5: The road to decreased value

Based on Norwegian standard NS 3454 "Life cycle costing" (2000), a norm figure for maintenance was calculated for a so called average municipality building. Life cycle was set to 60 years. For all the main elements frequencies for normal maintenance and replacements where given and net present value calculated. The net present value where distributed back as an annuity over the same period. The result was 170 NOK (23 EUR) per m^2 gross area. Norwegian Association of Local and Regional Authorities wanted to use this for budgeting. If the portfolio is big e. g. more than 50.000 m^2 it can be a base for yearly budget. In that scale it is enough money to take the big upgrading projects. But with less building portfolio there will not be enough to finance those projects. Municipalities with less than 50.000 m^2 gross building area make project budgeting instead of norm figure budgeting. In Norway over 300 municipalities are in the last category.

From the research project “Buildings and Property as Strategic Means for Effective Health Services” (Bjørberg et al., 2005-2010) most of the same results regarding backlog, lack of strategies and communication were found. In addition there are gaps regarding competences and closeness for the FM organization to the boardroom. Totally approximately 40 % of the building area is not acceptable regarding technical condition. This backlog caused by accumulated need for maintenance was calculated to be between 30 and 35 billion NOK (4 – 4,6 billion EUR). In this project further condition areas were defined, such as structural properties as base for adaptability for future changes in demands, usability today, energy etc. In the strategic planning within large portfolio it is important to strengthen the interaction between core business and support services and it is necessary to sort out which parameters are essential for decisions. Result of this is a series of modules in the tool "MultiMap" to map the total situation today and the potential in each building and floor. The principle is shown in Figure 6.

Bad technical condition can lead to accumulated humidity in the building envelope which can affect the indoor climate and social aspects e.g. health, safety and environment. This situation is not acceptable due to the health and safety at work act. The results from the inspections done by The Norwegian Labour Inspection Authority in 2009, 2010 and 2011, (Annual Report 2011), show lots of instructions for improvements are given to fulfill requirements in the act. See Table 2.

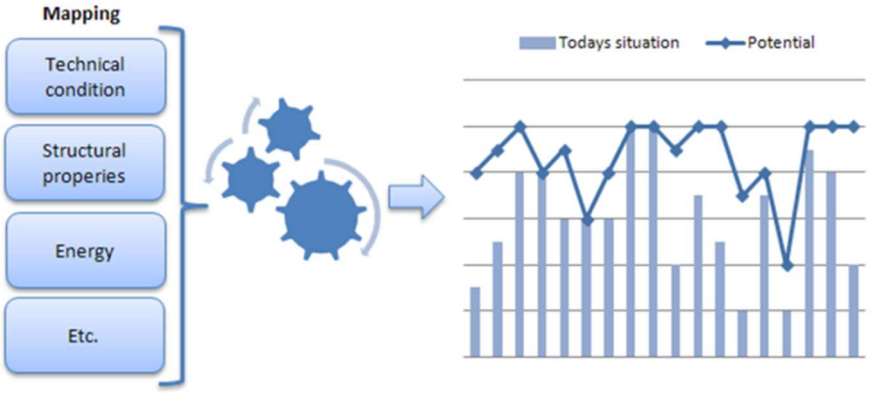

Figure 6: The principle behind the MultiMap method

Inspection	2009	2010	2011
Number of inspected municipalities	90	50	53
Number of municipalities given instructions	25	33	48
Instructions for improvement in %	28	67	90
Total number of instructions for improvement	45	68	255

Table 2: Number of inspections

Many of the municipalities lack a strategy for maintenance and are unable to document satisfactory indoor climate. Approximately 80 % of the municipalities have been instructed by the The Norwegian Labour Inspection Authority to improve their systems because unacceptable indoor climate can give headache, asthma suffering, tiredness, concentration problems etc. This may give 6-9 % productivity loss as a result.

From the Slovenian results we can stress the need of individual perception of the environment which surrounds human, with its specialties, characteristics, on which someone puts some special attention, because it is important for him, his life, existence, dwelling, leisure time and work. In Slovenia the housing rebuilding has been neglected in the last years (Temeljotov, 2006), and this is also the case for housing maintenance and also the renovating. From the owners of the apartment building it is quite difficult to get consensus in the terms of very fragmented ownership. The problem seems bigger also because many buyers have bought the apartments on the liquidation from the former social apartments which means the price was a lot lower that it would be otherwise. Many residents' incomes are quite low, so they cannot participate in the right way to renovate the apartment buildings. We are to make some specific incentive schemes and also suggest legal solutions which will lead to appropriate apartment renovating of the whole micro and macro locations and the renovating of the city centres, degraded objects and badly maintained neighbourhoods. The schemes will consist of physical renovating of the specific objects, modernisation of the housing objects and also the revival of the activities in these areas.

During the different projects regarding "hard facts" it has become more and more clear the necessity of improving presentation of results due to large amounts of data. Presentation of complex data in a way that easily communicates with stakeholders and decision makers is necessary.

One way of presenting data is by linking all data to each building on a map over the campus site as visualized in Figure 7.

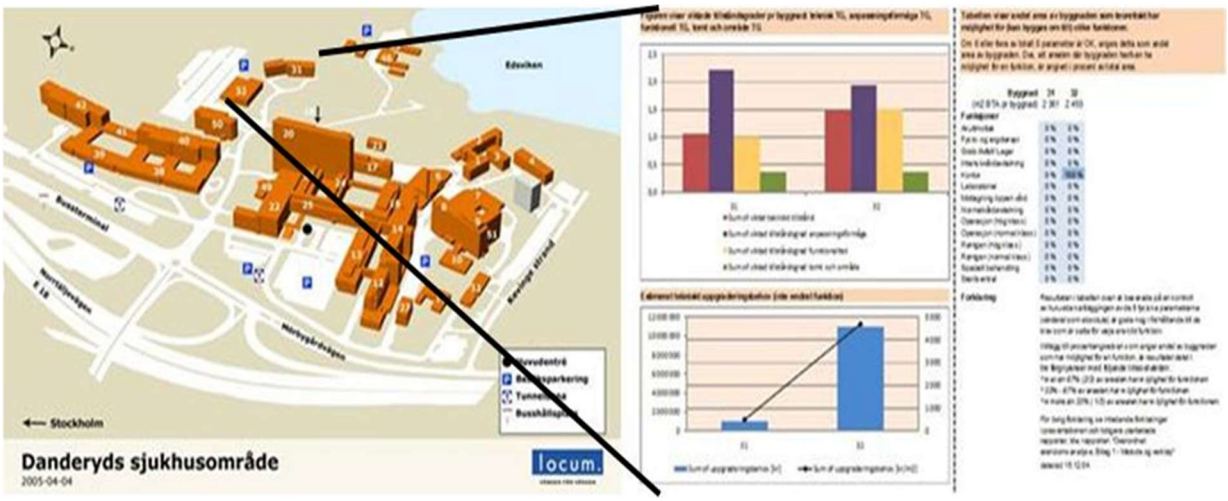

Figure 7: Presentation of results using map over campus site (Multiconsult)

For more sophisticated presentation BIM tools like Onuma Planning System together with Google Earth has been used. Onuma Planning System provides the possibility to model buildings in 3D and adding information directly to the model itself. Google Earth provides the maps and possibility to synthesize building and location. In figure 8, technical condition is presented using colours on the building models surface. Each colour represents one of the condition degrees. This way of presenting results makes the information very easily understood. It is also possible to add information on different levels, like building site, municipality, county and country.

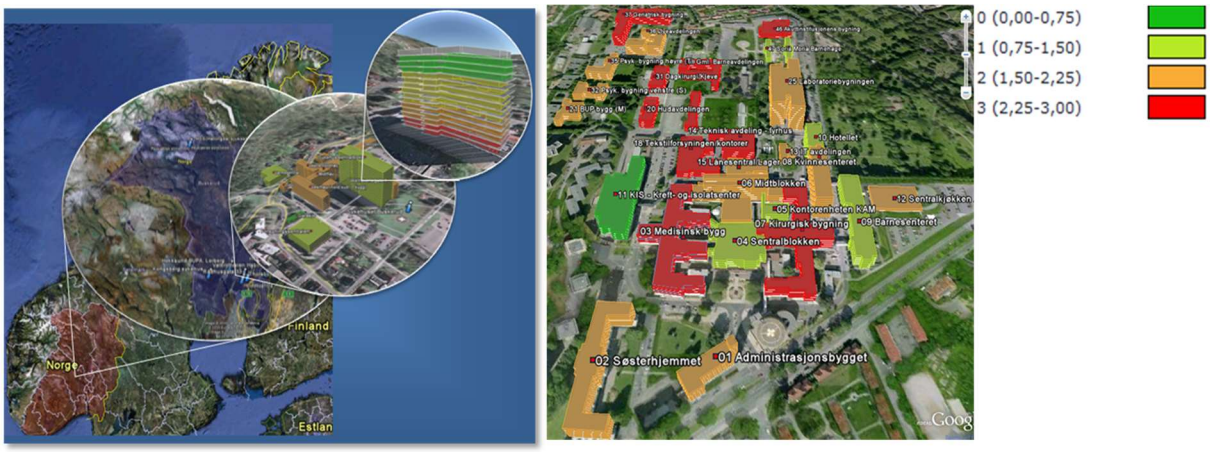

Figure 8: Presentation of results using Google Earth and Onuma Planning System (Multiconsult)

4. Reliability and validity of results

Because of few elements, 16 regarding technical, the uncertainty of cost calculations can be considerable for each element and each building. But as a whole portfolio this uncertainty will be minimized. In Figure 9, uncertainty is shown in % as a function of amount of buildings. For 20 buildings the uncertainty is 15 % but for 40 buildings it drops down to 10 %.

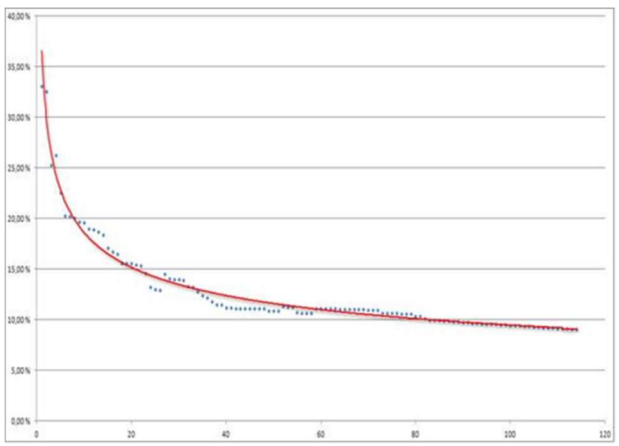

Figure 9: Uncertainty of mapping portfolio (Multiconsult)

5. Discussion

A main objective has been to provide tools that can strengthen the strategic FM practice and bridge the GAP between the core business and FM. So far the results from practice has shown that the active approach to backlog and the way results are communicated to decision makers as shown is effective, and is being used actively in strategic planning. The tools may also be effective for FM-personnel in their daily work, as an aid in the dialog with users, but this requires a shift in practice towards an active strategic role which is not so common today.

From the Slovenian results it is no doubt that bad environment and social condition has big impact on working and learning efficiency. It is also causes sickness among the users. Same conclusions are also found in reports from The Norwegian Labour Inspection Authority.

The economy in most of the municipalities, and also in the hospital sector, is not sufficient to solve the problem of the huge backlog.

6. Conclusions

It is essential that the role of FM is understood. They have to be proactive and involve users in own strategic planning, have access to decision makers and their arenas (management team, board meetings), take initiative to educate decision makers about the role of FM, increase ability to document and communicate on right level of aggregation etc. Trust, respect and status are earned by ability to deliver and communicate results.

Asset management (AM) and FM have a huge challenge due to building portfolio is partly out of date, i.e. that they do not match future demands and have enormous maintenance backlog. For most owners the burden of debt is so heavy that the long term economic viability represents a challenge because access to investment funding is, and will probably stay, limited.

FM has to meet these challenges by getting a national strategy on how the enormous challenges related to the upgrading, development and renewal of the building stock in accordance with the future development of health services is to be managed in hospitals. A central part must include strengthening the ownership. Furthermore it is necessary to develop competence and skills including use of tools and methods related to communication and documentation.

The assessment method described in this paper cover a need that is becoming increasingly more important as the focus of FM shifts towards strategic FM and added value for users. The MultiMap method has proved to be an excellent tool for mapping technical condition as a base for estimation of maintenance backlog in portfolios and as a first scan of single buildings. Presenting results in 3D BIM and Google Earth has proved to be communicative. The tools may also be effective for FM-personnel in their daily work, as an aid in the dialog with users, but this requires a shift in practice towards an active strategic role which is not so common today.

Presented methods and experiences are general and are also relevant for other sectors than public i.e. roads, bridges etc. It is also obvious that sustainable FM is more than energy efficiency, upgrading of maintenance backlog of the building itself. It is the combination with quality of environment and nature and the social interaction between the elements. A more holistic approach is therefore necessary for a strategic development of the building portfolio and in planning new buildings. This will be the main issue for the ongoing and further cooperation between Norway and Slovenia.

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