

MultiMapping and Urban FM

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Abstract

Purpose: The paper discusses a more active role of Facility Management (FM) to participate in the development of urban area with aim to build competitive and healthy surroundings with a high quality for residence, business and spare time. FM, as a supporting service in operational phase of built environment (building, complexes or areas), can pursue development from the first start of the use phase until its end. An active role is seen as co-creating the place together with estate owners or users in many perspectives, such as creating better environment (exp. sustainable oriented, against gentrification) or better services (exp. assistance/services for elderly people, financial models for supporting better living conditions, inter-generation models).

Design: MultiMap model is used for measuring building performance (technical, environmental, structural etc.) and with new strategy to use it for urban areas, it is more focused in urban value capture model, modifying forms of management and toward and new services for FM, oriented to a social responsibility. Developing and combining new modules for multiMap will produce criteria of which objects/cities/districts can be mapped and measured already from planning phase and follow the project until the end of the operation phase. This may contribute to maintain a desirable urban area throughout its lifecycle.

Findings: MultiMap model is generic and therefor found adaptable for more than buildings. Urban context is group of campuses and campuses is group of buildings. The complexity is about organizing FM services into Urban FM due to different stakeholders and huge amount of data to be handled.

Research limitations/implications: The presented research is developed for public as well as private sector, as the basic scientific principles are general and relevant for other sectors.



Practical implications: The research covers a need that is becoming more important as the focus on Well-being issues in high dense urban areas are increasing.

Originality/ value of paper: This paper can contribute to develop Urban FM as an increased area for FM organizations.

Keywords: Urban Facility Management, Business models, Value capture

1. Introduction

In most urban areas throughout the world there are three major trends going on; 1) transformation of existing urban areas (with division between industry building complexes, block of flats, office areas, abandoned buildings) to integrated multipurpose areas, 2) growing population and increasing living age and 3) needs for decreasing use of nonrenewable energy based transportation. It is expected that 60% of world population will live in urban areas within 2030 (<https://unhabitat.org/urban-themes/climate-change/>) and increase further up to 68% in 2050 (UN May 2018). Results of earlier research (Rus, 1997, Temeljotov 2004) show that the characteristics of physical microenvironment, especially the residential and working environment can significantly influence the quality of our life. It is also well known and documented (Bjørberg 2009, Bjørberg et al. 2012) that backlog of maintenance has a significant influence on the environment, both indoor as well as outdoor, which will affect the users of the buildings regarding health, safety, social and environment experience.

Norwegian White Paper "Good Building for a Better Society" (2012) stated the importance to create good buildings as a criteria to achieve "well-being" for users in buildings and in urban areas to get a better society. To fulfill this aim it is necessary to focus on life cycle planning. Connection between the design of the built environment, the quality of life of individuals, the social structure of society and business development are closely linked together. Planner-, construction and property industry plays a crucial role in enabling good cities and towns. Comprehensive research, however, shows that development of urban areas must be linked more closely to an understanding of the development of economic sustainability because of social improvements. In the research OSCAR "Value for owner and users of buildings" (2014-2018) it is stated in life cycle planning it is crucial with an integrated early design team with knowledge from the long user phase. In the team competence from users are essential and in that respect there can be four type of users; 1) the organization (core business), 2) employees in core business, 3) Facility Managers (FM) personnel and 4) visitors. Lack of understanding of this connection leads to cities and towns who, to a far lesser extent, got less desirable ability to create value for the citizens, business and society as a whole.

The FM function or campus (schools, hospitals, and universities) has developed from being janitor or caretaker to be a coordinator of all needs for supporting core business. According to EN 15221 – 4 "Taxonomy" FM is divided into "Space & Infrastructure and People & Organization" and is a strategic role to search, facilitate and demonstrate need of a business

organization as a proactive action that helps the business organization to understand their future needs (Valen et al. 2014). All FM activities is important for up keeping “well-being” aspects. Well-being is the balance between economy -, environmental - and social aspects as shown in figure 1.

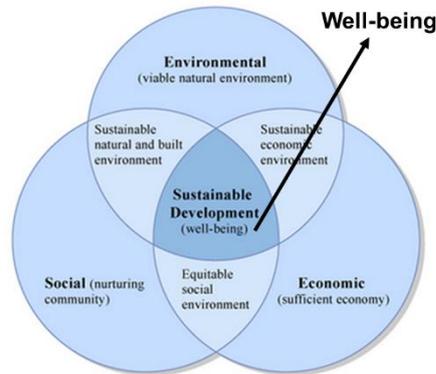


Fig. 1: Well-being as balance between sustainable aspects (Multiconsult)

Urban Thinkers Campus (2014) agreed on several key principles to get well-being, such as the city should be inclusive, has a human scale and is well planned, walkable, and has adequate, accessible, and affordable mobility, economically vibrant, unique identity and sense of place, safe, healthy and be well planned, financed and governed at all levels. In addition the urban areas should provide education and economic opportunities for all, have open and accessible public spaces and it should be made for and by people.

Documentation of needs for maintenance and upgrading is important to promote and communicate building needs, and aggregating these needs in an objective and comparable measure across the portfolio is a challenge for the Facility Management (FM) organisation. It is important to use models that cover all aspects, which have impact on the core business effectiveness. Urban areas has the same needs, but the big difference from campus mentioned above, is the fact that urban areas has a lot of different core business and stakeholders. To get all stakeholders satisfied FM should provide deliveries such as flexible solutions, well maintained and adaptable buildings and space between them as well as being service oriented towards the customers satisfaction and needs. Urban FM has to comprise the combination of socio-technical skills (Temeljotov et al 2018).

Seen from a transportation point of view, urban areas has three main groups of population; 1) children (to school / kindergarten), 2) grown-ups (work) and 3) elderly people (elderly centres, medical and social care). And all groups goes for shops, cafes, parks etc, as shown in figure 2.

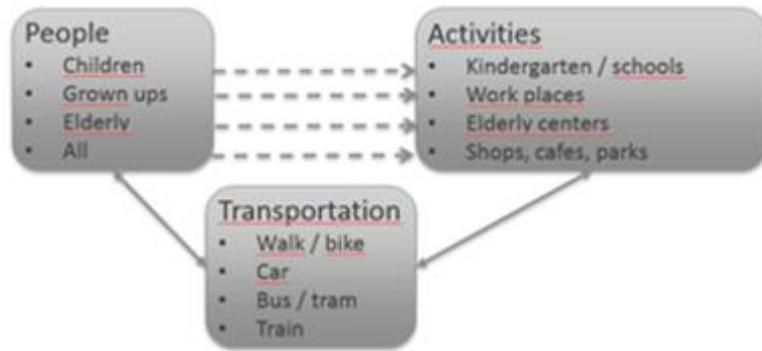


Fig. 2: Population groups and their activities and transportation (S. Bjørberg, Multiconsult)

During life time people are going through all three groups and they have changing social needs, see figure 3.

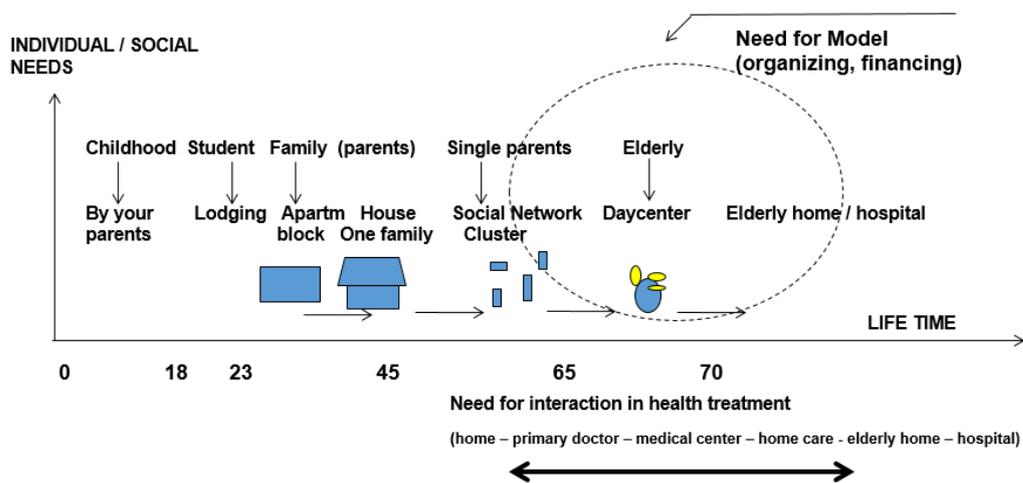


Fig. 3: Life Cycle Social Needs model (S. Bjørberg, Multiconsult)

Transportation is seen as a hierarchy with at least three levels; 1) come fast, 2) come often and 3) come slow and all time. The system should be integrated in urban context as shown on figure 4.

Urban FM should be able to take care of buildings, campuses and urban areas to upkeep the well-being aspects and develop new business models. But to take action FM must assess all type of conditions to make plans on long and short terms. Mapping the area from the perspective of an existing state of art in urban area, potential for future development and evaluating the gaps from social, economic, and environmental sides, are important for the analysis of every area. Combination of data mapping and value contribution should turn out to be effective tools for gathering and analysing large amounts of information. The way of classifying information gives opportunity to aggregate data to create comprehensive key performance indicators (KPIs), and with new technology to visualize results to obtain effective way of communicating complex information. Comparison assessed data (performance) and demands will give answer on upgrading needs.

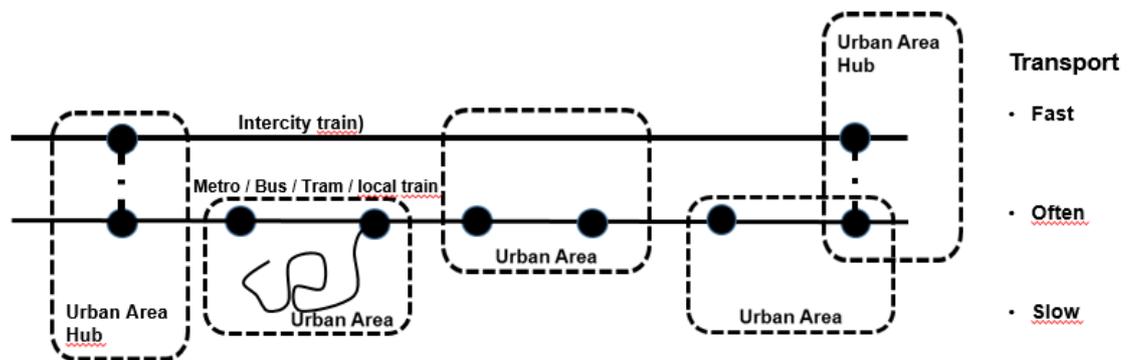


Fig. 4: Transport hierarchy integrated in urban context (S. Bjørberg, Multiconsult)

The new role and concept of Urban Facility Management should expand from typically business or public buildings to apply to the public, targeting urban neighbourhoods and should be seen as a position of knowledge, authority and trust in the urban community. This new role asks for broader access to detailed information, which should be structured in a communicative way for all stakeholders.

2. Methodology / approach

In 1997 Oslo City Council asked for an estimate of upgrading costs and value of their total building portfolio of approximately 4 million m². Due to short time for the assessment of technical condition and the size of the portfolio, the multiMap method was developed. Huge amount of data should be gathered, systematized and communicated. The methodology were based on classification and key words helping matrixes to get structured information from FM people knowing the buildings.

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 will lead to new performance requirements. Today multiMap consists of several modules, which give information of a building/-portfolio regarding the portfolio performance and potential for future use (see Figure 5), and several other modules is under development.

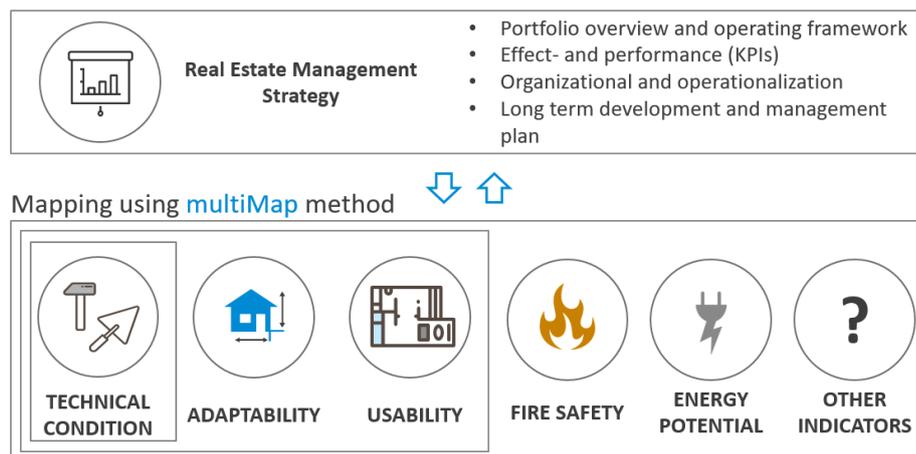


Fig. 5: Different modules and module packages in MultiMap (Ref.: Multiconsult)

Totally, the tool has been used for approximately 30M m² (GFA) of buildings, but since the model is generic, it has also been used on roads and nautical installations in Norway.

Norwegian Standards (NS), such as NS 3424 “Condition Assessment of Construction Works” (2012), NS 3451 “Table of Building Elements” (2009), NS 3454 “Life Cycle Costs for Building and Civil Engineering Work” (2012) and NS 3457 “Table for Building categories” (1995), was taken into use. The first one, NS 3424, is the most central. It uses condition grading between 0 and 3. Condition grade 0 is equivalent to the best grade (new construction), and condition grade 3 corresponds to the lowest grade. 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

Tab. 1: condition grades due to Norwegian Standard NS 3424

Building portfolio is divided into building types (schools, offices, hospitals etc.) and building elements (roof, façade, HVAC etc.). To systematize information for an objective assessment, matrixes / forms, including guidance, are developed. An example of a descriptive matrix is shown in table 2.

FUNCTIONALITY - INTERNAL LOGISTICS				
Parameters	Grade 0	Grade 1	Grade 2	Grade 3
Functions	The facilities contains the functions the organisation (user) needs, now and in the known future. No complaints from users.	The facilities contains to a high extent all necessary functions the users need in todays situation.. Only small amount of functions located in other facilities/building.	The facilities lack some essential functions, resulting in regularly use of other facilities/buildings.	The facilities does not give room for necessary functions. Large amount of essential functions located in other facilities/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 solutions is inexpedient. Essential functions is inefficively located.	Design and technical solutions is inexpedient. Internal logistics is bad and results in ineffective operation of the core activity.

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

Use of BIM tools, like Onuma Planning System together with Google Earth, provides the possibility to model buildings in 3D and adding information directly to the model itself. This provides maps and possibility to synthesize building and location. In figure 6, as an example, technical condition is presented using colours on the building models surface. Each colour represent 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.

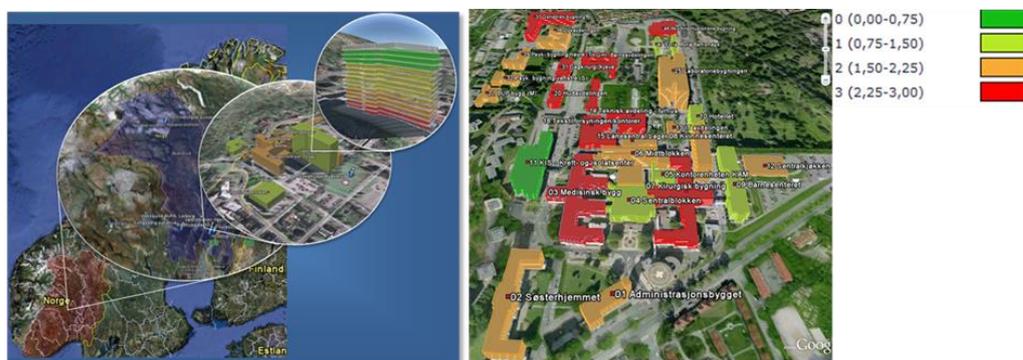


Fig. 6: Presentation of results using Google Earth and Onuma Planning System (Multiconsult)

3. Findings

Since the model is generic also roads and nautical installations in Norway has been mapped. For roads, division is road types and road elements, and for nautical installations, division is nautical types and nautical elements. But for totally Urban FM purposes multiMap should also include definition park types and elements, social aspects and elements etc.

In cooperation with Oslo municipality, agency responsible for parks, Bymiljøetaten (BYM), a module for assessing technical conditions of parks and park elements has been developed. BYM participated with several of their FM resources in the development and structuring of the module. Park types were previously established in the municipality and ranged from Type A (exclusive and high maintenance park) to Type D (more forested parks with less demanding upkeep). Note that pure woodlands and forests are not included in the portfolio. As for existing modules in multiMap, Norwegian Standards are used, if there is one relevant. For the park element structure, NS 3420-ZK “Operation and maintenance of parks and gardens” (2016) were used. For every park element, a cost function was derived, that is based on a few attributes of each park. This cost function is essential in weighting and aggregating the condition grades to a comparable measure across the portfolio.

The mapping process was performed by BYMs own FM resources supported by workshops and Multiconsult staff. Results of the mapping process and compared to other condition analysis were significantly less resource intensive. The complete results are utilized and analyzed internally in the BYM organization for strategic management, communication and resource / budget planning. Due to the flexible structure of the quantitative method, several other analyses may be performed and visualizations produced on demand. This way the message the organization wants to get across may be optimized based on the target group (internal / external, park professionals / laymen etc.).

3.1 Results part 1 – Portfolio overview

Clear and communicative portfolio overview contributes to a greater understanding internally in the organization and externally to political decision makers in the municipality. Challenges and difficulties, as well as the accomplishments and performance, are presented and traced over time. BYM management is segmented into divisions that are largely determined by geographic segments.

There were great diversities in the compositions of the different management divisions' portfolios. Of the 7 management divisions, portfolio m² ranged from 43% of total area to less than 3%. The smaller divisions' parks, however, were significantly more complex and consisted of proportionately more Type A parks. See figure 7 for visualization. This is naturally common knowledge for BYM, but the visualizations and the quantification of this information provides useful tools in gaining a common understanding of the organizations different needs for competence and resources and may be used for more in-depth analysis and external communication.

Type A parks are generally located closer to the city center and are generally more technically complex and with a higher gross technical value (unadjusted for condition). This creates different needs for capital that may not correlate with size. To illustrate this, the gross technical value of parks in different districts of Oslo is compared against gross park m² in the same districts. See figure 8 for illustration. This information is quantified and may be used in the budgeting process.

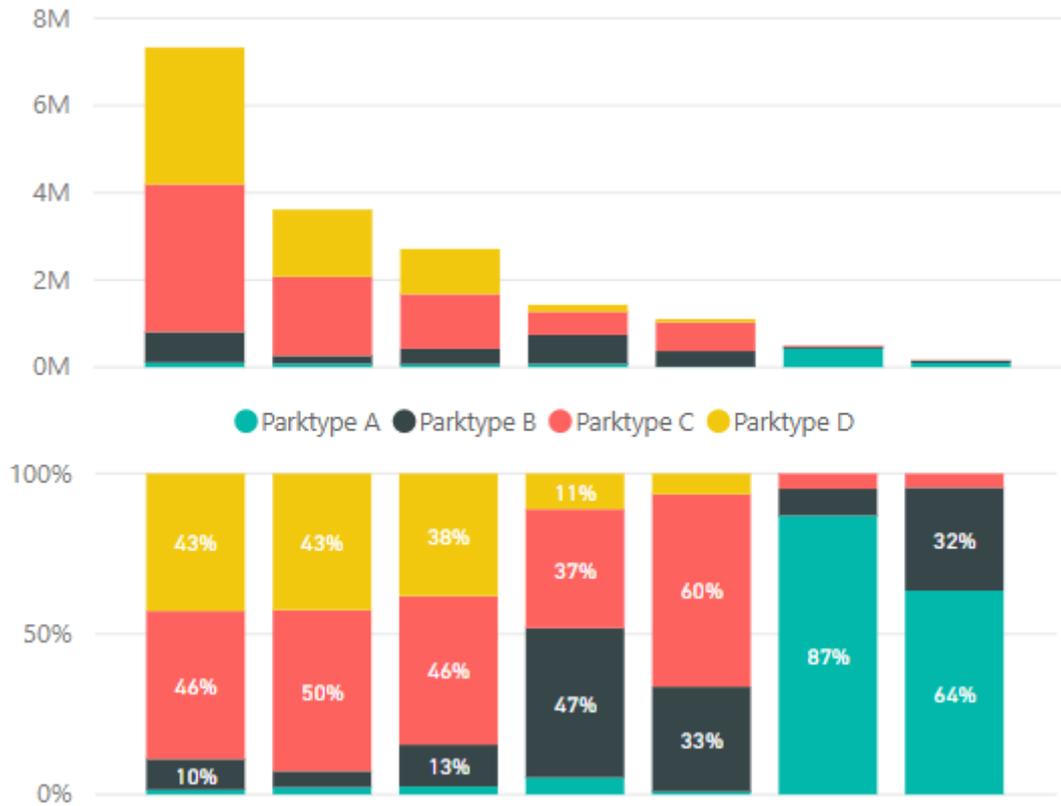


Fig. 7: Composition of FM divisions' park portfolios within BYM (m² and relative ratios)

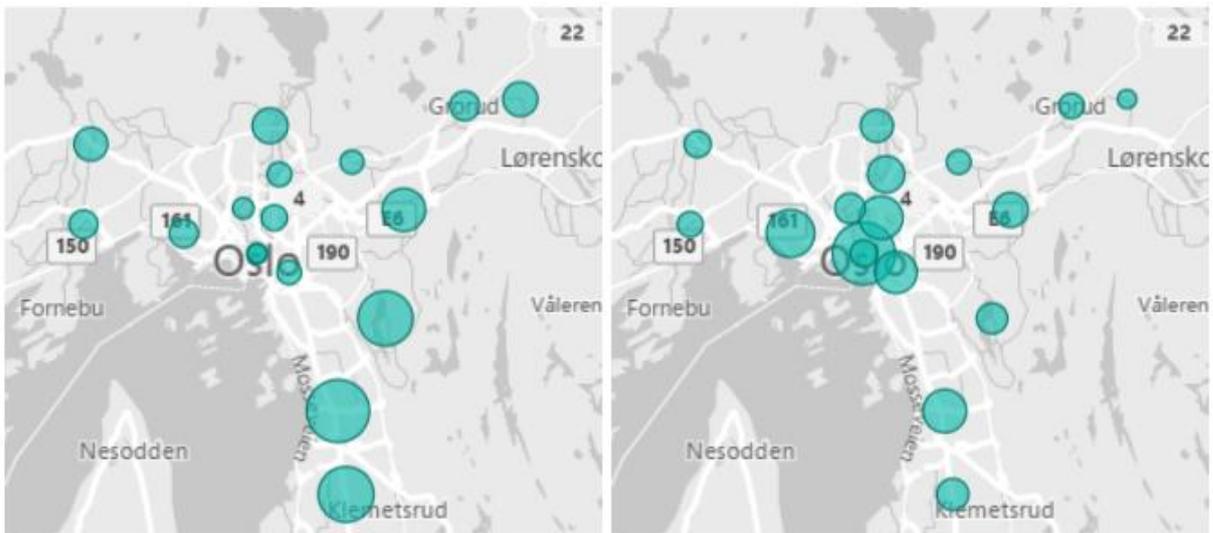


Fig. 8: Visualizations of parks in geographical districts by area (left) and gross technical value (right)

3.2 Results part 2 – Technical conditions

The technical conditions of parks are closely related to degree of upkeep. We have defined maintenance needs as separate from the need for general upkeep (such as mowing grass, shoveling snow, trimming hedges etc.). It is generally defined as maintenance need when a greater effort than normal upkeep is required to restore the element to condition grade 1. The aggregate weighted technical condition grade of the entire portfolio, is presented in Figure 9.

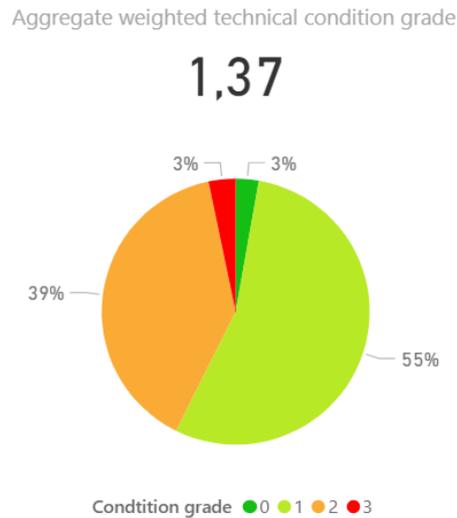


Fig. 9: Total grade (top number) and park area in the different grades (pie)

This grade and data may be separated by management division, geographical district, park types and any other relevant assortments of parks. The interpretation of the result depends on the municipalities ambition levels for certain parks. For instance may Park type A have a lower grade ambition than park type D. We see that over half of the parks are in good to satisfactory condition (grade 0 to 1), almost 40% is in unsatisfactory condition, and 3% is in poor condition. In Figure 10 we see that this distribution varies greatly across geographical districts.

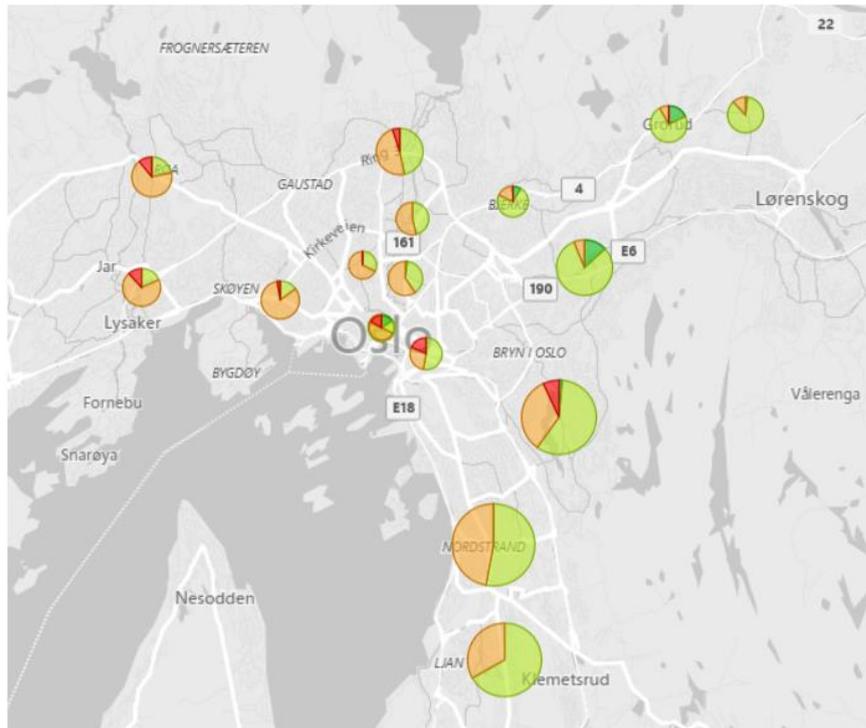


Fig. 10: Park area in the different grades in different geographical districts (pie size = total m²)

Figure 11 shows the same information distributed across management divisions.

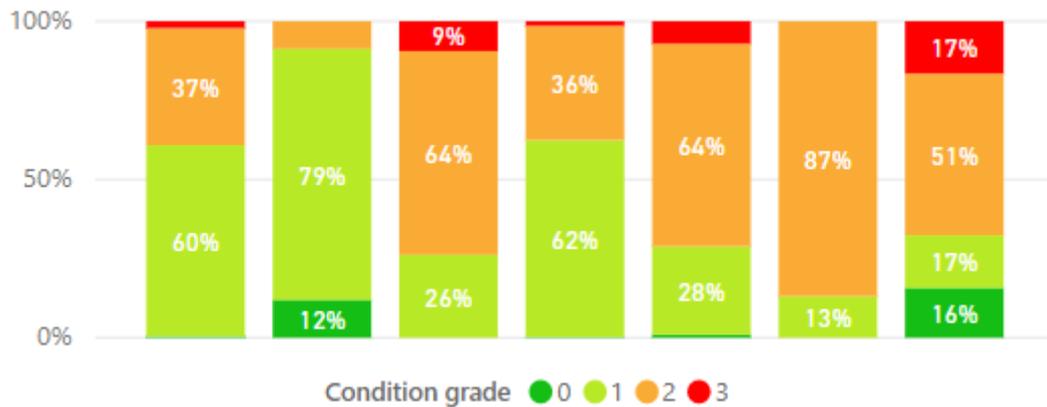


Fig. 11: Park area in the different grades in the different management divisions

3.3 Results part 3 – Maintenance capital needs

Elements and components with condition grade 3 are considered immediate needs and is recommended repaired/restored within a 5-year period. Elements with condition grade 2 is recommended restored within a 5-10 year period. Note that elements with condition grade 2 is not necessarily a maintenance backlog, but may be due to natural causes such as the component nearing its intended lifetime and is planned to be replaced. An ambition of no elements with condition grade 2 is therefore unrealistic. Elements in condition grade 0 and 1 are assumed maintained by normal upkeep and is not included in further calculations. Values are in NOK (2018) and are early estimates in the budgeting process.

Figure 12 presents the maintenance capital needs of the different maintenance divisions in BYM.

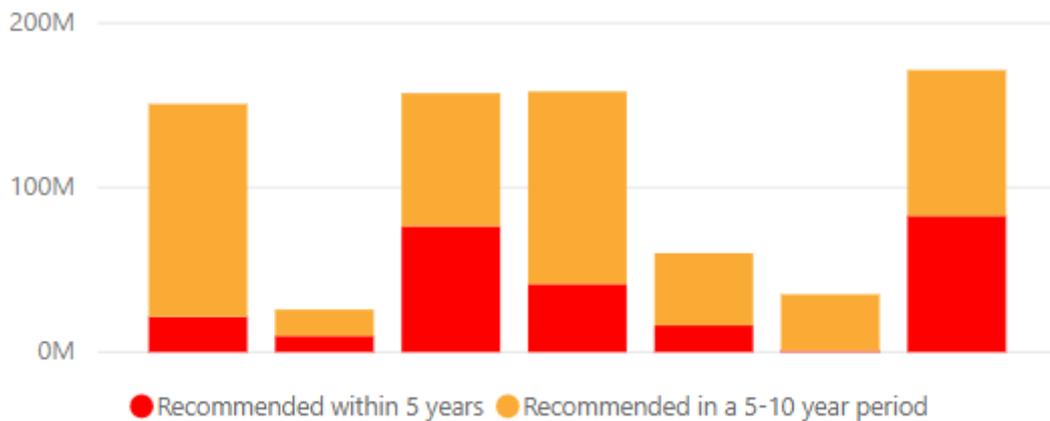


Fig. 12: Maintenance capital needs of different management divisions

3.4 Reliability and validity of results

Experience from using the methodology for huge amount of building, and same buildings several times, document that the methodology is replicable regardless which person doing the measures. It also shows, through case study, that the methodology is generic and can be used for other purposes than buildings.

The degree of uncertainty in these calculations make the values suitable for strategic use as orders of magnitude, but not as direct inputs in the budget process. Concrete actions needs to be defined, structured and cost estimated, preferably with the mapped conditions as basis. Because of the amounts of parks (close to 800) the uncertainty of cost calculations for the entire portfolio is somewhat mediated by the law of large numbers. In figure 13, uncertainty is shown in % as a function of amount of objects. For less than 20 objects, the uncertainty is 35-15 % but above 40 parks, it drops down closer to 10 %.

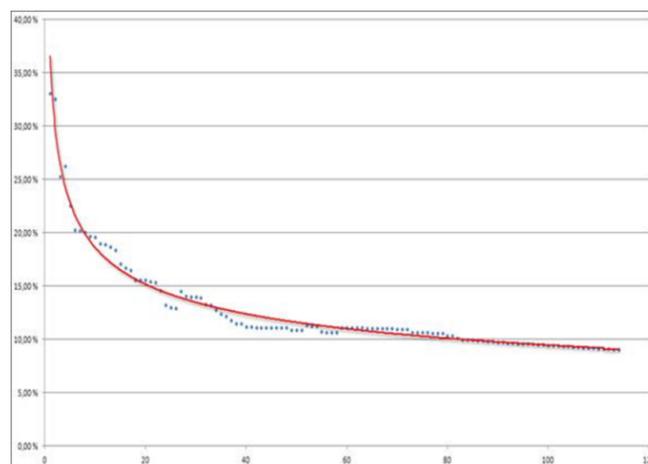


Fig. 13: Uncertainty of cost mapping portfolio (Multiconsult)

4. Discussion

A main objective has been to provide tools that can strengthen the strategic FM practice and bridge the gap between needs for users of urban areas by developing urban FM services. 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.

As the methodology is generic and based on measurable quantitative data, it can be used for any kind of issues. Aggregation of data is possible to obtain a communicative level for decision makers.

Based on increased interest for Urban FM, priority for further development should be a module assessing social aspects. To do that it is a need to define classification of social groups and – elements.

5. Conclusions

A new Urban FM role is seen as a position of knowledge, authority and trust in the urban community. To play this role it is important to have access to huge amount of data covering total aspects of services within urban context.

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 of urban areas. The multiMap method and methodology 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 and urban areas ie all space between buildings (parks, roads etc). Presenting results in 3D BIM and Google Earth has proved to be communicative.

Further development should focus on social aspects due to changing needs during people’s life (Life Cycle Social Needs). Children, grown-ups and elderly people (social “types”) has different needs (social “elements”) that shall be satisfied in urban context. Sustainable FM is more than energy efficiency, upgrading of maintenance backlog of the building itself, it is combination with quality of interaction between economy; environment and the social aspects so obtain well-being in buildings and campuses. The role of Urban FM is an expansion of services for all stakeholders in urban areas. This has to be understood and accepted as an important actor by all stakeholders.

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