ÖSTERREICHISCHE GESELLSCHAFT
FÜR NACHHALTIGE IMMOBILIENWIRTSCHAFT
AUSTRIAN SUSTAINABLE BUILDING COUNCIL

ÖGNI POSITION PAPER BENCHMARKS IN OPERATION

Created by the working group "Benchmarks in operation“

1.
THE TARGET OF THE POSITION PAPER

Most people spend around 90% of their time indoors, most of it at home and at work. People's well-being is a subjective perception that depends on numerous factors. In addition to the individual physical and mental condition of the person, these include influences from the respective environment such as thermal and material stress (e.g. from odours or air movements), noise, lighting quality, acoustics or the length of stay and the number of people present in a room.

Because of the individual sensitivity and adaptability of the human body, comfort cannot be measured uniformly. However, it is possible to create room conditions in which most people feel particularly comfortable. In technical building planning, aspects of thermal comfort, i.e. the indoor climate and indoor air quality, have to be taken into account. The essential factors are the room air temperature, the CO_2 content as an indicator for the air quality, the relative humidity and the air movement in the room.

ÖGNI has set itself the task, together with the participants of the working group "benchmarks in operation", of defining criteria that describe these comfortable room conditions. We want to convert comfort into verifiable and comprehensible values. In addition to definitions for comfort ranges for criteria such as room air temperature, CO_2 content, light quality or room humidity, this position paper also deals with requirements for technical building equipment and its maintenance, the importance of data monitoring and the correct analysis of these measured data. In addition, we have tried to describe the future requirements for facility management and to point out the possibilities of digitization in the real estate industry.

Energy-efficient buildings should not only be economical, but also offer a high level of comfort through the use of renewable energies, heat recovery, the right architecture and construction methods. Comfort achieved through intelligent building architecture saves complex technical solutions and energy costs. The European quality certificate of ÖGNI shows that investments pay off over the life cycle of a property. The processes involved in the maintenance of the systems and meaningful monitoring with subsequent analysis of the building data are necessary in order to guarantee the optimum effect of the systems over their entire life cycle. Well-trained facility management is of great importance for the efficient operation of comfortable and healthy properties. This is where new job profiles will emerge, whether it is the facility manager of the future or the building data manager. In the future, it will also be necessary to keep building models up to date about operations and to regularly enter monitoring data. This is the only way to realize the advantages of digitalization.

In short, we want this position paper to show that sustainability can only be achieved through proper operation and that sustainability and efficient operation go hand in hand.

2.
EXECUTIVE SUMMARY

ÖGNI defines the operation of comfortable properties as follows:

Interior comfort criteria

Criteria that lead to local discomfort, such as draughts, asymmetry of radiation temperature or vertical air temperature differences, have to be taken into account when designing buildings and HVAC systems. These criteria can be achieved either by architectural design, technical equipment or by mechanical operation and aids. The chosen solution has to be evaluated depending on the location. Important interior comfort criteria are, for example, the indoor temperature (in relation to the outside temperature), the indoor air humidity or the CO_2 content of the indoor air. In order to guarantee a high level of comfort in the long term, it is essential to check all these comfort criteria regularly and adjust them as required.

Digitization

We see great opportunities for the efficient operation of real estate in digitization. Especially in the areas of monitoring and analysis, maintenance intervals and control, digitization offers opportunities. We see positive effects on the energy-saving smoothing of heating and cooling curves, on targeted maintenance and replacement of consumables such as filters or on the demand-oriented operation of the individual rooms of a building. At this point one must also think further. We all have to do something about climate change to limit the warming of our planet - for this a switch to renewable energies and the use of alternative mobility is unavoidable. The building sector in Europe is responsible for around 40% of final energy consumption - which is precisely why buildings that reduce CO_2 emissions through the use of digitisation are of enormous importance. Networking between buildings and infrastructure will also shape future urban developments.
BIM (Building Information Modeling) should also be mentioned in this context. BIM can support comprehensive consideration and efficient operation in the sustainable use of planning, construction and operation. For example, it is advantageous to include facility management (FM) at an early stage of building planning. In this way, data relevant to FM can be entered at an early stage, thus supporting efficient and cost-effective operation.

Technical building equipment vs. energy efficiency

It is not the aim of ÖGNI to increase the energy consumption of buildings through the excessive use of technology. Therefore, we always assess the comfort of a building in relation to its energy consumption and the expected operating costs. We support the idea of increasing the comfort of a building with little technical support through intelligent architecture. We reject technology that patronises the user and restricts the design freedom of her/his personal comfort.

Requirements for Facility Management 4.0

Facility management is intended to ensure the functionality of built space by integrating the aspects of people, space, process and technology.

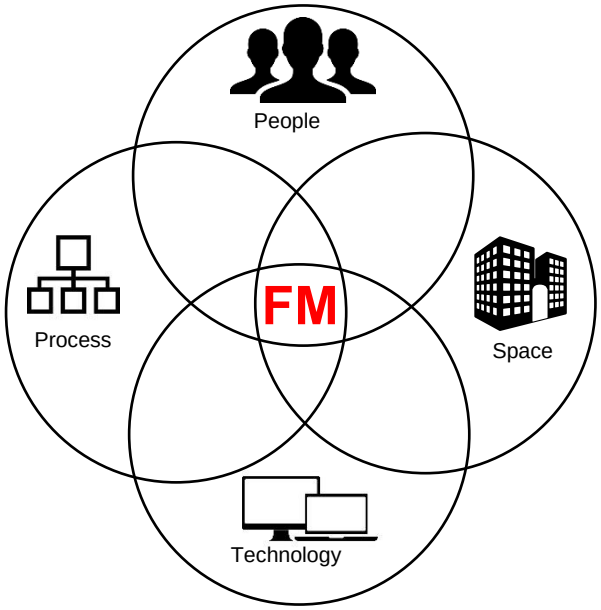

Figure 1: International Facility Management Association (IFMA) FM model.

In focus, the user is the starting point of all efforts and measures. In many companies, user integration by measuring workplace quality and user satisfaction is not yet carried out, or usually only selectively, in the context of employee surveys. However, quality and satisfaction can only be improved sustainably if they are also measured. "If you don´t measure, you can´t manage". A regular measurement of workplace quality and user satisfaction is therefore the core task of facility management and is clearly defined as necessary.

The provision of productivity- and health-promoting workplaces is becoming increasingly important as a core task of facility management. Employees have increasingly to be understood as customers, and knowing customer needs and measuring workplace quality are essential tasks. Facility management will continue to gain in importance in the future when considering sustainably efficient, comfortable real estate, as tasks become more and more complex.

ÖGNI therefore demands clearly defined processes for the training of facility managers not only at the beginning but also in the event of a change of management, a clearly defined list of values which are recorded and analysed including their time intervals, maintenance contracts concluded in line with requirements and the integration of FM into the communication on structural changes in the building. Comprehensive training of the facility managers employed and regular updates due to the rapid development of technology and digitization are indispensable for efficient operation. By networking of measured values, technology and operation, digitization will make administration easier and more comprehensive - provided that planning and use make this possible.

Maintenance, monitoring and analysis

Today there is more and more smart home technology. Everything is controlled and monitored via app. Our buildings are becoming more intelligent and are recording tons of data. These developments cannot be stopped and there are certainly advantages to knowing about your building through constant monitoring. However, the best technology will only be effective if it is regularly maintained. To name a few examples - air filters that are clogged become bacteria breeding grounds, incorrectly adjusted ventilation or heating systems lead to discomfort of the users/inhabitants, water pipes that have not been used for a long time can lead to the development of legionella, etc. The observance of regular service intervals, carried out by trained personnel and clearly defined processes for the operation of a building, avoid such problems. Another advantage of regular intervals is a better cost estimate. Thus, defective components can be detected early through annual maintenance and the operator is not surprised by the replacement of a completely defective system. In order to operate the systems optimally, regular analysis of the monitoring data is required in addition to maintenance. Only then building equipment can be adjusted and optimised for the residents and users. Only through perfectly regulated operation operating costs can be saved in the long term and lasting comfort can be guaranteed for the users.

3.
INTERIOR COMFORT CRITERIA

The air temperature, air velocity, air quality, air humidity and the radiation temperature (= temperature of the relevant walls and ceilings) form an interwoven compound, which essentially determines our feeling of comfort in interiors. Sound insulation, brightness and sunlight are further central comfort criteria. The aim in the planning and construction of buildings and apartments is to offer the greatest possible comfort, taking into account reasonable expenditure. Another aspect is air pollution. These can be caused by building materials, construction chemicals such as adhesives, paints or furnishings.
Indoor comfort is influenced by several parameters, such as room air temperature, room humidity, light quality or CO_2 content, which are representative of general air quality. These must be available in the right qualities to ensure that the well-being and health of the room users are not impaired. Here ÖGNI has listed the most important criteria that contribute to a healthy indoor feeling.

Air movement

Humans react sensitively to draughts because they increase their heat output through convection and evaporation. A permanent air velocity of more than 0.3 m/s is unpleasant (except in summer). The colder it is and the more constant it comes from one direction, the more strongly a person perceives draughts. Air movement is therefore particularly critical in air conditioning systems in summer.

Room air temperature

The air temperature has the greatest influence on people's sense of comfort. Which temperature is perceived as comfortable, depends strongly on subjective criteria such as clothing, activity, age and sex. The comfortable temperature range in residential buildings in the winter is between 20°C and 23°C. In summer, temperatures up to 26°C are still comfortable due to lighter clothing.

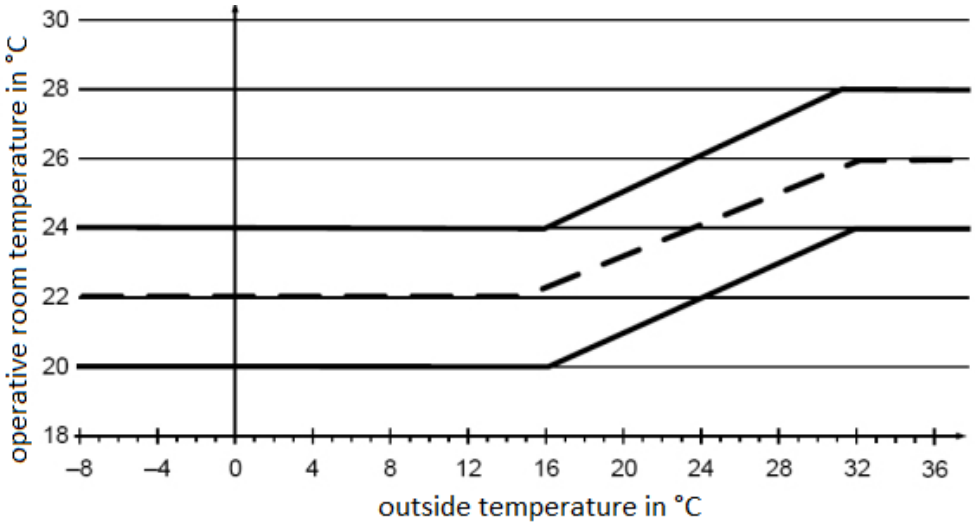

Figure 2: Comfort room temperature with the permitted tolerance range (source: DIN 15251).

Particulate Matter (PM_1, $PM_{2,5}$ & PM_{10})

The dust fractions referred to as particulate matter include coarse and fine dust. Particles of the fine dust fraction PM1 (all particles of size <1µm = 1/1000mm) can reach deep into the lung via the larynx and directly into the blood via the alveoli (Figure 3). The ultra-fine particulates (<0.1µm) and nano-particles (<0.05µm) located in this area are therefore particularly harmful to human health.

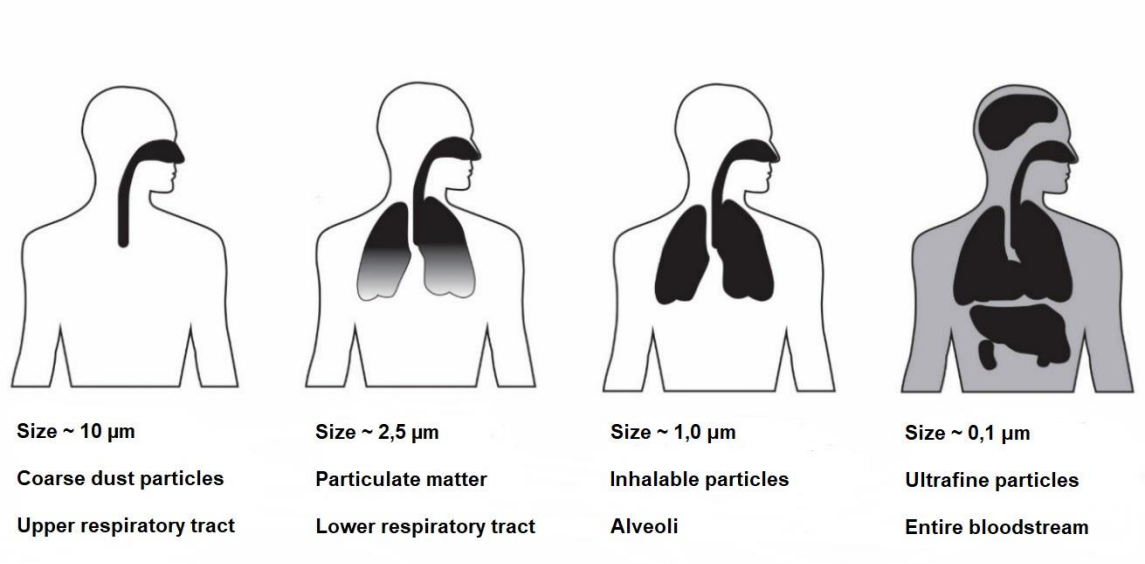

Figure 3: *Different size fractions of fine dust particles*

Room air humidity

Humidity is the content of water vapour in the air. As the temperature rises, the air's capacity to absorb water vapour increases. A distinction is made between absolute and relative humidity. The relative humidity is given in relation to the maximum possible saturation of the air with water vapour (100%). The value indicates how much of the maximum possible humidity the air actually contains. Since there can be more water vapour in warm air than in cold air, the value of the relative humidity decreases with rising air temperature and constant absolute humidity. The relative humidity should be permanently in balance between 40% - 60% in order to avoid health effects due to too dry air on the one hand and to prevent mould growth due to too moist air on the other (Figure 4).

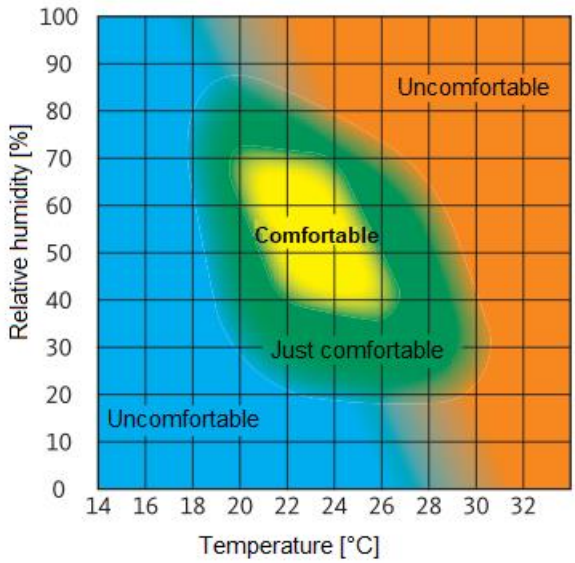

***Figure 4**: Human comfort range. The graph shows the dependency of room temperature on room humidity. (Source: Effizient Lüften - Bedarfsgerechte Wohnungslüftung. Optimale Raumluftqualität und Energieeffizienz - (GU).*

CO_2 content

CO_2 serves as an indicator for room air that is perceived as bad or for the associated disturbances in well-being and performance reductions. The concentration of this parameter is also a measure of the amount of volatile substances emitted by humans. In addition to this function, it is also suitable for other control areas, e.g. for dimensioning ventilation systems or for ventilation instructions in naturally ventilated rooms. As can be shown in Figure 5 when assessing indoor spaces, the activity carried out in the rooms has also to be taken into account (e.g. mental work, physical activity, sleep).

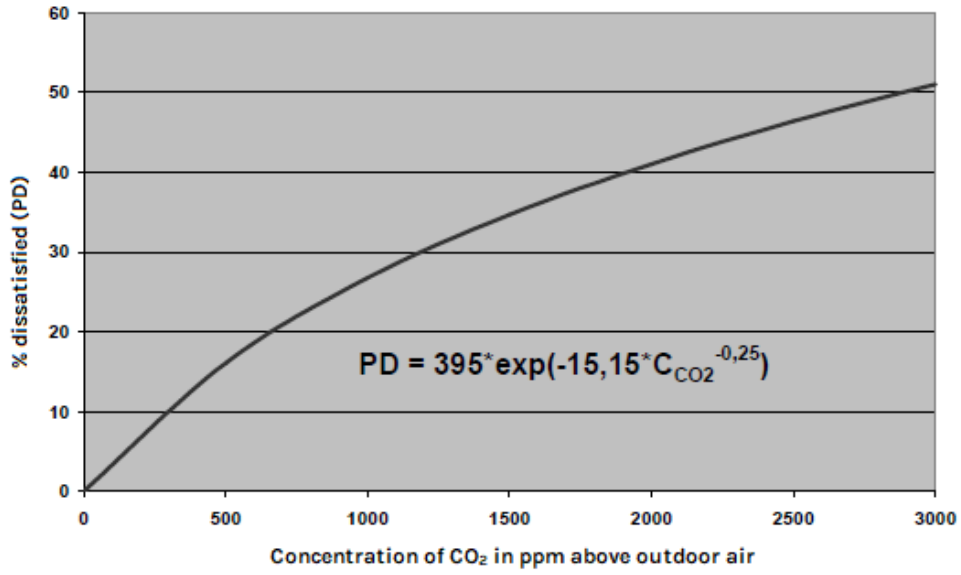

***Figure 5:** Correlation between CO_2 concentration as an indicator for anthropogenic emissions and number of dissatisfied persons (PD in %) in a room (according to ECA 1992). PD = Percentage of people dissatisfied with indoor air quality (Dissatisfied persons), C = Concentration of CO_2 in ppm above outdoor air concentration.*

The arithmetic mean of the instantaneous values in indoor spaces, that are intended for the permanent residence of persons and in which mental activities are carried out or which serve for regeneration (e.g. school and classrooms, lecture rooms, offices, bedrooms, hotel

rooms) should not exceed the value of 1000 ppm CO2 absolute in the respective assessment period.

Daylight and artificial light conditions

The quality of lighting affects the visual performance of people. It determines how accurately and quickly shapes, details and colours are recognised. Lighting influences the activity and well-being of employees. Poor lighting can lead to stress and premature fatigue. Illuminance levels have to be ensured by daylight, artificial light or a combination of both. The lighting criteria have to be selected in such a manner that they correspond to the tasks and activities to be performed and create comfortable conditions for building users.
Today's control concepts are becoming increasingly complex due to modern technologies. LED technology today requires far more complex control concepts than "conventional" lighting technologies. Digitization also plays a major role in lighting planning and should be taken into account in the planning process. For example, modern control concepts can be controlled via smartphones and tablets, depending on individual requirements. Modern lighting concepts also consider the control of biologically effective light (Human Centric Light (HCL), thereby promoting well-being and health as well as strengthening performance and concentration. ÖGNI will be dealing with this important topic in an individual working group.

Water quality

Drinking water is considered to be food and is regulated by food law and the Drinking Water Ordinance, which places the highest demands on drinking water preparation, taking health aspects into account. If consumed or used for a lifetime, it must not cause any damage to human health or the environment. The quality of raw water, which is delivered to the building boundary as drinking water, has to be of sufficient quality. It is generally assumed that pollutants (organic, inorganic) and pathogens must not be contained in the raw water. All piping, boilers and fittings in the building have to meet the quality requirements. Here, too, a regular analysis of the water - chemically, physically and bacteriologically - is recommended as a monitoring measure.

If pipes are not used for a longer period of time, for hygienic reasons either all pipes should be flushed up to every tap in the pipe system or they should even be blocked, emptied and flushed before the pipes are reused. Lines that are no longer in use, such as disused circulation lines of a hot water system, have to be disconnected for reasons of hygiene.

4. Digitization

Internet of Things (IoT)

The IoT ensures that all preset criteria (temperature, room humidity, etc.) are defined and adhered to. This requires intelligent, less noticeable systems for collecting and evaluating data on the presence and routes of users, temperature, humidity, noise level or air quality. The wireless networking of Internet-enabled sensors and actuators offers a significant plus in comfort, safety and energy efficiency.
Internet-capable fire alarms, intrusion detection systems, access control and emergency call systems provide more security: sensors can register unusual movements and forward the signals to central points such as police, fire brigade or rescue services. Energy efficiency can also be increased by intelligently controlling systems and installations such as heating, lighting and ventilation. Monitoring services - for example for the predictive maintenance of elevators - simplify servicing.

In short, intelligent control systems collect data to improve the interior comfort of the building. They are monitored, analysed and adapted if necessary. A well-planned building technology follows the Plan-Do-Check-Act cycle known from management contexts. Correct monitoring and subsequent analysis can identify health-endangering problems, increase the efficiency of equipment, and a detailed room analysis can optimize the efficiency and material usage of cleaning personnel, for example.
The data collected by these meters, sensors, building systems and other connected devices provide real-time guidance for the decision-making process and provide immediate feedback. They also provide novel insights into the workplace, helping to better understand how to optimize employee satisfaction and productivity.

BIM (Building Information Modeling)

BIM processes can also help to further optimize building operations. By continuously processing the information required for productive building management, building management is provided with a data basis that can be used to better organize all processes in technological and infrastructural FM. So far, intelligent building systems have taken on analytical tasks that support building management in an informative way and also relieve it of its work. Trained personnel are needed to cope with these new tasks.

Therefore, ÖGNI is of the opinion that FM should be part of BIM and has to be integrated during the planning phase. A higher level of information in the early phase enables optimisation of planning, construction and operation. Some examples of how BIM could make FM's work easier are - renting rooms, issuing keys and access cards, inventorying furniture, coordinating the cleaning of rooms or renovating without loss of quality. ÖGNI has also set up its own working group to define the minimum sustainability requirements for BIM.

5. TECHNICAL BUILDING EQUIPMENT VS. ENERGY EFFICIENCY

Building automation

The term building automation generally describes the entirety of monitoring, control, regulation and optimisation equipment in buildings. The aim is to network the technical units in the building in order to automatically carry out cross-device functional sequences according to specified parameters or to simplify their operation or monitoring. All devices are intelligently networked so that all functions can be managed centrally.

The networking of the building systems and the digitization of the structures offer the possibility to design the maintenance of buildings completely differently in the long term. The system identifies weak points in advance and informs the administration of impending damage. These can be remedied preventively that means less effort for the building operator. This process is known as predictive maintenance.

Technical Monitoring

After completion, innovative and energy-efficient planned buildings often struggle in actual operation with clear failures to meet target and planning values. The consequences are a long project follow-up, dissatisfied users as well as high operating costs and energy consumption. The causes can lie in planning, construction and commissioning and are often manifold and difficult to identify. Technical monitoring, as an addition to commissioning management, can be the solution.
Technical monitoring enables better and faster optimisation of the building operation of newly erected and renovated buildings. It ideally locates all hidden defects of a building services system before handover, but at the latest during the warranty phase. A target/actual comparison between planned and achieved quality is displayed so that defects can be located precisely and quickly (e.g. defective sensors in the ventilation system, control settings unsuitable for operation, frequent cycle behaviour of systems, incorrect documentation, etc.).

Lower costs as a bonus

Energy efficiency is an important factor in the automation of both private homes and public or industrial buildings. In this context, facility areas such as lighting, heating or air conditioning play a decisive role. Demand-oriented, day- and season-dependent lighting management can save a great amount of energy and thus costs. A further factor for savings is the extension of the service life of installations through efficient and appropriate handling. In addition, the individual adaptation of lighting, heating, air conditioning etc. makes it easy to create an optimum indoor climate for employees.

6.
FM 4.0

Technological development is more and more displacing low-quality work from the market and creating demand for new skills. New technologies require people to work more intelligently and new materials request more knowledge.

Time and again, the question arises as to whether new technologies are reducing jobs in facility management. We believe that they are more likely to open windows for new types of work and create new challenging jobs. Just as the steam engine has not cost any jobs globally, there will be similar developments in facility management with the use of new technologies. In the end, it will no longer be a question of working through simple tasks, but of meeting high-tech and demanding challenges in a building. The tasks will become more complex and will be closely linked to the data that the building will provide.

Usage and status information is collected and processed via sensors. Services for building operation are thus controlled and intelligently processed via big data solutions. Lean methods from industry 4.0 are the guiding principle for this.
Ideally, this can even be done by integrating external sources such as weather forecasts or other sources, all of which are centrally recorded and processed. Machine learning is set up and should finally open up the possibility of recognizing process patterns in buildings (behaviour, rituals, time sequences, etc.) and controlling the building or using services as required. In this way it could be avoided that meeting rooms are unnecessarily cooled without a meeting taking place in them, or that every room is cleaned every day even though it has not been used.

In addition, buildings and workplaces are increasingly being built and operated with the aspect of health in mind. As a result, the documentation requirements for environmentally relevant data are increasing. Automated building / room usage analyses help FM to evaluate these building data and thus to adjust and optimize the operation to the building users. Looking at the life cycle of a building, one becomes immediately aware that the operation alone has the greatest influence on the costs of the property due to the long period of time (usually estimated at 50 years).

The degree of complexity determines the usability of a building. We assume that everything can be digitized, but that the sense is always to be questioned.

In Figure 6, the life cycle of a building is simplified to emphasize the importance of efficient building operation.

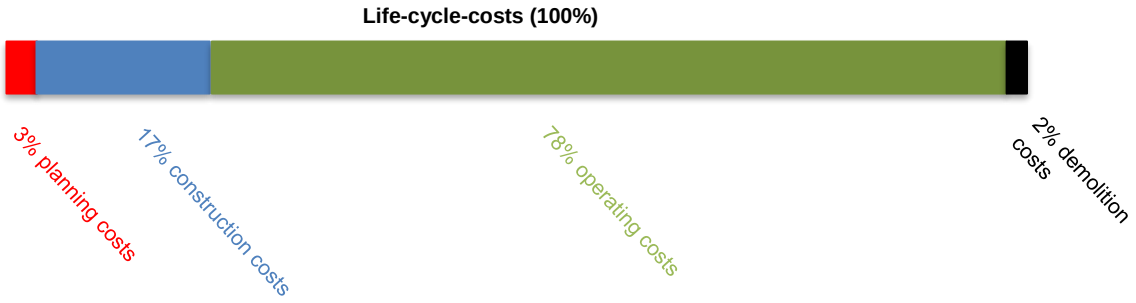

Figure 6: Schematic representation of the life cycle costs of a building. Approximately 80% of the costs are incurred for the management of a property (source: IG Lebenszyklus: IG Lebenszyklus: Der Weg zum Lebenszyklusorientierten Hochbau.

As a result of increasing digitization, the maintenance of future buildings will also become more labor-intensive and complex. As a result, FM training will also have to adapt to new technologies. Facility managers are becoming highly competent partners for their customers, whose solutions now become an integral part of day-to-day operations. As a result, FM and the service sector in general will benefit from rising wages and an increasing reputation. As with any service, the quality of FM services depends on the motivation and quality of the staff. Since the complexity of a matter or action is usually increased by sustainability, trained personnel is accordingly very important. In the course of personnel recruitment, attention is paid to various qualifications - training, references, communication and team skills as well as independent thinking and acting are important criteria.

Requirements for the FM 4.0

As already mentioned, the FM of the future will have to cope with many different activities in addition to "mopping up and snow shovelling". After consultation with specialists from the industry, the following fields of activity and tasks will be added:

- Maintenance of complex technical building equipment
- Monitoring and evaluation of building data
- IT application capabilities, such as preparing, maintaining and securing data, integrating systems or communicating digitally
- BIM know-how
- Technical training

In order to be able to offer consistent quality in these processes, regular training and the exchange of experience with other companies or consultants are absolutely necessary. Training courses on the following topics are particularly recommended:

- Data and area management (CAFM systems)
- Sustainable procurement
- Energy and resource management (e.g. training as energy manager)
- Building services engineering (balancing, building services engineering service)
- Environmental management (EMAS or ISO 14001)
- Ecological cleaning
- Waste management

- Communication with users

However, soft facts are also essential to increase user comfort. Among other abilities, sustainable facility managers should have the following qualifications:

- Communication skills - active and open communication
- Ability to cooperate - customer-oriented, internal or cross-structural cooperation
- Dealing with complaints and suggestions, conflict management and mediation
- Organization of change processes

7.
OUTLOOK AND GOALS

A building achieves the highest degree of sustainability when, thanks to planning and architecture geared to operation, only mechanical measures are necessary to enable a comfortable life. However, this is not often possible due to location or purpose of use.

Due to the rapid development of technology and the progress of digitization, comfortable living in buildings becomes possible, even taking into account energy consumption and operating costs. The prerequisite is not only the investment in modern technologies, but also the correct operation of these technologies.

ÖGNI, as a representative of the European Quality Certificate DGNB, will work to ensure that the planning of buildings enables efficient and comfortable operation. Together with our European partners, we will extend the building certification by the dimension "operation" and thus contribute to the fact that the sustainability of buildings is not only evaluated on the occasion of their completion.

Comfort was hitherto a term associated with luxury. We believe that comfort when living in buildings helps to create well-being, keep people healthy and therefore should be realized in all types of real estate.

8.
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9.
SUPPORT ÖGNI

ÖGNI is the contact for all questions concerning social sustainability. Within our network, we offer an extensive pool of experts for questions, events and projects as well as advanced tools such as the European Quality Certificate DGNB for quarters and various types of buildings.

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