

## English summary

A strategic approach and holistic planning are important elements of sustainable building development. They can be supported by current technology, which, for example, can visualise and benchmark a building's actual environmental performance. However, management of environmental building performance (EBP) through IT systems has experienced difficulties in gaining a solid base, partly due to a lack of core data on buildings, but also to erroneous consumption data and a lack of any overview of consumption patterns.

This PhD dissertation shows how the implementation of certain IT systems in Real Estate Management (REM), including Facilities Management (FM), can promote sustainability by reducing REM's negative environmental impacts. This is primarily achieved through the successful implementation of IT systems that can process large amounts of different data on buildings and their performance. However, to succeed with the implementation, IT systems must support the business processes that an organisation requires regarding REM or FM.

Nowadays IT systems such as Integrated Workplace Management System (IWMS) and Energy Management System (EMS) can collect, combine, analyse and present core data and dynamic consumption data. This opens up new possibilities to base EBP on actual operating data and provides opportunities for deeper performance analysis and faster failure detections. As at the time of writing research-based knowledge about IWMS is relatively limited, this PhD has chosen to study what this system actually is, how it can be implemented, what benefits it can realise and how the system, in combination with EMS, can be used to improve EBP. The research focus has been on four different REM/FM organisations that use various IT systems to monitor and benchmark EBP. The empirical results from the main case study show that IWMS implementations are complex and require a lot of resources, though they can add value particularly to large-scale REM organisations. In addition, the three remaining case studies show that the EMS is particularly beneficial for collecting and processing dynamic data on electricity, heating and water consumption. Moreover, the research shows that EMS can be further supported by BMS (Building Management System), which focuses on the management of technical installations, and that even simple IT systems like Microsoft Excel can be used to report and benchmark EBP. Cross-case analysis shows that in practice the focus in IT systems is on energy and water consumption and emissions, while environmental categories regarding space management, building materials and recycling are either not supported in IT systems or are not used by the organisations studied.

The PhD project also studies the future potential for managing and benchmarking EBP through IT systems. In dynamic life-cycle modelling and analysis of high-resolution data, the research shows that EBP not only depends on the energy consumption, but also on the time of that consumption and the location of the building (region).

Finally, based on empirical observations and research results, this PhD proposes a step-by-step model for improving EBP through IT systems.