white paper

enocean alliance
Building Smarter Connectivity

The influence of Smart Buildings upon the wellbeing and productivity of office workers (summary)

„The workplace is more than just a piece of real estate.
It's a living organism that enables people and companies to bring life and work together in a positive and constructive way." [1]

Version 01, 18th June 2020
Prof. Dr. Michael Krödel (IGT – Institut für Gebäudetechnologie)

For office-based businesses, the cost of labour represents the largest operating cost by far. For knowledge-based companies, it represents approx. 90 % of the budget compared with approx. 1 % spent on energy (Illustration 1).

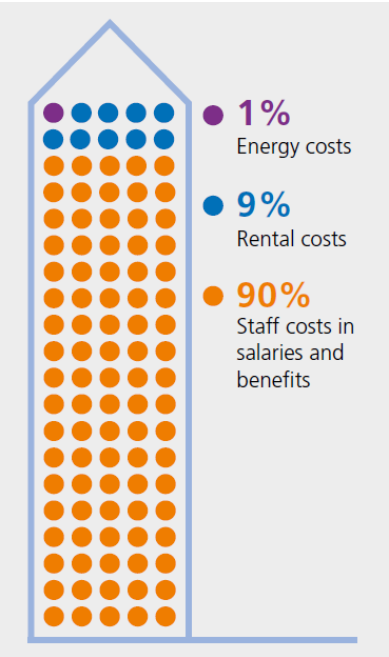

Illustration 1: operating costs of knowledge-based companies [WGBC 2014]

Therefore it goes without saying that employee productivity is the foremost priority. Next to personnel management, working atmosphere and remuneration, the quality of the workplace emerges as a key factor. A study involving more than 7.000 people from 12 nations indicates that more than 50 % of those interviewed stated that the quality of their workplace has a direct effect upon their productivity [JLL 2017]. Smart Buildings can make a significant contribution by providing optimal air quality, lighting, thermal comfort and flexible interaction with a modern office environment.

The direct effects of indoor air quality upon human health have been thoroughly analysed. Studies conducted in 2006 and 2008 have shown that performance (defined as speed of work at a standardised error rate) increases by between 8 % and 14 % when the fresh air intake rate is doubled (e.g. increased from 17 m³/h to 34 m³/h) [Wargocki 2008].

Workplace lighting influences wellbeing in the office as well as the quality of sleep at home. Restful sleep is an important factor for fitness and working performance, and fundamentally important for workplace safety. A lack of natural light and excessive exposure to artificial light, especially „cold" light, can lead to disturbed sleep and fatigue as well as poor concentration which, in turn, can increase the risk of accidents as well as depression and cardiometabolic illness [Kantermann et al. 2018].

Thermal comfort plays a decisive rôle in workplace wellbeing and employee productivity. Research conducted in 1986 supplied evidence that there is a clear relationship between rising temperature

[1] Dr Marie Puybaraud, Global Head of Research, JLL Corporate Solutions

and sinking physical and psychological performance. At 28 °C, physical performance drops by 50 % whilst psychological performance suffers a 20% loss [Dentel&Dietrich 2006], [Wyon 1986].

Another important factor is the flexible use of office space within Smart Buildings, with varying office furniture configurations as well as a mix of large open-plan areas and meeting rooms, plus communal spaces. Evolving work processes (team structures, procedures etc.) call for ongoing optimisation. A Smart Building can monitor and evaluate the utilisation of available spaces and supply data enabling the smart management of limited resources. When Smart Building facility users have more influence upon their workspace environment, e.g. by adjusting climate and lighting according to personal preference, this invariably leads to better workplace satisfaction and higher productivity [WGBC 2014].

A Smart Building is much more than just a resource-optimised facility. „Smart Building“ is often used to indicate that a building uses less energy and lowers operating costs. This is correct – building automation pays for itself in the space of a few years and generates appreciable savings in running costs [Merz et at 2016]. However, the main benefit of such „Smart Buildings“ lies elsewhere – in the positive effects upon employee productivity, employee loyalty and employer attractiveness for new talents.

Smart Building requirements must be taken into consideration at the planning stage. A key aspect is the timely planning of the sensor networks needed to supply essential data on occupancy patterns as basis for real-time building management and control, as well as for analytical purposes.

[Dentel&Dietrich 2006]	Dentel, A., Dietrich, U.; Thermische Behaglichkeit – Komfort in Gebäuden; 2006
[JLL 2017]	JLL Corporate Solutions; Global Report on „Workplace powered by human experience”; 2017
[Kantermann et al 2018]	Kantermann T., Schierz C., Harth V.; Gesicherte arbeitsschutzrelevante Erkenntnisse über die nichtvisuelle Wirkung von Licht auf den Menschen. Verein zur Förderung der Arbeitssicherheit in Europa e.V. (VFA); 2018
[Merz et al. 2016]	Merz H., Hansemann T., Hübner C.; Gebäudeautomation (Hanser Verlag); 2016
[Wargocki 2008]	Wargocki P.; Improving indoor air quality improves the performance of office work and schoolwork; 2008
[WGBC 2014]	World Green Building Council; Health, Well-being & Productivity in Offices; 2014
[Wyon 1986]	Wyon, D.P.; The effect of indoor climate on productivity and performance, revised version of a Swedish publication in VVS & Energy; 1986