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Dr. Derek Clements-Croome is Professor of Construction Engineering. He is a Director and founder of MSc Intelligent Buildings Programme and Intelligent Buildings Research Group and Director of Research in the School of Construction Management and Engineering at the University of Reading.

The second edition of his book **CREATING THE PRODUCTIVE WORKPLACE** (Clements-Croome 2000) was published by Routledge in 2005. His book **INTELLIGENT BUILDINGS** (Clements-Croome 2004) became available in Chinese. He has a portfolio of many projects including sustainability, building facades, system reliability, building rating methodology and design quality (including ventilation) in schools and effects of this on students learning, all funded by EPSRC/DTI. He was Vice-President of CIBSE 2005--7 and chairs several committees including one on intelligent buildings that has over 2000 members from over 118 countries. He is a member of the College for Engineering and Physical Sciences Research Council and also has served on the Panel on the Dynamics of Ageing for the Economics and Social Sciences Research Council. He was President of National Conference of University Professors in UK. He is Editor of the peer reviewed journal **INTELLIGENT BUILDINGS INTERNATIONAL** published by Earthscan.

Keynote Abstract

SUSTAINABLE INTELLIGENT BUILDINGS FOR PEOPLE

An intelligent building is one that is responsive to the requirements of occupants, organisations and society. It is sustainable in terms of energy and water consumptions besides being lowly polluting in terms of emissions and waste: healthy in terms of well-being for the people living and working within it; and functional according to the user needs.

Clements-Croome, 2009

Intelligent buildings should be sustainable, healthy, technologically aware, meet the needs of occupants and business besides being flexible and adaptable to deal with change. This means the processes of planning, design, construction, commissioning and facilities management including post-occupancy evaluation are all important. Buildings comprise many systems devised by many people and yet the relationship between buildings and people can only work satisfactorily if there is integrated team with a holistic vision.

Buildings affect people in various ways. They can help us to work more effectively; they also present a wide range of stimuli for our senses to react to. Intelligent buildings are designed to be aesthetic in sensory terms not just visually appealing but ones in which occupants experience delight, freshness, airiness, daylight, views out and social ambience. All these factors contribute to a general aesthetic which gives pleasure and affects one's mood. If there is to be a common vision, it is essential for architects, engineers and clients to work closely together throughout the planning, design, construction and

operational stages which represent the conception, birth and life of the building. There has to be an understanding of how patterns of work are best suited to a particular building form served by appropriate environmental systems. A host of technologies are emerging that help these processes, but in the end it is how we think about achieving responsive buildings that matters. Intelligent buildings should cope with social and technological changes and also be adaptable to short-term and long-term human needs.

Intelligent buildings need to be sustainable (i.e. sustain their performance for future generations), healthy and technologically up to date; meet regulatory demands; meet the needs of the occupants; and be flexible and adaptable enough to deal with change. Buildings will contain a variety of systems devised by many people, and yet the relationship between buildings and people can only work satisfactorily if there is **integration** between the supply and demand side stakeholders as well as between the occupants, the systems and the building. **Systems thinking** is essential in planning, design and management, together with the ability to create and innovate whilst remaining practical. The ultimate objective should be **simplicity** rather than complexity. This not only requires technical ability but also the powers of interpretation, imagination and even intuition.

Building Regulations can stifle creativity but are necessary to set a minimum level of expectation and obey health and safety requirements. However we should aim to design well above these conditions. After all, buildings form our architectural landscape and they, and the environment they generate, should uplift the soul and the spirit of those people within them as well as those who pass by them.

The creation of shared visions, effective teams, clear structures and robust processes ensures that the intelligent building being constructed will demonstrate the purpose for which it was conceived. Times are changing so there needs to be an outlook by the team which is long term. Key issues for intelligent buildings are sustainability (energy, water, waste and pollution), the use of information and communication technology, robotics, embedded sensor technology, smart-materials technology including nanotechnology, health in the workplace and social change. Eventually by coating and embedding materials with nano-particles we will be able to specify material properties much more easily. Such materials in facades for example will provide sophisticated forms of feedback and high levels of control besides regulating heat losses and gains. Self healing materials will revolutionize facades in the future. However the technology must be an enabler rather than an end in itself. Passive environmental design is equally important so that the energy demands are minimized by using natural means such as mass, orientation and building form to capture sunlight, fresh air and rain water.

The intelligent buildings control markets are strong worldwide even after the gloomy economic period of 2009. The largest markets are in the US, Asia, Middle East and Europe but some smaller countries are showing rapid growth. BSRIA Member e-News August 2009 shows that Scandinavia, Germany and Qatar spend most per capita on sophisticated intelligent controls. The increasing demand for sustainable, healthy and low

carbon intelligent buildings seems likely to sustain this dynamic market. Building management systems provide control and interoperability between the various systems servicing the building. Innovations such as internet-based, common, open communication standards and protocols increasingly make it more important to integrate the systems within intelligent buildings. This in turn will require an extended range of professional expertise that could force a cultural change.