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15. Evaluation of innovative workplace design in the Netherlands

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4035 words
4 figures
2 tables
1 glossary

Over the last decade many businesses are engaged in making organizational changes; adopting new management styles and ways of working. Concurrently, there has been a rise in the number of non-territorial “flexible” office designs based on job functions and work processes rather than individually assigned workstations. Office buildings are becoming more ‘intelligent’ through the use of advanced building management systems, automatic indoor climate controls, innovative (day)lighting systems and so on. Such innovations in workplace design are intended to facilitate organizational change, improve user satisfaction, increase efficiency, and lower costs. To cope with the rapid innovation and changing nature of work environments, building environment-behaviour researchers in the Netherlands are developing ways to measure workplace performance.

15.1 Overview

This chapter describes how several researchers in the Netherlands are using Building Performance Evaluation (BPE) to test innovative designs for workplaces. After summarizing the general background, drivers and objectives of BPE in the Netherlands, two case studies are introduced. The first is an effectiveness review and a Post-Occupancy Evaluation (POE) of a new, non-territorial office design for ABN-AMRO bank. The second focuses on the pre- and post- occupancy evaluation of a new “intelligent” (day)lighting system for the Rijnland Water Board

Building. A number of observations and recommendations about BPE based on the case studies are included at the end of the chapter.

15.2. Building Performance Evaluation in The Netherlands

In the Netherlands, it is unusual to undertake performance evaluations throughout the delivery and lifecycle of a building. POE and all other phases of the integrative framework for BPE as described by Preiser and Schramm (1997) and in Chapter 2 are not explicitly included in standard agreements between clients and their designers, consultants and contractors. BPE does, however, have a role in the Netherlands.

Office workers in the Netherlands have come to expect a relatively high quality work environment. The Dutch follow the decision-making tradition of the "polder model" where consensus is reached through consultation rather than through top-down authority (van Riet 2001). As a result of this culture of consultation-based processes, the regulations concerning the health and welfare of office workers in the Netherlands, known as the *ARBO-besluit,* are quite high. Though not always comprehensive in nature, most building design delivery processes involve an effectiveness review, a program review and a design review. Once a building is occupied, larger organizations commonly employ health and safety officers, and even physicians, to deal with worker concerns and complaints.

The current trend towards organizational change and new ways of working has fueled the demand for new and innovative workplace solutions. Before investing in such solutions, stakeholders want assurances that proposed innovative designs and building systems will meet the needs of their users.

15.3. Evaluation methods and performance criteria

In most POEs in the Netherlands, the main objectives are to test if clients' goals and objectives are achieved, and to improve the understanding of the complex

relationships between facilities, employee satisfaction and organizational goals and needs (Table 1). As will be demonstrated in the ABN-AMRO case study in section 15.4, the typical focus of the investigation is on user satisfaction and organizational performance, Technical aspects and facility costs are included less often (Table 2).

<insert TABLES 15.1 and 15.2 about here>

Detailed evaluation of environmental systems in the workplace, such as of heating or lighting systems, usually take place only when a particular problem has been identified by a previous study or worker complaint. Environmental system evaluations tend to be diagnostic in nature, focusing on particular performance aspects such as glare, user control, maintenance, and so forth. In some situations, such as the Rijnland Water Board building discussed later in this chapter, where new relatively unknown innovative systems are being considered for use in a workplace, full-scale mock-ups are built to evaluate them before they are installed.

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15.4. Case 1: Office innovation at ABN AMRO Bank in Breda

Today, many business units of ABN AMRO bank apply innovative strategies for flexible working. This includes the short and long term time-sharing of spaces such as: open plan or group offices for communication and routine work; cockpits for concentration; coffee corners for breaks and informal meetings; formal meeting rooms; and touch-down places for short-time activities such as reading mail and checking email. With new workplace concepts such as these, ABN AMRO wants to support organizational and cultural change that is open and dynamic, and improves its overall performance without decreasing occupant satisfaction.

The first large scale flexible office for ABN AMRO was their regional office in Breda (Figure 1). The original office building was functionally and technically out of date and had to be renovated. There were two options: keeping individually as signed desks and making an extension to the building of 2,600 $m^{2,}$, or keeping the same floor area and introducing desk-sharing. A cost comparison showed the innovative option increased investment costs by 9%, and reduced operation costs per employee by 17% (Lohman and Van der Voordt 2000). Given this potential cost reduction, combined with a space-savings of nearly 30%, the managers adopted the innovative option, referred to as the "Flexido-concept."

<<Insert figure 1 here (ABN AMRO photo and floorplan) >>

In the new building 336 employees share 255 desks. This consists of 311 full time employees using 194 desks in an open lay-out, 61 cockpits, 17 'touch down' workplaces, 18 team rooms, 15 meeting rooms and 30 seats for informal gathering, for a total of 400 places. A POE comparing user satisfaction pre- and post-move revealed the overall space reduction has not led to user dissatisfaction (van den Brink 2000)(van der Voordt and Diemel 2001). Sixty-nine percent of occupants are positive about the lay-out, compared to 37% in the previous situation of an open plan office and personal desks. Fifty-one percent of people are positive about the effect of the physical environment on their productivity (formerly 14%) and 83% of people surveyed do not want to return to the former working environment.

As a consequence of flexible working, where employees may use different types of workplaces for long or short periods of time, people tended to plan more of their activities in advance, which has improved their effectiveness. By using team archives instead of personal archives, the space needed for filing was reduced by almost 50%, with only a slight decrease in user satisfaction. Communication has improved slightly in the more open plan, whereas concentration cells allow people to work in a concentrated way when necessary. The overall success of this project can also be attributed to a careful design

delivery process, that included an inspiring 'champion' from management to steer the process, sound pre-occupancy research into spatial needs, good communication with users, and post-occupancy care to solve minor problems.

According to pre- and post- occupancy evaluations in several other ABN AMRO flexible workplace projects, most employees surveyed tend to be satisfied with the spatial transparency, nice interior design, ergonomic furniture and the improved freedom of choice of when and where to work (Van der Voordt and Beunder 2001). Compared to cellular offices, improved transparency aids communication, and unlike former open plan offices, concentration is improved by adding cockpits. In time, people eventually become accustomed to desk sharing and using different task-specific areas (desk-rotating).. Complaints arose, however, because of distractions caused by a lack of visual and auditory privacy, ,time loss from repeated logging in and the clean desk policy. The overall evaluation of the new workplace is slightly more positive than negative. In ABN-AMRO flexible workplace projects evaluated the majority of employees surveyed say they do not want to go back to their former workplaces.

15.5 Case 2: Building System Innovation in Rijnland Water Board Building
In 1998, the provincial government of Rijnland decided it needed a new building to house their Water Board. The new building needed to accommodate 350 employees. The two key performance requirements of the new facility were that it: (1) have a high energy-efficiency (sustainable) and, (2) provide a supportive and comfortable working environment for its occupants.

To address the requirements for energy-efficiency and indoor comfort and it was decided to incorporate several innovative environmental building systems. This included hot and cold underground storage tanks, heat pumps, under floor heating, radiant cooled ceilings, and a ventilation system that includes heat recovery. The most innovative measure was to install a new type of daylighting system.

As part of the overall building design evaluation and development, a three part performance evaluation of the innovative lighting system was undertaken:

1. pre testing of innovative daylighting designs in test settings
2. evaluation of the selected system on site, and
3. pre-move and post-occupancy user surveys.

15.5.1 Pre-testing

The goal of the first phase of evaluation was to select one out of four innovative daylighting system solutions. Mock-ups of each daylighting design were created in existing office rooms at the Eindhoven University of Technology. Each room was set up to be as close as possible to the size, layout, and materials of the office rooms in the proposed new design for Rijnland.

Over a period of four months, data were collected and analyzed about each system according to the Measured-Observed-Perceived-Simulated or MOPS-model of building environment evaluation (Mallory-Hill 2004):

- ***M****easured.* Monitoring physical performance through data loggers connected to lighting sensors and spot measurements to determine light levels and energy use.
- ***O****bserved.* Walk throughs and time utilization studies to track occupant activities and responses.
- ***P****erceived.* User surveys or interviews to capture occupants' satisfaction with the environment.
- ***S****imulated*. Computer visualizations to examine the performance of the system year round and in different exterior weather conditions.

A photograph and plan of one of the experimental settings is shown in Figure 3. For more detailed explanation of the evaluation see (Zonneveldt and Mallory-Hill 1998) and (Mallory-Hill 2004).

<< Insert Figure 2 about here>>

The system most successful in terms of energy efficiency was selected by the client. The selected system, shown in its experimental setting in Figure 3, is designed by Bartenbach Lichtlabor in Aldrans, Austria. It combines indirect high efficiency electric lighting with reflective ceiling finishes and computer operated reflective blinds to optimize daylight penetration into the room. The concave profile of the venetian blinds further helps to "scoop" light into the room. Luminaires near the back of the room are controlled by light sensors directed at the worksurface. When more daylight is available at the back of the room, the electric lighting is automatically dimmed. The system was so effective in using natural light that for 70% of the daytime working hours no electrical lighting was required.

15.3.2. On-site testing

After the new building was constructed, further testing was undertaken to optimize the daylight system design with actual employees from the Rijnland Water Board (van Wagenberg et al 1998). A new test setting was set up on the ground floor of the new building. In total 28 employees evaluated the system during two days, during which they did their normal work in the test setting. Each participant completed a questionnaire about their general opinion of the daylight system, their preferred type of blinds (perforated or non-perforated), perception of the view outside, the illumination level, and their satisfaction with working in the new office.

The research showed that 64% of the employees were satisfied with the light quality, compared to their normal worksetting where only 39% percent were satisfied. When asked about the outside view (blinds down, half closed), 50% of the subjects were dissatisfied . Forty percent 40% of participants preferred perforated over non-perforated blinds because of the improved view. This finding was still lower than in their normal workstations, where 57% of the subjects were satisfied with their outside view.

While working in the test setting, nearly half (47%) of all of the subjects pulled up the blinds, both perforated and non-perforated, and a majority (67%) had switched on the light at the window or the light at the ceiling or both. These occupant modifications effectively compromised the majority of the energy-saving features of the design.

15.5.3. User Surveys

Before and after the move, users were surveyed on how satisfied they were with their their building regarding its location, building characteristics and facilities such as: catering, cleaning, layout and maintenance.Users were also queried about workplace characteristics such as the indoor climate, health, perceived productivity and the innovative daylighting system (van Wagenberg 2001).

Most findings showed a significant increase in the satisfaction of the employees in the new building (Figure 3). After moving from the historic center of the city to the new location in a business park, the only aspect employees were unsatisfied with was the location, where the level of dissatisfaction increased from 1.5% to 27.1%...

<<insert Figure 3 about here (photos of exterior and interior new Rijnland)>>

The best improvements relate to indoor climate factors and perceived productivity. Formerly, 34.9% of occupants complained about the overall indoor climate compared to 19.9% in the new facilities. Figure 5 shows the results for each indoor climate factor. In the old facilities all scores were less than six on a scale from 1 to 10. In the new building every indoor climate factor received an average score of seven.

<< insert figure 4 here (Rijnland indoor climate factors graph)>>

The employees' perceived productivity improved significantly. Previously 42% of the employees believed their building had a negative influence on their productivity compared to 9% in the new building. Now 33% (formerly only 3%) of the employees say the building environment has a positive influence on their productivity.

15.5.4. Discussion of Rijnland Water Board results

In this case study performance evaluation in experimental settings helped to select and then optimize an innovative daylighting system. The satisfaction with the innovative daylight system in the new building is good; but not as good as expected. This partly relates to occupant expectations for blinds and the distribution of lighting. In the selected daylighting system, the blinds must be closed to work effectively. To most occupants, blinds are associated with keeping daylight out and not with bringing in extra daylight. When the blinds are closed, the illumination level produced by the system is very evenly distributed over the room. The level of lighting is adequate, but some users find the lighting quality to be too uniform or dislike obstructed outside view. Some occupants, therefore, are likely to continue to open the blinds. Though this has the benefits of the daylighting and view, it reduces the energy-saving performance of the system.

Similar comments about the perceived quality of lighting produced by the system were recorded in the very first experimental setting, but the substantial energy savings offered by this system made it very attractive to the client. The multi-dimensional evaluation methodology used in this case study allows for the congruence between qualitative and quantitative results to be compared. Potential problems can occur, however, when quantitative performance measures, such as superior energy efficiency, are given priority over qualitative measures of occupant perceptions or observed behaviours in the selection of the design solutions. The experience of this case study suggests the primacy of occupant opinion should always be considered, even in limited, experimental settings.

15.6 Lessons learned from both case studies

Based on a comparison of the BPE methods used the POE case-studies described in this chapter, the following observations and recommendations are made:

- Experimental settings are good a way to test innovative building systems. The key is the ability to accurately replicate the proposed future setting. It is much harder to evaluate the success of flexible office design in purely experimental settings as it is dependent on issues that are hard to replicate such as: organizational culture, emerging information technology, and outside economic or competitive pressures.
- User satisfaction is often used to judge the quality of physical environments for work, but is satisfaction a good measure of a successful workplace? Many businesses interested in outcomes, like productivity or cost-effectiveness. Workplace performance evaluation needs to find ways to measure the contribution of the space to business and its goals.
- There is a shortage of cost data in workplace performance evaluation. Surprisingly, most organizations do not record their cost data carefully. Ways to collect reliable data on investment, maintenance and running costs would be extremely valuable in supporting design decision-making.
- Many BPEs rely on user questionnaires alone. Using a variety of qualitative and quantitative measures allows congruence to be checked on different levels. Taken together, a multi-dimensional evaluation provides the most accurate picture of overall performance, but the primacy of occupant opinion should be considered.
- Currently, workplace BPEs are undertaken in a variety of ways. Standardized collection tools, definitions and classifications of performance measures would allow for the comparison and sharing of data and knowledge beyond individual case studies.

This chapter has shown that BPE has played an important role in helping to reduce risk and promote the understanding of the benefits and use of new innovative design solutions for which few or no precedents exist. Flexible working has spawned many innovations and changes in workplace layouts, furnishings, systems and,equipment. Most employees, however, view physical workplace change with concern and suspicion: “Are we downsizing?” “What if I don’t “get” this new technology?” The introduction of innovation into office design requires careful change management. Changes need to be introduced both top-down and bottom-up, in a balanced way. In the Netherlands, building performance evaluation combined with stakeholder participation throughout the design process has helped to acquire and disseminate the information needed to help create better, more effective places to work.

Key words: Post-Occupancy Evaluation (POE); Innovative Workplace Design; Performance-Based Evaluation; Netherlands; Case Studies.

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Table 15.1 Goals and objectives of POEs of innovative offices

- To support the choice of a future office concept with an feasibility study (pre-occupancy evaluation)
- To be able to write a sound strategic brief and project brief (pre-occupancy evaluation)
- To test if clients' goals and objectives have been reached
- To record unanticipated results, positive or negative
- To improve the understanding of complex relationships between facilities and ways of working, organizational needs and user preferences
- To legitimize a continuation or adaptation of accommodation policies
- To steer improvement and upgrading of buildings
- To monitor trends and developments within office organizations
- To develop theories and tools to support complex decision making processes
- Input for a data base of office buildings, including best practices and worst cases to build up a body of knowledge and data for theory development and benchmarking.

Source: (Volker and Van der Voordt, 2004)

Table 15.2 Common criteria measured in POE's of innovative offices

Frequently measured	**Less Frequently measured**
• Employees' characteristics (gender, age, education, occupation) • Characteristics of working processes (what are people actually doing, when, where) • Characteristics of old and new workplaces (location, lay-out, yes or no desk sharing) • User satisfaction on accessibility of colleagues (physically, by phone or email), communication, concentration, privacy, thermal comfort, use and experience of facilities • Most positive and most negative aspects • Overall satisfaction • Perceived productivity • Critical factors in successful implementation and management of building-in-use	• Occupancy level • Actual behavior (e.g. frequency of desk rotating, claiming a favorite desk) • Psychological aspects such as status, territoriality, social contacts and personalization • Organization's characteristics such as strategy, corporate culture, vision on the future • Employees' health and safety • Image i.e. effects on attracting and retaining employees and clients • Actual productivity • Economic Value Added • Facility costs • Adaptability and future value

Source: (Volker and Van der Voordt, 2004)

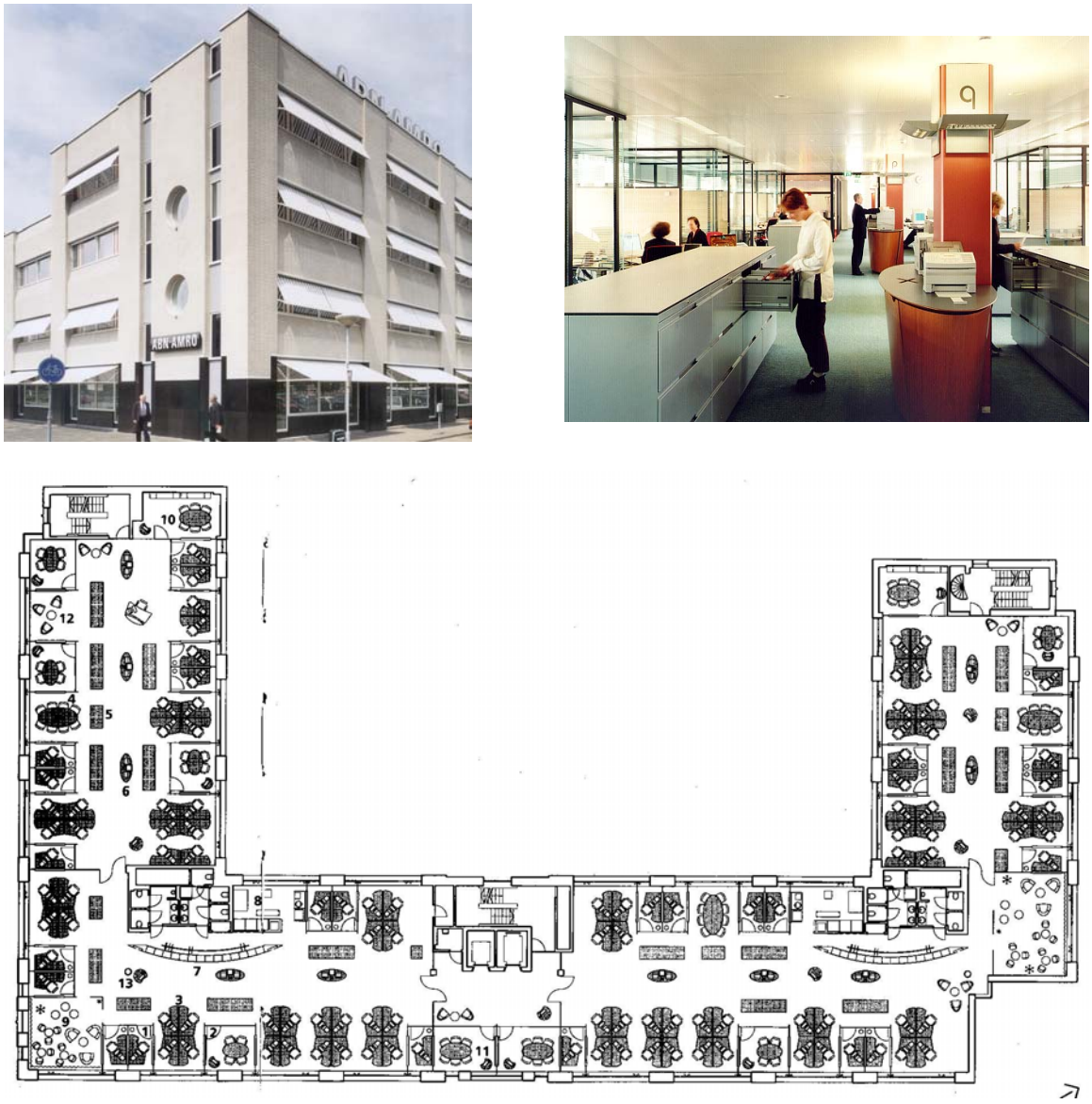

Figure 1: ABN AMRO new innovative office: exterior, interior and second floor plan

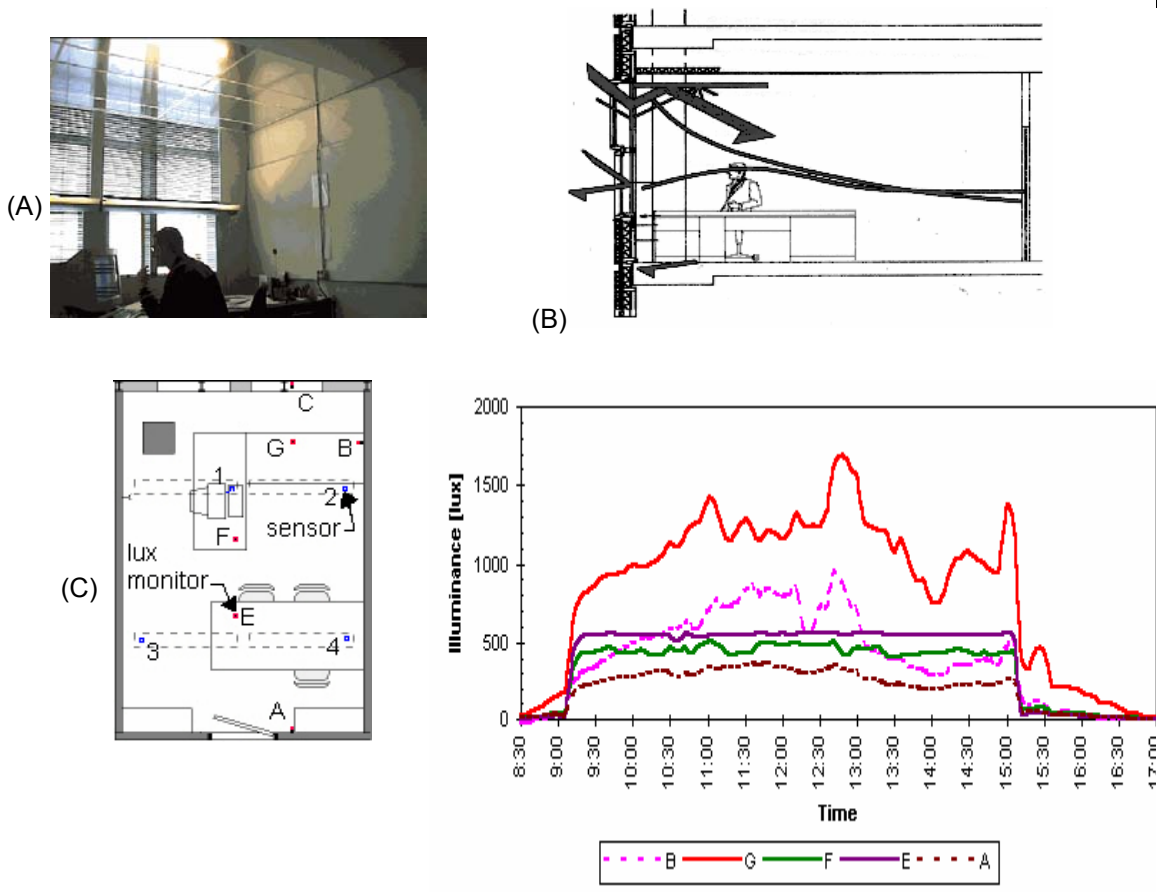

Figure 2 Evaluation of an innovative daylighting system: (A) design mock-up, (B) section showing conceptual design (Bartenbach Lighting Laboratory) and (C) example of physical measurement of lighting levels (Zonneveldt and Mallory-Hill 1998).

Figure 3: New Rijnland Water Board Building: views of exterior and typical 4 person workspace with innovative daylighting system

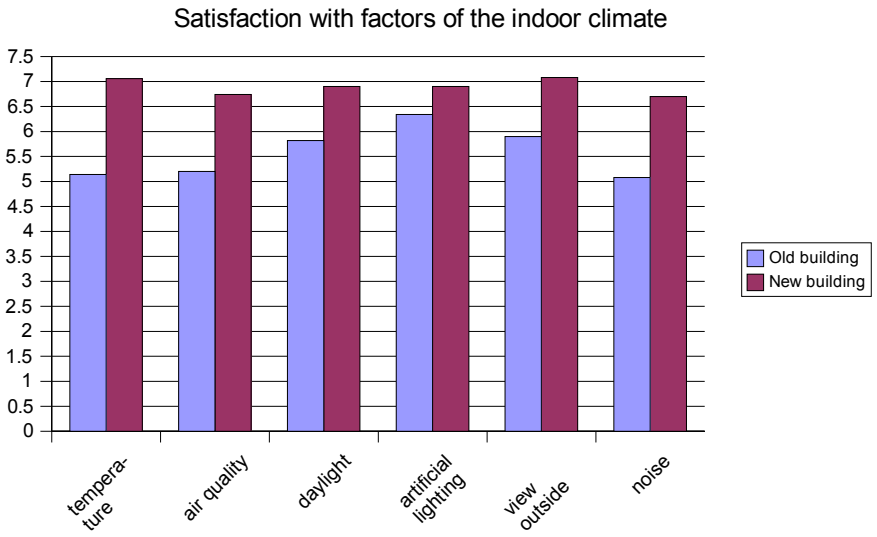

Figure 4 –Pre- and post-occupancy evaluation of indoor climate (van Wagenberg et al 2001)

Chapter 15 Glossary

Non-territorial, flexible, or alternative offices: workplace environments where employees are typically not assigned individual desks, but share a variety of job related workspaces such a workplaces in an open plan setting for communication, cokpits for concentration, coffe corners for informal meetings and so on.

indoor environmental systems: passive or active building (sub)systems that control and provide ambient conditions inside buildings.

indoor climate factors: ambient conditions inside a workplace that impact on human comfort and productivity, and are provided and controlled by specific building subsystems including: temperature, air quality, lighting quality and quantity, noise level and acoustic privacy.

pre-occupancy, pre-move or pre-design programming evaluation: evaluation of an organization and its existing accommodation, as a basis for decisions about consolidation, adaptation or renovation of the existing facilities or programming requirements for new facilities.

multi-dimensional evaluation: building performance evaluation that includes measurement and analysis of qualitative and quantitative factors such as: perception, behaviour, costs, technical performance and so on.

workplace innovation: a new solution with a great stride forward, for example a change from status-oriented assigning of personal desks towards job-related assignment of shared desks, or a jump from a traditional lighting system to an intelligent lighting system.

desk-sharing: use of the same desk by different persons.

desk-rotating: use of a number of different task-related desks by the same person.