

Implications

VOL. 11 ISSUE 01

www.informedesign.org

A Newsletter by Informedesign. A Web site for design and human behavior research.

Key Performance Indicators of Successful Workplace Design in an Innovation Economy

Young S. Lee, PhD, LEED AP, NCIDQ

The United States is undergoing an era of unprecedented uncertainty in the global business economy and, subsequently, workplaces that support new ways of doing business. The recent financial market turbulence seems to have left the global economy volatile and has raised questions about the economic capacity of commerce to grow and compete in the global market. Fluctuating prices and rates of commodity, constantly emerging new competitors, and demands from customers with various demographics have forced companies to stay agile and seek new business models.

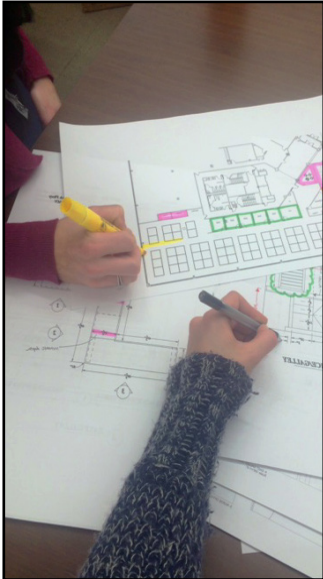
Responding to the need for a new economic development model, two American agencies have introduced the idea of the Innovation Economy (US Department of Commerce & the National Economic Council, 2012). The US Economic Development Administration and the US Department of Commerce suggest that an Innovation Economy allows companies to exceed their growth of outcomes beyond

their growth of inputs (US Department of Commerce & the National Economic Council, 2012). For this to occur, employees must transfer creative ideas into innovations that produce new or significantly improved products and services, which increase financial returns for the company.

One strategy that supports this model is to provide successful design and management of 'knowledge workplace' environments. These environments must be conducive to innovation and support employees' workplace needs in transferring creative ideas to innovative products and services. Successful knowledge workplaces manifest well-orchestrated environments specifically intended to positively influence people working on a creative task that produces new innovations (Hemlin, Allwood, & Martin, 2004). Figure 1 shows a technology enhanced workstation with features that enhance innovation.



Fig. 1: Technology enhanced workstations



IN THIS ISSUE

Key Performance Indicators of Successful Workplace Design in an Innovation Economy

Related Research Summaries and *Implications*

Key Performance Indicators (KPIs) of Creative Workspaces

The problem then becomes, which physical environment features of a knowledge workplace actually provide a competitive advantage to employees who leverage these features to enhance their innovation performance? The majority of studies in knowledge workplaces conducive to innovation have focused on organizational environments and culture in lieu of the physical workspaces. Those that examined the physical spaces were mostly anecdotal stories based on case studies. There is a limited amount of scientific or academic studies that link the physical work environment to employees' creativity and subsequent innovation (Martens, 2011).

The Innovative Workplace Institute (IWI) recently completed a project whose outcome is evidence-based identification of physical features that are KPIs of knowledge workplaces conducive to innovation. The project was a joint effort between the American Society of Interior Designers (funded by the ASID Foundation's Transform Grant) and the IWI. The goal of the project was to link evidence-based design practice to workplace design and management and, subsequently, to businesses' economic success. The project results identified seven KPIs of physical workspaces conducive to innovation:

- Space Type (ST),
- Space & Furniture Layout (SFL),
- Space Size & Access to Equipment (SSA),
- Neural & Psychological Stimulation and Relaxation (NPSR),
- Furniture Ergonomics and Technology (FET),
- Ambient Conditions (AC), and
- Healthfulness (H).

This was accomplished through an extensive set of intellectual exercises with over 40 industry and academic expert participants. Among these expert

participants were the leaders from various disciplines relevant to workplace design, management, and evaluation, including principals of leading architectural and design firms, directors and senior managers of facility management in Fortune 500 companies, and directors and senior researchers of workplace research in industry and academia. The exercises they participated in were comprised a set of video conferencing discussions; prioritization ratings of KPIs; open-ended surveys; and linking between the KPIs and attributes of organizational culture, creative practice processes, and people critical to organizational innovation. KPIs were identified, tested, revised, tested, and finally confirmed with these expert participants. Figure 2 shows a model of the seven KPIs and the visual icons that were developed to represent them. Following is a discussion of each of the KPIs identified in the study.

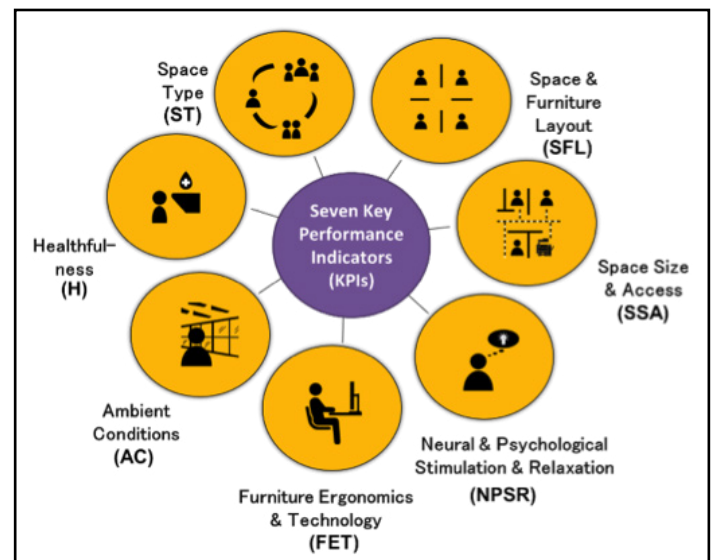


Fig. 2: Seven KPIs of successful knowledge workspaces.

Space Type (ST)

It was found that three types of spaces are required to support employees' performance in their knowledge workspaces: those that support employees' critical work modes, interaction and collaboration, and

recharging. Although various researchers identified different work modes, these three were found to consistently appear.

- **Spaces supporting critical work modes** in knowledge creation include spaces to support focus, collaboration, and socialization modes. Focus space is for individual tasks requiring concentration without interruption by others; collaboration space is for group tasks to achieve a common goal among members; and socialization space is for social networks and interactions building camaraderie and collegiality.
- **Interaction and collaboration spaces** have various degrees of supportive tools for idea generation via such activities as brainstorming, charrette, doodling, design improvisation, model making, or role playing. These spaces include formal, informal, and impromptu meeting areas with or without tools for idea documentation and displaying and sharing of ideas.
- **Recharge spaces** are intended for a short mental break to restore individuals' mental capacity after mental overload or blocks. Recharge spaces can support either individual activities such as contemplating, napping, or personal lounging or camaraderie-building group activities such as physical games or mini-sports events that restore or recharge mental strengths. Figure 3 is a napping space that is intended to be a mental recharge station.



Fig. 3: Recharge space.

Space & Furniture Layout (SFL)

There are two principles critical to the layout of creative knowledge workspaces: flexibility and flow and connectivity.

- **Flexibility** of the primary workspaces is required to support effective information and work flow for conceptual ideas to easily evolve to realization. Flexible spaces need to be expandable to accommodate growth, convertible to support a change in function, and versatile to accommodate several different activities as multifunctional space.
- **Flow and connectivity** of spaces are necessary to support appropriate adjacencies for information flow and openness. Successful knowledge workspaces provide visual access to other people; distribute the core interaction networks within a department along the core circulation paths for easy access and increased exposure; implement core circulation paths that connect to the spaces where people frequently meet and gather informally; and employ space planning strategies that blur the traditional power structure at work through different space allocation or layout from traditional planning.

Space Size and Access to Equipment (SSA)

Sufficient amount of space and easy access to equipment are two critical components to support job functions of innovative knowledge workers.

- **Sufficient amount of space** is required for employees' personal needs, collaborative tasks, and storage needs to support their key job functions. The square footage of each of individual, collaborative, and storage space must be at least 90% of suggested sizes for their relative purposes (e.g., executive offices, private offices, cubicles, etc.) found in the office planning guidelines and

standards of the company or in industry such as those from the International Facility Management Association (IFMA) or the Building Owners and Managers Association (BOMA).

- **Easy access to equipment** is a critical component. Although employees are encouraged to walk and move around their facilities for the purpose of health and wellness at work, reasonable distances (such as within 100 feet) should be established for critical equipment to easily capture and transfer ideas.

Neural & Psychological Stimulation and Relaxation (NPSR)

Creative and innovative ideas occur when people are cognitively and/or psychologically relaxed or stimulated by inspiring instances. Three principles to promote these opportunities include having a unique and fun atmosphere, sensory stimulation, and relaxing environments. Figure 4 is an example of using an unconventional interior element to promote the atmosphere of creativity.

- **Unique and fun atmosphere** allows workspaces to become vehicles that promote inspirations for creative ideas by bringing in playfulness and visual inspirations. Such an ambience contributes to



Fig. 4: Unusual furnishings support an atmosphere of creativity.

uplifting employees' cognition and psychology for fun and spontaneity while introducing a sense of whimsy (Hardy, 2014). Three strategies include:

- utilizing inspiring art, design, and/or craft work to cognitively inspire workers;
 - integrating unconventional functions and shapes as well as dramatic elements of interior architecture and design; and
 - employing whimsical and fun decorative objects for signage or ornaments.
- **Sensory stimulation** raises mental awareness and cognitive engagement (Gee, 2006). Olfactory stimulation uses such smells as beverage, food, aroma, or scent; auditory stimulation can be music and the sound of nature; and visual stimulation can include accentuated color and patterns. Visual stimuli tend to be more effective than olfactory or auditory stimuli due to the human neurophysiological condition whereas a higher portion (10 times) of the human's cerebral cortex is allotted to vision rather than auditory or olfactory senses (Lasbury, 2011). Visual complexity and interest tend to elevate intellectual and cognitive stimulation, which assists creative behaviors (McCoy & Evans, 2002).
 - **Relaxing environments** reduce stress and increase relaxation. Integrating natural elements, such as daylight, views of nature, interior vegetation/plants, water features, and other natural elements can accommodate cognitive and psychological relaxation. As shown in biophilic design, spaces that enhance and restore the connection between humans and nature fulfill the biological need of humans (Wilson, 1984). Integrating natural elements in workspaces can contribute to attention restoration, stress reduction, enhanced cognitive focus and stamina, and improved social capacity (Gray & Birrell, 2014). In addition to implementing

natural elements as a strategy to reduce stress, restore optimal mental function, and increase comfort, workplaces can incorporate de-stressing destinations that provide the ease and warmth of a home-like setting, which emphasize freedom and nonconformity (Bluyssen, 2010). Freedom and nonconformity are known to be critical to a creative organizational culture. Thus, home-like settings reinforce such cultures to thrive based on a supportive physical environment.

Furniture Ergonomics and Technology (FET)

Furniture ergonomics and technological supports are two features of successful knowledge workplaces.

- **Furniture ergonomics** is required for employees' physical comfort and health. Furniture ergonomics has shown the strongest impact on job performance regardless of business units or job types, greatly enabling employees' ability to perform focused-mode individual work (Brill, Weidemann, & BOSTI Associates, 2001). Key ergonomic principles: versatility, flexibility, fit, and postural change and maintainability, should always be referenced when selecting furniture. Ergonomic guidelines/standards must also be referenced including those of the Business and Institutional Furniture Manufacturers Association (BIFMA), the American National Standards Institute/ Human Factors and Ergonomics Society (ANSI/HFES), and the Occupational Safety and Health Administration (OSHA). Lastly, employees' involvement in selection, training for appropriate use, and post-occupancy satisfaction surveys are ways to identify the appropriate furniture needed to resolve employees' workplace productivity and health issues. Figure 5 shows ergonomic supports integrated into chair designs to support posture of workers using new technology.

- **Technological support** for knowledge access, exchange, and creation is important to successful workplaces. The most innovation comes from workplaces where a wide range of low tech and high tech tools are found and utilized by employees (Peschl & Fundneider, 2013). To encourage an easy flow of ideas from conception to execution, spaces need to supply both manual tools and high tech or electronic tools. Manual tools are for easy display of ideas and communication within a group, including writing surfaces, whiteboards, flip charts, and pin ups. High tech or electronic tools are used for fast group sharing, creation of ideas, and effective decision making.



Fig. 5: Ergonomics supporting the use of new technology.

Ambient Conditions (AC)

Four ambient conditions of indoor environmental quality (IEQ) support vital functions of knowledge workers: acoustics, visual comfort, thermal comfort, and indoor air quality (IAQ).

- **Acoustic conditions** include noise reduction and sound privacy. Noise is a well-known leading stressor in the workplace, which can cause distraction, tiredness, loss of concentration, anxiety, and low productivity (Bluyssen, 2010). Implementing appropriate acoustic controls can

be achieved through four strategies:

- use space planning principles to reduce noise including grouping similar types of areas together, placing buffer spaces to separate noisy spaces, avoiding room shapes that cause sound to reflect or focus in specific spots, and staggering doorways to avoid a straight path for noise;
 - use materials and systems furniture with proper acoustic properties;
 - isolate spaces that constantly generate noises, such as mechanical equipment rooms and copy rooms, from the primary workspaces; and
 - comply with acoustics guidelines/standards such as the ones from ANSI, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), and the Acoustical Society of America (ASA).
- Visual comfort can be achieved with both electric and natural lighting. Undesirable lighting has various adverse physical and mental impacts on knowledge workers, including causing headaches, eyestrain, productivity loss, and circadian rhythm imbalance (World Green Building Council, 2014). To support visual comfort, five strategies are suggested:
- require an appropriate amount of light available for focus tasks via both ambient light and task light,
 - use daylight in the primary workspaces via sidelight or skylight,
 - include available devices for daylight redirection and/or glare control,
 - have a direct line of sight to outdoor views in the primary workspaces, and
 - include devices for user control.
 - **Thermal comfort** is required to support employees' concentration and productivity. Many studies indicate a direct link between employees' thermal comfort and their productivity. To support appropriate thermal comfort, three strategies are suggested:
 - require an appropriate level of temperature and humidity so that less than 10% of users express problems with temperature and/or humidity;
 - include devices for user control of thermal comfort such as windows, a thermostat, or a control for air speed, air temperature, radiant temperature, and/or humidity; and
 - comply with thermal comfort standards and guidelines including those from ASHRAE and the International Organization for Standardization (ISO).
 - **IAQ** is one of the strongest predictors of employees' workplace performance and well-being (Kupritz, 2002). Five strategies to provide good IAQ include:
 - provide high quality, fresh indoor air with no odor and proper air movement where less than 10% of users express problems with each of these issues;
 - implement appropriate planning, mechanisms, and devices to isolate and remove indoor air chemicals, particles, and irritants in areas with a high concentration of these substances such as copy rooms, janitor's closets, or entryways;
 - use low-emitting finishes and furnishings that are certified by a third party such as C2C, SCS FloorScore®, CRI Green Label, MTS SMaRT, Green Seal™, GREENGUARD, BIFMA level®, or SCS Indoor Advantage; provide devices for user control of IAQ such as operable windows or openings; and

- comply with IAQ guidelines/standards such as the one from ASHRAE.

Healthfulness (H)

Other environmental issues critically affecting knowledge workers' health and productivity include chemicals in cleaning materials and products, dust and microbial contamination in the workspaces, and appropriate hydration to maintain cognitive and bodily function. Three strategies are suggested to support the healthfulness of knowledge workers:

- use green cleaning materials and products with no harmful chemicals that are certified by a third party such as Green Seal or Environmental Choice CCD;
- achieve cleanliness and hygiene equivalent to the Level 2 Ordinary Tidiness defined by the Association of Higher Education Facilities Officers (APPA) custodial guideline (The Level 2 Ordinary Tidiness means that all surfaces are clean without build up in corners or along walls, but there may possibly be two days' worth of dust, dirt, stains, or streaks, and noticeable marks, dust, smudges, and fingerprints upon close examination.); and
- provide access to clean and fresh drinking water on each floor in such places as drinking fountains, kitchenettes, cafeterias, or commons.

Analytics for Knowledge Workspace Performance

The implementation of these evidence-based KPIs is available through an open source analytic platform called the Comparative Assessment and Performance Tool for Innovative Workplaces (CAPTIW©) and is available at through the Innovative Workplace Institute (www.inno-wp.com) (see Figure 6). CAPTIW© was developed for practitioners in the fields of workplace design and management by integrating the seven

KPIs of the knowledge workspace with employees' performance in relation to innovation.



Fig. 6: CAPTIW ©.

CAPTIW© is grounded on the seven KPIs and utilizes objective and prescriptive measures to diagnose the performance of knowledge workspaces. Then, it links workspace performance to innovation performance in five innovation indicators and a set of measures. The five innovation indicators are adopted from the innovation instruments of the United States, Canada, Australia, and the European Union and include innovation of product, process, organization, marketing, and intellectual property. Further, the KPIs and sub-KPIs of the workspace performance are identified in relation to specific organizational pursuits critical to innovation, and highlights these indicators as either strength or opportunity based on the comparison to the benchmark. Then, CAPTIW© informs the users of the results of the workspace performance by generating automated analyses (see Figure 7). CAPTIW©, a free analytics of the knowledge workspace performance, is a first-of-its-kind effort

to move forward the practice of workplace design and management and promote further application of evidence-based practice.

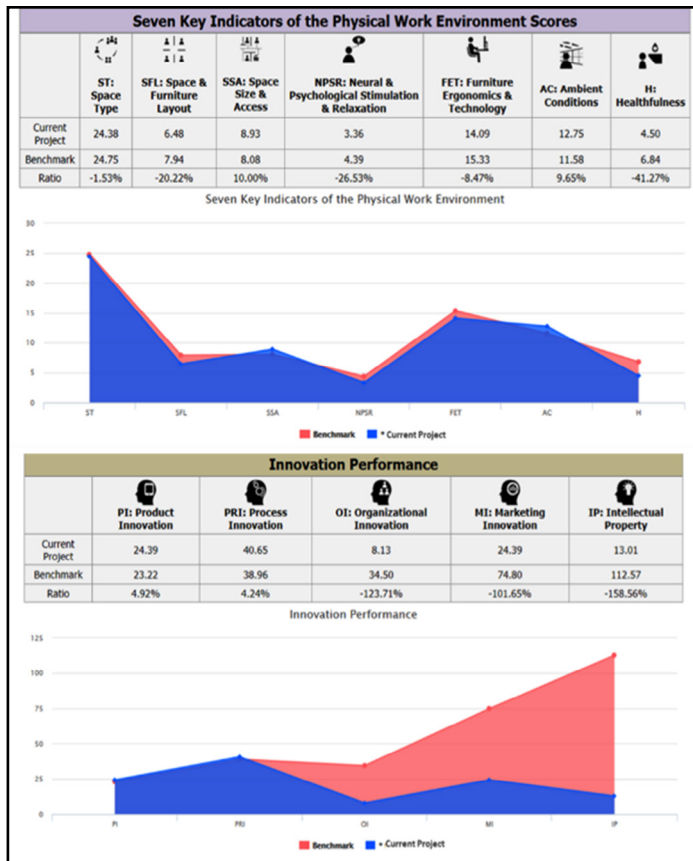


Fig. 7: Example of CAPTIW © analysis.

References

—Bluyssen, P. M. (2010). Towards new methods and ways to create healthy and comfortable buildings. *Building and Environment*, 45(4), 808-818.

—Brill, M., Weidemann, S., & BOSTI Associates (2001). *Disproving widespread myths about workplace design*. Jasper, IN: Kimball International.

—Gee, L. (2006). Human-centered design guidelines. In D. Oblinger (Ed.), *Learning Spaces*, (pp. 10.1-10.13). Washington, DC: Educause.

—Gray, T., & Birrell, C. (2014). Are biophilic-designed

site office buildings linked to health benefits and high performing occupants? *International Journal of Environmental Research and Public Health*, 11(12), 12-204- 12-222.

—Hardy, Q. (2014). The monuments of tech. Retrieved from http://nytimes.com/2014/03/02/technology/the-monuments-of-tech.html?_r=0

—Hemlin, S., Allwood, C. M., & Martin, B.R. (2004). What is a creative knowledge environment? In Hemlin, Allwood, & Martin (Eds.), *Creative knowledge environments: The influences on creativity in research and innovation* (pp.1-28). Cheltenham, UK: Edward Elgar Publishing.

—Kupritz, V. W. (2002). The relative impact of workplace design on training transfer. *Human Resource Development Quarterly*, 13(4), 427-447.

—Lasbury, M. (2011). Why does your telephone have two holes: Perspective on our senses. Retrieved from <http://biologicalexceptions.blogspot.com/2011/09/why-does-your-telephone-have-two-holes.html>

—Martens, Y. (2011). Creative workplace: Instrumental and symbolic support for creativity. *Facilities*, 29(1), 63-79.

—McCoy, J. M., & Evans, G. W. (2002). The potential role of the physical environment in fostering creativity. *Creativity Research Journal*, 14(3/4), 409-426.

—Peschl, M. F., & Fundneider, T. (2013). Spaces enabling game changing and sustaining innovations: Why space matters for knowledge creation and innovation. *Journal of Organisational Transformation & Social Change*, 9(1), 41-61.

—US Department of Commerce & the National Economic Council (2012). The competitiveness and innovative capacity of the United States. Retrieved from http://www.commerce.gov/sites/default/files/documents/2012/january/competes_010511_0.pdf

—Wilson, E. O. (1984). *Biophilia*. Cambridge, MA:

Harvard University Press.

—World Green Building Council. (2014). *Health, wellbeing & productivity in offices*. Retrieved from <http://www.worldgbc.org/activities/health-wellbeing-productivity-offices>

About the Author:



Young Lee, PhD, LEED AP ID+C, NCIDQ, was educated in interior architecture and interior design. Her expertise is in innovative workplace design and evaluation as well as the impact of IEQ, especially sustainable design attributes

on occupant performance, health, and well-being. Formerly an educator at Michigan State University, she is currently Director of the Innovative Workplace Institute. She was the project lead on the KPIs of Knowledge Workplace and CAPTIW© project. The groundwork of her decade-long research in two areas became the foundation of CAPTIW©: workplace design criteria for creativity and innovation and workplace design criteria for employee performance, health, and well-being. She has numerous publications in refereed journals such as *Indoor and Built Environment* and *Building and Environment*. She has presented at international and national conferences including Neocon, the Healthcare Design Expo and Conference, and the Environmental Design Research Association (EDRA) Conference.

Related Research Summaries and Implications

InformeDesign has many Research Summaries and *Implications* about workplace design and related topics. This knowledge will be valuable to you as you consider your next design solution and is worth sharing with your clients and collaborators.

Related Research Summaries

- “Workplace Design Can Support Workplace Creativity” - *Journal of Interior Design*
- “Sense of Self Influences Perception of Workplace” - *Journal of Environmental Psychology*
- “Distinctive Visual Quality is Important to Creative Districts” - *Journal of American Planning Association*
- “Ergonomic Impact of Desk Type and Display Height” - *Applied Ergonomics*

Related Implications

- “Acoustics of Green Buildings” - Ralph T. Muehleisen
- “Multiple Chemical Sensitivity” - Linda Nussbaumer
- “Solid State Lighting Design Considerations” - Mark Ricketson

Images Courtesy of:

Figures 1 & 5: Steelcase, 2015

Figure 2: Y. Lee, Innovative Workplace Institute, 2015

Figure 3: Sharon Risedorph Photography/STUDIOS Architecture

Figure 4: Stefan Camenzind

Figures 6 & 7: Innovative Workplace Institute Web site (www.inno-wo.com)

Sponsored by:



The mission of Informedesign is to facilitate designers' use of current, research-based information as a decision-making tool in the design process, thereby integrating research and practice in an evidence-based design (EBD)-approach.