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The Nature of Environmental Quality in the Workplace: A Johnson Controls Institute Position Paper

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A Monograph of the
Johnson Controls Institute for Environmental Quality in Architecture

JOHNSON CONTROLS

INSTITUTE FOR ENVIRONMENTAL QUALITY IN ARCHITECTURE

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ABSTRACT

This monograph argues for a positive model of what the workplace should be, a set of goals and criteria that can guide the innumerable decisions which go into the creation or remodeling of workplaces. Both the creation and the experience of workplaces are examined though the overarching criteria of *environmental quality*, in an attempt to discover ways to improve the creation of workplaces and, ultimately, to enhance the productivity and satisfaction of everyone who experiences them. The current research literature on workplaces, whether from an organizational, architectural, social or public health and safety standpoint, is in general agreement that the state of the American workplace is changing rapidly, and that those changes will have fundamental impacts on the competitiveness of businesses, on the health and satisfaction of their workers, and on the communities in which they operate. However, this information grows exponentially, and in fact often serves to hinder the larger goal of integrating our efforts into the creation of good workplaces. Pp. vi + 70; illustrated.

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EXECUTIVE SUMMARY: MANY QUESTIONS — AND A FEW ANSWERS

The physical nature of a workplace — from efficient floor plans to the proper position of computer keyboards, from ensuring clean indoor air to capturing the right aesthetic "feel" — is a critical factor in any business process. The current research literature on workplaces, whether from an organizational, architectural, social or public health and safety standpoint, is in general agreement that the state of the American workplace is changing rapidly, and that those changes will have fundamental impacts on the competitiveness of businesses, on the health and satisfaction of their workers, and on the communities in which they operate.

A great number of people in many professions and disciplines are investigating the current problems of the workplace — repetitive stress injuries, indoor air quality, waste disposal and recycling, worker comfort and safety, data quality and security, space planning and flexibility, energy inefficiency, zoning and workplace-neighborhood relations, and hundreds of other specific problem areas. The information grows exponentially, and in fact often serves to hinder the larger goal of integrating our efforts into the creation of good workplaces.

What we need is a positive model of what the workplace should be, a set of goals and criteria that can guide the innumerable decisions which go into the creation or remodeling of workplaces. We need a strong image of what we are striving toward in order to make sense of all of the information we have which warns us of what to avoid.

Workplaces, like all buildings, are created by people and organizations, and are subsequently experienced by other people and organizations. The creation and use of the workplace also exist within a framework of cultural values as well as individual and organizational values. We must examine the creation and the experience of workplaces though the overarching criteria of *environmental quality*, in an attempt to discover ways to improve the creation of workplaces and, ultimately, to enhance the productivity and satisfaction of everyone who experiences them.

The examination of environmental quality in this position paper is framed as a series of questions about workplace use and workplace creation:

- First and most basic, we need to ask what a workplace is, and look at the ways in which the settings for work have historically and presently responded to human, organizational and cultural needs. This requires an examination of the ways that a workplace serves to convert some resources into others.
- We then look at who uses workplaces, and why. Who are the participants in the work setting? What do they want?
- From that we are able to ask our third question: what does it mean to say that a workplace works well? What are the criteria that will allow us to evaluate the environmental quality of the workplace?
- At this point, our focus shifts from the use of workplaces to their creation, and we ask our fourth question: who are the players in the processes of workplace creation? Who are the people engaged in trying to achieve environmental quality, what processes do they engage in, and what aspects of the environment do they have control over?
- This brings us to our fifth question, which encapsulates much of the research done to date on workplace problems: at what point in the creation process do problems and mistakes enter the picture? Do different kinds of problems arise at different points in the process? If so, how must the processes of creating workplaces be changed so that the resulting places meet the criteria that individual and organizational users set for it, and at the same time satisfy our larger cultural goals and ideals as well?

The answer to these questions will require a significant restructuring of the way we think about building, about development, about the design and construction professions. We argue, though, that addressing them with care and creativity is the only way that our workplaces can become the fully healthy and productive environments they must be.

INTRODUCTION: WHERE DOES THE IDEA OF ENVIRONMENTAL QUALITY COME FROM?

> *I know there are people out there studying building security, and people studying indoor air quality, and people studying acoustical design, and other people studying a thousand other things. And I'm here studying human thermal comfort and building energy conservation, and I know those other things fit in with what I'm doing, somehow. . .but I can't take time to read all of that work. I know it all fits, though.* -- a building science researcher discussing the state of architectural research.

When Johnson Controls, Inc., and the Johnson Foundation jointly agreed to sponsor the creation of this Institute, the term "environmental quality in architecture" was really only a pleasantry, like apple pie and the flag. *Of course* we were interested in environmental quality -- what were the options? To be *opposed* to it?

We quickly realized that each participant had unique and separate agendas for environments, sometimes complimentary and sometimes divergent, that underlay our interest in the Institute. Thermal comfort, user satisfaction, energy efficiency, occupant health and safety, a broader sense of sustainability and "green development," cost-effective facility development and management, and increased attention to previously unheard constituent groups were just some of the issues that we brought to the table in the early months of Institute development. It was clear that we needed a way to be able to frame a great number of concerns into similar language and toward similar goals, both in terms of our success as an entity and in terms of advancing the building industry and the field of building research.

Existing models of what were called "environmental quality" (for example, Craik & Zube, 1976) attempted to be holistic and inclusive in their definition, but were skewed toward a certain set of environments rather than all environments (places of leisure and recreation were examined closely, while places of production were not prominent), and offered little in the way of active directions for change. The state of the art in post-occupancy evaluation was likewise limited, because solid criteria for building success had never been established (for example, Presier, Rabinowitz & White, 1988). We decided that these were flaws that needed to be corrected.

The question of environmental quality is inherently one that disallows a single disciplinary approach. We must respond to many facets of buildings, organizations, occupants, laws and codes, cultural standards and economics in any exploration of such a diverse question. Our backgrounds -- primarily in architecture and urban planning, but also in psychology, anthropology, sociology, cultural geography, mechanical engineering,

education, facility management and real estate development -- gave us a lot of concepts to bring to bear on this problem and a large number of prior models to work from. This wide academic and practical storehouse offered the tools we needed in order to take a creative approach to redefining environmental quality, not only as an intellectual and evaluative concept but also as a powerful design method in the hands of practitioners in the planning, design, and facility management professions. We have applied this model to issues of office productivity (Childress, Witzling & Lackney, 1994), to an examination of public school facilities (Lackney, 1994), to an investigation of the responsiveness and adaptability of the last 40 years of office buildings (Rabinowitz & Lackney, 1994), to an experiment on the effectiveness of personal control over the thermal and acoustical environment (Utzinger & Childress, 1994), to an exploration of the effects of regional growth management (Witzling & Park, 1994) and to questions of teenagers' use of public places (Childress, 1994), among others. In each case, not only does the model make sense as an analytical tool, it also requires us to be more thorough in our questioning, it gives us a common language to discuss our diverse work, and it allows us to develop a database of environmental quality assessments which all use those common concerns and questions so that we will ultimately be able to generalize our findings over a great number and type of environments.

This is why our environmental quality framework was created, to bring together an enormous amount of research into the pursuit of a coherent and consistent goal: the creation of better places for all of us. And the model is not yet complete; small modifications are being made to it as we apply it to new problems, new environments, new user groups. But the basic questions seem to hold and the process has proven useful for all of our work. We hope it will be useful in your work as well.

WHO USES workplaces, and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*

I. WHO USES WORKPLACES --AND WHY?

> *"My first priority is to the citizens of this county, to give them the best, most effective criminal justice system we can provide. But we've got to do that with a budget that's far too small. That means that we're going to have to have to handle more cases more quickly, and process defendants through the building faster. This old shell just won't handle the workload we're delivering. We've got clerks working in corners of hallways on temporary desks, working in spaces where defendants are waiting before their appearances at the bench. I have to be fair to my workers, too; that's a dangerous situation for them that they shouldn't be subjected to."* -- a Circuit Court justice on the need for a new court facility.

We began our process by doing some basic thinking about what a workplace was all about -- and by workplace, we mean to say any place where organized activity goes on, whether that is an office or a school or a factory. Why are workplaces built or bought? In order to satisfy a set of goals -- the goals of the organization in particular, but also the goals of the society that surrounds it and the goals of the individuals who are a part of it.

These goals have varying degrees of specificity, as seen in Table 1. At the largest scale, there are what we can call **philosophies or ideals**, things we believe in and which guide our decisions. These will include such philosophies as TQM or outcome-based education for organizations; ideals of equal rights and progress as a culture; and ideals of fairness and excellence as individuals. These are only examples -- there are thousands of others.

In each case, these ideals are translated into a series of **goals** to be achieved-- the philosophy of TQM spawns goals such as 100% customer satisfaction and zero defects; the ideal of equal rights has led to the goal of non-discrimination in hiring; the ideal of personal excellence may lead to the goal of continuing education. Attainment of these goals can often be measured or otherwise evaluated. But even these goals are still one step away from what happens in action. Goals have to lead to a set of **operational strategies**, or put more simply, a system of things to do in order to achieve the goal and thus satisfy the basic ideals. The goal of customer satisfaction may lead to the act of holding focus group meetings with current customers, for instance.

What we are arguing in this framework is that ***environmental quality is simply defined as how well a particular place allows and assists the achievement of all of the goals that are set for it.*** It's always a relative definition -- the same environment may be highly suited to one use or one group and not to another, or it may be satisfactory for the organization but not for the larger society around it.

	Society	Organization	Individual
Philosophies, Ideals and Beliefs	Equal rights for all citizens	Total Quality Management	Continual advancement and self-improvement
Goals	Non-discrimination in hiring practices	Complete customer satisfaction	Completing a university degree
Operational Strategies	Affirmative action and fair-hiring laws, promotion of minority scholarships and training programs, etc.	Immediate-response service practices, holding focus groups with customers, strengthening guarantees, etc.	Enrolling, attending classes, doing homework, studying for tests, applying new knowledge to work problems, etc.

Table 1 -- An Example of Philosophies, Goals and Strategies

When we look at these three levels of goals, we need to understand that people, organizations and even societies do not always act in a consistent fashion. They may strongly adhere to a particular philosophy and still act in ways that are counter to it, either through misunderstanding the nature and effects of their actions or through the pressing needs of some particular circumstance or larger context. Thus, one of the first questions that must be asked when examining the workplace is to what extent the operational strategies that are carried out in that place are reflective of and supportive of the participants' larger goals and ideals? This is not an environmental question, and the answers to it are likely not going to be architectural; but a remarkable number of expressions of building dissatisfaction stem from this sort of failure of correspondence between ideals, goals and acts. This is crucial knowledge for those involved in workplace assessment.

Ultimately, the ability of the workplace to fulfill the full range of goals of individuals, organizations, and larger societies determines its overall success. A valid and comprehensive evaluation of workplaces must examine each of these three unique perspectives.

Individual Goals

The desired goals from the individual's viewpoint include *economic gain* in the form of income and benefits, of course, but it also includes *biological needs* such as comfort,

healthful conditions, and personal safety; *psychological goals* including satisfaction, stability, delight, identity and security; and *social goals* such as status and group membership.

If the goals of the individual are not recognized and achieved, the workplace will suffer from workers who are frustrated and resentful, who are limited in their ability to function, who feel that work is a burden rather than an expression of themselves and their skills, who may in fact be ill more often and may stay with the company for a shorter amount of time.

Organizational Goals

Because organizations are different kinds of entities than people, the desired goals from the organization's standpoint are different. Organizational goals generally begin with *survival and growth,* the need to make a profit and continue operations. But within that large goal lie several others: the *need for productivity and efficiency* which allow a company to be competitive in its field; the *need to change* in response to new conditions and new opportunities; the *need to reduce risk* in order to avoid sudden and unforeseen problems; and *a desire for recognition* or social status, symbolic expressions of position both in the market and within the larger culture.

If the goals of the organization are not recognized and achieved, the workplace will suffer from management who feel as though the place is inappropriate to their larger mission, that it is no longer viable as a capital asset, that it stands in the way of their market and product needs, and that it should be sold, closed or even abandoned.

Social Goals

The goals which the larger society holds for the workplace are again different. They include the *need to uphold cultural ideals* by creating things which are broadly valued and behaving in ways which are generally accepted; the *need for conservation and sustainability* in order to ensure the continued viability of the culture; the *need to maintain order and community*, through conformance to established regulations and the practice of fair relations with neighbors and competitors; the *need to push for progress*, to go beyond current standards and help us become a better society; and the need for *ethical and equitable behavior*, ensuring that the success of any one party does not come at intolerable expense to others.

If the goals of the larger society are not recognized and achieved, the workplace will suffer politically by being seen as a "bad neighbor;" it will suffer economically by unnecessarily and repeatedly expending energy and resources confronting cultural standards rather than moving with the stream of society; and the larger society will suffer by unnecessarily spending its time and energy in combative efforts, by contributing resources to a particular workplace beyond the benefits it will receive, or by spending too much to maintain the present without sufficient consideration for the future.

In general, then, workplaces are used by individuals, organizations and societies in order to achieve a remarkably diverse set of goals. The failure to meet these goals will result in workplaces which unnecessarily absorb human and material resources and which do not provide the conditions for human, organizational or cultural health and satisfaction.

We need a closer examination of the aspects of the workplace which allow us to reach these goals. This is the subject of our next question: what exactly <u>is</u> a workplace, and how does it work?

WHO USES workplaces and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*

WHAT IS a workplace — and how does it work?	*Desired products and achievements*	*Organization*	*People (skill, talent, knowledge)*	*Resources*	*Environment (place, tools, equipment)*

II. WHAT IS A WORKPLACE -- AND HOW DOES IT WORK"?

> *"I find that the biggest difference since the move is that I don't necessarily pass by the mailboxes. In our old space, I was right next to the mailboxes, so that whenever I went out to see Jim or Beth about something, I'd automatically look into my mailbox. That way, if somebody left me a note or a memo, I'd have it within an hour or so of when they put it there, and could go after their problem right away. Then the next time I left the office, I could leave them a note with a question, or to tell them I'd resolved their problem. The way things are now, I only go to the mailboxes on purpose, which means that I do it much less often. That means that if somebody leaves me a note on Monday, I might not get it until Tuesday, and then I won't put an answer into their mailbox until later on Tuesday so that they might not get it until Wednesday. What used to take half a day now takes two days."* -- an office manager, on her new $20 million building.

Taking the word *workplace* literally, we can divide it into its two compound words: *work*, an organized, goal-oriented human activity which is rooted within a cultural context; and *place*, the location and objects with (and within) which people or groups live and act. Work and place are both of critical importance in people's self-identity. Ask people to describe themselves and the most common responses will be their names, their jobs, and where they live or where they're from. The combination of work and place often has a significance for people which includes but goes far beyond the economic.

Work is also descriptive of a larger scale of human activity, people coming together to do what would have been difficult or impossible separately. From the earliest records of human history, we see that individuals have banded together into organized groups in order to achieve common goals. This is more the case now than ever before; for almost all of us, work means working within some larger organization toward some goals which are larger than our own.

Work and place are linked to the surrounding culture, and take on much of their meaning from the social context in which they are found. Culture determines what is valuable and what is not; which practices and conditions are acceptable and which are

intolerable; which products are necessary and which are expendable. Individuals and organizations take on meanings and beliefs from the larger cultural system.

There are any number of examples throughout history of the ways in which individuals and organizations have come together within a cultural context to create ways and places of work. We include a handful for illustration.

- English crafts shops 1600 C.E.
- The early factories of Manchester and Liverpool 1750 C.E.
- New England mills 1800 C.E.
- Wright's Larkin Building 1900 C.E.
- Kahn's Ford Motors River Rouge plant 1920 C.E.
- Burolandschaft and the Open Plan 1955 C.E.
- The Open Systems Office 1980-90 C.E
- The Virtual Workplace: Car, Home, and Airport
- The Social Workplace: Coves and Caves, Private/Communal Systems
- The Fluid Workplace: Hotelling, "Hot Desks," and Temps

This list is obviously far from complete; many millions of Americans work in industrial or crafts or retail workplaces which more closely resemble our examples from earlier centuries than the information workplace we think of as the American office. Even in those environments, though, just as in our modern examples, we can see that workplaces are a tool which assists peoples' activities in pursuit of their own goals and those of the operating organization. The creative act of the workplace is the transformation of resources into these desired products or achievements, whether through creative thought, physical labor, or technology. It is a central place in which all of the necessary resources are brought together, procedures and tasks are set for all of the participants, and resources are placed in proper relationship to one another for the transformations to occur smoothly and efficiently.

What are the components of this workplace system? Certainly the workplace has **a physical environment**, and at the Johnson Controls Institute, we are most specifically interested in working with this physical setting. But there is of course more than that.

Any workplace is based upon **a set of expected products and achievements**, and these will differ greatly depending upon the type of workplace we're talking about and the culture within which it is situated. The factory is based around the production of objects, while the school may be based around the production of knowledge and the achievement of its students.

There are a certain **set of resources** that any particular workplace will require in order to meet these products and achievements. These can range from energy to tools to office supplies to money, and again the resources required will be specific to that type of workplace.

There are **a group of people** that will be necessary in a given workplace, again varying depending on the type of workplace. One workplace may require creative people, while another may not; one workplace may require people who are physically strong, while others will not. And finally, there is **an organizational structure** specific to the type of workplace we're examining, ranging from tight to loose, hierarchical to flat, collaborative to individualistic.

Any workplace type can be defined by its unique pattern of these components that make it up. But what we find is that a building is a difficult scale to do this kind of analysis, that there are nested within any workplace a number of much more specific places, each of which can be described by a particular pattern of these five elements.

As different as companies are from one another, and as different as workplaces can be from one another, when we examine the workplace system -- the people, organization, resources, products and achievements, and the environment -- we find that, even though there are an almost infinite number of possible configurations, the system all comes together in a fairly few common patterns in late 20th century architecture.

A list of those patterns for an information-based workspace might include:

- the front office
- the "war room"
- the mailroom
- the hallway
- the coffee machine - water cooler
- the hotel
- the virtual office
- the rabbit warren
- the production space
- the back office
- the bullpen
- the office pool
- the studio
- the factory
- the cove
- the skunkworks
- the den
- the conference space

Each of these differ in their organization and personnel, in the resources they demand, in the products and achievements they can deliver, and in the environment they demand for successful operation. Each of these can be enormously productive environments *in its*

own way, but our expectations for a productive office pool are quite different than for a virtual office. Let's look at a couple of places in a typical office and see how this plays out.

Example 1: ***The Bullpen***

The bullpen consists organizationally of a group of people who work cooperatively and collaboratively on group-based problem solving activities, such as developing new advertising strategies or product line development. This type of work activity requires close proximity and an environment that fosters social camaraderie, and the participants will be expected to be creative, open, and critical. The setting might take the form of small office workstations focused on a central meeting area in which the team spends a good deal of time tossing ideas back and forth. The products of this place are solutions to particular problems. The resources used in this process, both material and informational, are shared among the members of the workgroup.

Example 2: ***The Water Cooler***

The water cooler and its associated workplace patterns such as hallways are often thought of as simple support spaces, but in fact are productive elements of many work systems. Typically, they support face-to-face meetings between people who might not have sought one another out but who are somewhat familiar with one another's work. Meetings in such places are typically very brief, lasting a few seconds to a few minutes, and are characterized by an exchange of information about current projects. These meetings can be directly productive through a fortunate mesh of knowledge need and information at hand; they can be indirectly productive through the promotion of social cohesion and group formation that allows for better teamwork; and they can be completely unproductive.

This workplace pattern, when successful, has some specific environmental features. It will be located in or near common travel areas which are large enough to support both brief conversations and passers-by; they have some non-meeting function that draws people to them, such as coffee and vending machines, bathrooms, or drinking fountains; and they have an informal and unprogrammed nature, so that people feel as though they are "off-duty" momentarily and that normal organizational boundaries and hierarchies are relaxed.

The nature of environmental quality will be different for both of these examples, and for all of the other places we've identified. Each one of them has a different set of operational strategies to satisfy, and will require a different collection of people, organization, resources, physical environment, and achievements to get there. The

question of environmental quality then becomes, "How well does this place, this small specific component of the work system, do what it's supposed to do?" And by "what it's supposed to do", we mean those social, organizational and individual strategies that we discussed earlier.

The critical focus of this paper is the environment within which all of these diverse resources are brought together, organized, and converted into desired goals; the medium through which work is done and resources used for the creation of wages, products, profit and knowledge. Even in the electronic age, when many of the traditional forms of gathering, organizing, transforming and exchanging are being replaced by digital communication, the physical necessities of the workplace cannot be ignored or minimized. The building and its equipment still plays a strong role in the day-to-day operation of any business. Because resources of all sorts are finite, it is critical that as many resources as possible be converted to desired goals rather than wasted within a inefficient conversion system.

Our understanding of the workplace as a system is still limited by thinking of the nature of work as being individual (and usually fixed and repetitive) tasks. Sundstrom's (1987) review of research on work environments showed that human factors psychology and ergonomics were the largest contributing fields to our understanding of workplaces, and were mostly focused upon individual performance.

Table 2. Empirical Studies Concerning the Physical Environment in Offices and Factories *

Level of Analysis & Topic of Study	No. of Studies Cited				
	Lab Exper.	Field Exper.	Surveys	Field Studies	Totals
Individual Worker					
Lighting	13	1	–	5	19
Windows	–	–	3	1	4
Temperature	27	2	2	8	39
Air Quality	4	–	2	1	7
Noise	72	1	1	1	75
Music	9	9	1	–	19
Color	25	–	1	–	26
Work-stations	2	–	5	1	8
Interpersonal Relations					
Status	–	–	1	1	2
Personalization and participation	–	1	1	3	5
Ambient conditions and interaction	8	–	–	–	8
Proximity of workspaces & interaction of groups	–	–	–	9	9
Room layout and interaction	11	–	1	9	21
Privacy and enclosure	–	–	4	8	12
Seating arrangement and group discussions	12	–	–	–	12
Organization					
Organization, structural and physical layout	–	–	–	1	1
Comprehensive studies and post-occupancy evaluations	–	2	15	6	23
Totals	183	16	37	54	290

* Source: Sundstrom, E. (1986). Workplaces. New York: Cambridge University Press.

While certainly beneficial, this attention on individual performance and satisfaction has been of limited use in helping us to understand the nature of the work environment in supporting interpersonal relationships. This is unfortunate, because the modern knowledge-based workplace is centered around communication, collaboration, and the development of effective groups (Boyett & Conn, 1991). The era of the isolated worker doing repetitive tasks is in decline; the real potential for productivity improvements in the white-collar workplace is to be found in the improved creativity, effectiveness, leadership and timeliness of the managers and professionals who set the agenda for the organization rather than in incremental increases in clerical speed (Lehrer, 1983; Weiss, 1984).

There are a great number of goals that various participants may have for any particular workplace, from comfort to self-expression, from productivity to job satisfaction, from

income to group membership. The workplace system can only be evaluated on the basis of how well it meets those goals. A workplace environment can hinder achievement of goals in two ways. First, it can be set up such that some available resources are not used at all. Examples would include resources not getting to the site because of distance or inaccessibility; workers' skills and knowledge not being required or fully utilized; and trained and qualified people not being brought in because of failure to meet their accessibility needs.

Second and far more common, workplaces can be set up such that available effort and resources are wasted or absorbed by the workplace rather than converted to desired goals. Inefficient office layouts that require too much travel; energy wasted through inefficient equipment and building components; slowdowns or even lost work days due to glare or repetitive stress injuries at computer-intensive jobs: these are only a few examples of the many ways in which workplace environments waste resources through some combination of failures large and small.

Because the workplace is an intertwined system, a change in any of the resources, especially the environment, will have effects -- often unforeseen -- in achieving its goals. Because the workplace is part of a larger, dynamic social and economic system, both resources and goals are always changing to a greater or lesser extent. Thus the workplace is never completely constant but rather always adjusting to new circumstances and constraints.

This general definition of the workplace -- a system of resources, including people and their environment, intended to create socially valued products and achievements -- leads us to our next question: How can we evaluate such a complex system? What are the criteria for environmental quality in the workplace?

WHO USES workplaces and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*

WHAT IS a workplace — and how does it work?	*Desired products and achievements*	*Organization*	*People (skill, talent, knowledge)*	*Resources*	*Environment (place, tools, equipment)*

What makes a workplace GOOD?	*Helpful*	*Dependable*	*Satisfying (aesthetically, emotionally)*	*Fair*

III: WHAT MAKES A WORKPLACE "GOOD?"

> *"We built this facility in 1982. Planned it for 130 workstations, which we thought was pretty reasonable. Then the State shifted two new departments under our jurisdiction, and we got 40 new employees almost overnight. The building was only five months old, and we were over capacity. Now we've got 184 full-time workers in this building, and we're trying to lease some office space. That's what we were trying to get away from when we built this place."* -- a regional program manager on his "state-of-the-art" building.

It is unfortunate but true that almost all of the current research into the state of the modern workplace is centered around a great number of specific problems. This makes some sense, of course; applied research has most often been thought of as a problem-solving activity. The collective body of research has allowed us to make an almost inexhaustible list of things which we know make workplaces *bad*, some of which are:

- Uncomfortable
- Outdated technology and infrastructure
- Poor indoor air quality
- Visually inappropriate (aesthetically or historically)
- High employee turnover and absenteeism
- Gaps in communication
- Unprepared for emergencies
- Fragile or non-durable
- Unusable and unhealthy by-products
- Non-responsive to their larger community
- Unsafe
- Inflexible
- Improper size
- Inequitable
- High risk
- Confusing
- Low morale
- Inaccessible
- Non-productive
- Wasteful

As valuable as this exercise may be in organizing current research, it is of little enough help in assisting us with making workplaces *fundamentally better* at their task of allowing people to convert resources into desirable goals.

We could flip this list around and look for the opposite of each of these conditions as requisites for a good workplace, but this strategy also has its drawbacks. First, it is almost inexhaustible, offering an immense number of criteria. But worse, it encourages an incremental and segmented approach to improved environmental quality, and offers the potential danger of increasing certain problems in the effort to eliminate others. A prime example of this segmented, non-integrated approach is the current concern with indoor air quality. This problem was almost unheard of twenty years ago. Since the 1970s, however, energy conservation has been a strong goal, and buildings have been increasingly "tightened" against unwanted outside air infiltration to make them more efficient. While the energy savings have been significant, we have discovered that this strategy has often resulted in higher concentrations of airborne gases from building materials and of biological hazards such as bacteria and viruses. We have also discovered that building occupants are frequently dissatisfied with non-operable windows, in terms of temperature, air flow regulation and perceived control over their spaces. The singular pursuit of one good environmental feature -- energy efficiency -- has resulted in the deterioration of other conditions -- indoor air quality and worker satisfaction.

What we need, then, is an overarching definition of what a good workplace ought to be. This is analogous to the recent search in medicine for a definition of "wellness" rather than innumerable definitions of illnesses. In order for us to create a similar definition of "workplace wellness" or *environmental quality,* we must return to our concern with workplace goals.

A good workplace will help to attain desirable goals of all sorts, from good wages and high worker satisfaction to solid profits to culturally valued products, services or knowledge. A good workplace will be flexible enough to continue producing those goals even in the face of shifting amounts and types of resources. There are many ways to model or categorize the ways that physical environments such as workplaces provide the means to achieve our goals. In architecture, one of the most trusted historical models for looking at buildings maintains that there are three essential qualities of good environments — ***firmness, commodity, and delight.*** Originally conceived by the master builder Vitruvius during the middle Roman Empire and rediscovered in the 17th century, this model still provides a good starting point.

- Historically, workplaces have always had to be stable or structurally sound (that is, to provide *Firmness*). Today, the idea of long-term stability goes beyond just structural issues to include mechanical, electrical and communications systems, for example, as well as issues of sustainability and resource conservation. Underlying all of these is the need to rely upon workplaces for long-term day-to-day operation. That is, the workplace has to be *dependable,* even in the face of uncertain and shifting resources, able to perform its conversion functions consistently.

- Workplaces, however, must go beyond just dependability. They must also actively assist in the achievement of goals: from making a profit and providing a service to developing new ideas and enhancing our communities. We need workplaces which do more than passively accommodate our activity (that is, to provide *Commodity*); we need workplaces which are actively *helpful* tools in the system.

- Built environments, including workplaces, should also please us aesthetically (that is, to provide *Delight*). This category, however, has to be viewed in broader terms than just those of visual aesthetics. Today's workplace must be *satisfying* to us on several aesthetic and emotional levels, from the individual pleasure of the five senses to a sense of organizational elegance and corporate image to even higher levels of social and cultural achievements (as, for example, in our current cultural focus on "excellence").

- Finally, work is an activity imbedded in social systems with laws, moral values, and associated cultural constraints. Perhaps in Vitruvius' time it was taken for granted that built environments fit the social system of the Roman Empire. Today, with increasing social and cultural diversity, it is important to state explicitly that workplaces should be *fair*, that all of the participants — individual, organizational and cultural — must benefit from its operation, that one must not be penalized in order that another might gain, that the levels of resource required from each participant are proportional to the benefits received.

In folding these four criteria into our concern with the goals of a specific workplace, our most basic question is, "In what ways does the physical environment, interacting with the people, organization, resources, and expected achievements, **Help** society, the organization and the individual participants achieve their desired actions and goals?" After answering questions of helpfulness, we ask, "Whatever this place does to be helpful, does it do it all of the time, without fail, without worrying about it? Can you **Depend** on it?" A third question for environmental quality is, "Whatever this place does to be helpful, is it at the same time **Emotionally Satisfying**? Does it make us feel good about ourselves and our role within this place?" And our final question is, "Whatever this place does to be

helpful, does it do it for everybody? Is it **Fair**? Are some people asked to contribute too much or to receive too little?"

By framing all of the diverse research in environmental quality problems through these four larger criteria, we can begin to see some common patterns -- both in workplace failures and in responses to them. These four criteria have been at the root of many concerns about the workplace, from indoor air quality to computer workers' repetitive strain injuries, from efficient work flow to enhanced communications, from energy efficiency to life-cycle equipment costs. We can say, then, that the underlying criteria for environmental quality in a sound workplace are that it be helpful, dependable, emotionally and aesthetically satisfying, and ethical.

The workplace environment, which we depend upon for assistance in achieving our goals, is itself the product of several creative processes. In order to meet our criteria for a good workplace, we must understand the ways in which the contemporary workplace is created, which leads to our next question: who makes workplaces, and why?

WHO USES workplaces and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*		
WHAT IS a workplace — and how does it work?	*Desired products and achievements*	*Organization*	*People (skill, talent, knowledge)*	*Resources*	*Environment (place, tools, equipment)*
What makes a workplace GOOD?	*Helpful*	*Dependable*	*Satisfying (aesthetically, emotionally)*	*Fair*	
Who MAKES workplaces and why?	*Processes of occupancy and use*	*Facility management processes*	*Building development and delivery processes*	*Regulatory and litigation processes*	

IV: WHO MAKES WORKPLACES — AND WHY?

> *"I made sure everyone knew about all of the planning meetings, but hardly anybody came. But boy, once the first plans were drawn up, then we got the comments. One of my principals had been at the planning meetings but didn't ever say anything. But he took the plans back to his school and got a lot of complaints over it, and came back to the next meeting all charged up, ready to fight us on every point. He was just trying to look out for his staff, he said, but I think he was just embarrassed that he hadn't looked out for them earlier. We lost a lot of time -- and money -- when we thought we'd resolved everything earlier."* -- an architect explaining his experience with a school district client.

Historically, every society has created its own style of workplaces. During the last century, enormous changes in the design and implementation of workplaces have occurred. Manufacturing environments have radically changed: from the village-like factories of the early 19th century to the assembly-line plants pioneered by Ford's River Rouge plant, and again to the contemporary models of integrated manufacturing, research, and administration. Office environments have moved from the labyrinths of private offices to hierarchical arrangements based on organizational status; these were later replaced by the open office systems. And workplace change is hardly ended; we are now seeing the newest rounds of team-line settings for multiple forms of worker interaction, the electronic office, and the emerging "virtual work space" environments of the home and car.

All of these workplaces, regardless of their form, are the result of some creation process; a number of groups and clients who bring knowledge, labor and investment to the planning and design of an environment. Certainly, all of the parties involved want to create

workplaces which are helpful, dependable, satisfying and ethical, but often those goals are missed. We must step back, in the face of all of the potential failures of environmental quality which formed that imposing list in the last section, and ask a most basic question: how are these workplaces created?

The process of creating environments is a process of problem solving. It has the same typical components of other problem solving processes — defining goals, finding solutions, implementing those solutions, and evaluating the results. The physical sciences, social sciences, and the arts all offer paradigms of problem solving procedures, many of which are applied to various aspects of the creation of the built environment, from structural and mechanical engineering to programming and space planning to the facade relationships of windows and solid surfaces.

The problem of creating workplaces is defined by different types of groups or individuals, each of which has a unique role in the creation of workplace environments. In contemporary society, there are four basic groups of people and that have emerged as key actors in the creation of workplaces — *the occupants of the workplace; the building management and service industry; the building development and delivery industry; and regulators.* We need to examine how each of these groups has an effect on the creation and modification of the workplace; which aspects of the workplace are under their control; and what their goals are for the creation process.

We must begin by acknowledging that even though these four groups are quite different, they share several characteristics which are important to understand. First, *each of these groups has subgroups.* The occupants of a workplace include teams, committees, persons of different rank and so forth. Facility managers are often large organizations, sometimes with hundreds or even thousands of employees and a complex internal organizational structure. The building industry includes engineers, architects, contractors, developers, and all of their sub-specialties and constituent groups. Finally, regulators include entire divisions of local, state, and federal governments, with individual roles as diverse as legislators and field inspectors.

Each of these groups are trying to create, modify, or constrain physical environments. Each group participates in problem-solving processes — formal or informal — which determine specific properties of the physical workplace environment. These properties range from the structural integrity of columns to the color harmony between surfaces, from the ability of materials to withstand earthquakes, wind, and fire to the aesthetic composition of windows and doorways. The four groups have different means at their disposal and

often different end goals, but they are all involved in decisions which ultimately shape the final form of the workplace.

Each of these groups makes decisions in a dynamic context. The costs of materials and services changes frequently. Organizations regularly develop new strategies and tactics. And the technology of creating environments also advances rapidly. Yet these four groups must continue to make decisions which determine the physical properties of the workplace.

Keeping these common characteristics in mind, we can examine the specific goals and processes of each of the creation participants to see the ways in which they affect the physical workplace setting.

How do occupants create workplace environments?

The *goals* of workplace occupants usually involve increasing their ability to perform their jobs, or making their activities more comfortable or enjoyable. Workplace occupants continually try to improve the environmental conditions in which they work. Today, occupants demand more in terms of basic comfort. They are increasingly aware of health risks and make their concerns known. Occupants prefer to control the configuration and design of their workstations, the allocation of space within them and the boundaries around them.

The goals of any one occupant, or set of occupants, may or may not be supportive of other occupants. They may also conflict with, or be supportive of, the goals of the larger organization or the societal context. Nevertheless, in some cases work environments can be improved by placing more control in the hands of the occupants. This often means that workers must become more involved in the management decisions that govern their environments by participating in the procedures for making environmental decisions — building committees, lease arrangements, equipment purchasing, and similar activities.

Of all the *processes* for creating environments, those used by occupants are the most widely divergent. Some individuals will make fairly few changes, and others will strive to maximize their impact on the work environment. These decision-making procedures are no more or less complicated than any other work-related task; the significant issue is the degree to which such decisions are allowed or proscribed by the larger organizations and social context.

How does the building management and service industry create workplace environments?

Increasingly, workplaces are not created from scratch, but are the result of the modification of existing workplaces. It is estimated that over 90% of all workplaces are located in facilities which previously housed another workplace. This modification process is performed primarily by facility managers, who work either as independent professional organizations or as a part of the larger organization which owns or operates the workplace.

The *goals* of facility managers typically involve providing satisfactory service to the facility occupants within the constraints of limited financial resources. This overarching goal has been redefined over the last decades. Facility management used to be considered primarily a custodial function, with the primary goals defined in terms of maintenance and repair of the physical plant. More recently, facility management has been viewed as a question of managing major capital assets and real estate, and the goals have expanded to include protecting or enhancing capital investments.

Today, facility management is beginning to emerge as a decision making process intertwined with the ongoing activities of the host organization. Consequently, the goals of facility management are intended to correspond more directly with the missions of their organizations in both the private and public sectors. Facility managers go far beyond custodial services — they control large volumes of equipment purchases, address questions of safety and security, solve problems of environmental health, install new communications networks, and are now beginning to participate in the formulation of strategies for reshaping the environments for which they are responsible. They are also no longer expected to be passive servants of the host organization, but to be active and forward-looking consultants, bringing new information and technologies to their clients and suggesting courses of action.

The decision making *process* whereby facility managers impact the physical environment relates to the type of goals they are intended to achieve. Basic custodial and service decisions are made as part of the annual cycle of budgeting in large organizations. Work programs and operating costs are evaluated as part of these annual organizational cycles. When facility management goals include capital investment and/or broader organizational missions, the decision making process also changes (or <u>should</u> change) to include the techniques and procedures found in longer-term strategic planning.

With regard to workplace environments, the goals of the facility managers are not always congruent with those of all of the occupants, the other organizational units or the

broader societal context. Saving resources in one part of a facility often means diminishing someone else's ability to work, or reducing their comfort or enjoyment. Distributing resources to further one organizational mission may require taking resources away from another goal.

How does the building development and delivery industry create workplace environments?

There is a highly decentralized and complex web of developers, designers (architects, engineers and planners, construction contractors, process managers and suppliers -- each with several specializations -- involved in the creation of office buildings and factories. In addition, many clients also employ their own representatives and project managers. There are several layers of general contractors and subcontractors. There are union and non-union employees within each.

Throughout the building industry, basic business *goals* dominate the decision-making process. This usually means making an annual profit, avoiding risks that threaten the organization's survival, and looking forward to longer-term business growth. While these seem like private-sector goals, there are similar counterparts in the public-sector components of the building industry; increasing revenues, holding down costs, maintaining the organization's efficiency and planning for future activity.

The goals of the various actors in the building industry are typically formalized in contracts that elaborate the decision-making *process* and responsibilities among the various parties. Two sets of such contracts — those of the architects and the contractors — stand out as primary determinants of the decision-making process. The contracts used by architects lay out a specific sequence and scope of activities: programming, schematic design, design development, construction documents and specifications, and construction observation. The contracts governing construction, often prepared by architects and/or construction managers, typically organize the decision making process into the sixteen categories established by the Construction Specifications Institute — general requirements, sitework, concrete, masonry, metals, woods and plastics, thermal/moisture protection, doors and windows, finishes, specialties, equipment, furnishings, special construction, conveying system, mechanical systems, and electrical systems.

As each component of the building industry defines problems of the workplace environment, they follow different paths to establish their proposed solutions, employ different techniques in implementation, and use different values and measurements when evaluating their success. It is often presumed that the items which are specified in the

building industry process have already been designed and/or selected in accordance with the environmental goals of the client, occupant, and/or facility managers during the design process. In fact, these decisions are often made with other goals in mind. Amory Lovins has identified at least 25 separate groups who participate in the creation of a modern American building. Each group has their own goals, their own specialized language, their own processes, and their own criteria for success. It is hardly a surprise when conflicts occur.

How do regulators create workplace environments?

Workplace occupants, managers, and the building industry all operate within the constant constraints of regulations, often made explicit though public legislation. The *goals* of those who regulate the workplace environment typically focus on human health and welfare in broad terms, and are intended to strike a balance among individual, organizational, and broad social concerns. There are codes and policies from the federal level on down through state and local government which regulate the creation of the work environment.

There are also regulations from non-governmental authorities in the form of union rules, organizational policies, professional codes of conduct and contractual practices. These all add to the number and complexity of constraints that delimit the creation of work environments. Contracts, responsibilities and liability assignments are modified each year to meet new legislation and court decisions regulating the building industry. Elaborate bureaucracies emerge around public sector projects. Plans are reviewed by many public agencies. Manufacturers must also respond to numerous and ever-changing codes and requirements.

The decision making *process* of establishing regulations governing the physical environments is both the policy making process of government and the contractual process established by the legal system. Both procedures are exceedingly complex and, once again, are do not necessarily provide environmental constraints that encourage a close match to the specific environmental goals of the clients, constituents, and/or customers served by such constraints. Almost by definition, the goals of regulators conflicts with the anticipated behavior of at least some of the occupants, facility mangers, and members of the building industry. If all of these groups were behaving in ways that already enhance and protect the general health and welfare of themselves and of the other parties, there would be no need to establish any regulation. It is precisely <u>because</u> there are conflicting goals that regulation has become a prominent building creation component. This does not imply that

all regulations are appropriate — regulations can be as inappropriate as any decision by workplace occupants, managers, or builders of workplaces.

To summarize, the workplace is created and modified by a large number of participants whose effects can be divided into four general processes: occupancy, facility management, building development and construction, and regulation. Each of these groups have goals which they establish and attempt to satisfy, and each of them have a specific set of processes which they use in order to pursue their goals. These goals and processes may or may not be internally compatible, and may or may not coincide with the goals and processes of the other participants.

These sorts of inconsistent goals -- whether between subsets of creators or between creators and users -- can be found at the core of the problems in many unsuccessful workplaces. But can we be more specific? Are there some particular failures in the building creation process which result in different kinds of workplace problems? This is the subject of our final question: how does the process of creating workplaces fail, and how must it be changed?

WHO USES workplaces and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*		
WHAT IS a workplace — and how does it work?	*Desired products and achievements*	*Organization*	*People (skill, talent, knowledge)*	*Resources*	*Environment (place, tools, equipment)*
What makes a workplace GOOD?	*Helpful*	*Dependable*	*Satisfying (aesthetically, emotionally)*	*Fair*	
Who MAKES workplaces and why?	*Occupants*	*Building management and service industry*	*Building development and design industry*	*Regulators*	
How does the process FAIL, how must it be CHANGED?	*Improve knowledge about desired quality*	*Improve design to achieve goals*	*Improve implementation of a good design*	*Improve operation of the implemented design*	

V. How Does the Process of Creating Workplaces Fail -- and How Must It Be Changed?

> *"The state says I've got to have two smoke alarms in this shop. Fair enough. The bid goes out and we buy smoke alarms for the whole building. Turns out they're particle-sensing instead of heat-sensing, which means that every time I run a saw or a planer, the fire alarm goes off. I told Terry that we needed to replace the two alarm sensors in the shop. But because they cost more than the department estimate, it has to go through the central Purchasing office. It's been two weeks now, I can't run the shop, and nobody's getting their projects done."* -- a production manager on his ad company's new display shop.

Each of the four processes noted in the previous section — occupancy, facility management, building development and construction, and regulation — eventually intersect and have direct impacts on the environment. Using the criteria shown earlier, those who undertake each of these four processes have some intent and responsibility to make workplaces that are reliable, helpful, satisfying, and ethical.

Ideally, the process whereby each set of creators tries to achieve its own goals will also lead to satisfying the goals of the individuals, organizations, and society to whom they are responsible. In many cases the ability of the creators of environments to satisfy their own needs (such as business success) clearly interacts with their ability to satisfy the environmental goals of their clients. Making a profit in the building industry may be

directly linked to satisfying the customer's concurrent needs for a profit-making environment. Creating legislation that is supported by the electorate is often linked to balancing the needs on one set of constituents, such as the building industry, with those of other constituents, such as building occupants. Nevertheless, it is also easy to see how conflicts can emerge and allow inappropriate goals to become dominant.

If a workplace environment fails to achieve the goals of any of its users -- whether individuals, organizations, or society -- it is critical to ask where in the process the failure occurred? Was it a failure of the physical element itself, a faulty piece of equipment or a bad case of industrial engineering? Although this type of flaw certainly exists, other far more common failures stem from not understanding the basic goals of the users; from having a good object in the wrong place or at the wrong time; and from having two good objects in conflict with one another. These kinds of failures make up a great number of workplace deficiencies exactly because the workplace system is so complex and because so many groups come together in its creation, each trying to maximize their own outcomes without concern (or even knowledge) of the others.

Put another way, the failures of creating effective workplaces are not necessarily failures of technology or skill in construction and manufacturing, but failures of the environmental decision-making process. Communication has failed; either between different members of the creation side or between those who create workplaces and those who use them.

Four primary types of failures occur. In the first type, decision makers have a *lack of knowledge about the environmental goals* of some or all of the users. Examples of this failure abound in the built environment, most often when builders and designers simply do not include one or more important participants in the planning process, when they deal with an unknown client or when the client does not represent the final user. As a great deal of office construction has moved away from "headquarters buildings" for a particular company and into speculative lease space, this problem has become even more widespread.

A second basic failure stems from decision makers who understand the environmental goals of the users, but somehow still create designs *that do not correspond to those environmental goals.* This can occur through incomplete resolution of conflicting goals in the planning process, through lack of information and precedents which designers can draw upon for creative problem solving, or through a lack of one or more resources needed to support a successful design.

A third and also frequent failure occurs when a good design is created, one which incorporates reasonable responses to all of the users' goals, but an *improper implementation* somehow occurs. This is extraordinarily common, given the great number of participants in the building creation process. As installation goes on in the field, designers, engineers, facility managers, contractors and their workers must make innumerable decisions which cannot have been predicted beforehand. Each person will generally make these decisions on the basis of how their particular process will best be served, whether that process be HVAC or waterproofing or construction finance or the coordination of contractors. The intersection between all of these diverse processes, which ultimately determines the nature of the final workplace, can often be left unconsidered.

And finally, a design can be thoughtful, well-planned and carefully implemented, and still be operated in a way which minimizes its effectiveness or even defeats its purpose. This can come from a lack of knowledge on the part of those charged with operation, or from a lack of correspondence between an organization's underlying principles and its operational strategies.

Each of these four types of error needs to be understood as it relates to the overall decision making process. How do these errors relate to different types of environmental goals? Is one type of error more common at a particular type of decision maker or stage in the process? All of these questions need to be addressed in order to prescribe actions that can help improve our workplaces.

Table 2. How do EQ Criteria Interact with Common Errors in Building Creation?

	knowledge about user needs	*ability to design a good solution*	*solution implemented and operated*
Helpful	must design with user needs in mind	too many divergent needs may be insoluble	intersections between partial solutions may reduce the helpfulness of each
Dependable	once needs are found, they must be made explicit and codified	needs are known, but solutions may depend too closely on ideal inputs or conditions	intersections between partial solutions may reduce the dependability of each
Emotionally Satisfying	these needs are difficult to discover and to state	the role of art	the completely designed and well-thought solution
Ethical	everyone's needs must be considered	all needs are known, but some may be unnecessarily favored over others	last-minute field decisions may undermine the inclusiveness and fairness of the design solution

Table 2 shows the three aspects of creation failures compared against the four basic criteria for environmental quality. To ensure that new knowledge is well integrated and made into sound and responsive designs, the four goals of dependability, helpfulness, satisfaction and ethics must be given specific benchmarks for the particular workplace in question, criteria which can easily be compared against the developing design in order to evaluate progress. This again is a process which must involve all of the ultimate users of the workplace.

We can also see from this table that knowledge of user needs, although critical to the success of the workplace, is only the first step toward the creation of good workplace environments. Clearly, more knowledge is always advisable in a decision making context, but is only usable when focused and coordinated toward the achievement of specific goals. The design process itself, as the potential center of the coordination effort, is vital to the end result, and the implementation process perhaps most critical of all.

Paradoxically, one of the reasons that the gaps among building creators and between creators and users have grown so large is because we have become increasingly concerned with the certainty and predictability of the design and construction processes. In our drive to make the building creation process both more efficient and less liable, we have depended far more upon formal procedural mechanisms such as codes and contracts and standards of conduct, and far less upon information gathering and consensus building and coordination between diverse participants and duties. Precedents and prototypes and repetition are seen as the most likely paths to success, while participation and collaboration are seen as inefficient, political, time consuming, and perhaps even dangerous.

Table 3 shows the three aspects of creation (knowledge, design and implementation) compared against the four participants in the creation process. All too often, the regulation side is thought of as the ultimate arbiter between divergent user needs; in our litigious era, the regulatory process has come to be more and more involved in the proscriptive tasks involved in design and implementation. Our drive to increase the certainty and efficiency of building design and implementation has, to a large extent, resulted in an inability to state and understand the environmental goals of both the users and the other creators of the workplace except through conflict and regulation.

Table 3. How do Creation Processes Interact with Common Errors of Building Creation?

	Knowledge	Design	Implementation and Operation
Occupants	They know their individual criteria, but don't always share them	They need more skills and assistance to participate in design decisions	They need more responsibility, opportunity and accountability
Facility Managers	They need to learn organizational and social goals	They need more skills and greater responsibility in design decisions	They need more participation and responsibility
Building Industry	They have a strong concern, but don't know how to judge "who's right"	They need to learn "team design," participatory and collaborative methods	They need coordination between participants and tasks, and less liability
Regulators	The often fail to recognize diversity and project specifics	They need performance rather than prescriptive criteria	They need a clear delegation of authority and performance criteria

In order to ensure that designers understand the goals of all of the ultimate users of the building, we need to ensure that those users are encouraged and assisted in making their needs clear, and in negotiating between conflicting goals. This has traditionally been part of the architectural task of programming, but must be made more robust and inclusive, with information actively sought out from all potential participants. Designers must provide users with more opportunities and processes to state their goals, and provide themselves with the tools that are necessary to understand them.

Unfortunately, the knowledge aspects of building creation are becoming as diverse and specialized as the building industry itself, with the research that is being done in the area of environmental quality often based on one narrow aspect of environmental quality to the exclusion of all others. One particular trade group or manufacturer's consortium or professional organization has a specific problem that they need to address in order to carry out their own role more effectively, and they sponsor research which addresses that problem directly, leaving aside consideration for larger systemic effects.

This compartmentalization extends beyond research practice and into communication as well. When the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) does research into workplace comfort, for instance, the results often stay buried in the *ASHRAE Journal* when there is a much larger need for this information by architects, interior designers, lighting designers, furniture manufacturers, lenders, facility managers and even workers themselves. In an age where most environmental

quality problems stem from failures of implementation and coordination, the study of narrow and trade-specific technical problems can in fact be counterproductive to the larger goals of workplace quality. As long as there is no central place for environmental quality as a overarching goal -- both for building and for building research -- problems of implementation, coordination and communication among well-meaning specialists will increase.

Traditionally, the architect has played the role of the coordinator of the creation process; assisting the client in listing his or her needs, hiring and coordinating the trades, acting as the client's agent in all transactions. Now, however, the act of building has become so complex (and expensive and litigious) that the architect's role has been minimized. The architect is often brought in when many of the most central decisions about the building — its size, orientation, site, basic uses, and others — have already been made on the basis of financial and real estate criteria.

Unfortunately, the architectural community have responded to these developments not by expanding their knowledge of the processes of building creation and striving to maintain their central role, but rather by drawing back their area of expertise into the one field which hasn't been encroached upon, that of creating form and visual design. Parts of the building creation sequence which had traditionally been the architects' province are now being handled by interior designers, structural engineers, facility managers, maintenance engineers, and even bankers.

The problem, though, is not so much that architecture is a fading discipline as that no other discipline has stepped in to take on architecture's traditional role as coordinator. Construction managers are often thought of as the new integrators, but they coordinate design implementation only, and not the knowledge and design phases. If most environmental quality failures are due to conflict between diverse needs, the need for coordination is clear. In an enormously complex process involving so many players, it is absolutely essential that some knowledgeable professional is able to insist on a systemic, start-to-finish view of the whole, avoiding the ever-more common problems of conflict between two good solutions.

To create better workplaces, we need a building creation process which allows the skills of the creators to work in collaboration rather than competition. The outcome of each profession and each trade must be focused on the criteria set for the project, rather than against internal benchmarks which are uniform from job to job and year to year. Each of the participants in the creation process must learn to — and be allowed to — accept more

latitude in their standard practices, to accept less certainty and more interplay, with the overall criteria set at the center of all efforts.

We feel that it is necessary for some person or group of people to be ultimately responsible for ensuring that these three processes occur, facilitating the flow of information between creators and users and between different groups of creators. It may be that this facilitation role should be within the domain of an emergent and vibrant new architectural profession which regains its traditional role of coordination. It may be that facilitation is best done by independent professionals drawn from disciplines already skilled in information transfer and interpersonal mediation. Or it may be that environmental quality facilitation is an entirely new field, one which will require new training and the development of new techniques.

Regardless of the ultimate identity of the environmental quality supervisor, that person or group will have at lest five specific tasks that they will have to perform:

- *gather the best knowledge available* on various environmental quality problems, disseminate it, and try to integrate it;
- *continue to coordinate and conduct research* on the gaps in our knowledge;
- *bring key people together* in forums where they can brainstorm and create new systemic environmental quality ideas;
- go into the field and *facilitate collaborative pursuits* of healthy workplaces; and
- *educate new groups of professionals* who understand the complex system of workplace creation, and who are willing to take on the new kind of collaborative stance necessary to ensure its success.

WHO USES workplaces and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*		
WHAT IS a workplace — and how does it work?	*Desired products and achievements*	*Organization*	*People (skill, talent, knowledge)*	*Resources*	*Environment (place, tools, equipment)*
What makes a workplace GOOD?	*Helpful*	*Dependable*	*Satisfying (aesthetically, emotionally)*	*Fair*	
Who MAKES workplaces and why?	*Occupants*	*Building management and service industry*	*Building development and design industry*	*Regulators*	
How does the process FAIL, how must it be CHANGED?	*Improve knowledge about desired quality*	*Improve design to achieve goals*	*Improve implementation of a good design*	*Improve operation of the implemented design*	
How can this information be used to EVALUATE workplaces?	*Definition*	*Evaluation*	*Application*		

VI. How Can This Information be Used to Evaluate Workplaces?

I sit in this office and get complaints all day long about this building -- in person, on the phone, memos in the mailbox. It never ends. They're usually little problems, and we get them taken care of right away for the most part, but sometimes I wonder if we're doing something wrong. We never hear about something being right, so I can't really tell how well the building is working, and I get so many little complaints that I can't tell which ones are important and which ones are trivial. A burned-out light bulb or a spill on the carpet sounds like the end of the world by the time it gets to me. -- a physical plant manager describing his maintenance planning.

This chapter outlines a procedure for assessing the environmental quality of any occupied building. In order to conduct the environmental quality assessment in a reliable and valid way, articulating a series of procedural steps is critical. The procedure presented in this chapter explicitly requires formulating an accurate description of the places being assessed, and establishing environmental quality assessment criteria that are consistent with the goals and objectives of the organization occupying the building.

A total of ten steps in three phases have been formulated:

Phase I: Definition

(1) identifying relevant goals particular to the assessment of a building or set of buildings;
(2) clarifying the objectives of the assessment;
(3) establishing the relevant levels of analysis;
(4) identifying place;
(5) prioritizing places; and
(6) describing places that make up a building;

Phase II: Evaluation

(7) evaluating these places according to the environmental quality criteria established in earlier steps;

Phase III: Application

(8) from this evaluation identifying the nature of the problems that have been discovered;
(9) identifying the processes by which these problems can be alleviated; and finally
(10) repeating and/or evaluating the effectiveness of the procedure itself.

PHASE I. DEFINITION

This stage will consist of identifying goals, establishing objectives for the assessment, identifying, prioritizing and describing places to be assessed. These tasks will be completed through a process of negotiation with an evaluation team comprised of representative members from the organization and evaluation consultants.

Step 1. Identify goals of society, organization and individuals

The first step consists of identifying the relevant goals of society, organization and individual occupants with respect to building(s) being considered for assessment.

1.1 What are society's goals for the building or facility?

Examples of societal goals might include: in the case of schools, producing responsible citizens, established standards and for asbestos abatement and other environmental health issues, standards for student achievement; and, in the case of

workplaces, provision of steady employment, various fire and life-safety codes, and indoor air quality regulations, among many others.

1.2 What are the organization's goals for the building?

Examples of organizational goals might include: in the case of schools, increase student achievement scores, improving parental and community involvement, improving school climate, etc.; and, in the case of work organizations, increase profits, added value, improving measures of productivity, total quality improvement, etc.

1.3 For each occupant group, what are the individual goals relative to this building?

There are two levels to be concerned with here:

1. What are individuals goals for the building as a whole?

2. What are individuals expected products and achievements for particular places within which they work?

Examples of individual goals for any workplace might include: gaining satisfactory levels of privacy, comfort, autonomy and control for productive work, improved social interaction and communication between occupants, achieving a satisfactory sense of security, accessibility, various professional goals and achievements, and many other goals.

Step 2. Establish assessment objectives

The choice of buildings to be assessed should follow a certain set of objectives. These objectives should be clearly stated in order to provide a clear direction to the assessment work.

2.1 Identify the facility(s) to be assessed

2.2 Why are these) particular buildings or facilities being selected for assessment?

2.3 What are the stated objectives of the assessment?

Objectives might include a narrow assessment of particular environmental quality goals such as indoor air quality, asbestos abatement, productivity, energy cost effectiveness, or performance. An assessment could be used to measure the performance of facility management services in relationship to occupant goals, or include a broader assessment of the total environmental quality of a place according to a broader set of goals of society, organization or individuals. The objective of the assessment may be still more global: to develop measurable benchmarks for comparison to other buildings over time.

Step 3. Determine level of analyses

This step requires the assessment team to determine the level of analyses appropriate or required. This can be done by investigating the existing correspondence, or fit between philosophy, goals and operational strategies, and the building and places within the building designed to support those philosophy, goals and operational strategies. A lack of correspondence, or fit may indicate a mismatch and suggests the need for assessment at the particular level of analysis: at the philosophical level, goals level, or the level of operational strategies. This step constitutes a preliminary test of where key problems may arise in the building assessment.

3.1 Is there correspondence between organizational philosophy, goals and operational strategies relevant to the building?

In other words, is the espoused philosophy for a particular organization manifesting itself through the goals and operational strategies within the building? An example might be that a school espousing a middle school philosophy (team teaching, houses) is operating as a junior high school (departmentalized, autonomous classrooms); or a work organization may espouse the philosophy of multidisciplinary team problem solving, but the prevailing management strategy within the organization continues to favor a departmental mentality.

3.2 Is there correspondence between goals and the facility which serves these goals?

Referring back to the middle school operating as a junior high, the following example illustrates a lack of correspondence between organizational goals and the facility: a middle school program (which requires clusters of classrooms off a main corridor in order to support team teaching and the concept of 'houses') being implemented in a school building originally designed as a double loaded corridor.

3.3 Is there correspondence between operational strategies and the places they are contained in?

Within the context of a work organization espousing teams as the basis for their operations, this lack of correspondence would manifest itself physically by the lack of provision of adequate group work space to support team efforts: not providing group work space might inhibit the performance of teams.

3.4 What level(s) of analysis will be considered in this assessment?

Depending on the levels of correspondence identified above, the assessment might focus more or less on a particular level of analysis.

Step 4. Identify place(s)

Once the level of analyses have been determined, all possible places associated with those levels of analyses should be identified. At this step, an exhaustive list of all the places present in a particular building to be assessed should be made.

4.1 What are the places that can be identified within a particular building?

4.2 What are the place adjacencies within the building?

Step 5. Prioritize places

Some places may be more important than others in relation to the goals of the assessment. Not all places can always be investigated at once due to the limitations of cost and time. A list of prioritized places should be developed. The reasons for the particular prioritization should be clearly stated and documented.

5.1 Establish criteria for prioritizing places: Prioritize according to:

(a) most critical to least critical to stated organizational goals,

(b) cost limitations,

(c) time limitations,

(d) political acceptability, and/or

(e) other criteria.

5.2 Explain the rationale for selected criteria in 5.1

5.3 Prioritize places to be assessed according to criteria established in

Step 6. Describe places

Describe places to be assessed according to the five components: organization, people, materials, products and achievements, environment. For each place the following questions must be answered:

6.1 Describe the physical environment which comprises the place:

6.2 Describe the expected products and achievements (place-specific goals) of the place:

6.3 Describe the people, the normal participants/occupants of the place:

6.4 Describe the organizational structure of the place:

6.5 Describe the materials (supplies, information) required to optimally maintain the place:

PHASE II. EVALUATION

Once the definitional issues are resolved and agreed on the evaluation phase will begin. This phase will consist of conducting a series of survey questionnaires, interviews, walk-throughs, observations, and archival research, among other data collection techniques required to answer the general questions which follow. (These questions will be more clearly specified for the places that are eventually identified.)

Step 7. Evaluate places

This step is at the heart of the PEQA. Places identified, prioritized and described in the previous steps (4, 5, & 6) will be evaluated according to how well they meet the operational goals and strategies for individuals, the organization and society (identified in Step 1).

The global question of concern at this step is: is this place helpful, dependable, satisfying and equitable with respect to a specific set of goals and expectations of either individuals in that place, or required by the organization and/or society? This generic question can be broken down and particularized for society, organization and individuals:

7.1 Assessing EQ from the perspective of society's goals

1. Is this place helpful in meeting society's established goals? (such as cost effectiveness?, accountability?, safety codes and regulations?, or other goals relevant to maintaining environmental quality?)

1.1 and, if the place is helpful, in what ways does this place actively help society in achieving these goals?

(a) that is, to what extent do the people and organization of the place contribute to helping society achieve these goals?

(b) that is, to what extent does the environment and resources of the place contribute to helping society achieve these goals?

1.2 if this place is not helpful, in what ways does this place hinder the meeting of societal goals?

(a) that is, to what extent do the people and organization of the place contribute to helping society achieve these goals?

(b) that is, to what extent does the environment and resources of the place contribute to helping society achieve these goals?

2. Does the place consistently meet society's established goals, that is, is the place dependable?

2.1 if this place is not dependable, can you explain why this is so?

(a) that is, to what extent are the people and organization of the place undependable? and in what ways?

(b) that is, to what extent are the environment and resources of the place undependable? and in what ways?

3. Finally, does this place meet society's established goals in a fair and equitable way?

3.1 if not, what are the conditions under which a particular unfair or unequitable situation exists in this place?

(a) that is, to what extent do the people and organization of the place contribute to the unfair situation?

(b) that is, to what extent do the environment and resources of the place contribute to the unfair situation?

7.2 Assessing EQ from the perspective of organizational goals

1. Is this place helpful in meeting established organizational goals? (such as productivity and performance?, effectiveness?, social interaction?, communication?, or other goals relevant to maintaining environmental quality?)

1.1 and, if the place is helpful, in what ways does this place actively help the organization in achieving these goals?

(a) that is, to what extent do the people and organization of the place contribute to helping the organization achieve these goals?

(b) that is, to what extent does the environment and resources of the place contribute to helping the organization achieve these goals?

1.2 if this place is not helpful, in what ways does this place hinder the meeting of organizational goals?

(a) that is, to what extent do the people and organization of the place contribute to helping the organization achieve these goals?

(b) that is, to what extent does the environment and resources of the place contribute to helping the organization achieve these goals?

2. Does the place consistently meet established organizational goals, that is, is the place dependable?

2.1 if this place is not dependable, can you explain why this is so?

(a) that is, to what extent are the people and organization of the place undependable?

(b) that is, to what extent are the environment and resources of the place undependable?

3. Finally, does this place meet organizational goals in a fair and equitable way?

3.1 if not, what are the conditions under which a particular unfair or unequitable situation exists in this place?

(a) that is, to what extent do the people and organization of the place contribute to the unfair situation?

(b) that is, to what extent do the environment and resources of the place contribute to the unfair situation?

7.3 Assessing EQ from the perspective of individual goals

1. Does this place help you achieve your goals and objectives? (such as expected products and achievements?, flexibility? privacy?, safety?, comfort?, accessibility?, social interaction?, communication?, or other goals relevant to maintaining environmental quality?)

1.1 and, if the place is helpful, in what ways does this place actively help you in achieving these goals and objectives?

(a) that is, to what extent do the people and organization of the place contribute to helping you achieve these goals and objectives?

(b) that is, to what extent does the environment and resources of the place contribute to helping you achieve these goals and objectives?

1.2 if this place is not helpful, in what ways does this place hinder the achievement of your goals and objectives?

(a) that is, to what extent do the people and organization of the place contribute to helping you achieve your goals?

(b) that is, to what extent does the environment and resources of the place contribute to helping you achieve your goals?

2. Does the place consistently help you achieve your goals and objectives, that is, is this place dependable?

2.1 if this place is not dependable in helping you achieve your goals, can you explain why this is so?

(a) that is, to what extent are the people and organization of the place undependable?

(b) that is, to what extent are the environment and resources of the place undependable?

3. Does this place help you achieve your goals and objectives in a fair and equitable way?

3.1 if not, what are the conditions under which a particular unfair or unequitable situation exists for you in this place?

(a) that is, to what extent do the people and organization of the place contribute to the unfair situation?

(b) that is, to what extent do the environment and resources of the place contribute to the unfair situation?

4. To what degree, overall, do you feel satisfied with this place?

4.1 If you are not satisfied, what is the source of your dissatisfaction?

(a) that is, to what extent do the people and organization of the place contribute to your dissatisfaction?

(b) that is, to what extent do the environment and resources of the place contribute to your dissatisfaction?

4.2 If you are satisfied, what is the source of your satisfaction?

(a) that is, to what extent do the people and organization of the place contribute to your satisfaction?

(b) that is, to what extent do the environment and resources of the place contribute to your satisfaction?

PHASE III. APPLICATION

The objective of this final stage is to apply the knowledge gained during the evaluation to improve the environmental quality of the places evaluated. Problems are fed back into the processes that can best address those problems. The final step calls for addressing the continuous improvement of the assessment procedure itself.

Step 8. Identify nature of problems

From the previous step, a series of problems, or correspondence mismatches will emerge. These problems can be categorized or classified as either problems of knowledge,

design or implementation. From this classification, it will be easier to identify change agents to help solve the problem.

8.1 List the problems and/or issues that have surfaced during the previous step.

8.2 Which problems are due to problems of knowledge?

8.3 Which problems are due to problems of design?

8.4 Which problems are due to problems of implementation and operation?

Step 9. Identify processes

What is the process by which a particular problem or issue can be resolved?

9.1 Which problems could be solved through increasing the knowledge of occupants toward these problem/issue? How?

9.2 Which problems/issues could be solved through improving operations and management procedures? How?

9.3 Which problems could be solved through redesign and construction? How?

9.4 Which problems could be solved by engaging the regulatory process? How?

Step 10. Repeat and/or evaluate effectiveness of procedure

This step calls for the procedure to be repeated for each place being assessed (Steps #s 7-9). Second, if problems with scope have surfaced, then re-evaluating Steps #s 1-6 may be necessary. Finally, problems may surface concerning the manner in which problems are being categorized and assigned to change agents.

10.1 Have all places been assessed, and if so, has all relevant data been collected?

10.2 Are there problems with the scope of the project which have surfaced? If so, what are they and how might the scope be revised to accommodate/address these problems?

10.3 Are there problems with the manner in which problems have been categorized and assigned to a particular process?

10.4 If so, what are they and how might this procedure be revised to accommodate/address these problems?

What is a WORKPLACE — how does it work?	*Desired products and achievements*	*System of resources and procedures*	*People (skill, talent, knowledge)*	*Environment (place, tools, equipment)*
WHO USES workplaces and WHY?	*Individual goals*	*Organizational goals*	*Societal goals*	
What makes a workplace GOOD?	*Dependable*	*Helpful*	*Satisfying (aesthetically, emotionally)*	*Ethical*
Who MAKES workplaces and why?	*Occupants*	*Building management and service industry*	*Building development and delivery industry*	*Regulators*
How does the process FAIL, how must it be CHANGED?	*Improve of knowledge about desired quality*	*Improve design to achieve goals*	*Improve ability to implement a good design*	
How can this information be used to EVALUATE workplaces?	*Definition*	*Evaluation*	*Application*	

EPILOGUE: THE ROLE OF THE JOHNSON CONTROLS INSTITUTE FOR ENVIRONMENTAL QUALITY IN ARCHITECTURE

> *"I'm so tired of hearing that the Company has decided to change the network access, or that the Company didn't order enough chairs, or that the Company hasn't settled on a protocol for managing weekend access to the building. Isn't there some human somewhere that can take responsibility for this stuff and get it fixed?"* -- a department supervisor commenting on the building commissioning process.

These five tasks -- to gather knowledge, to conduct and coordinate research, to bring key people together, to facilitate collaborative pursuits, and to educate a new body of professionals -- are directly related to the mission of the Johnson Controls Institute for Environmental Quality in Architecture. Some of the current projects of the Institute reflect this comprehensive view of environmental quality.

In order to *gather the best knowledge available* on various environmental quality problems, disseminate it, and try to integrate it, the Institute is investigating systematic

differences in private vs. public sector building costs and development processes for the Wisconsin Department of Facilities Management. We are also exploring the creation of a publicly accessible information network to promote increased knowledge about environmental quality. And, of course, this white paper is an effort at integrating the current state of knowledge about environmental quality in the workplace.

In order to *continue to coordinate and conduct research* on the gaps in our knowledge, we are progressing with three active research projects: a longitudinal study of office building responsiveness to changes in organizational and social demands; a pilot study of the concepts behind personal environmental control systems, their effects on occupant satisfaction, and their ramifications for general HVAC design; and the development of impact analysis methodologies to examine new construction from a community-wide perspective.

In order to *bring key people together* in forums where they can brainstorm and create new systemic environmental quality ideas, the Institute and the American Institute of Architects are co-sponsoring a Taliesin Institute discussion of healthy and productive buildings. This two day meeting will be part of the highly successful AIA video conference series which was viewed by over 10,000 professionals in 1993. The Institute will also sponsor a weekend retreat at the Wingspread Center in September for leaders in the environmental quality field to share their work and their ideas.

In order to go into the field and *facilitate collaborative pursuits* of healthy workplaces, the Institute is developing collaborative field research with the Wisconsin building industry on the process of constructing environmentally responsive buildings. This research includes designers, contractors and clients as well as our research staff, in order to ensure a broad representation of goals and criteria.

Finally, in order to *educate new groups of professionals* who understand the complex system of workplace creation, and who are willing to take on the new kind of collaborative stance necessary to ensure its success, the Institute is developing a traveling exhibit on sustainability and environmentally responsive architecture for the AIA; is engaged in curriculum development for programming, design, and management of environmental quality; and is creating a series of continuing education courses to promote awareness of environmental quality among current design practitioners.

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